Port of Seattle
Lora Lake Apartments Site

Engineering Design Report

Prepared for

Port of Seattle
Aviation Environmental Programs
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Lora Lake Apartments Site Engineering Design Report

PROFESSIONAL ENGINEER CERTIFICATION

This document has been prepared for the Port of Seattle under the direction of:

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(Wetland design only - Sections 5.4.1, 5.4.2, and 5.4.3, including all of their subsections)

Table of Contents

List of Tables

List of Figures

List of Appendices

List of Appendices (cont.)

List of Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
AKART	All known, available, and reasonable methods of prevention, control, and treatment
ARAR	Applicable or relevant and appropriate requirements
bgs	Below ground surface
BMP	Best management practice
CAA	Controlled Activity Area
CAP	Cleanup Action Plan
CD	Consent Decree
CESCL	Certified Erosion and Sediment Control Lead
CMP	Compliance Monitoring Plan
COC	Contaminant of concern
cPAH	Carcinogenic polycyclic aromatic hydrocarbon
CSWGP	Construction Stormwater General Permit
DMCA	1982 Dredged Material Containment Area
EDR	Engineering Design Report
FAA	Federal Aviation Administration
GPS	Global positioning system
HASP	Health and Safety Plan
HDPE	High-density polyethylene
LL Apartments Parcel	Lora Lake Apartments Parcel
LL Parcel	Lora Lake Parcel

Acronym/ Abbreviation	**Definition**
µg/kg	Micrograms per kilogram
MDNS	Mitigated determination of nonsignificance
MDP	Master Drainage Plan
mg/kg	Milligrams per kilogram
MTCA	Model Toxics Control Act
NAVD 88	North American Vertical Datum of 1988
NERA	Northeast Redevelopment Area
NPDES	National Pollutant Discharge Elimination System
NRMP	Natural Resource Mitigation Plan
O&M	Operations and maintenance
PCP	Pentachlorophenol
pg/g	Picograms per gram
pg/L	Picograms per liter
POC	Point of compliance
Port	Port of Seattle
PPE	Personal protective equipment
PVC	Polyvinyl chloride
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RPZ	Runway Protection Zone
SAP	Sampling and Analysis Plan
SEPA	State Environmental Policy Act
Site	Lora Lake Apartments Site
SR 518	State Route 518
STIA	Seattle-Tacoma International Airport
SWPPP	Stormwater Pollution Prevention Plan
TEE	Terrestrial Ecological Evaluation
TEQ	Toxicity equivalent
TPH	Total petroleum hydrocarbons
USACE	U.S. Army Corps of Engineers
WAC	Washington Administrative Code
WHMP	Wildlife Hazard Management Plan
WSDOE	Washington State Department of Ecology
WSDOT	Washington State Department of Transportation
XOFA	Extended Object Free Area

1.0 Introduction

This Engineering Design Report (EDR) was prepared on behalf of the Port of Seattle (Port) per the requirements of Washington Administrative Code, Section 173-340-400(4)(a) (WAC 173-340-400(4)(a)) and describes the engineering concepts and design criteria for the remedial action selected by the Washington State Department of Ecology (WSDOE) for the Lora Lake Apartments Site (Site), as detailed in the Cleanup Action Plan (CAP) for the Site (State of Washington 2015, Exhibit B). The Site is located at 15001 Des Moines Memorial Drive in Burien, Washington (Figure 1.1), near the northwest corner of Seattle-Tacoma International Airport (STIA). The Site is being remediated under the authority of the Model Toxics Control Act (MTCA; Chapter 70.105D of the Revised Code of Washington), administered by WSDOE under the MTCA Cleanup Regulation Chapter 173-340 WAC), and in accordance with Consent Decree (CD) No. 15-2-21413-6, entered into by WSDOE and the Port (State of Washington 2015).

Information used to develop this EDR included the CAP and the *Lora Lake Apartments Site Remedial Investigation/Feasibility Study* (RI/FS; Floyd|Snider 2015a), as well as pre-design and performance monitoring data collected for the Site. These data, along with the corresponding analyses and evaluations that informed the remedial design are included as appendices to this EDR.

According to the CD (State of Washington 2015), the Site consists of three parcels: (1) the Lora Lake Apartments Parcel (LL Apartments Parcel), (2) the Lora Lake Parcel (LL Parcel), and (3) the 1982 Dredged Material Containment Area (DMCA). The configuration of the Site is shown in Figure 1.2. This EDR addresses all three Site parcels.

1.1 OVERVIEW OF REMEDIAL ACTIONS

The general cleanup areas at the Site and the selected remedial actions that will occur in each of these areas are summarized below.

- **LL Apartments Parcel Cleanup Area.** The remedial action on this parcel includes excavation and off-site disposal of contaminated soils with concentrations that exceed the dioxins/furans toxicity equivalent (TEQ) remediation level of 100 picograms per gram (pg/g) and/or the applicable cleanup levels for the other Site contaminants of concerns (COCs). After excavation, backfilling, and site grading, the entire LL Apartments Parcel will be covered with a wildlife barrier/cap to prevent exposure of human and ecological receptors by direct contact. This wildlife barrier/cap will control exposure to dioxins/furans-contaminated soil with concentrations less than the remediation level and greater than the cleanup level.
- **LL Parcel Sediment Cleanup Area.** The extent of this cleanup area is based on the protection of surface water from contaminants that could leach from sediments and includes the sediments within Lora Lake extending to the lake shoreline. Remediation of the lake includes the placement of a sediment cap to immobilize COCs in the sediment and prevent them from leaching to surface water. The remedial action in this area also includes the conversion of the existing open water and benthic sediment conditions of the lake to a rehabilitated palustrine scrub-shrub wetland.

- **LL Parcel Shallow Soil Cleanup Area.** The extent of the LL Parcel Shallow Soil Cleanup Area is defined by exceedances of soil cleanup levels that are based on the protection of terrestrial ecological receptors. Remediation in this area consists of excavation. After excavation, the area will be backfilled, graded, and replanted to match the existing conditions and comply with the Port's Natural Resource Mitigation Plan (NRMP) for the area (Parametrix 2001).

Although a physical remedial action is not required in the DMCA, administrative controls are required. The selected remedy for the DMCA involves the establishment of an environmental covenant for this area. The environmental covenant will require that planned land use improvements for the area be constructed in a manner that provides a barrier to wildlife. The environmental covenant will also require that the wildlife barrier be monitored and that the area remain in industrial use.

1.2 ROLES AND RESPONSIBILITIES

The Port, the Port's consultant, the selected contractor and its subcontractors, and WSDOE will be involved in the implementation of the project. The Port is the contracting party and is ultimately responsible for the performance of the work. The Port's consultant will ensure that implementation of the EDR is satisfactory, will provide construction oversight, will provide some of the sampling required and discussed in this report, and will document the performance of the remedial action construction. The Contractor and its subcontractors will be responsible for all of the construction work described in this report, including the remedial action construction work on the LL Apartments Parcel, the LL Parcel, and the DMCA, and they will provide some of the sampling required and discussed in this report. The Contractor and its subcontractors will act as the Certified Erosion and Sediment Control Lead (CESCL), ensuring appropriate implementation, function, and inspection of best management practices (BMPs) and compliance with Site permits. WSDOE will review and approve the project plans and reports, as described herein.

1.3 REPORT ORGANIZATION

The remainder of this EDR is organized as follows:

- **Section 2.0—Site Description and Summary of Environmental Conditions.** This section describes the Site setting, geology, and hydrogeology, and summarizes the COCs, cleanup standards, and contaminant distribution throughout the Site.
- **Section 3.0—Site Sequencing and Construction Water Management and Treatment.** This section presents an overview of the sequencing and coordination between the remediation and construction activities on the three Site parcels, as well as other stormwater and roadway projects being implemented adjacent to the Site.

- **Section 4.0—Lora Lake Apartments Parcel Remedial Action Construction Activities.** This section presents the design for the remedial action construction activities at the LL Apartments Parcel. The activities include project permitting; site preparation; excavation of contaminated soil, backfilling, and grading; wildlife barrier/cap construction; soil handling and disposal; well installation; groundwater monitoring; and implementation of institutional controls.
- **Section 5.0—Lora Lake Parcel Remedial Action Construction Activities.** This section presents the design for the remedial action construction activities at the LL Parcel. The activities include project permitting; site preparation; sediment capping; lake filling and wetland rehabilitation construction; excavation of contaminated shallow soil, backfilling, grading, and planting; soil handling and disposal; well installation; sediment cap monitoring; and implementation of institutional controls.
- **Section 6.0—1982 Dredged Material Containment Area Construction Activities.** This section presents the design for the construction activities in the DMCA. The activities include permitting, site preparation, grading, wildlife barrier/cap construction, and implementation of institutional controls.
- **Section 7.0—Compliance and Cultural Resources Monitoring.** This section describes the protection, performance, and confirmation monitoring that will be conducted during and after the remedial action construction, as well as cultural resource monitoring.
- **Section 8.0—Health and Safety.** This section discusses the health and safety components that will be followed as part of the remedial action construction, including decontamination procedures.
- **Section 9.0—Schedule and Reporting.** This section presents the schedule and the reporting that will be completed as part of the remedial action construction.
- **Section 10.0—References.** This section provides a list of documents cited in this EDR.

The appendices are organized as follows:

- **Appendix A—Lora Lake Parcel Groundwater Modeling—Support for Remedial Action Design Memoranda.** Presents results of groundwater modeling and field data collection and analyses supporting design of the sediment cleanup on the LL Parcel.
- **Appendix B—Lora Lake Parcel Pump-Down/Pump-Back Test Memorandum.** Presents an infiltration assessment of the SR 518 Construction Stormwater Pond and summarizes the Lora Lake pump down/pump-back test activities to assess groundwater inflow to Lora Lake.
- **Appendix C—Lora Lake Apartments Parcel Soil Performance Monitoring Data Report.** Presents the methodology and results of the soil performance monitoring activities conducted at the LL Apartments Parcel.

- **Appendix D—Hazardous Materials Testing and Disposal Documentation.** Presents the waste designation conducted for disposal of contaminated soil to be removed from the LL Apartments Parcel and LL Parcel.
- **Appendix E—Draft Construction Stormwater Pollution Prevention Plan.** Presents the Draft Stormwater Pollution Prevention Plan (Draft SWPPP) for stormwater and construction water management to be finalized by the selected Contractor as a pre-construction submittal.
- **Appendix F—Lora Lake Apartments Parcel Excavation Volume and Extent Analysis.** Presents the methods and design basis for determining excavation volume and extents at the LL Apartments Excavation Areas.
- **Appendix G—Lora Lake Apartments Site Geotechnical Report.** Presents geotechnical recommendations and analytical data for considerations related to grading, temporary slopes, shoring, soil reuse suitability, backfill, conceptual dewatering, and temporary and permanent erosion control.
- **Appendix H—Lora Lake Parcel Remedial Action Mitigation Plan, Engineering Floodplain Analysis, and Miller Creek Bank Stability Analysis.** Presents a functional analysis of the LL Parcel wetland rehabilitation, model results determining no flood plain impacts, and no negative impacts to the banks of Miller Creek and design elements that protect and enhance bank stability.
- **Appendix I—Geotechnical Support for the Lora Lake Parcel Remedial Action Memorandum.** Presents geotechnical recommendations for sediment removal, capping, and open-water filling of Lora Lake.
- **Appendix J—Sampling and Analysis Plan/Quality Assurance Project Plan Addendum.** Describes field compliance monitoring activities to be performed as part of the soil excavation at the LL Apartments Parcel and groundwater sampling to be performed on the LL Apartments Parcel and LL Parcel after remedial action construction.
- **Appendix K—Rating Form and Documentation for Wetland 8.** Presents the rating summary for Wetland 8.
- **Appendix L—Health and Safety Plan.** Includes protection standards and mandatory safe practices and procedures for all personnel involved with cleanup and construction activities at the Site.
- **Appendix M—Inadvertent Discovery Plan.** Includes procedures that must be followed should archaeological resources be discovered during any ground-disturbing activity.
- **Appendix N—Design Drawings.** Includes engineering design drawings for Site cleanup.

2.0 Site Description and Summary of Environmental Conditions

2.1 SITE DESCRIPTION AND BACKGROUND

The Site straddles the boundary between the cities of Burien and SeaTac, Washington (Figure 1.2). The LL Apartments Parcel is located within the City of Burien, at 15001 Des Moines Memorial Drive. The LL Parcel is located across Des Moines Memorial Drive to the southeast, and the DMCA is located northeast of the LL Parcel, both within the City of SeaTac.

A portion of the LL Apartments Parcel and all of the LL Parcel and the DMCA are within designated safety zones established for operation of the STIA 3rd Runway (Figure 1.2). Collectively, these zones are called Runway Protection Zones (RPZs). Areas of the Site are located within two subzones: the Extended Object Free Area (XOFA) and the Controlled Activity Area (CAA). The XOFA must be kept clear of objects (including structures, equipment, and terrain), with the exception of objects necessary for air navigation or aircraft ground-maneuvering purposes. The CAA is farther from the runway; however, construction of residences and public gathering places, such as shopping centers, offices, or hospitals is prohibited in the CAA (FAA 2014). The Port will own the land within the RPZs in perpetuity.

2.1.1 Lora Lake Apartments Parcel

The LL Apartments Parcel occupies approximately 8.3 acres of currently vacant land that is bounded to the north by State Route 518 (SR 518), to the east and southeast by Des Moines Memorial Drive, to the west by 8th Avenue South, and to the south by an open area currently owned by the Port and previously used as a commercial area, and the former Seattle City Light Sunnydale Substation, which was purchased by the Port in 2011. Land use to the west and north of the LL Apartments Parcel is primarily residential and light commercial. Southeast of the LL Apartments Parcel is the LL Parcel (described further in Section 2.1.2).

Historical operations at the LL Apartments Parcel included the cleaning of metal drums, barrels, and other containers between the mid-1940s and the early 1950s. It is suspected that container drainage and washing activities took place in an operations area near the center of the parcel, where container contents were then released to the ground or a sump structure. The highest concentrations of contamination on the parcel are located in this area. Between the 1960s and the 1980s, the LL Apartments Parcel was used for auto wrecking and auto storage. In 1987, apartment buildings were constructed on the LL Apartments Parcel. During development of the apartments, a small excavation to remove metals- and petroleum-contaminated soil was completed in the assumed area of container-washing operations with approval from WSDOE. In 1998, the Port purchased the LL Apartments Parcel, along with other properties east of Des Moines Memorial Drive, as part of the STIA 3rd Runway Project. The apartment buildings on the LL Apartments Parcel were vacated and subsequently demolished by the Port in 2009.

The LL Apartments Parcel is currently vacant land covered by asphalt parking areas, concrete building foundations, and landscaped areas remaining from the previous Lora Lake Apartments complex. The Port's current objective for the LL Apartments Parcel is to redevelop the property along with the adjacent Port-owned properties to the south for airport-compatible commercial or light industrial use after implementation of the remedial action.

An active City of Burien stormwater system currently traverses the LL Apartments Parcel; it includes a main stormwater line that conveys stormwater drainage from the upstream City of Burien drainage network. This main stormwater line enters on the west side of the LL Apartments Parcel and exits on the east side of the parcel. On-site stormwater collection is provided by a network of catch basins, pipes, and detention pipes that tie into the main stormwater line as it crosses the parcel. A second, smaller subsystem drains the northeastern portion of the LL Apartments Parcel and conveys water through smaller pipes. The two systems independently connect to the adjacent Des Moines Memorial Drive drainage system downstream of the LL Apartments Parcel and discharge, with additional stormwater from Des Moines Memorial Drive, to Lora Lake through an outfall located at the northwestern edge of the lake (Figure 1.2).

2.1.2 Lora Lake Parcel

The LL Parcel is located southeast of the LL Apartments Parcel, on the east side of Des Moines Memorial Drive. The LL Parcel consists of approximately 7.1 acres of land, including the approximately 3-acre Lora Lake and a Port-constructed wetland aquatic habitat mitigation area. It is bounded to the north by the SR 518 highway interchange, to the east and south by a Port-owned habitat mitigation area and the northern boundary of the STIA air operations area, and to the west and northwest by Des Moines Memorial Drive. Miller Creek runs past the southeast margin of Lora Lake (Figure 1.2). The LL Parcel and surrounding areas are located within the Miller Creek Watershed, which eventually drains to Puget Sound. The LL Parcel is located within a secured fence associated with STIA. Entry by the public is prohibited.

Lora Lake was created in the 1940s and 1950s when this area was mined for peat. After mining operations were discontinued, single-family residences were built around the west and north sides of the lake. These residences remained through the late 1990s, when the Port acquired the LL Parcel as part of its plan for constructing the STIA 3rd Runway Project. The residences were demolished by the Port before construction of the habitat mitigation area.

The LL Parcel currently lies within a habitat mitigation area developed and enhanced by the Port in compliance with requirements of Clean Water Act, Section 404 Permit No. 1996-4-02325 issued by the U.S. Army Corps of Engineers (USACE) to support aquatic, amphibian, and wetland habitat as part of the mitigation requirements associated with development of the STIA 3rd Runway in 1997 (Port of Seattle 2011). The mitigation area is designated in the NRMP as the Miller Creek/Lora Lake/Vacca Farm Wetland and Floodplain Mitigation Area (Port Mitigation Area; Parametrix 2001). The operation and maintenance requirements for the Port Mitigation Area are described in the NRMP. The mitigation plan requirements support specific ecological functions, but the functions are managed within the context of the Port's Wildlife Hazard Management Plan (WHMP; Port of Seattle 2005), the controlling authority for this special-use area. The WHMP provisions require, and result in, careful control of birds, mammals, and plants within the area to minimize aircraft navigation dangers associated with bird strikes and wildlife in the runway area. The existing Restrictive Covenant for the Miller Creek/Lora Lake/Vacca Farm Wetland and Floodplain Mitigation Area (Mitigation Area Restrictive Covenant) prohibit any future development on the LL Parcel, which, after the remedy implementation, will be maintained as a protected wetland habitat area in perpetuity.

As noted in Section 2.1.1, Lora Lake currently receives stormwater runoff from the LL Apartments Parcel, the City of Burien drainage areas upstream of the LL Apartments Parcel, and the surrounding roadways downstream of the LL Apartments Parcel through a single outfall located near the northwestern edge of Lora Lake. This outfall discharges into a sediment settling basin that was constructed with a rock berm in the northwest corner of the lake. Additionally, the lake receives non-point source overland flow from the LL Parcel. An overflow discharge culvert connects Lora Lake and Miller Creek at the southeastern edge of the lake.

2.1.3 1982 Dredged Material Containment Area

The DMCA is located adjacent to the LL Parcel, to the northeast, on Port property. The DMCA is located within a secured fence associated with STIA that is monitored and access-controlled by Port security. Entry by the public is prohibited.

In 1982, King County dredged approximately 4 feet of sediment from the bottom of Lora Lake in response to complaints from residents around the lake regarding excessive siltation caused by stormwater discharge into the lake. At this time, King County, which owned the stormwater system, arranged with the Port to place the dredged material in a specifically constructed facility on Port-owned property northeast of Lora Lake. The historical project plans for the dredging work indicate that a total of 16,000 cubic yards of material would be dredged, then placed and dewatered inside an approximately 120,000-square-foot area surrounded by a constructed soil berm. The dredging project was implemented in 1982. The dredged spoil containment area is now referred to as the DMCA.

The DMCA covers an area of approximately 2.75 acres, according to the project plans and a review of aerial photographs; as-built documentation for the dredging project has not been located. The eastern half of the DMCA is an approximately 1.5-acre vegetated area covered by a few trees and a mix of grasses and invasive and pioneering plant species, including Scotch broom, alder saplings, Himalayan blackberry, and butterfly bush. The remaining approximately 1.25 acres of land is the location of the approach lighting system for the STIA 3rd Runway, which was constructed in 2006. This area has been regraded and covered with gravel and is kept vegetation-free by the Port; it is used for construction staging. The DMCA is located outside the Port Mitigation Area. It is subject to the requirements of the WHMP.

Future land uses in the DMCA will be airport-compatible uses in compliance with the Federal Aviation Administration (FAA) RPZs, such as temporary construction laydown or equipment storage.

2.2 SITE GEOLOGY AND HYDROGEOLOGY

The Site is underlain primarily by glacial recessional outwash deposits thought to have been deposited in a southwest-northeast-trending ancestral channel roughly corresponding to the present-day Miller Creek valley. In the northwestern portion of the Site, on the LL Apartments Parcel, the recessional outwash deposits are largely overlain by fill material. On the lower elevation LL Parcel and DMCA to the southeast, closer to the center of the outwash channel, the recessional outwash deposits thicken, and recent deposits including peat are encountered at the ground surface overlying the recessional outwash, or they have been excavated to form the current lake. Recessional outwash deposits in the Site vicinity are underlain by glacial till on top of glacial advanced outwash deposits, although the continuity of the till beneath the Site has not been confirmed.

In the northern portion of the LL Apartments Parcel, recessional outwash deposits are present at the ground surface, and the remainder of the parcel consists of a discontinuous sandy fill layer that overlies recessional outwash deposits and was substantially regraded during construction of the Lora Lake Apartments complex. The fill unit in the vicinity of the LL Apartments Parcel is observed to have a variable thickness of up to 15 feet and is composed of medium-dense to dense, fine- to coarse-grained sand with rounded gravel. The underlying recessional outwash deposits are variable in thickness but generally extend to depths of 15 to 45 feet in the vicinity of the LL Apartments Parcel, increasing with depth toward the southwest, and they may be deeper in the vicinity of the LL Parcel because of their proximity to the center of the ancestral outwash channel. The recessional outwash deposits are characterized as dense to very dense, fine- to coarse-grained sand, with gravels up to 2 inches in diameter and occasional silt lenses. At the bottom of the recessional outwash deposits, a silt unit about 10 feet thick was encountered in the eastern portion of the LL Apartments Parcel, which likely indicates a transition into glacial till deposits (Aspect Consulting 2008).

The LL Parcel is also underlain primarily by recessional outwash deposits, which are exposed at the surface and locally may include recent alluvial and recent lacustrine deposits. The most notable of these recent deposits are peat deposits that were mined from Lora Lake and are still present in a portion of the lake sediments and surrounding area south of Lora Lake (Papadopulos 2006). As part of the remedial investigation (RI), subsurface sediment cores were collected from Lora Lake at depths up to 5.5 feet below mudline. The sediment types were observed to be variable between the three sampling locations. They included sandy silts with gravels, silts, and a thick reddish-brown peat layer in one of the cores beneath a layer of silt (Floyd|Snider 2015a).

Beneath the recessional outwash deposits on the LL Parcel, it is inferred on the basis of nearby borings south and east of Lora Lake on the east side of the Miller Creek valley that till deposits form a continuous layer between the recessional outwash and advance outwash deposits below. It is unknown whether the till deposits are continuous in this area, which is near the center of the ancestral outwash channel, or whether they were eroded, leaving the underlying advance outwash deposits (Aspect Consulting 2010).

The DMCA is covered with a fill layer similar to that of the LL Apartments Parcel (i.e., fine- to coarse-grained sand with some silty sands and gravels), with a dredged material horizon of dark brown silty sand with peaty material over recessional outwash, as observed in test pits advanced to 6 feet below ground surface (bgs) as part of the RI (Floyd|Snider 2015a).

2.2.1 Hydrogeology

The uppermost groundwater aquifer in the vicinity of the Site is the recessional outwash aquifer, which is a shallow, unconfined sand and gravel aquifer that is present in fill, recessional outwash, and recent alluvial and lacustrine deposits including peat. Where it is present, a till confining unit (aquitard) acts as a low-permeability barrier to limit potential downward groundwater flow into the deeper advance outwash deposits and regional aquifers. The hydraulic conductivity of recessional outwash aquifer materials is estimated to range from 96 to 263 feet per day for sand and gravel outwash to 22 to 25 feet per day for silty sand and sandy silt outwash or alluvium. The hydraulic conductivity of shallow wetlands soils is estimated to range from 5 to 12 feet per day (Aspect Consulting 2015). The hydraulic conductivity of pre-remediation peat deposits is estimated to be 1.1 foot per day (Appendix A).

The groundwater surface in the recessional outwash aquifer at the Site generally corresponds with the topography and occurs as deep as approximately 22 feet bgs at the Lora Lake Apartments Parcel. Groundwater occurs at shallower depths on the lower elevation LL Parcel and DMCA. At Lora Lake and in surrounding wetlands, the groundwater surface intersects with the ground surface.

Based on water level measurements representative of seasonal change (Aspect Consulting 2015), groundwater flow in the recessional outwash aquifer in the vicinity of the LL Apartments Parcel is to the southeast, perpendicular to Des Moines Memorial Drive, toward Lora Lake. The horizontal gradient of the groundwater surface on the LL Apartments Parcel steepens from approximately 0.01 foot per foot on the west side to 0.04 foot per foot closer to Des Moines Memorial Drive. The horizontal gradient steepens further to approximately 0.06 feet per foot on the west side of Lora Lake. Groundwater on the LL Parcel and DMCA generally converges on Lora Lake and continues southward into Miller Creek. Groundwater on the LL Parcel north of the lake flows southward toward the lake at a gradient of approximately 0.02 foot per foot, and the groundwater flow east of the lake and north of Miller Creek is southwestward toward the lake, at a similar gradient. Groundwater flow continues its southward direction downgradient of Lora Lake, where groundwater discharges to Miller Creek.

Shallow groundwater in the recessional outwash aquifer generally discharges to Lora Lake, surrounding wetlands, and Miller Creek. Groundwater interaction with Miller Creek also includes "losing" stretches, where surface water recharges groundwater. The recessional outwash aquifer and Lora Lake are in hydraulic continuity, although the presence of peat deposits surrounding the lake and sediments on the lake bottom, both of which have lower hydraulic conductivity than the recessional outwash deposits, limits the rate of groundwater discharge to the lake. Slow recovery of the lake level recovery was observed after the lake level was intentionally drawn down (Appendix B). Water level data indicate that Lora Lake is hydraulically connected to Miller Creek by means of groundwater flow out of the south side of the lake, as well as surface water leaving the lake through the overflow culvert in the southeast corner of the lake (Aspect Consulting 2015).

Whether a till aquitard forms the lower boundary of the recessional outwash aquifer throughout the Site or, in places, the recessional outwash aquifer directly overlies advance outwash, the recessional outwash aquifer in the vicinity of Lora Lake appears to be prevented from discharging to the advance outwash aquifer by upward vertical gradients associated with groundwater discharge to Miller Creek throughout the valley. Upward vertical gradients are present between the regional aquifer and the overlying advance outwash aquifer near the center of the recessional outwash channel. Groundwater contours in the advance outwash aquifer indicate that this aquifer ultimately discharges to Miller Creek as it flows to the southwest, toward Puget Sound (Aspect Consulting 2010), suggesting upward groundwater flow into the recessional outwash aquifer. The successful calibration of a numerical groundwater flow model provides support for these inferred upward gradients, as well as other hydrogeologic interpretations. The numerical model, which showed a good comparison between modeled and measured values, included upward vertical gradients in the recessional outwash aquifer, groundwater discharge to Lora Lake, and a continuous till aquitard (Appendix A).

2.3 CONTAMINANTS OF CONCERN

The COCs identified for the Site in the RI/FS and the CAP are presented in Table 2.1. These contaminants are consistent with the past site uses, assuming that barrel-washing residue would contain a variety of chemicals, such as wood-treating compounds, solvents, and petroleum products.

Table 2.1
Contaminants of Concern

Contaminant	Soil	Groundwater	Lora Lake Sediment
Arsenic	✓	✓	✓
Carcinogenic polycyclic aromatic hydrocarbons	✓	✓	✓
Pentachlorophenol	✓	✓	✓
Dioxins/Furans	✓	✓	✓
Total petroleum hydrocarbons (gasoline, diesel, and heavy oil range hydrocarbons)	✓	✓	
Lead	✓		✓
Toluene	✓		
Ethylbenzene	✓		

2.4 CLEANUP STANDARDS

Cleanup standards, including both the cleanup levels for each COC in each impacted medium on each parcel and the applicable points of compliance (POCs), have been established for the Site in both the RI/FS and the CAP and are summarized in this section. Refer to the RI/FS and the CAP for a more detailed description of these cleanup standards (Floyd|Snider 2015a; State of Washington 2015).

To address Lora Lake sediment contamination, the planned remedial action includes capping and filling the open water to rehabilitate Lora Lake to a wetland system (described further in Section 5.0). Once implemented, the remedy will result in a contiguous wetland on the LL Parcel. The wetland will be designed so that open water does not occur for more than 6 consecutive weeks per year; hence, the wetland surface will be classified as soil because it will not meet the definition of sediment in the Sediment Management Standards (WAC 173-204-505(22)). After the remedy implementation, soil and groundwater cleanup levels and the associated MTCA regulations will apply to the entire LL Parcel rather than sediment-based cleanup levels.

2.4.1 Cleanup Levels

2.4.1.1 Soil Cleanup Levels

Different soil cleanup levels apply to each of the three parcels at the Site because of the different current and future uses and associated exposure pathways for these parcels. The soil cleanup levels for the LL Apartments Parcel, LL Parcel, and DMCA are summarized in Tables 2.2, 2.3, and 2.4, respectively.

For the LL Apartments Parcel, the applicable soil cleanup levels in Table 2.2 are MTCA Method B (or MTCA Method A where Method B is unavailable) cleanup levels based on the protection of human health from contaminant exposure by direct contact with soil, with the exception of arsenic for which the soil cleanup level is based on natural background concentrations in Washington state soils. Additionally, a soil remediation level for dioxins/furans was selected for use at the LL Apartments Parcel to define which dioxins/furans-contaminated soils must be excavated and disposed of at an off-site facility.

Table 2.2
Lora Lake Apartments Parcel Soil Cleanup Levels

Contaminant	Cleanup Level	Remediation Level
Dioxins/Furans TEQ	13 pg/g	100 pg/g
Arsenic	20 mg/kg	—
Lead	250 mg/kg	—
Gasoline range hydrocarbons	100 mg/kg	—
Sum of diesel and heavy oil range hydrocarbons	2,000 mg/kg	—
Pentachlorophenol	2,500 µg/kg	—
cPAHs TEQ	137 µg/kg	—
Ethylbenzene	8,000 mg/kg	—
Toluene	6,400 mg/kg	—

Note:
— A remediation level has not been defined.

Abbreviations:
cPAH Carcinogenic polycyclic aromatic hydrocarbon
µg/kg Micrograms per kilogram
mg/kg Milligrams per kilogram

For the LL Parcel, the applicable soil cleanup levels in Table 2.3 for gasoline range hydrocarbons, pentachlorophenol (PCP), cPAHs, ethylbenzene, and toluene are MTCA Method B (or Method A where Method B is unavailable) cleanup levels based on the protection of human health from contaminant exposure by direct contact with soil. The soil cleanup level for arsenic is based on natural background concentrations in Washington state soils. The soil cleanup levels for lead and the sum of diesel and heavy oil range hydrocarbons at the LL Parcel are based on MTCA ecological indicator soil concentrations that are protective of terrestrial plants and animals, and the dioxins/furans TEQ soil cleanup level at the LL Parcel is based on the natural background concentration for dioxins/furans TEQ in Washington state soils.

Table 2.3
Lora Lake Parcel Soil Cleanup Levels

Contaminant	Cleanup Level
Dioxins/Furans TEQ	5.2 pg/g
Arsenic	20 mg/kg
Lead	50 mg/kg
Gasoline range hydrocarbons	100 mg/kg
Sum of diesel and heavy oil range hydrocarbons	200 mg/kg
Pentachlorophenol	2,500 µg/kg
cPAHs TEQ	137 µg/kg
Ethylbenzene	8,000 mg/kg
Toluene	6,400 mg/kg

The DMCA met the MTCA criteria for establishing soil cleanup levels for industrial land use. The applicable soil cleanup levels in Table 2.4 are MTCA Method C soil cleanup levels that are protective for industrial use and workers who could be exposed to contaminants by direct contact with soil, with the exception of the petroleum hydrocarbon cleanup levels, which are based on the MTCA Method A cleanup levels.

Table 2.4
1982 Dredged Material Containment Area Soil Cleanup Levels

Contaminant	Cleanup Level
Dioxins/Furans TEQ	1,700 pg/g
Arsenic	88 mg/kg
Lead	1,000 mg/kg
Gasoline range hydrocarbons	100 mg/kg
Sum of diesel and heavy oil range hydrocarbons	2,000 mg/kg
Pentachlorophenol	330,000 µg/kg
cPAHs TEQ	18,000 µg/kg
Ethylbenzene	350,000 mg/kg
Toluene	280,000 mg/kg

2.4.1.2 Groundwater Cleanup Levels

The groundwater cleanup levels for the Site are applied site-wide (Table 2.5). The applicable groundwater cleanup levels are based on the protection of human health from contaminant exposure by drinking water consumption. They are either MTCA Method B (or MTCA Method A where Method B is unavailable) groundwater cleanup levels (dioxins/furans TEQ, arsenic, petroleum hydrocarbons, cPAHs TEQ) or state and federal drinking water maximum contaminant levels (PCP).

Table 2.5
Site-Wide Groundwater Cleanup Levels

Contaminant	Cleanup Level
Dioxins/Furans TEQ	6.7 pg/L
Arsenic	5 µg/L
Gasoline range hydrocarbons	1,000 µg/L
Sum of diesel and heavy oil range hydrocarbons	500 µg/L
Pentachlorophenol	1 µg/L
cPAHs TEQ	0.12 µg/L

Abbreviations:
µg/L Micrograms per liter
pg/L Picograms per liter

2.4.2 Points of Compliance

POCs (i.e., locations at which the cleanup levels must be achieved) have been established for soil, groundwater, and sediment throughout the Site in the CAP. These POCs are shown in Figure 2.1 and summarized in the following subsections.

2.4.2.1 Soil Points of Compliance

For the LL Apartments Parcel, the POC for the soil cleanup levels is based on the direct contact exposure pathway. The MTCA standard POC for this pathway is throughout the LL Apartments Parcel from the ground surface to a depth of 15 feet bgs. However, WSDOE also recognizes that it acceptable to use containment to comply with the cleanup standards. Soil with contaminant concentrations exceeding the soil cleanup levels within the POC must be contained or excavated. The soil POC extends to the LL Apartments Parcel boundary, plus a zone of the adjacent former Seattle City Light property and a zone of the adjacent area between the east side of LL Apartments Parcel boundary and Des Moines Memorial Drive (Figure 2.1), where in coordination with WSDOE during the CAP preparation, it was determined that the exceedances of the dioxins/furans TEQ cleanup level are greater than the range of exceedances observed in residential neighborhoods and are, therefore, assumed to be associated with the Site. This POC also establishes the area that must be covered by a barrier to wildlife to prevent wildlife exposures to contaminated soils as part of the Terrestrial Ecological Evaluation (TEE) exclusion for the LL Apartments Parcel. The POC for soil to protect groundwater at the LL Apartments Parcel is the limits of soil with dioxins/furans TEQ concentrations exceeding the LL Apartments Parcel remediation level of 100 pg/g.

For the LL Parcel, the soil POC encompasses the areas in which the dioxins/furans TEQ concentrations and lead concentrations in soil exceed their cleanup levels (Figure 2.1). The depth of the conditional soil POC for terrestrial exposure is 6 feet bgs.

Industrial soil cleanup levels were applied to the DMCA. An institutional control is required when industrial cleanup levels are used (WAC 173-340-440(4)(c)). The POC to which the institutional control will apply is the entire extent of the DMCA. This POC is also used to establish the area that must be covered by a barrier to wildlife to prevent wildlife exposures to contaminated soils as part of the TEE exclusion for the DMCA.

2.4.2.2 Groundwater Point of Compliance

The standard POC for groundwater under MTCA is "throughout the site from the uppermost level of the saturated zone extending vertically to the lowest most depth which could potentially be affected by the site" (WAC 173-340-720(8)(b)). At the Site (including the future conditions of Lora Lake after remedy implementation), the standard POC for groundwater is applied (Figure 2.1).

2.4.2.3 Lora Lake Sediment Point of Compliance

Modeling has indicated that COC concentrations in Lora Lake surface sediment may cause exceedances of surface water quality standards for dioxins/furans unless a remedial action is performed. The POC for the existing sediment, the area within Lora Lake with contaminant concentrations in excess of the sediment cleanup standards, is shown in Figure 2.1. This area must be remediated in a manner that will address surface sediment COC concentrations and prevent leaching of COCs to surface water.

2.5 CONTAMINANT DISTRIBUTION

This section summarizes the current distribution and extent of Site COCs in affected soil, groundwater, and sediment at the Site based on information in the RI/FS and CAP, as well as recently collected soil performance monitoring data from the LL Apartments Parcel. A summary of the horizontal distribution of contamination at the Site is provided in Figure 2.2.

2.5.1 Lora Lake Apartments Parcel Soil

Soil contamination on the LL Apartments Parcel reflects the use history of the Site. Contamination is greatest and deepest in the central area of the parcel, the primary location of the barrel-washing operations (Figure 2.2). High concentrations of COCs also occur in the southeastern portion of this parcel, where it is assumed that during development of the land for apartments, soil was pushed downslope to the east for grading. Generally, the areas of higher concentrations of dioxins/furans correspond with the areas with exceedances of cleanup levels for COCs other than dioxins/furans.

Soil performance monitoring was conducted on the LL Apartments Parcel in September and November 2015 and February 2016 to fully delineate the vertical and horizontal extents of contaminated soil on this parcel before implementation of the selected remedial action. This performance monitoring was conducted per the requirements of the WSDOE-approved *Lora Lake Apartments Site Compliance Monitoring Plan* (CMP; Floyd|Snider 2015b), which is discussed in further detail in Section 7.0. The methodology used for this soil performance monitoring and the results from the sampling in September and November 2015 and February 2016 are presented in the *Lora Lake Apartments Parcel Soil Performance Monitoring Data Report*, included as Appendix C. The results of the September and November 2015 soil performance monitoring indicated three locations in which the vertical extent of contaminated soil containing dioxins/furans had not been fully delineated. Additionally, the horizontal extent of surface soil contamination with dioxins/furans in one location and the horizontal extent of surface soil contamination with lead in one location had not been fully delineated. Therefore, additional performance monitoring sampling was conducted in February 2016 to delineate the vertical and horizontal extents in these five locations. The February 2016 sampling events were also conducted to potentially decrease the horizontal extent of the excavation in areas with less data density. The results of the February 2016 sampling fully delineated the extent of contaminated soil. The results of the February 2016 additional samples also successfully decreased the horizontal extent of the excavation in the areas with less data density.

The horizontal extents of soil on the LL Apartments Parcel with contaminant concentrations exceeding the LL Apartments Parcel soil cleanup levels, as well as the dioxins/furans TEQ remediation level are based on the recently collected 2015 and 2016 soil performance monitoring data and the previously collected RI/FS data (Figure 2.2). A cross section showing the deepest vertical extent of soil with concentrations exceeding the dioxins/furans TEQ remediation level or the cleanup levels for the other Site COCs across the LL Apartments Parcel is shown in Figure 2.3; the location of the cross section is shown in Figure 2.2. These horizontal and vertical extents of soil contamination were used to define the extent of the excavation required for the remedial action on this parcel, as further described in Section 4.3.

2.5.2 Lora Lake Apartments Parcel Groundwater

Groundwater contamination at the Site is limited to the LL Apartments Parcel. Groundwater downgradient of the LL Apartments Parcel, beneath the LL Parcel, and beneath and downgradient of the DMCA has not been affected by Site contamination (Figure 2.2).

Historical releases and operations on the LL Apartments Parcel have affected shallow groundwater in two on-site wells, and deeper groundwater beneath this parcel has not been affected by contamination. Well MW-1, located in the central portion of the LL Apartments Parcel where barrel-washing activities occurred, has had dioxins/furans TEQ and arsenic concentrations exceeding their groundwater cleanup levels (Figure 2.2). In MW-1, the greatest dioxins/furans TEQ concentration detected in groundwater is approximately 5.7 times its cleanup level, and the arsenic concentration has exceeded its cleanup level by approximately 2.8 times. Well MW-5, located on the eastern boundary of the LL Apartments Parcel and downgradient of the historical barrel-washing activities, has had detected arsenic and PCP concentrations exceeding their groundwater cleanup levels. The greatest detected arsenic and PCP concentrations in this well are approximately 1.1 and 1.4 times their cleanup levels, respectively.

2.5.3 Lora Lake Parcel Soil

In shallow soils along the western edge of the LL Parcel, concentrations of dioxins/furans and lead exceed their cleanup levels. Dioxins/furans TEQ concentrations exceeded the cleanup level of 5.2 pg/g in 10 of the 29 soil samples collected in this area. In 5 of the 10 samples with exceedances, the concentrations were more than two times the cleanup level. Lead exceeded its cleanup level of 50 mg/kg in 2 of the 19 soil samples collected and analyzed for lead, at concentrations of 58 and 64 mg/kg. These lead concentrations were detected in the surface soil (0 to 0.5 foot bgs).

On the LL Parcel, contaminated soil exists in two areas along the western property boundary. These two areas cover approximately 0.2 acre (Figure 2.2). In the southern contaminated area identified on this parcel, soil contamination was identified only in the surface soil. In the northern contaminated area on this parcel, dioxins/furans soil contamination was bounded vertically at a depth of 2 feet bgs in the northern portion of this area; however, dioxins/furans contamination has not been bounded vertically in the southern portion of this area, with a dioxins/furans TEQ concentration of 40.1 pg/g at a depth interval of 4 to 5 feet bgs. Soil performance monitoring will be conducted in this unbounded portion of the northern contaminated area after the excavation of the LL Parcel Shallow Soil Cleanup Area has been completed to document soil concentrations at the excavation base in this area (refer to Section 7.1.6 for further details of this performance monitoring).

2.5.4 Lora Lake Parcel Sediment

Lora Lake sediment has been affected by elevated dioxins/furans TEQ concentrations, ranging from 7.55 to 217 pg/g. Detected concentrations of arsenic and lead in Lora Lake sediments were greater than the Sediment Cleanup Objective levels based on the protection of benthic aquatic organisms but less than Cleanup Screening Levels, as evaluated in the RI/FS. Biological toxicity testing demonstrated that the sediments would not cause adverse effects on benthic organisms. In the RI/FS, the extent of sediment contamination in Lora Lake was presumed to be the full extent of the LL Parcel Sediment Cleanup Area, or the lake footprint.

2.5.5 1982 Dredged Material Containment Area

COC concentrations in soil in the DMCA were all less than their cleanup levels, which are based on industrial land use.

3.0 Site Sequencing and Construction Water Management and Treatment

This section discusses the sequencing of the construction work on the three Site parcels relative to one another. Additionally, this section summarizes three other independent infrastructure construction projects occurring in the vicinity of the Site. These projects are expected to be implemented either before or during the time period currently planned for remedial action construction on the Site. This section describes how these projects are expected to affect construction at the Site.

3.1 SEQUENCING OF WORK ON THE SITE PARCELS

Construction on three Site parcels is scheduled to begin in the spring of 2017. Remedial action construction on these parcels will occur over two construction seasons, Construction Season 1 (work completed during 2017) and Construction Season 2 (work completed during 2018).

On the LL Apartments Parcel, the majority of the remedial action construction is anticipated to occur in 2017, during Construction Season 1, including site preparation, excavation, backfilling, and grading; however, the Contractor will be given the option of conducting the LL Apartments Parcel remedial action in 2018 in Construction Season 2 to optimize the timing of work activities and water treatment and management. The Port-owned property located south of the LL Apartments Parcel will be used for construction staging associated with the remedial action construction on the LL Apartments Parcel. Within 4 years of completion of the remedial action construction on the LL Apartments Parcel, the wildlife barrier/cap must be constructed on the LL Apartments Parcel (State of Washington 2015), and is expected to be constructed in coordination with site redevelopment.

Remedial action construction on the LL Parcel will occur over both construction seasons. During Construction Season 1, work on the LL Parcel will include site preparation, sediment capping, fill placement within Lora Lake, and excavation of the areas of contaminated shallow soil. Between Construction Seasons 1 and 2, the lake fill material will be allowed to settle, as anticipated on the basis of a geotechnical settlement evaluation described in Section 5.0. The Contractor will return to the LL Parcel in the summer of 2018 to place any additional fill needed to bring the Site to final fill grade, install the sediment cap monitoring wells, place wetland soils and drainage channel materials, perform final grading, and install the plantings. Construction is expected to be completed by the fall of 2018. A portion of the DMCA will be used for construction staging associated with the LL Parcel remedial action construction, requiring preparation of the DMCA for construction staging use during the spring of 2017. This DMCA preparation work includes the construction of an engineered surface that functions as a barrier to terrestrial growth, ecological exposure, and direct contact by workers, as described in Section 6.0.

A conceptual summary of estimated timing of construction activities on each of the Site parcels is provided in Figure 3.1. After the Contractor has been selected, a detailed construction schedule will be developed to include more accurate dates and durations for each phase of the project.

3.2 CONSTRUCTION WATER MANAGEMENT AND TREATMENT

Project construction stormwater is anticipated to be generated during field activities including lake dewatering, stormwater runoff, earthwork, groundwater dewatering, and other operations. Some remedial excavation areas within the LL Apartments Parcel will require dewatering. The project construction stormwater and water generated during dewatering will be conveyed to an on-site water treatment system that is expected to be operated as necessary throughout the project duration. Any construction water not infiltrated on-site will be trucked off-site for disposal at a permitted facility. The primary COC for construction water treatment is dioxins/furans, as this is the Site-wide primary COC. The pumping rates from the LL Apartments Parcel and the lake, the lake stage, and the SR 518 Construction Stormwater Pond stage will be continually monitored by the Contractor. Water will be treated using a system applying all known, available, and reasonable methods of prevention, control, and treatment (AKART). The Port will implement project construction and stormwater management in compliance with the Port's 2017 Lora Lake Apartments MTCA Remediation Projects specifications, which are more stringent than the Construction Stormwater General Permit (CSWGP) conditions, and BMP C250 of the Stormwater Management Manual for Western Washington (WSDOE 2014). Site-specific treatment system requirements will include the following:

- **Pre-Treatment:** Oil/water separation, turbidity, and any pH adjustment required to enable adequate performance of the treatment system per Ecology Use Conditions shall occur during pre-treatment.
- **Treatment:** An Ecology-approved general use level technology for construction activities shall be utilized for treatment to condition the water for filtration and subsequent granulated activated carbon adsorption.
- **Filtration:** Water shall be passed through a sand filtration system to remove solids. Additional filtration (such as bag or canister) may be required.
- **Adsorption:** Granular activated carbon shall be used to remove dissolved constituents.
- **Final Treatment:** This step may include pH or dissolved oxygen adjustment to satisfy the discharge limits. It also shall include monitoring and control of residual flocculent concentrations to satisfy discharge limits and Ecology use conditions.
- **Operation:** The system will be operated by a Construction Water Treatment Operator trained and certified per Ecology requirements.

At the time of this report, the Port is pursuing a National Pollutant Discharge Elimination System (NPDES) CSWGP, administered by WSDOE, to allow for potential contingency overflow of treated construction water from the SR 518 Construction Stormwater Pond to an existing vegetated swale that discharges to Miller Creek. While not discussed further in this report (given that coordination with WSDOE is ongoing), this option will be available to the Contractor in the event that a NPDES CSWGP is secured. The proposed approach for construction water management and treatment are described in the following sections.

3.2.1 Lora Lake Apartments Parcel

During construction, the LL Apartments Parcel will be maintained and graded as needed to allow continued infiltration of stormwater to the maximum extent. Stormwater that does not infiltrate and is within the active construction area (i.e., disturbed ground or area with potential for contaminated soil) will be collected and treated prior to discharge. The current proposed plan includes pumping collected stormwater through an existing storm drain (that during construction will no longer receive the City of Burien stormwater, which will be rerouted as part of the City of Burien's retrofit project prior to the start of construction work) that traverses under Des Moines Memorial Drive from the LL Apartments Parcel to the LL Parcel. The existing storm drain will be sliplined by the Contractor and the water will be conveyed to a construction water treatment system, located on the LL Parcel or DMCA, before being discharged to the SR 518 Construction Stormwater Pond for infiltration.

3.2.2 Lora Lake Parcel

The lake surface water currently discharges to Miller Creek via a 12-inch-diameter culvert in its southeast corner. Before any in-water work begins within the lake, the lake will be drawn down to below the culvert elevation and the culvert plugged to isolate the lake from the creek and protect the creek water quality. Additionally, an existing failed section (e.g., exchanging surface water) of the eastern lake berm and any other potential overflow points will be temporarily augmented to maintain a hydrologic barrier between the creek and the lake.

Once fill of the lake has begun, daily pumping, treatment, and discharge of the lake water will be required to prevent overflow of the lake. A water conveyance system will pump the lake water to the construction water treatment system, located on the LL Parcel or DMCA, before being discharged to the SR 518 Construction Stormwater Pond for infiltration.

3.2.3 Water Treatment Effluent Limits and Discharge

As part of construction water treatment system operation, the Contractor will conduct daily testing for turbidity, pH, and visible sheen to ensure compliance with effluent limits prior to discharge. Proof of Treatment process will be conducted twice during the project and will include physical and chemical analyses of treated water prior to discharge. A Proof of Treatment effluent sample will be collected (1) prior to initial project start of discharging to the SR 518 Construction Stormwater Pond, and (2) prior to starting discharge of the water treated from the LL Apartments Parcel excavation area for laboratory analysis of dioxins/furans and total suspended solids to demonstrate Proof of Treatment and compliance with applicable site-wide groundwater cleanup levels described in Section 2.4.1.2. There is an approximate 3-week turn-around-time for dioxins/furans analysis at the laboratory; therefore, the Contractor will hold treated water during these periods of time while awaiting analytical results, without discharge, and conduct other project activities. Table 3.1 summarizes the minimum monitoring requirements and effluent limits for the construction water treatment system.

Table 3.1
Construction Water Treatment Effluent Limits

Parameter	Monitoring Location	Frequency	Effluent Limit
Turbidity	Pre-treatment	Daily	<500 NTU
Turbidity	Effluent	Daily	<5 NTU
pH	Effluent	Daily	6.5 to 8.5
TPH	Effluent	Daily	<5 mg/L, and no visible sheen[1]
Dioxins/Furans	Effluent	Twice; Proof of Treatment Testing	6.7 pg/L
Total Suspended Solids	Effluent	Twice; Proof of Treatment Testing	Informational

Note:
1 TPH numerical limit must be applied and a sample must be taken ONLY when visible sheen is observed. The numerical limit will not apply when there is no visual sheen observed.

Abbreviation:
TPH Total petroleum hydrocarbons

Sampling for laboratory analysis of effluent discharge will be performed by the Contractor's Water Treatment System Operator to meet project specification requirements and demonstrate system performance. The collected samples will be analyzed by a WSDOE-certified laboratory. Analytical reporting limits for dioxins/furans will be less than the specified effluent limit. The project specifications require that the Proof of Treatment effluent samples collected for chemical analysis must have a measured turbidity level less than the effluent limit of 5 NTU and must be representative of consistent system performance.

3.3 CONSTRUCTION PROJECTS IN THE VICINITY OF THE SITE

There are three infrastructure construction projects occurring adjacent to the Site. These projects include realignment of the on-ramp to SR 518 from Des Moines Memorial Drive, construction of a new eastbound off-ramp from SR 518 to Des Moines Memorial Drive, and retrofitting of the City of Burien stormwater conveyance system to prevent the current system from traversing the LL Apartments Parcel and discharging to Lora Lake. The locations of these projects relative to the Site are shown in Figure 1.2. A brief summary of each of these projects is provided in the following subsections, along with details of the expected time frame for each project and how each project may affect the construction at the Site.

3.3.1 State Route 518 On-Ramp Realignment Construction

Realignment of the eastbound SR 518 on-ramp will occur in the northern portion of the LL Parcel (Figure 1.2); however, this construction will be located outside the LL Parcel remedial cleanup areas and the area covered by the existing Mitigation Area Restrictive Covenant. This construction project is expected to begin in 2016 and be completed before the construction of the remedial action on the Site begins; however, the duration of this effort is currently unknown. Construction staging for this work will use a portion of the Port's paved roadway located on the LL Parcel extending between Des Moines Memorial Drive and the DMCA. This paved roadway will also be used during construction of the remedial action on the LL Parcel and during construction in the DMCA. All other existing roads and the current on-ramp alignment are to be removed as part of this work and will not be available for use after completion of SR 518 project. The current LL Parcel design and contractor access and haul route plan include the SR 518 on-ramp post-construction road configuration. The existing SR 518 Construction Stormwater Pond will remain in place during this on-ramp work, and it is expected to be available during construction of the Lora Lake remedial action for infiltration of lake water during sediment capping and lake filling (refer to Section 5.3 for further details). The Port will be responsible for managing the SR 518 on-ramp realignment construction project.

3.3.2 State Route 518 Off-Ramp Construction

A new SR 518 eastbound off-ramp is also currently being planned by the City of Burien in the Site vicinity, in coordination with the Washington State Department of Transportation (WSDOT). Construction of this off-ramp will use a portion of the northeast corner of the LL Apartments Parcel (Figure 1.2). No excavation of contaminated soil is required in this portion of the LL Apartments Parcel (refer to Section 4.3). It is assumed that any required site preparation work (e.g., vegetation clearing, foundation removal, or grading) within the footprint of the SR 518 off-ramp project area will be conducted by WSDOT. WSDOT will be responsible for managing the SR 518 off-ramp construction project. It is assumed that WSDOT will purchase the portion of the LL Apartments Parcel from the Port, and as part of this land transaction, WSDOT will enter into a prospective purchaser agreement with the Port and become a signatory of the Site CD. Responsibility for implementation of environmental covenants and the wildlife barrier/cap in this area will be negotiated as part of the property sale and coordinated with WSDOE. Construction of the SR 518 off-ramp is expected to begin in fall of 2017, and the project duration is unknown.

3.3.3 City of Burien Stormwater System Improvements

A portion of the City of Burien's existing stormwater system drains an approximately 80-acre subbasin of the City of Burien through a main line that traverses the LL Apartments Parcel and discharges directly to Lora Lake. The City of Burien is currently in the process of designing stormwater quality retrofit improvements in the vicinity of the Site that include a new detention facility and associated conveyance systems. These retrofit improvements are funded in part by a grant from WSDOE and address concerns about contaminants from urban development in this discharge that would otherwise drain to the future rehabilitated wetland on the LL Parcel. The retrofit project is being conducted in conjunction with the Port and the City of Burien's Northeast Redevelopment Area (NERA) and Master Drainage Plan (MDP) improvements addressing stormwater runoff entering Miller Creek at and above the Port Mitigation Area.

In addition to providing water quality treatment, the combined 8th Avenue South subbasin stormwater retrofit and NERA MDP improvements will significantly reduce the total volume and peak discharge rate of stormwater runoff flowing into Lora Lake. The contributing drainage area will decrease from 79.1 acres under current conditions to just over 1 acre under proposed conditions. The currently proposed retrofit design includes the construction of a new City of Burien trunk line running along 8th Avenue South, which will include collection of runoff from the LL Apartments Parcel. The alignment continues south on 8th Avenue South, then east along South 152nd Street, under Des Moines Memorial Drive and discharges into the Vacca Farm portion of the Miller Creek/Lora Lake/Vacca Farm Wetland and Floodplain Mitigation Area (Mitigation Area Restrictive Covenant) as shown on Figure 1.2. The Vacca Farm portion eventually discharges to Miller Creek just north of South 156th Street.

The new 8th Avenue South trunk line will tie into a future regional detention facility to be constructed within the next 3 to 5 years on Port property near the northeast corner of 8th Avenue South and South 152nd Street as part of the NERA MDP. During the interim period, water quality treatment will be provided by Low Impact Development BMP facilities along 8th Avenue South and a water quality treatment vault to be constructed under South 152nd Street as part of the retrofit design. The existing main trunk line running across the LL Apartments Parcel and discharging into the northwest corner of Lora Lake will be decommissioned and removed during construction at the LL Apartments Parcel. Under the current design, the only stormwater flow into Lora Lake will be a small volume of runoff collected by less than a dozen remaining catch basins immediately adjacent to the LL Parcel along Des Moines Memorial Drive.

Discharges from the relocated outfall to the Vacca Farm portion of the Port Mitigation Area will be analyzed for compatibility with the NRMP design objectives and performance standards, including a hydroperiod analysis to assess potential impacts on the established vegetation. The City of Burien's analysis and design activities are expected to be completed by the fall of 2016, with permitting and construction to immediately follow, for completion by early 2017, before construction at the Site begins in the spring of 2017. The City of Burien is currently proposing to construct the 8th Avenue South trunk line retrofit separately from the water quality treatment facility. The proposal is to construct the water quality treatment facility at the time the Site is developed for commercial/light industrial use. Assessment of discharges to the Vacca Farm portion of the Port Mitigation Area will be reported separately to USACE and WSDOE, in compliance with the requirements of the Mitigation Area Restrictive Covenant.

3.4 CONTRACTOR SELECTION AND PLANNING

Given the complexity of the remedial action proposed for the Site and the potential complications associated with the additional infrastructure projects in the vicinity, the selection of a qualified contractor will be essential. The Port is proposing to select a Contractor in late 2016, allowing for multiple months of Port and Contractor coordination prior to the start of construction in spring of 2017. Project plans and specifications developed for the remedial action construction will require the Contractor to develop detailed schedules and work plan submittals describing the proposed sequencing and implementation of the work required on each parcel. These contractor submittals will be made available for WSDOE review.

4.0 Lora Lake Apartments Parcel Remedial Action Construction Activities

The remedial action at the LL Apartments Parcel consists of excavation of all contaminated soil with dioxins/furans TEQ concentrations greater than the remediation level of 100 pg/g (approximately 24,000 cubic yards) for off-site disposal at a permitted and approved Subtitle D landfill. This excavation will also remove soil contaminated with all of the other site COCs at concentrations greater than their respective cleanup levels (lead, PCP, gasoline range hydrocarbons, diesel range hydrocarbons, and heavy oil range hydrocarbons), with one exception, which is discussed in the following text.

The excavation at the LL Apartments Parcel will be backfilled to final grade using a combination of existing on-site soil known as common excavation fill material, imported fill as needed, and recycled crushed concrete. Regrading of the LL Apartments Parcel will result in approximately 36,500 bank cubic yards of soil that, if geotechnically suitable, can be used for backfill as needed to achieve the proposed final grade. The existing on-site soil that is regraded and used for backfill may have dioxins/furans TEQ concentrations greater than the cleanup level of 13 pg/g but less than the remediation level of 100 pg/g, as approved by the CD. Approximately 1,670 cubic yards of crushed concrete can be used as backfill as needed.

After the site grading has been completed, the future use of the parcel has been determined, and a redevelopment plan has been developed, a wildlife barrier/cap will be established. This wildlife barrier/cap, which will be the impervious surface of the developed property, is expected to be constructed of building foundations, concrete, and/or asphalt pavement. The timing for installation of this wildlife barrier/cap will lag behind the excavation and backfilling by up to 4 years, as allowed by the CD. This is because there are currently no plans for site redevelopment by the Port. The design of the wildlife barrier/cap requires WSDOE approval. After the completion of backfilling, the LL Apartments Parcel will be rough graded to drain to a biofiltration swale constructed at the southeast corner of the parcel. The biofiltration swale will drain to a newly constructed catch basin and storm drain line that connects to the City of Burien's manhole near South 152nd Street. The graded surface at the LL Apartments Parcel will be stabilized with topsoil and hydroseed to control erosion, stormwater runoff, and dust generation. A 24-foot-wide temporary access road consisting of crushed rock will be installed on the LL Apartments Parcel.

The soil excavation on the LL Apartments Parcel is expected to remove the contaminant source that is located above and in contact with groundwater. Groundwater will be encountered during excavation activities, and excavation dewatering will be required. Dewatering water will be managed on-site and pumped to a construction water treatment system, located on the LL Parcel or DMCA, before being discharged to the SR 518 Construction Stormwater Pond for infiltration. It is assumed that the Contractor will slip line the current storm drain line that runs underneath Des Moines Memorial Drive from the LL Apartments Parcel to the LL Parcel for movement of water from the LL Apartments Parcel to the east side of Des Moines Memorial Drive. No construction water may be discharged to the local sanitary sewer system. Additional information regarding construction water management and treatment is provided in Section 3.2.

Other construction activities associated with the remedial action include clearing and grubbing, demolition and removal of concrete and asphalt structures and surfaces, and removal of existing utilities that interfere with excavation or regrading. These activities are discussed in greater detail in the following subsections.

4.1 PERMITTING

This MTCA remedial action is being conducted under a CD with WSDOE and, therefore, is exempt from certain procedural and permitting requirements of certain Washington state laws and regulations and all local permits (WAC 173-340-710(9)(b)). However, implementation of the cleanup action must comply with the substantive requirements of any otherwise applicable permits. This remedial action will meet the substantive requirements for applicable regulations and standards and will comply with all action-, chemical-, and location-specific applicable or relevant and appropriate requirements (ARARs) as identified in the CAP. Exhibit E of the CD identifies procedurally exempt requirements in accordance with the requirements stated in WAC 173-340-710(9)(d).

Compliance with the State Environmental Policy Act (SEPA) is required for any state or local agency action. A SEPA checklist was prepared by the Port and included in the CD as an attachment to the CAP. WSDOE reviewed the SEPA checklist, as well as the information presented in the RI/FS and the CAP, and decided that a mitigated determination of nonsignificance (MDNS) is warranted.

Due to the current plan to treat and infiltrate project construction water resulting in no discharge to waters of the state, the site-wide remedial action construction is not required to obtain a NPDES CSWGP, administered by WSDOE. However, the Port is pursuing a NPDES CSWGP as part of the final design process and before construction to potentially allow for contingency overflow of treated construction water from the SR 518 Construction Stormwater Pond to an existing vegetated swale that discharges to Miller Creek. In the event the Port obtains a NPDES CSWGP, the permit will then be transferred to the Contractor and the Contractor will comply with all permit conditions and discharge requirements. The Contractor (or their subcontractor) will act as the CESCL for the project, and be responsible for monitoring and permit compliance. A Draft Construction SWPPP prepared for the work at the LL Apartments Parcel and DMCA and for the soil excavation work at the LL Parcel describes the management of stormwater during construction. This Draft SWPPP will be updated by the selected contractor as part of the required pre-construction submittals and expanded to include requirements for implementation of the lake sediment remedy. Additional information regarding construction water management and treatment including effluent discharge limits is provided in Section 3.2.

Local permitting requirements for construction at the LL Apartments Parcel fall within the jurisdiction of the City of Burien. The planned work is exempt from the requirement for a City of Burien Clearing and Grading Permit but will comply with the applicable substantive requirements of the permit and associated Burien Municipal Code. The project will also be required to meet the substantive requirements of the abutting City of SeaTac Haul Permit and Maintenance of

Traffic Plan, as applicable, because the work will require the use of City of SeaTac roadways for site access. The Contractor will be required by the project specifications to obtain a Haul Permit from the City of SeaTac prior to the start of construction.

4.2 SITE PREPARATION

The first construction activity that will be conducted is site preparation, which involves installing temporary erosion and sediment control BMPs, removing trees and other vegetation, blocking current site access roads, installing temporary construction access roads and wheel washes, and preparing the surface for excavation of contaminated soil. These activities must be conducted before the excavation activities begin in order to maximize the Contractor's usable space on-site and to ensure that subsurface contamination is handled in a manner that prevents erosion and migration.

4.2.1 Site Preparation

Before the excavation activities begin, the following site preparation activities will be conducted:

- **Site Security**: A perimeter fence currently prevents access to the Site by unauthorized persons. This fence will be repaired, if necessary, extended to include areas of the Site outside the current fence line, and maintained by the Contractor for the duration of the work, except where noted. The Port property south of the LL Apartments Parcel will be used as the Staging Area (for equipment staging and stockpiling of clean material). Temporary access from the Port property to the LL Apartments Parcel, is shown in Drawing G04.1 in Appendix N.
- **Site Clearing and Grubbing:** The entire LL Apartments Parcel will be cleared and grubbed such that a clear and clean surface remains (Appendix N, Drawing CB01.1). No trees, shrubs, or plants will remain. All vegetation that is removed from above ground will be cut flush with the ground without disturbing the surrounding soil and hauled off-site by the Contractor to be disposed of as compost. Root masses of trees and shrubs will also be removed. Root masses removed from all areas of the Site will be disposed of at a permitted and approved Subtitle D landfill with the contaminated soil. The top 12-inches of surface duff, or fallen leaves, needles, and branches will also be cleared from the ground in areas outside the excavation where on-site soil will be used as backfill to remove unsuitable organics from the backfill. Approximately 4,450 cubic yards of surface duff including the organic material will be disposed of at a permitted and approved Subtitle D landfill.
- **Surface Demolition:** All concrete structures, foundations, curbing, sidewalks, and sport courts will be demolished as part of construction (Appendix N, Drawing CB01.1). Clean, unpainted concrete will be crushed on-site and reused as backfill in the subsurface vadose zone. Non-yellow painted concrete may also be crushed on-site and reused as backfill if analytically tested for leachable metals before use. Recycled concrete may not leach metals at concentrations greater than the MTCA Method A groundwater criteria. Yellow-painted concrete may not be reused on-site, because

this paint has already been determined to contain elevated concentrations of lead. Approximately 22 cubic yards of yellow-painted concrete containing lead will be removed during demolition and will be disposed of at a permitted and approved Subtitle D landfill. Prior paint bulk and toxicity characteristic leaching procedure (TCLP) analytical results from samples collected at the LL Apartments Parcel are included in Appendix D (Hazardous Materials Testing and Disposal Memorandum). Approximately 1,500 cubic yards of concrete is expected to be removed during demolition. Once crushed, the 1,500 cubic yards of concrete is expected to bulk to 1,670 cubic yards and will be available for reuse as backfill.

All asphalt roads, parking lots, and curbing at the Site will also be demolished as part of the remedial action construction. Approximately 1,600 cubic yards of asphalt is to be removed and hauled off-site for disposal or recycling. If recycling is selected by the Contractor, asphalt will be clean and free of contaminated soil prior to being hauled off-site. Select sections of the asphalt or concrete paving at the Site will be maintained for use as access and stockpiling areas during construction. These areas will then be demolished once the construction has been completed, before final grading. The miscellaneous rock walls and berms will also be removed during parcel clearing. This rock material will be reused as backfill if the material is determined by the geotechnical engineer to be acceptable for reuse; otherwise, it will be disposed of off-site at a licensed disposal facility.

- **Monitoring Well Decommissioning:** All existing Site groundwater monitoring wells within the LL Apartments Parcel and downgradient of the parcel will be decommissioned in accordance with applicable regulations (WAC 173-160-460) before excavation begins, with the exception of one well (existing well MW-10) that will be used for long-term groundwater monitoring, as discussed in Section 4.10. The locations of wells that will be decommissioned before the beginning of excavation activities are shown in Drawing CB01.2 in Appendix N.
- **Subsurface Demolition:** Abandoned utilities that were left in place during the previous demolition of the apartment complex and the two remaining and abandoned concrete swimming pools will be demolished to remove these features from the excavation and grading areas (Appendix N, Drawing CB01.2). After the demolition of the two swimming pools, any clean, unpainted concrete will be crushed and reused on-site as backfill. Existing abandoned utilities that interfere with excavation and regrading activities will also be demolished. Abandoned utilities that are located outside the excavations or at a depth below ground surface greater than the proposed final grade will be left in place, as described in Section 4.2.2.
- **Staging and Stockpile Areas:** As discussed previously, the Port property south of the LL Apartments Parcel will be used as the Staging Area, which will serve as the laydown area for offices, equipment staging, worker parking, and clean material stockpiling. Select existing asphalt and concrete surfaces on the LL Apartments Parcel will be maintained by the Contractor for the majority of the project to be used for stockpiling contaminated materials.

- **Site Access and Establishment of Haul Routes:** Primary access to the LL Apartments Parcel will be established from the Port property south of the Site. This entrance will be used for all site access, including material delivery, employee access and parking, general construction purposes, import of backfill, and export of contaminated soil. This temporary construction access road is required because the contaminated soil excavations will block site access via the two existing entrances off 8th Avenue South and Des Moines Memorial Drive. Drawing G04.1 in Appendix N shows the new temporary construction access road and the anticipated on-site haul route to be used by trucks hauling contaminated soil off-site. The actual off-site haul route, which will be determined by the Contractor, will depend on the location of the selected landfill or transfer station. A Traffic Control Plan will be prepared by the Port or the Contractor identifying which local roads will be used and specifying the traffic control systems and signage required for any temporary lane or sidewalk closures.

4.2.2 Utility Protection, Abandonment, or Removal

An existing stormwater conveyance system within the LL Apartments Parcel (consisting of two separate systems that together cover the parcel) will be demolished as part of the construction. The demolition will include abandonment and removal of pipes, catch basins, and manhole structures throughout the LL Apartments Parcel, as shown in Drawing CB01.2 in Appendix N. Before its demolition, the on-site stormwater conveyance system will be cleaned by jetting lines and removing solids from catch basin structures. Water and solids generated during line cleaning will be collected and disposed of as contaminated material. The City of Burien stormwater main line that traverses the LL Apartments Parcel is described in Section 3.2.3. Stormwater from this pipe will be diverted to a new pipe along 8th Avenue South that is designed and constructed by the City of Burien before the beginning of remedial activities. The main line conveyance pipe that leaves the Site, located along Des Moines Memorial Drive, will be cut and capped where it exits the parcel, so that the downstream segments of the system remain active. The secondary storm drain system located in the northeast corner of the LL Apartments Parcel will also be capped at the exit to Des Moines Memorial Drive, and removed from within the LL Apartments Parcel.

Other miscellaneous abandoned underground utilities including sewer, gas, water, power, telephone, and cable utilities, may be encountered during excavation. All Site utilities (with the exception of stormwater) were demolished or abandoned during the apartment demolition. If abandoned utilities are encountered during excavation and regrading activities, they will be removed.

All active utilities outside the limits of construction will be located and protected by the Contractor to ensure that they are not damaged during construction. There are overhead power lines along Des Moines Memorial Drive and 8th Avenue South and multiple subsurface utilities in the right-of-ways abutting the parcel. Known utilities are shown in Drawing CB01.2 in Appendix N. Active utilities within the extents of excavation along Des Moines Memorial Drive will be located prior to start of construction by the Contractor. The Contractor will be required to coordinate with local utility companies to accurately locate, and temporarily disconnect (if necessary), any active utilities that may interfere with excavation activities. Alternatively, excavation extents may be modified to allow for safe completion of soil removal activities, based on the location and condition of active utilities. The Contractor may employ excavation methods such as hand digging when working in the vicinity of active utilities. Any modification to the excavation extent will require Port and WSDOE approval.

4.2.3 Stormwater, Erosion, and Sediment Controls

Currently, stormwater at the LL Apartments Parcel either infiltrates the soil in unpaved areas or flows to the existing stormwater conveyance system, which discharges to Lora Lake.

During construction, the LL Apartments Parcel will be maintained and graded as needed to allow continued infiltration of stormwater to the maximum extent. Once ground is broken at the LL Apartments Parcel, stormwater is within the active construction area (i.e., disturbed ground or area with potential for contaminated soil) will be considered contaminated stormwater and will be collected and treated as described in Section 3.2. The current proposed plan includes pumping collected stormwater through an existing storm drain or pipe that traverses under Des Moines Memorial Drive from the LL Apartments Parcel to the LL Parcel. The storm drain line will be slip lined by the Contractor and the water will be conveyed to a construction water treatment system, located on the LL Parcel or DMCA, before being discharged to the SR 518 Construction Stormwater Pond or the LL Apartments Parcel for infiltration. At the time of this report, the Port is pursuing a NPDES CSWGP for the project, to potentially provide contingency overflow of the SR 518 Construction Stormwater Pond to a vegetated swale discharging to Miller Creek.

Erosion and sediment control BMPs will be installed and maintained by the Contractor for the duration of the project (Appendix N, Drawing CE01.1). They will be installed to prevent off-site migration of contamination by means of dust, track-out, or stormwater and for general environmental control. These BMPs are discussed in greater detail in the Draft SWPPP (Appendix E). The following BMPs, or equivalent, will be used during construction:

- Installation and maintenance of a silt fence around the perimeter of the work area.
- Installation of filtration-only catch basin inserts in catch basins that have not or will not be demolished.
- Application of water to dry soil as necessary to suppress airborne dust.
- Use of erosion control devices to prevent contaminated soils from migrating off-site (e.g., soil stockpiles may be covered with plastic and sandbagged during dry periods).
- Maintenance of excavation equipment in good working order. The Contractor must immediately clean up any contaminated soil resulting from any spilled fuel, hydraulic oils, or other hazardous materials and take out of service any equipment that is leaking or dripping until adequate repairs are made.

- Minimization of equipment traffic through the excavation areas to prevent contaminated soils from being transported by track-out to other parts of the parcel or off-site. Removal of soil from the wheels of vehicles before they exit the Site (i.e., wheel wash) and compliance with decontamination requirements for equipment before it leaves the excavation areas.
- Establishment of specific truck haul routes before beginning off-site transport of contaminated soil and use of on-site truck routes that minimize or prevent traffic over unpaved contaminated areas.
- Establishment of loading areas for contaminated soil on pavement in, or at the edge of, the stockpile location(s) and frequent cleaning of areas by sweeping or vacuum methods.
- Ensuring that soil transported off-site contains no free liquids or is contained in equipment designed for transporting liquid waste.
- Loading of trucks in a manner that prevents the spilling, tracking, or dispersal of contaminated soils and covering of loads before they exit the parcel.

The Contractor will be responsible for finalizing the Draft SWPPP (Appendix E) to be specific to the Contractor personnel and construction methods planned. The Draft SWPPP identifies the BMPs for preventing contaminated soils at the Site from entering the stormwater drainage systems. The Contractor will also be responsible for providing a CESCL who can inspect and repair BMPs, as necessary, and implement additional BMPs as needed on a regular schedule.

In addition to these BMPs, the Contractor will prepare a Spill Prevention, Control, and Countermeasures Plan, which will detail methods for preventing petroleum and hazardous materials spills and provide methods for an efficient and timely cleanup if a spill occurs during construction activities.

After the completion of contaminated soil removal and backfilling, the LL Apartments Parcel will be graded to the elevations shown on the project plans, and a biofiltration swale, catch basin with beehive grate, manhole, and storm drain line will be constructed at the southeast corner of the parcel. All areas of the LL Apartments Parcel will be hydroseeded or planted. A crushed rock-surfaced temporary access road will be constructed to provide site vehicle access for maintenance and monitoring while the parcel awaits redevelopment. This will leave the Site in a stable temporary condition, to remain until future redevelopment occurs. In this stable temporary condition, the entire LL Apartments Parcel will drain to the newly constructed biofiltration swale and catch basin and discharge to the storm drain line that will connect to the City of Burien's manhole near South 152nd Street (Appendix N, Drawings CG05.1 and CG05.2).

4.3 CONTAMINATED SOIL EXCAVATION

All contaminated soil with dioxins/furans TEQ concentrations greater than the remediation level of 100 pg/g will be excavated and disposed of off-site at a permitted and approved Subtitle D landfill. Approximately 24,000 cubic yards of contaminated soil are expected to be excavated and disposed of off-site. Excavation will occur in both shallow soil and in deeper soil located below the groundwater table. The depth of excavation varies by area from 1 to 24 feet below the existing ground surface.

Limited TPH contamination in soil will remain in place after the remedial action. This TPH contamination is located in the main source area at depths below the POC for direct contact (15 feet bgs). Current empirical data indicate that there is no TPH in groundwater within this soil source area and, therefore, there is no exposure pathway between the TPH contamination in soil and the groundwater at the Site. Future groundwater monitoring will be conducted at the LL Apartments Parcel (including a monitoring location within the former source area) to confirm that TPH remaining in deep soil does not affect groundwater at concentrations greater than the MTCA Method A cleanup levels. The vertical extent of TPH in soil is shown in Figure 2.3.

4.3.1 Excavation Extent

The horizontal and vertical extent of excavation was developed on the basis of data from the RI sampling conducted in 2011 and the soil performance monitoring conducted in 2015 and 2016 (refer to Section 2.5.1).

With the exception of a small area of Excavation Area 3 and a small area of Excavation Area 4, the extent of excavation is driven by dioxins/furans contamination, meaning that all soil contaminated with the other Site COCs will be excavated to the extent determined necessary to remove the soil with dioxins/furans TEQ concentrations in excess of the remediation level (100 pg/g). The surface extent of excavation is shown in Drawing CG01.1 in Appendix N. The depth of excavation varies by area and is discussed in greater detail in the following sections and shown in cross section in Figure 2.3.

The Lora Lake Apartments Parcel Soil Performance Monitoring Data Report, which is included as Appendix C, provides a detailed description of the data that were collected. How these data were used to determine the excavation extent is described in Appendix F. The excavation extent differs from the conceptual excavation extent presented in the CAP. Additional samples collected during the soil performance monitoring events provided greater data density to refine the excavation extent. The additional data also provide a more detailed delineation of the required depth of excavation.

There are four excavation areas within the LL Apartments Parcel: Excavation Areas 1, 2, 3, and 4 from west to east across the parcel (Appendix N, Drawing CG01.1). This nomenclature, which is different from that used in the CAP, has been adopted for design and construction. This change was made because of changes in the horizontal extent of the excavation areas and to eliminate potential confusion during construction due to repetition in area nomenclature (e.g., Cleanup Areas A, B, and C).

Each of the excavation areas has been subdivided into grid cells. The Contractor will excavate cells to a consistent base elevation as specified by the excavation plan and project specifications. Excavation to a prescribed elevation was selected due to the variable nature of the existing surface grade. Excavation to a depth prescribed in feet bgs would not be constructible, so the base elevation method was developed. As described in detail in Appendix F, sample collection depths were converted to elevation, and a base of excavation surface was created. Each grid cell is then excavated to the deepest elevation of the excavation surface present within that grid cell. The size of the grid spacing varies by excavation area to minimize the amount of clean "extra" soil being excavated. Excavation Area 1 has been divided into 40-by-40-foot grid cells, Excavation Area 2 has been divided into 43-by-43-foot grid cells, and Excavation Areas 3 and 4 have been divided into 20-by-20-foot grid cells. The design of these grid cells and the associated base elevations represent the excavation plan. This excavation plan results in the removal of all contaminated soil with dioxins/furans TEQ concentrations greater than 100 pg/g.

The grid cell approach for excavation means that the base of excavation elevation changes for each grid cell. Generally, there is less than a 4- to 5-foot change in elevation between grid cells. However, this is not always the case, and there are instances where the change in base elevation between adjacent cells is greater than 4 feet. In these areas, the Contractor may be required to use stabilization methods such as shoring or laying back sideslopes to prevent sloughing or destabilization of the excavation sidewalls. There may be areas within the excavation where the sideslopes can be allowed to slough, so long as there are no workers in these areas, and the sloughing does not destabilize the excavation sidewalls or interfere with the removal of contaminated soil. Because all performance monitoring data were collected before excavation, confirmation of the excavation extent will be conducted by means of a survey to the grades and elevations specified in the project plans and specifications. Soil that sloughs into an excavation area that has not been verified by survey will be required to be excavated and disposed of as contaminated. Performance monitoring methods are discussed in greater detail in Section 7.1.2. Recommendations for temporary shoring and design parameters are included in the Lora Lake Apartments Site Geotechnical Report (Appendix G).The total estimated volume of contaminated soil that will be excavated is approximately 24,000 cubic yards. A description of the methods used for the analysis of volume and excavation extent is provided in Appendix F.

4.3.2 Excavation Area 1

Excavation Area 1 is approximately 13,200 square feet and located in a flat area on the west side of the Site (Appendix N, Drawing CG01.1). Excavation Area 1 is shallower than the other three excavation areas. Contaminated soil will be excavated on a 40-by-40-foot grid to elevations ranging from 301.6 to 305.8 feet relative to the North American Vertical Datum of 1988 (NAVD 88), a depth between approximately 2 to 5 feet below the existing ground surface. Standard excavation techniques will be used in this area, and the contaminated soil will be disposed of off-site at a permitted and approved Subtitle D landfill. Approximately 1,200 in-place cubic yards of contaminated soil, surface vegetation and asphalt will be excavated in this area. The final grade in this area is near or below the excavation base elevation, so backfilling in this excavation area will also not be required.

The excavation in Excavation Area 1 will not extend to the groundwater table, and no dewatering will be required. The excavation base elevation differences between adjacent grid cells range from inches to 2 feet, so shoring or other slope stabilization methods are not expected to be required.

Stormwater infrastructure is present within the footprint of Excavation Area 1 and will require removal as part of the work in this area. The locations of catch basins and stormwater detention piping that will require removal to complete the contaminated soil excavation are shown in Drawing CB01.2 in Appendix N.

4.3.3 Excavation Area 2

Excavation Area 2 is approximately 17,900 square feet and is located in the central portion of the parcel, southeast of Excavation Area 1 (Appendix N, Drawing CG01.1). Contaminated soil will be excavated on a 43-by-43-foot grid, as described in Appendix F, to base elevations ranging from 301.6 to 307.8 feet NAVD 88, at depths between approximately 1 foot and 6 feet below the existing ground surface. Standard excavation techniques will be used in this area, and the contaminated soil will be disposed of off-site at a permitted and approved Subtitle D landfill. Approximately 2,200 in-place cubic yards of contaminated soil, surface vegetation, and asphalt will be excavated in this area. The final grade in this area is near or below the excavation base elevation, so backfilling in this excavation area will also not be required.

The excavation in Excavation Area 2 will not extend to the groundwater table, and no dewatering will be required. The excavation base elevation differences between adjacent grid cells range from inches to 4 feet, so shoring or other slope stabilization methods are not expected to be required.

Stormwater infrastructure is present within the footprint of Excavation Area 2 and will require removal as part of the work in this area. Additionally, one of the former swimming pool foundations is located within Excavation Area 2. The locations of the pool foundation, catch basins, and stormwater pipes that will require removal to complete the contaminated soil excavation are shown in Drawings CB01.1 and CB01.2 in Appendix N.

4.3.4 Excavation Area 3

Excavation Area 3 is approximately 47,300 square feet and is located in the central portion of the parcel, east of Excavation Area 2 (Appendix N, Drawing CG01.1). Excavation Area 3 is the location of the historical operations responsible for contamination at the Site and is the largest and deepest of the planned excavation areas. As described in Appendix F, contaminated soil will be excavated on a 20-by-20-foot grid to base elevations ranging from 306.9 to 276.9 feet NAVD 88, at depths that range from approximately 1 to 24 feet below the existing ground surface. Standard excavation techniques will be used in this area, and the contaminated soil will be disposed of off-site at a permitted and approved Subtitle D landfill. Approximately 20,500 in-place cubic yards of contaminated soil, surface vegetation, and asphalt will be excavated in this area.

Dewatering will be required in this area because the excavation extends to a depth of approximately 5 feet below the water table. Dewatering methods are discussed in Section 4.4.

The excavation base elevation differences between adjacent grid cells range from inches to 16 feet. Sidewall stabilization is anticipated to be required to complete the contaminated soil removal in this excavation area. The project plans and specifications will allow the Contractor to determine trench safety and stabilization methods for the excavation based on the procedures and sequencing selected for completion of the work. The Contractor will be required to prepare and submit for review and approval a work plan for excavation that includes the shoring design stamped by a licensed engineer for any proposed shoring or trench safety systems.

If the Contractor elects to lay back the excavation sidewalls, slopes that are less than 20 feet in height must be no steeper than 2 feet horizontal to 1 foot vertical (2H:1V) unless otherwise determined stable by a licensed geologist. Alternatively, soils may be benched in order to reduce the overall height of the vertical cut. Excavations that will be entered by personnel may be benched to a maximum height of 4 feet within a horizontal distance of 8 feet (averaging a 2H:1V slope). Excavations that will be entered only by personnel-operated heavy machinery may be benched to a maximum height of 6 feet with in a horizontal distance of 12 feet (averaging a 2H:1V slope). With time and the presence of seepage and/or precipitation, the stability of temporary unsupported cut slopes can be significantly reduced. Therefore, all temporary slopes will be protected from erosion by the installation of a surface water diversion ditch or berm at the top of the slope.

If the Contractor elects to install temporary shoring, it is an anticipated that sheet pile will need to be driven to a depth of approximately 15 to 25 feet below grade before excavation. It is assumed that the ground conditions will allow sheet pile to be driven to the required depths based on the current geological characterization. In February 2016, two geotechnical borings were drilled to a depth of 51.5 feet bgs. Additional details of the geotechnical evaluation and temporary shoring recommendations and design parameters are provided in Appendix G.

Stormwater infrastructure is present within the footprint of Excavation Area 3 and will require removal as part of the work in this area. Additionally, the other former swimming pool foundation is located within Excavation Area 3. The locations of the pool foundation, catch basins, and stormwater pipes that will require removal to complete the contaminated soil excavation are shown in Drawings CB01.1 and CB01.2 in Appendix N.

4.3.5 Excavation Area 4

Excavation Area 4 is approximately 7,200 square feet and is located on the east side of the parcel, along Des Moines Memorial Drive (Appendix N, Drawing CG01.1). This area encompasses most of the area defined as the Eastern Source Area in the CAP, and the excavation extent was determined to remove dioxins/furans in exceedance of the remediation level, and lead concentrations in exceedance of the cleanup level. Contaminated soil will be excavated on a 20-by-20-foot grid, as described in Appendix F, to base elevations ranging from 296.6 to 284.4 feet NAVD 88, at depths that range from approximately 1 to 10 feet below the existing ground surface. Standard excavation techniques will be used in this area, and the contaminated soil will be disposed of off-site at a permitted and approved Subtitle D landfill. Approximately

1,200 in-place cubic yards of contaminated soil, surface vegetation, and asphalt will be excavated in this area.

Dewatering may be required in this area but is dependent on the elevation of the groundwater table at the time of excavation. Any required dewatering will be conducted in accordance with the dewatering methods discussed in Section 4.4.

The differences in excavation base elevation between adjacent grid cells range from inches to 8.6 feet. Sidewall stabilization is anticipated to be required to complete the contaminated soil removal in this excavation area. As discussed previously, project plans and specifications will allow the Contractor to determine the trench safety and stabilization methods for the excavation based on the procedures and sequencing selected for completion of the work. The Contractor will be required to prepare and submit for review and approval a work plan for excavation that includes the shoring design stamped by a licensed engineer for any proposed shoring or trench safety systems. If the Contractor elects to lay back the excavation sidewalls, the slopes must be no steeper than 2H:1V unless otherwise determined stable by a licensed geologist. The temporary shoring recommendations and design parameters, as well as recommendations for temporary slopes, are provided in Appendix G.

Stormwater catch basins are present within the footprint of Excavation Area 4 and will require removal. Stormwater pipes are also present within the footprint of Excavation Area 4 and will be removed. The locations of the catch basins and pipes that will require removal are shown in Drawing CB01.2 in Appendix N.

4.3.6 Verification of Excavation Extent

When excavation within a given excavation area or grid cell is completed, the vertical and horizontal extents will be surveyed by a licensed surveyor registered in Washington state. Verification of the excavation extent may also be conducted with the use of a global positioning system (GPS). Either method must be accurate to the nearest tenth of a foot (0.1 foot).

4.4 EXCAVATION DEWATERING

Dewatering will be required in Excavation Area 3 and potentially in Excavation Area 4 because the excavations are expected to extend below the groundwater table. Dewatering is required to maintain a relatively dry excavation to allow the complete removal of soil with dioxins/furans concentrations greater than the remediation level and the placement and compaction of backfill.

In Excavation Area 3, where the maximum excavation depth is approximately 24 feet bgs, and the groundwater table is approximately 19 to 20 feet bgs, it is necessary to reduce the groundwater elevation to approximately 2 feet below the excavation bottom by means of adjacent dewatering wells (or similarly effective methods) in order to allow the excavation of dry material and backfilling and compaction in the base of the excavation. Based on the excavation grid schematic, it is anticipated that dewatering will be required in an approximate 11,200-square-foot area. Various potential dewatering techniques are available, including well points, pumping wells, and sumps. The method of dewatering will be determined by the Contractor; however, the Contractor will be required to submit a complete dewatering plan as a pre-construction submittal for review and approval. The plan will include details regarding method, installation, and construction of the dewatering system, indicating number and type of equipment, depth and locations, conveyance and capacity(ies), water discharge locations, estimated advance time to dewater the excavation before work in the excavation when necessary, and such other information to verify acceptable control and performance. The total volume of water required to effectively dewater the proposed excavation is directly proportional to the bulk hydraulic conductivity of each major water-bearing unit. Preliminary dewatering flow rates were calculated using assumptions for hydraulic conductivities and excavation heads. Based on these assumptions, a pumping well dewatering system will need to produce a total flow rate of 50 to 100 gallons per minute. Excavation dewatering water will not be able to be discharged to the local sewer; therefore, excavation dewatering water will be conveyed to a construction water treatment system located on the LL Parcel or DMCA, before being discharged to the SR 518 Construction Stormwater Pond or the LL Apartments Parcel for infiltration. Additional information describing construction water management and treatment at the LL Apartments Parcel is presented in Section 3.2.1 and effluent discharge limits for infiltration are presented in Section 3.2.3.

Additional details of potential dewatering flow rates, a conceptual dewatering model, and approximate dewatering cost guidelines are provided in Appendix G.

4.5 BACKFILL, COMPACTION, AND GRADING

The excavation areas will be backfilled with a variety of fill types, including on-site soil generated from regrading activities on the LL Apartments Parcel referred to as common excavation fill material, clean imported backfill as needed to reach final grade, and crushed recycled concrete from on-site building foundations. Approximately 36,500 bank cubic yards of common excavation fill material and 1,670 cubic yards of crushed concrete will be available for reuse as backfill. Approximately 2 percent (730 bank cubic yards) common excavation soil is expected to be unsuitable for use as backfill due to grain size and/or organics and will be disposed of off-site. The common excavation fill material is a result of reducing the final grade of the LL Apartment Parcel to between 298 and 302 feet NAVD 88 from the current elevation of between 300 and 310 feet NAVD 88 across the majority of the parcel. Backfilling applies to Excavation Areas 3 and 4. A typical backfill cross section with minimum depth and compaction requirements is shown in Drawing CG04.1 in Appendix N.

Before its placement on the LL Apartments Parcel, imported material to be used for backfill will be analytically tested for the presence of LL Apartments Parcel soil COCs (Table 2.2) and MTCA 5 metals (arsenic, cadmium, chromium, mercury, and lead) to ensure that the imported material meets the applicable chemical criteria. Results of the soil testing will be compared to the LL Apartments Parcel soil cleanup levels (for the COCs) and applicable Method A cleanup levels for unrestricted land use (for other metals). The analyses to be conducted on this material and the acceptance criteria are provided in Table 4.1. Additionally, it is required that the material be sourced from a facility or location in which an assessment has been conducted to confirm that there are no impacts on fill material based on historical operations. The Contractor selected to complete the work will be required to provide confirmation that the backfill soil meets these requirements.

Recycled concrete from demolition activities will also be used as backfill material. However, the painted concrete on-site was sampled, and it was determined that concrete that has been painted with yellow paint contains lead and, therefore, cannot be used as backfill. This concrete will be separated from the clean, unpainted concrete and disposed of off-site. The clean, unpainted concrete (and non-yellow painted concrete) will be crushed to meet the standard specification for WSDOT Select Borrow (9-03.14(2)) or an equivalent Port standard gradation and will be compacted to a minimum of 95 percent of the maximum dry density based on ASTM D1557. Crushed concrete can be used as backfill in any of the excavation areas on the LL Apartments Parcel with the following limitations (per Appendix G and as shown in Drawing CG04.1 in Appendix N): crushed concrete must remain at least 3 feet above the typical groundwater table, and it cannot be placed within 2 feet of the final graded surface. These limitations are based on future site development in order to minimize the risk of soil loss into pore spaces and the associated potential for possible ground settlement. Additionally, BMPs will be implemented during the concrete crushing process, and to concrete stockpiles to control runoff of potentially pH impacted water from the concrete stockpiles and crushing operations.

While awaiting construction of the wildlife barrier/cap during site redevelopment, the finished temporary surface of the LL Apartments Parcel will be backfilled, graded for drainage, and compacted. Following compaction, 6 inches of topsoil will be placed on the surface and hydroseeded. A biofiltration swale and catch basin will be constructed at the southeastern corner of the parcel. A new storm drain line will be installed to convey runoff from the newly constructed catch basin to a City of Burien manhole near South 152nd Street. . The majority of the parcel will slope from approximately 302 feet NAVD 88 at the perimeter to 298 feet NAVD 88 in the southeast near the catch basin. The slopes at the perimeter of the parcel will be graded to match existing grade. The Contractor will coordinate with WSDOT to match grade with the SR 518 off-ramp construction project on the northern parcel boundary. The parcel will generally be graded for drainage, as shown in Drawing CG05.1 in Appendix N. The eastern property boundary will be graded at a 2H:1V slope down to meet the existing elevation of Des Moines Memorial Drive, as shown in Drawing CG05.1 in Appendix N. This slope will also be stabilized with hydroseed. As part of backfilling and regrading, the entire parcel will be compacted to be geotechnically capable of addressing the expected loads from future site redevelopment, as discussed in the Lora Lake Apartments Site Geotechnical Report (Appendix G).

4.6 WILDLIFE BARRIER

After excavation, soil remaining on the LL Apartments Parcel will contain dioxins/furans TEQ concentrations between 13 and 100 pg/g. This contaminated soil will be contained beneath a barrier to wildlife and monitored to ensure that exposure pathways are controlled. The CAP requires construction of a wildlife barrier/cap that isolates contaminated soil from contact with human and ecological receptors. Restriction of surface water infiltration is not a required function of the wildlife barrier/cap, because soil protection of the groundwater pathway is addressed by the removal of soil with dioxins/furans TEQ concentrations greater than the remediation level of 100 pg/g.

The barrier to wildlife will be established within 4 years of the completion of excavation and backfilling, as required by the CD (State of Washington 2015). This delay allows the Port time to identify a tenant, determine the commercial use and desired layout of the property, and integrate the barrier to wildlife with property development. The barrier design requires WSDOE approval before implementation. In the meantime, at the completion of excavation, backfilling, and regrading, the LL Apartments Parcel will be topsoiled and hydroseeded for stabilization as described in Section 4.5, and a temporary access road will be installed as described in Section 4.7 and shown in Drawing CG05.1 in Appendix N.

4.7 OTHER SITE IMPROVEMENTS

4.7.1 Temporary Access Road

A temporary access road will be constructed of crushed rock with a minimum thickness of 6 inches to provide access for site monitoring and inspections, groundwater monitoring well sampling, and surface completion maintenance and repair as needed. The approximate location of this road is shown in Drawing CG05.1 in Appendix N. This road will be accessed from the Port property directly south of the LL Apartments Parcel via the newly established access point. In the future, when the barrier to wildlife is established, this temporary access road will be removed. At that point, primary access to the LL Apartments Parcel will be from 8th Avenue South. Currently, primary access is from Des Moines Memorial Drive; however, regrading construction activities will remove this access point.

4.7.2 Site Security Fencing

Security fencing will be placed around the entire LL Apartments Parcel to control site access. The existing fencing will be repaired as needed, and new fencing will be placed in all areas where construction activities required removal of the existing fence. The majority of the fence along Des Moines Memorial Drive will be removed and replaced by temporary fencing during construction. When construction is completed, a new fence will be installed at the base of the regraded slope.

4.7.3 Temporary Stormwater Collection and Management

As mentioned in Section 4.5, after completion of the contaminated soil excavation, backfilling, and rough grading and before construction of the permanent wildlife barrier/cap as part of site redevelopment, the LL Apartments Parcel will remain vacant and is expected to generate a small volume of stormwater runoff. During this temporary condition that may be up to 4 years in duration, the surface of the parcel will consist of hydroseeded topsoil. Infiltration will occur, but any stormwater that does not infiltrate will drain to a biofiltration swale and catch basin at the southeast portion of the parcel. This catch basin will be connected to a new storm drain line that extends south across the Port's property and connects to a City of Burien manhole near South 152nd Street (Appendix N, Drawing CG05.1).

When the LL Apartments Parcel is redeveloped, and a permanent stormwater collection system is installed on the parcel with the construction of the wildlife barrier/cap, drainage from the LL Apartments Parcel will be routed to a stormwater detention facility (Facility 7) constructed by the City of Burien as part of the NERA project. These stormwater infrastructure projects are being constructed by the City of Burien as an area-wide infrastructure improvement over the next few years. The facility planned for the vicinity of the LL Apartments Parcel will be constructed in coordination with LL Apartments Parcel redevelopment according to the City of Burien's current schedule.

4.8 STOCKPILE MANAGEMENT

Stockpiles are expected during construction, and materials to be stockpiled are likely to include crushed concrete, asphalt, trees and other compost, woody debris and root balls, other demolition debris, contaminated soil, and imported and on-site backfill. These stockpiles will be segregated, as appropriate, to ensure that material is disposed at the proper location, to control migration of contaminated material and prevent cross-contamination, and to protect the quality of materials to be used on-site. Stockpiles containing contaminated material are not allowed in the Staging Area south of the LL Apartments Parcel. Stockpiles containing contaminated material will be constructed on an impermeable surface that may include existing asphalt, existing concrete, or a constructed impermeable high-density polyethylene (HDPE) liner of sufficient thickness to withstand damage during material placement and removal. If a liner is used, before placement and after removal of the stockpile and liner, surface soil samples will be collected from beneath all contaminated soil stockpile areas and analyzed. If the analytical data indicate that the underlying soils have been contaminated by infiltrated water or mixing with stockpiled material, the contaminated material will be excavated and disposed of. Contaminated material stockpiles will also be bermed for management of free liquids, if encountered. They will be covered with plastic sheeting when they are not being worked. Backfill material stockpiles may also be covered with plastic sheeting to protect the material and maintain moisture content. Water that drains from the stockpiles containing contaminated material will be collected and managed on-site along with the dewatering water that is removed from the excavations.

4.9 OFF-SITE DISPOSAL OF CONTAMINATED SOIL AND WASTES

The wastes and stockpiles that are expected to be generated at the LL Apartments Parcel, the preferred option for handling and/or disposing of the waste, and any special testing requirements are identified in Table 4.2. A list of Port-preapproved disposal facilities will be provided to the Contractor in the specifications. If the Contractor chooses to use a facility that is not on the list, the Contractor must first obtain Port approval. Further details of this process are provided in this section.

Table 4.2
Waste and Stockpile Management and Disposal Requirements

Waste/Stockpile	Disposal, Treatment, or Backfill Option	Stockpile Management Requirements
Crushed concrete	Clean, unpainted concrete (and non-yellow painted concrete) will be crushed and used on-site as backfill. Concrete with yellow paint will be disposed of off-site at a permitted and approved Subtitle D landfill.	Concrete with yellow paint must be segregated, and managed as contaminated soil. Line and cover as needed to prevent runoff.
Untreated or unpainted lumber, logs, or bark free of soil, nails, and decay	Disposed of off-site at a recycling or composting facility.	Cover as needed to prevent runoff.
Scrap metal/stormwater utility demolition debris	Cleaned and recycled off-site at a scrap metal recycler.	Cover as needed to prevent runoff.
Solid waste and uncontaminated demolition debris	Disposed of off-site at a permitted and approved municipal waste landfill.	Cover as needed to prevent runoff.
Contaminated soil (from excavation areas or soil that is geotechnically unsuitable for use as backfill)	Disposed of off-site at a permitted and approved Subtitle D landfill.	Line, cover until disposed of if pile is not being worked. Collect water seepage from stockpiles and manage with excavation dewatering water.
Asphalt	Disposed of off-site at a recycling facility.	Not applicable.

Contaminated soil and any other materials hauled off-site will be disposed of at facilities that are permitted to accept the waste and approved by the Port. The project specifications will provide the Contractor with multiple disposal location options for each waste type that are preapproved by the Port. The Contractor may request Port approval of alternative disposal locations that are permitted, have capacity to accept the waste, and have no recent permit violations. The Port will reserve the right to refuse approval of any facility at its sole discretion.

Chemical testing of contaminated soil has confirmed that the characteristics of the waste meet the necessary criteria for disposal at a permitted and approved Subtitle D landfill as non-hazardous waste. The waste characterization determination for contaminated soil at the Site is provided in Appendix D.

Any additional material testing required for disposal of any of the waste streams from the Site must be conducted by the Contractor.

Trucks transporting contaminated soil from the Site will cover all loads with tarpaulins or equivalent before exiting the parcel and will comply with all applicable regulations and local ordinances, including the substantive requirements of the City of SeaTac Haul Permit.

4.10 GROUNDWATER MONITORING

Consistent with the WSDOE-approved CMP, after completion of remedy construction and regrading at the LL Apartments Parcel, three new monitoring wells will be installed, and one existing well will be used to conduct quarterly groundwater monitoring after the construction is completed. This section describes the well locations, which have been updated from those in the CMP based on remedial design considerations, and provides well construction details.

4.10.1 Monitoring Well Locations

The proposed confirmation monitoring well network consists of the following wells (Appendix N, CU02.1):

- One upgradient monitoring well located in the northwest corner of the parcel, replacing existing well MW-2 after site regrading. This well is identified as MW-C1/VB1.
- One centrally located monitoring well within Excavation Area 3, replacing existing well MW-1 after soil excavation. This well is identified as MW-C2.
- One monitoring well downgradient of the source area, directly west of Des Moines Memorial Drive and in the vicinity of existing well MW-5, where arsenic and PCP were historically detected in groundwater at concentrations slightly exceeding their cleanup levels. This well is identified as MW-C3.
- One existing monitoring well located farther downgradient, across Des Moines Memorial Drive on the western edge of the LL Parcel. This well is identified as MW-10/C4.

The monitoring well locations have been adjusted since the preliminary locations described in the CMP (Floyd|Snider 2015b). The CMP proposed installation of two wells within the LL Apartments Parcel, downgradient of the source area. This layout has been revised to place one well on the parcel boundary downgradient of the source area as proposed and a second well farther downgradient, across Des Moines Memorial Drive to the east. This allows for early warning of contaminant migration should chemical concentrations be detected in groundwater downgradient of the source area. Because cleanup level exceedances have historically been detected in a well near the eastern parcel line (MW-5), this also provides a monitoring well downgradient of the zone of historical groundwater contamination.

4.10.2 Well Decommissioning

Before remedy construction, all monitoring wells installed as part of the RI activities (MW-1 through MW-17) at the Site with the exception of existing MW-10 will be decommissioned in accordance with WAC 173-160-460. Wells located within the excavation areas will be removed after decommissioning. The wells located outside the excavation areas will be decommissioned by filling them with bentonite and capping the surface. Decommissioned wells will be removed as necessary during site regrading activities. Monitoring well logs generated during well installation are available for all Site wells; therefore, the wells will not require over-drilling for abandonment.

4.10.3 Well Installation, Development Methods, and General Well Construction

The three new groundwater monitoring wells will be installed to approximate depths of 20 feet bgs and screened in the same shallow aquifer and fill unit as those in the RI Site monitoring well network. The replacement monitoring wells will be installed according to the Minimum Standards for Construction and Maintenance of Wells (Chapter 173-160 WAC). The wells will be installed using hollow-stem auger technologies. During well installation, soil samples will be collected for visual classification, using a split-spoon sampler, and logged and recorded by a field technician under the supervision of a licensed geologist.

Consistent with the existing RI monitoring well network, the confirmation monitoring wells will be constructed of a 2-inch-diameter, flush-threaded, Schedule 40 polyvinyl chloride (PVC) well casing and screen. Well screen assemblies will consist of a 10- to 15-foot length of 0.020-inch (20-slot) machine-slotted PVC with a 0.5-foot-long sump and threaded end cap. The screened interval will span across the water table, and the screen will be set in a 10/20 (or equivalent) silica sand filter pack. The sand filter pack will be installed by pouring sand into the space between the well casing and the auger as the auger is withdrawn. A weighted tape will be used to monitor the filter pack placement and depth during installation. The sand filter pack will extend a minimum of 1 foot and up to 2 feet above the top of the screened interval. A minimum 2-foot-thick seal of hydrated bentonite chips will be installed in the annular space immediately above the sand filter pack and hydrated with potable water if installed above the water table.

Well development will be performed on newly installed wells to remove water and fines from the well casing, the filter pack, and the surrounding formation disrupted by well installation. Well development will establish a hydraulic connection between the well and the surrounding water table and will be completed by alternating cycles of surging the well with a surge block or submersible pump to draw fine-grained material into the well casing and pumping at a steady rate to remove the fine-grained material.

4.10.4 Groundwater Confirmation Monitoring

Groundwater confirmation monitoring will include the collection of groundwater samples from all wells in the confirmation monitoring network (a total of four wells) during four quarterly events per year. Quarterly events will consist of two wet season monitoring events and two dry season monitoring events. The first confirmation monitoring event after remedy construction completion is expected to occur in the winter of 2017–2018 as a wet season event if the LL Apartments Parcel remedial construction occurs in Construction Season 1. Once the groundwater cleanup levels have been met for an individual analyte (dioxins/furans TEQ, arsenic, or PCP) in four consecutive monitoring events, confirmation monitoring for that analyte will be considered completed and will be excluded from the quarterly monitoring events with approval from WSDOE. Groundwater monitoring will continue until four consecutive monitoring events have documented that chemical concentrations in groundwater are less than the Site cleanup levels for all groundwater COCs, and WSDOE has authorized discontinuation of confirmation monitoring.

If COC concentrations at the Site are greater than the applicable cleanup levels for more than 5 years after remedy implementation, contingency actions will be evaluated by the Port in coordination with WSDOE. Contingency actions considered will use the collected data to determine an appropriate and protective contingency action. Contingency actions could include statistical evaluation of data to identify trends, collection of additional groundwater data from the existing monitoring network, modification of the monitoring frequency or monitored analytes included in the monitoring program, installation of additional groundwater monitoring wells, and/or an extension of the duration of institutional controls (groundwater use restrictions) on Site groundwater. Determination of appropriate contingency actions will be coordinated with WSDOE.

4.11 INSTITUTIONAL CONTROLS

Environmental covenants to implement institutional controls will be placed on the LL Apartments Parcel. The covenants will require institutional controls to maintain the barrier to wildlife to prevent wildlife exposure to soil contamination greater than the cleanup levels, to prevent groundwater withdrawal while contamination remains on-site at concentrations greater than the cleanup levels (groundwater contamination is anticipated to exceed the cleanup levels for less than 5 years), and to require that the property remain in commercial use in perpetuity and, therefore, not be subject to terrestrial cleanup standards.

The environmental covenants will describe the nature and extent of contamination remaining on-site after completion of remedial action construction and detail the restrictions applicable to the Site to prevent human and wildlife exposure to contaminants remaining on-site.

Two draft environmental covenants will be submitted to WSDOE. One covenant will relate to maintaining the long-term institutional controls for the barrier to wildlife and keeping the area in commercial use. The other covenant will prevent groundwater withdrawal; it is anticipated that this covenant will be removed once confirmation monitoring indicates that groundwater is in compliance with the cleanup standards.

Separate environmental covenants may be needed for the following areas:

- **SR 518 Off-Ramp Project Area (When Property Is Transferred to WSDOT).** One environmental covenant would be required for this portion of the Site to maintain the long-term institutional controls for the barrier to wildlife and to keep the area in commercial use. No environmental covenant to prevent groundwater withdrawal would be required, because groundwater is in compliance with the cleanup standards in this area of the Site.
- **Former Seattle City Light Sunnydale Substation (Now Port-Owned).** A small area of the Site is located on this property, where dioxins/furans concentrations exceed Site cleanup levels. One environmental covenant would be required for this property to maintain the long-term institutional controls for the barrier to wildlife and to keep the area in commercial use. No environmental covenant to prevent groundwater withdrawal would be required, because groundwater is in compliance with the cleanup standards in this area of the Site.
- **Small Area East of LL Apartments Parcel Boundary in City of SeaTac Right-of-Way.** The need for environmental covenants in this area will be determined after compliance monitoring data have been collected, after excavation has been completed and the COC concentrations remaining outside the excavation area in the City of SeaTac right-of-way are known. If concentrations indicate that an environmental covenant is warranted, the Port will coordinate development of the covenant with the City of SeaTac, WSDOE, and the attorney general's office as appropriate.

5.0 Lora Lake Parcel Remedial Action Construction Activities

The selected remedial action at the LL Parcel includes two components: one related to the isolation of contaminated Lora Lake sediments and the rehabilitation of the lake area to historical wetland conditions and the other related to the removal of contaminated shallow soil located along the western boundary of the parcel.

The contaminated lake sediments will be isolated by the placement of a permeable geotextile fabric and carbon-amended cap and fill sand material, followed by the placement of wetland topsoil. The open-water filling of the lake and placement of wetland topsoil and plantings will result in the conversion of the existing open water and benthic sediment conditions of the lake to a palustrine scrub-shrub wetland. The wetland was designed to be compatible with the ecological functions of the Port Mitigation Area covered by the NRMP (Parametrix 2001). The rehabilitated wetland will be capable of supporting emergent and woody vegetation and will create aquatic habitat that is consistent with the goals of the NRMP. The conversion of the lake to a palustrine scrub-shrub wetland will also help eliminate a source of low-oxygen, high-temperature water to Miller Creek in the summer. Additionally, this loss of open water will help to achieve the safety objectives of reducing bird strike risk outlined in the Port's WHMP (Port of Seattle 2005).

Contaminated shallow soil located along the western boundary of the LL Parcel is contaminated with dioxins/furans and lead at concentrations slightly greater than those required to protect wildlife. This contaminated soil will be excavated and taken off-site for landfill disposal.

Other construction activities associated with the remedial action on the LL Parcel include installation of a temporary construction lake access road, removal of a rock berm and excavation of the associated settling basin within the lake, restoration of the excavation areas and temporary road areas, and construction of the monitoring well network for the sediment cap. The rehabilitation of the wetland includes the removal of the existing eastern Lora Lake berm to improve floodplain connectivity between Miller Creek and the rehabilitated wetland, excavation and fine grading of a new swale outlet to Miller Creek, grading of the new wetland surface within the former lake footprint, and installation of plantings after the fine grading is completed. These activities are discussed in greater detail in the sections that follow.

Sediment capping and the majority of the lake filling will occur in 2017, during Construction Season 1. This filled area will be left to settle during the winter between Construction Seasons 1 and 2. Then in the summer of 2018, during the Construction Season 2, additional sand fill will be placed in the lake and graded as needed, improvements to the eastern Lora Lake berm and construction of the south swale outlet will be completed, sediment cap monitoring wells will be installed, wetland topsoil will be placed and graded, and wetland plantings will be installed. The excavation and restoration of the contaminated shallow soil areas will occur during Construction Season 1 (2017).

After the remedial action construction, an environmental covenant will be placed on the LL Parcel Sediment Cleanup Area; it will require the rehabilitated wetland to continue to be managed in accordance with the recorded Mitigation Area Restrictive Covenant already in place as part of the NRMP. Performance monitoring will be conducted in the shallow soil excavation areas to determine whether environmental covenants are also required after completion of the remedial action. Additionally, post-construction confirmation monitoring of the sediment cap will be performed to assess whether sediment contamination is migrating through the sediment cap and affecting groundwater.

5.1 PERMITTING AND EXISTING MITIGATION REQUIREMENTS

The LL Parcel remedial action must comply with applicable local, state, and federal laws, identified as ARARs for this parcel (State of Washington 2015, Exhibit D). Because this LL Parcel remedial action is being conducted under a CD with WSDOE under MTCA, it is exempt from certain procedural and permitting requirements of select Washington laws and regulations and all local permits (WAC 173-340-710(9)(b)). However, implementation of the cleanup action must comply with the substantive requirements of any otherwise applicable permits. This remedial action will comply with the ARARs identified for this parcel and will meet the substantive requirements for applicable regulations and standards as identified in CD (State of Washington 2015, Exhibit E).

The Port has prepared a SEPA checklist as part of the CAP, and it has undergone the public review process. WSDOE is the lead agency for the SEPA review and has provided an MDNS for the checklist. The mitigation required by the MDNS consists of restoration of plantings removed during the excavation of the shallow soil in accordance with the NRMP and grading and planting the area damaged during the lake filling with wetland terrestrial species that are consistent with the NRMP. Due to the current plan to treat and infiltrate project construction water resulting in no discharge to waters of the state, the site-wide remedial action construction is not required to obtain a NPDES CSWGP, administered by WSDOE. However, the Port is pursuing a NPDES CSWGP as part of the final design process and before construction to allow for the potential contingency overflow of treated construction water from the SR 518 Construction Stormwater Pond to an existing vegetated swale that discharges to Miller Creek. In the event the Port obtains a NPDES CSWGP, the permit will then be transferred to the Contractor and the Contractor will comply with the permit conditions and discharge requirements. A Draft SWPPP prepared for the work to be performed at the LL Apartments Parcel and DMCA and for the soil excavation work on the LL Parcel describes how stormwater will be managed during construction (Appendix E). This Draft SWPPP will be updated by the selected contractor as part of the required pre-construction submittals. Due to the unique nature of the Lora Lake sediment cap and fill activities, the project specifications require the Contractor to submit a SWPPP specifically applicable to the lake cap, fill activities, and wetland rehabilitation. Once prepared, this SWPPP will be reviewed by the Port and the WSDOE project manager. Additional information regarding construction water management and treatment is presented in Section 3.2.

As noted earlier, the LL Parcel lies within the Port Mitigation Area. USACE and WSDOE have the authority to approve activities on the LL Parcel because it is within their jurisdictional areas and covered by the Mitigation Area Restrictive Covenant (Port of Seattle 2003). The WSDOE-required remedial action was authorized by the USACE under three nationwide permits: Nationwide Permit No. 27—Aquatic Habitat Restoration, Establishment, and Enhancement Activities; Nationwide Permit No. 33—Temporary Construction Access, and Dewatering administered by the USACE; and Nationwide Permit No. 38—Cleanup of Hazardous and Toxic Waste. The project Nationwide permits were received on July 5, 2016 and WSDOE concurrently determined that the project meets the requirements for a Washington State 401 Water Quality Certification and Coastal Zone Management Act Consistency under the issued Nationwide permits. Therefore, an individual 401 certification is not required for this project.

The Mitigation Area Restrictive Covenant requires that after any activity in the Port Mitigation Area, the Port restore the area to the conditions specified in the NRMP governing the area. Additionally, the wetland was designed so that it will not adversely affect the functions of the Port Mitigation Area. The wetland design and construction will also comply with all applicable permits and resource agency requirements (refer to Section 5.4.1 for further details of the wetland design requirements). A Qualitative Functional Assessment was conducted and provided to USACE and WSDOE as part of the permit application package in the Lora Lake Parcel Remedial Action Mitigation Plan (Appendix H). Overall water quality, hydrologic functions, and habitat functions are expected to improve as a result of the remedial action and these improvements would result in positive credits for these functions. The results of the impact analysis indicate that the project will be self-mitigating, meaning the benefits of rehabilitating the wetland will offset the short-term construction impacts (including the temporary loss of function due to the clearing for the temporary construction lake access road); therefore, it is assumed that no additional mitigation would be needed for the implementation of the remedial action.

Local permitting requirements for construction on the LL Parcel fall within the jurisdiction of the City of SeaTac. The applicable substantive requirements for the LL Parcel remedial action include the City of SeaTac Critical Areas Code (discussed further in Section 5.4.1), as well the substantive requirements of the City of SeaTac Haul Permit, Maintenance of Traffic Plan, and Clearing and Grading Permit.

5.2 SITE PREPARATION

As part of the Contractor's site preparation activities on the LL Parcel, a temporary construction lake access road will be installed on the LL Parcel, and a portion of the DMCA will be prepared for use as a construction staging and stockpiling area. Additionally, LL Parcel site preparation activities include the removal of the crest of a rock berm and excavation of the associated settling basin near the existing stormwater outfall in the northwest corner of the lake to facilitate remedial action construction. The existing stormwater outfall will remain in place and be protected during construction; however, before construction begins, flows to this outfall will be significantly altered relative to current flows. Site preparation activities also include the installation of temporary erosion and sediment control BMPs. Each of these site preparation activities is described in further detail in the following subsections.

5.2.1 Site Preparation and Access

The LL Parcel is currently enclosed within a perimeter fence, which prevents access to this parcel by unauthorized persons and the general public. This fence will be repaired, if necessary, and maintained by the Contractor for the duration of the LL Parcel work. An existing access gate and road located off Des Moines Memorial Drive provide access to the northern portion of the LL Parcel. This gate and road will be used by the Contractor for accessing the LL Parcel and DMCA (Appendix N, Drawing G05.1).

The remedial action will require the construction of a temporary construction lake access road along the north shoreline of the lake. The accessible northern shore of the lake is low and flat, but a steep 10- to 12-foot-high slope currently obstructs access by construction machinery and haul trucks from the existing paved access road down to the lake edge. A single temporary construction lake access road will be constructed from the northwest corner of the LL Parcel, near Des Moines Memorial Drive, down the steep slope on a diagonal route to the lake to a point near the east end of the rock berm that will be removed (located in the northwest corner of the lake), a distance of about 270 feet (Appendix N, Drawing G05.1). This first leg of the temporary construction lake access road will require both cut and fill to provide safe access for the heavy construction equipment needed to complete Construction Season 1 and 2 operations. The temporary construction lake access road will then traverse the low, flat lake shoreline for an additional distance of 200 feet to the east, providing access to the shoreline. Connecting back, the temporary construction lake access road will continue northeast a distance of 180 feet to tie into the existing paved access road at a point just west of the STIA 3rd Runway approach lighting system. The road configuration is designed to minimize impacts on the surrounding vegetation, and the width will generally be less than 25 feet. The Contractor will have the option to construct one 40-foot by 40-foot turnout area as part of the southern portion of the temporary construction lake access road, if needed. This will allow for coordination of large equipment movement and will be located along the eastern lake edge.

Any vegetation removed above ground during the temporary construction lake access road clearing may be recycled or composted for disposal. If roots or other belowground material must be removed for adequate access to the lake shore, this material will be disposed of at an approved Subtitle D landfill. After clearing and grubbing, a geotextile barrier and crushed rock working surface will be placed to cover the native soil along the temporary construction lake access road.

Various configurations for potential temporary construction access roads were assessed to minimize the impact on vegetation in the Port Mitigation Area to the extent practical. The configuration for the temporary construction lake access road and DMCA staging area shown in Drawing G05.1 in Appendix N was selected as the best balance between construction feasibility, particularly given the steep slope along the uplands area north of the lake, and impact avoidance and minimization. Construction of this road will result in the temporary disturbance of approximately 0.2 acre of previously planted area within the Vacca Farms/Lora Lake wetland boundary. After the completion of the construction of the remedial action at the end of Construction Season 2 in 2018, the temporary construction lake access road will be removed, the soils will be decompacted, additional backfill will be placed if needed, and the area will be revegetated in accordance with the NRMP.

A small stockpile area will be prepared in the DMCA to accommodate a few thousand cubic yards of imported fill material at a time. This DMCA area will provide access and turnaround space for dump trucks and allow stockpiling of fill material during periods of heavy highway traffic or when truck unavailability could result in delays of fill importation (Drawing G05.1 in Appendix N shows the proposed haul routes). The stockpile area will also allow the Contractor to take advantage of lighter traffic periods to accumulate material on-site. The cap and fill material will be transported from this stockpile area to the lake edge for placement primarily by off-road construction equipment. Further details of this DMCA construction staging and stockpiling area are provided in Section 6.0.

After the initial mobilization to the LL Parcel, the location of the temporary construction lake access road for the parcel will be marked to clearly delineate the allowable limits of clearing within the road alignment. BMPs for erosion control will be installed, as appropriate, as described below in Section 5.2.4.

5.2.2 Settling Basin and Rock Berm Remediation

The rock berm located in the northwest corner of the lake will be removed to facilitate the placement of the sand cap thickness required to isolate the contaminated lake sediments in this portion of the lake (refer to Section 5.3 for further details of this cap). This rock berm, which surrounds the existing stormwater outfall, extends in a broad arc with the crest of the berm located approximately 60 feet from the discharge point of the existing stormwater outfall. Design drawings for the berm indicate that it was built to a design slope of 3H:1V and, therefore, extends approximately another 15 to 20 feet into the lake beyond its crest. It was designed to be built using rock weighing up to 500 pounds per piece. At winter lake levels, only the crest of the rock berm is visible above water. Furthermore, the “settling basin” enclosed by the rock berm is nearly full to the crest of the berm with sediment from the storm drain outfall. The crest of the berm and underlying rock will be excavated to a depth of 265.5 feet NAVD 88 and placed offshore in deeper water to make room for the geotextile placement, a rock splash pad at the culvert discharge, and capping and filling of this nearshore lake area. The sediment infill will be excavated and disposed of at an approved Subtitle D landfill. The excavated rock berm relocated offshore will be covered with geotextile, sand cap, and gravel lake fill in the normal course of the main lake filling construction. The excavation area for the rock berm and sediment infill is shown in Drawing CG06.1 in Appendix N.

5.2.3 Stormwater Outfall Conveyance Modifications and Protection

Lora Lake currently receives stormwater runoff from the LL Apartments Parcel, the City of Burien residential and commercial drainage areas upstream of the LL Apartments Parcel, and the surrounding roadways downstream of the LL Apartments Parcel (e.g., Des Moines Memorial Drive, the SR 518 interchange, and the City of SeaTac) through a single outfall pipe located near the northwestern edge of the lake. As described in Section 3.3.3, the City of Burien will be constructing stormwater quality retrofit improvements in the vicinity of the Site with expected completion in early 2017, before construction of the LL Parcel remedial action. The proposed retrofit improvements will divert the current flow of stormwater that is conveyed through the main line traversing the LL Apartments Parcel and discharged through the LL Parcel outfall into Lora Lake into a newly constructed stormwater line that runs south along 8th Avenue South (Figure 1.2). The existing stormwater conveyance system on the LL Apartments Parcel will be demolished as a part of the construction work on that parcel (refer to Section 4.2.2). The existing outfall pipe on the LL Parcel will remain in place and be protected by the Contractor to prevent damage during construction. This existing stormwater outfall is a 24-inch-diameter corrugated HDPE pipe.

After the completion of cap and fill placement during Construction Season 1 on the LL Parcel in 2017, appropriately sized scour protection will be installed at the existing stormwater outfall. This scour protection includes a splash pad consisting of rock armoring that will be placed over the sediment cap and lake fill material and will grade down gradually to the rehabilitated wetland surface and perimeter drainage channel (Appendix N, Drawing CG10.1). Design criteria for sizing and construction of the rock splash pad were determined in accordance with Outfall Protection criteria outlined in the 2009 King County Surface Water Design Manual. The flow condition used to design the splash pad is the 10-year peak flow. The 10-year peak flow was determined using a WSDOE-approved continuous hydrologic model (the Western Washington Hydrology Model). Conservative assumptions about the contributing basin were used: the basin was assumed to be 1.04 acres in size, with 95 percent of the land surface covered by flat impervious surfaces, and the remaining area was represented by flat lawn land cover over well-draining soil. With these design criteria assumptions and the known characteristics of the existing outfall (pipe size, material, slope, etc.), the design flow discharge velocity was calculated to be between 0 to 5 feet per second. The splash pad was then sized using this design flow velocity. For outfalls with discharge velocity within the range of 0 to 5 feet per second, providing a rock lining with a minimum thickness of 1 foot and a minimum height of 1 foot above the crown of the outfall meets the King County Surface Water Design Manual criteria. The width and length of the splash pad will be 8 feet wide by 8 feet long based on the diameter of the outfall. The splash pad will be constructed of quarry spalls, consistent with the King County Surface Water Design Manual.

At end of Construction Season 2, stormwater drainage through the LL Parcel outfall will flow through the newly constructed rehabilitated wetland before discharge to Miller Creek via the new outlet, as shown in Drawing CG10.1 in Appendix N.

5.2.4 Stormwater, Erosion, and Sediment Controls

As noted previously, construction stormwater will be treated and discharged to the SR 518 Stormwater Construction Pond for infiltration. At the time of this report, the Port is pursuing a NPDES CSWGP, administered by WSDOE, to allow for potential contingency overflow of treated construction water from the SR 518 Construction Stormwater Pond to an existing vegetated swale that discharges to Miller Creek (Section 3.2).

Erosion and sediment control BMPs will be installed and maintained by the Contractor for the duration of the LL Parcel remedial action construction. These will be installed to prevent off-site migration of contamination by means of dust, track-out, stormwater, or surface water discharge to Miller Creek and for general environmental control. Due to the unique nature of the lake sediment cap and fill activities, the project specifications require the Contractor to submit a SWPPP specifically applicable to the Contractor personnel and construction methods planned for the lake cap and fill activities and wetland rehabilitation. This SWPPP will be reviewed by the Port and the WSDOE project manager. BMPs applicable to the work associated with the shallow soil excavation on the LL Parcel are discussed in greater detail in the Draft SWPPP (Appendix E), which will be updated by the Contractor before construction begins. The Contractor will also be responsible for providing a CESCL who can inspect and repair, as necessary, and implement additional BMPs as needed on a regular schedule. The following BMPs, or equivalent, will be used during the LL Parcel construction:

- Protection of vegetation located outside the identified temporary construction lake access road, haul routes, and soil excavation areas. This includes the placement of silt fences along the edges of the temporary construction lake access road to help minimize the impact on surrounding vegetation.
- Application of water to dry soil as necessary to suppress airborne dust.
- Maintenance of construction equipment in good working order. The Contractor must immediately clean up any contaminated soil resulting from any spilled fuel, hydraulic oils, or other hazardous materials.
- Minimization of construction equipment traffic to prevent contaminated soils from the shallow soil excavation area or contaminated sediments from the lake from being transported by track-out to other parts of the LL Parcel or outside the LL Parcel.
- Placement of construction fencing and straw waddles around the shallow soil excavation areas before excavation and backfilling.
- Establishment of specific truck haul routes before beginning off-site transport of excavated contaminated soil and use of on-site truck routes that minimize or prevent traffic in contaminated areas.
- Ensuring that soil or materials transported off-site contain no free liquids or are transported in vehicles designed for transporting liquid waste.

- Loading of trucks in a manner that prevents the spilling, tracking, or dispersal of contaminated soils, and covering of loads before they exit the LL Parcel.
- Removal of soil or sediment from the wheels of vehicles before they exit the LL Parcel (i.e., wheel wash). The proposed wheel wash location is shown in Drawing CE02.1 in Appendix N.
- Protection of the wetlands adjacent to the lake from sediment deposition by the appropriate use of vegetative buffer strips, sediment barriers or filters, dikes or mulching, or equivalent measures.
- Plugging of the culvert connecting Lora Lake and Miller Creek before beginning in-water activities at the lake to isolate the lake from the creek and protect water quality in the creek.
- Drawdown of the lake during in-water construction as feasible and in-line with fill activities to break the surface water connection between the lake and Miller Creek. Drawdown of the lake during construction is further described in Section 5.3.2.
- On-site treatment of any collected or pumped construction water intended for discharge and infiltration to the SR 518 Construction Stormwater Pond or LL Apartments Parcel. Water treatment is further described in Section 3.2.
- Temporary augmentation of the existing failed section of the eastern lake berm between the lake and the creek to maintain a hydrologic barrier.
- Routine monitoring of the culvert plug and barrier and adjustment as necessary to maintain effectiveness.
- No grading within in the low-flow channel of Miller Creek.
- Continuous isolation of the LL Parcel Sediment Cleanup Area from Miller Creek during Construction Season 1, Construction Season 2, and the settling period between construction seasons.
- If monitoring results indicate failure of the LL Parcel Sediment Cleanup Area isolation, adjustment of the BMPs by the Contractor to prevent discharge to the creek.
- Construction of final connections to Miller Creek only when the internal site is stable and approved by the Port or the Engineer.

A summary of the temporary erosion and sediment controls for the LL Parcel is provided in Drawing CE02.1 in Appendix N.

Additional erosion and sediment control BMPs to be implemented at the DMCA staging and stockpiling area during LL Parcel construction are described in Drawing CE02.1 in Appendix N.

In addition to these BMPs, the Contractor will prepare a Spill Prevention, Control, and Countermeasures Plan, which will detail methods for preventing spills of petroleum products and hazardous materials and provide methods for an efficient and timely cleanup if a spill occurs during the remedial action construction activities.

5.3 SEDIMENT CAPPING AND LAKE FILLING

Contaminated Lora Lake sediments will be contained in place by a permeable geotextile fabric layer below a carbon-containing sand cap designed to immobilize the current COCs in the sediment, preventing their leaching to surface water. This cap will extend throughout the LL Parcel Sediment Cleanup Area (shown Appendix N, Drawing CG08.1). The carbon-amended sand will be used to fill the lake to the final Construction Season 1 design elevation, requiring approximately 34,000 cubic yards of sediment cap and lake fill sand material and covering approximately 2.9 acres. Placement of the majority of the sediment cap and lake fill sand in Lora Lake will occur during Construction Season 1 (summer of 2017).

The LL Parcel Sediment Cleanup Area as presented in this EDR (Appendix N, Drawing CG08.1) was adjusted from the cleanup area shown in the CAP in order to accurately reflect the location of the cleanup area relative to the existing site features and the constructability of the remedial action. The intent of the current delineation of the LL Parcel Sediment Cleanup Area is to implement the remedy of capping the contaminated sediments to immobilize COCs where contaminated sediments would have come to be located. The extent of the LL Parcel Sediment Cleanup Area shown in the CAP was originally estimated on an aerial photograph of the Site during the RI/FS process, in coordination with WSDOE.

As part of the remedial design process, a site-specific topographic survey was conducted and control points, positioned approximately every 100 feet around the approximate extent of the LL Parcel Sediment Cleanup Area extent, were staked by the Port survey crew. The site staking and surveying of the cleanup area for field verification was conducted on February 3, 2016, during winter high-water-level conditions. Therefore, it provides a conservative extent of sediment cap in accordance with the CAP requirements. This staking and surveying allowed the design team to identify Site features positioned inside or outside the approximate extent of the cleanup area and adjust the extent as appropriate to ensure that the entire footprint of contaminated sediments is capped and that the extent is accurately defined for construction. An example of the modifications to the extent of the LL Parcel Sediment Cleanup Area from the extent in the CAP to the extent in the current remedial design is located along the southern lake berm. The cleanup area shown in the CAP extended to the top of the lake's southern berm, which is higher than the water level in the lake water level and not a location where sediment could have come to be located; therefore, the extent of the cleanup area was moved directly waterward of this berm.

The remainder of this section describes the composition of the cap, how it will be placed within the LL Parcel Sediment Cleanup Area, and how the extent and settlement of the fill will be verified after construction.

5.3.1 Cap Composition

As part of the RI/FS, a numerical cap modeling evaluation was conducted for the Lora Lake surface sediment COCs (i.e., arsenic, lead, dioxins/furans, PCP, and cPAHs). The results of this modeling evaluation indicated that a sand cap thickness of 18 inches with an organic carbon content of 0.06 percent would effectively isolate the surface sediment concentrations of all of the sediment COCs. Based on this evaluation, the CAP specified that the sand cap to be placed in Lora Lake have a minimum thickness of 18 inches and a minimum organic carbon content of 0.1 percent to provide a margin of safety over the modeling results. This sand cap will prevent leaching of the sediment COCs to surface water and human exposure to contaminants via the surface water consumption pathway.

However, the carbon-amended sand material will be used as fill throughout the LL Parcel Sediment Cleanup Area with a fill thickness approximately between 2 and 16 feet, based on the existing bathymetry, to achieve the final Construction Season 1 design elevations. The plan view of the fill extent is provided in Drawing CG08.1 in Appendix N, and a schematic cross section of the fill placement in the lake is provided in Drawing CG08.2 in Appendix N. Extending the use of the sand cap material to the final fill elevation will ensure a minimum cap thickness of 18 inches is achieved without having to employ underwater surveying techniques and will avoid the challenges of verifying the minimum thickness placement with areas of localized settlement due to underlying peat material. Additionally, the cost of purchasing and blending surplus organic carbon amendment is balanced by the elimination of specialty equipment mobilization required to place thin lifts of the material across Lora Lake.

The gradation specifications of the sand are designed to optimize the hydraulic connectivity of groundwater to Miller Creek and maintain an upward groundwater flow path within the former lake area (Appendix A). Groundwater modeling results indicated that the use of medium to coarse sand as the lake fill will provide a higher conductivity for groundwater migration relative to the adjacent recessional outwash deposits and wetland soils, in support of maintaining the current upward groundwater flow path beneath Lora Lake.

The cap source material will be tested to ensure that the sediment cap and lake fill material meets all specifications. If the cap source material is found to contain less than the necessary 0.1 percent carbon, a carbon amendment, such as granular activated carbon, will be blended with the sand. Gradation and hydraulic conductivity testing will be performed on the cap source material to ensure it will maintain the designed groundwater flow path and meet project specifications. The cap source material will also be analyzed for the Site soil COCs and MTCA 5 metals to ensure that the material has chemical concentrations less than the LL Parcel soil cleanup levels and applicable MTCA cleanup levels for metals that are protective of plants, soil biota, and wildlife. The analyses to be conducted on this material and the acceptance criteria are provided in Table 5.1. The organic carbon, chemical, hydraulic conductivity, and gradation testing will be completed before the sand is imported to the Site and if and when the source of the material changes during construction. Compliance with the carbon content requirement will be confirmed on a minimum of one sample per 1,000 cubic yards of imported sand, and once per 5,000 cubic yards for compliance with the chemical, hydraulic conductivity, and gradation requirements. Additionally, it is required that the sand be sourced from a facility or location in which an assessment has been conducted to confirm that there are no impacts on fill material based on historical operations. The Contractor selected to complete the work will be required to provide confirmation that the sand cap material meets these requirements.

5.3.2 Cap Placement

The required construction sequence for the sediment cap and fill placement begins with the placement of a geotextile fabric, followed by the placement of the carbon-amended sand. The geotextile fabric is placed over the lake sediments before the placement of the sand cap to reduce the suspension of soft sediments during the sediment cap and lake fill material placement and to provide a wildlife barrier where the cap and fill thickness within the LL Parcel Sediment Cleanup Area is less than the 6-foot conditional POC (protective of ecological receptors). Drawing CG08.1 in Appendix N provides the plan view of the LL Parcel Sediment Cleanup Area, and a schematic cross section of the geotextile and sand placement in the lake is provided in Drawing CG08.2 in Appendix N.

Construction of the sediment cap and lake fill material included the following activities:

- **Lake Water Management and Creek Protection.** The lake discharges to Miller Creek via a 12-inch-diameter culvert in its southeast corner. Before any excavation or capping occurs in the lake, the lake will be drawn down to below the culvert elevation and the culvert will be plugged to isolate the lake from the creek and protect the creek water quality. Additionally, the existing failed section (e.g., exchanging surface water) of the eastern lake berm and any other potential overflow points will be temporarily augmented to maintain a hydrologic barrier between the creek and the lake.

  Once fill of the lake has begun, daily pumping, treatment, and discharge of the lake water will be required to prevent overflow of the lake. A water conveyance system will discharge the lake water after treatment to the SR 518 Construction Stormwater Pond, which is just north of the lake (Appendix N, Drawing CG08.1). Pumps will be installed with sufficient capacity to pump out the lake water at a controlled rate in coordination with the rate of the placement of the sediment cap and lake fill material. The acceptable pumping rate will also depend on the antecedent soil moisture conditions, groundwater inflow rate to Lora Lake, and moisture content of the fill material. The Contractor will install gauges to monitor the lake and SR 518 Construction Stormwater Pond stages prior to any water pumping. The pumping rate, lake stage, and SR 518 Construction Stormwater Pond stage will be continually monitored by the Contractor. Additional information regarding lake water management and treatment is presented in Section 3.2.2.

  To assist in the lake dewatering design, a drawdown test was performed on Lora Lake in late September and early October 2015 by Aspect Consulting (Appendix B). This drawdown test confirmed that during remedial action construction, pumping surface water from Lora Lake to the SR 518 Construction Stormwater Pond will be an effective water management option. Additionally, during the observations period, drawdown of the lake level to 1.5 feet below the discharge culvert did not adversely affect the adjacent soils in terms of erosion or slumping. The lake drawdown test was limited by the short duration to observe whether infiltrated water reached Lora Lake. During fill placement with a longer duration than the drawdown test there may be an increase in groundwater inflow to Lora Lake due to infiltration at the SR 518 Construction Stormwater Pond (refer to Appendix A for more details of the SR 518 Construction Stormwater Pond infiltration analysis). The Contractor will be required to submit a Dewatering and Infiltration Plan that will include the layout of the pump and pipe line installations and configurations, discuss the monitoring of the lake and infiltration pond water levels, and describe the treatment system to remove suspended sediment in the pumped lake water.

Any water discharged to the SR 518 Construction Stormwater Pond for infiltration will first be treated using the treatment system and AKART, as described in Section 3.2.

- **Placement of Geotextile Fabric.** To initially contain the soft contaminated sediments, a permeable geotextile fabric will be placed over the entire lake bottom. Prior to placement of the geotextile fabric, a sweep for debris along the lake bottom will be performed by the Contractor in order to remove any protruding debris that may cause damage to the fabric. All removed debris will be disposed of in an approved Subtitle D landfill.

  A single geotextile barrier will be constructed by stitching together individual panels of the geotextile fabric. The fabric panels, which are approximately 50 feet wide and 300 feet long, can feasibly be handled and allowed to float on the water to be pulled into position. The fabric will then be sunk in place using sandbags or other weighted material starting in the middle and working outward.

- **Installation of Settlement Monitoring Gauges.** Potential settlement of the underlying peat material due to the increased load from the sediment cap and fill material was evaluated using information obtained from a review of existing sediment and soil core logs and the geotechnical properties of the peat and soil (refer to the Geotechnical Support for the Lora Lake Parcel Remedial Action Memorandum [Appendix I]). A large portion of the expected settlement of the fill material is likely to occur within about 1 month after fill placement. Around the perimeter of Lora Lake, where the peat is thickest and the fill is thinnest, approximately 3.5 feet of settlement is expected in the first 6 months after fill placement; near the center of Lora Lake, where peat is assumed to be absent and the fill thickness is greatest, approximately 1 foot of settlement is expected in the first 6 months after fill placement.

  Settlement monitoring gauges will be installed after placement of the geotextile fabric in specified locations across the LL Parcel Sediment Cleanup Area as shown in Drawing CG08.1 in Appendix N. The Contractor will submit a Settlement Monitoring Plan outlining the proposed equipment, installation plan, maintenance plan, and backup contingency plan for destroyed or lost gauges. These gauges will be used to track settlement of the fill lift during fill placement, over the winter, and until completion of Construction Season 2.

- **Placement of Sediment Cap and Fill Material.** The sediment cap and lake fill material will initially be placed using either a crane, long-reach excavator, or telebelt system in combination with a bulldozer to place the sand in the lake along the temporary construction lake access road edge. After sturdier lake access has been established, the Contractor may transition to moving and dumping the sand material using off-road haul trucks. The Contractor will then begin placing the material in swaths at least 50 feet wide working first along the lake perimeter and then inward toward the deepest part of the lake. This method will encourage any loose contaminated sediment under the geotextile barrier to migrate downslope toward the deeper water.

  It is understood that this work presents multiple approaches and the Contractor will bring with them expertise from performing related in-water construction activity. The construction specifications will be written to encourage innovative solutions to placing the fill material, while limiting allowable damage to the existing site and ensuring compliance with the requirements of the CAP.

  Sediment cap and lake fill material will be placed to an elevation of 268.5 feet NAVD 88 along the northern Lora Lake cleanup area boundary and be graded gradually to 267 feet NAVD 88 along the southern Lora Lake cleanup area boundary during Construction Season 1, as shown in Drawing CG08.1 in Appendix N. After placement, the sediment cap and lake fill material will be left to settle before the construction of the wetland is finished during Construction Season 2.

- **Stabilization between Construction Seasons.** Augmentations to the lake berms will remain in place between Construction Seasons 1 and 2 to maintain the hydrologic barrier between the lake and Miller Creek. To reduce the potential of runoff sediments from the filled surface during an interim construction season storm event, the Contractor will stabilize the filled area prior to demobilization. This will be done by blowing 4 inches of straw over the lake surface and incorporating it into the sand.

5.3.3 Verification of Cap Extent and Thickness

The 0.1-percent carbon-amended sand will be used for the entire Construction Season 1 cap and fill volume, and will therefore extend beyond the required 18 inches of cap thickness once the final Construction Season 1 design elevations are achieved.

At the start of Construction Season 2, a survey of the fill surface will be conducted to determine the extent of the fill and any settlement that has occurred. This will be used to determine the necessary additional fill required to achieve the final target lake fill elevation of 266 feet NAVD 88, above which the wetland topsoil and drainage channel materials will be placed and graded. After completion of Construction Season 2, the wetland final Construction Season 2 fill surface will be surveyed on 1-foot contours, to a horizontal and vertical accuracy of within 0.1 foot. Survey data will be included in the Construction Completion Report, which will be issued after construction is completed.

5.4 WETLAND CONSTRUCTION

After placement of the sediment cap and lake fill material, the lake will be converted to a palustrine scrub-shrub wetland system. The fill material placed in Construction Season 1 has been left to settle until Construction Season 2 (2018), at which time the Contractor will return to the LL Parcel to regrade the surface of the settled fill, place any additional fill needed due to localized settlement, install the sediment cap monitoring wells, construct the final connections between the wetland and Miller Creek, place wetland soils and materials to form drainage channels, perform final grading, install seed mix, and install the plantings. This section provides design and construction details for these elements.

5.4.1 Wetland Design Requirements

The rehabilitation of a wetland at Lora Lake is a critical component of the overall remedial action. Rehabilitating a wetland in this location has the potential to substantially increase ecological function compared to the existing open-water lake, resulting in a net benefit for the Miller Creek/Vacca Farm system. The rehabilitation of the lake to a palustrine scrub-shrub wetland will help eliminate a source of low-oxygen, high-temperature water to Miller Creek in the summer. Additionally, this removal of open water will help to achieve the safety objectives outlined in the Port's WHMP.

The design for the lake filling and wetland rehabilitation was developed for consistency with the ecological functions of the Port Mitigation Area covered by the NRMP and to provide substantive compliance with state and local regulations, as well as the remedial design requirements in the CAP. The CAP design requirements that specifically relate to the rehabilitated wetland include the following:

- The rehabilitated wetland will be a palustrine scrub-shrub wetland system.
- The rehabilitated wetland will be capable of supporting emergent and woody vegetation and will create habitat that is consistent with the goals of the NRMP.
- The design will maintain the current upward groundwater flow path beneath Lora Lake by requiring placement of high-conductivity fill material (relative to the adjacent wetland soils).
- The wetland will be designed so that it does not adversely affect the function of the Port Mitigation Area covered by the NRMP.

The wetland design also considers the City of SeaTac Critical Areas Code and floodplain regulations. Though permits will not be needed from the City of SeaTac, the design was developed to comply with the intent of the city's code requirement. In order to achieve the ecological requirements of the CAP and meet the intent of city codes, the project design includes a number of elements to avoid and minimize impacts due to the placement of fill in the floodplain and in critical areas. The project design includes a series of swales and fill that has a high hydraulic-conductivity to minimize groundwater level impacts and to minimize the elevation of the finished grade of the wetland in order to also minimize the volume of fill needed. The project also enhances floodplain connectivity between Miller Creek and the rehabilitated wetland. Improved floodplain connectivity here slows water velocities in the creek during floods and mitigates for the reduction of floodplain storage within the lake footprint, resulting in a net decrease in the 100-year flood elevation adjacent to Lora Lake. This approach was presented to the City of SeaTac in January 2016, and the City indicated that it was acceptable with the appropriate documentation for the Federal Emergency Management Agency (FEMA). A floodplain analysis was developed to document the approach for the floodplain and was submitted to the City of SeaTac in May 2016 (Appendix H).

5.4.2 Lake Filling and Wetland Design Analysis

The wetland design has been supported by various field studies and numerical modeling efforts. Water levels and flow data were collected throughout the project area from 2013 to 2014 (Aspect Consulting 2015). The 2015 drawdown test, discussed in Section 5.3.2, also provided empirical data to support the modeling of pre-remediation and post-remediation groundwater levels, as well as construction planning (refer to the Lora Lake Parcel Pump-Down/Pump-Back Test Memorandum [Appendix B]). Additionally, two modeling efforts were conducted by the design team to support the development of alternatives for the lake fill and wetland designs that meet the remedial objectives described in the CAP. The two modeling efforts were an integrated and iterative process that formed the basis of the selected remedial design.

One of these efforts consisted of Lora Lake groundwater modeling, which incorporated information from field data collection, including measurements of baseline water levels, flow monitoring, and the Lora Lake drawdown test (refer to the Lora Lake Parcel Groundwater Modeling—Support for Remedial Action Design Memorandum [Appendix A]). The groundwater model simulates three-dimensional transient flow using the U.S. Geological Survey's groundwater modeling code MODFLOW 2005 with a specialized solver to allow calculation of partially saturated conditions. Environmental Simulations Incorporated's Groundwater Vistas modeling software was used to construct the model and interpret results. Additional details of the groundwater model construction, modeling approach, key project assumptions and empirical data use, and results are provided in Appendix A. The objective of this groundwater modeling was to (1) simulate pre-remediation groundwater flow and groundwater/surface water conditions to provide confidence in applying the model to post-remediation conditions, and (2) to evaluate alternative scenarios (e.g., alternative fill specifications and wetland designs) in terms of their ability to achieve several key remediation design objectives.

The other modeling effort by the design team included the development of a conceptual hydrologic model of the lake and creek system, which included a one-dimensional hydraulic model of the portion of Miller Creek between the Lake Reba outlet control structure and South 156th Place (Appendix H).

5.4.3 Wetland Grading and Plantings

After the placement of fill material within the former lake footprint, approximately 10,000 cubic yards of wetland topsoil will be placed over the fill material to support scrub-shrub vegetation and restore Lora Lake to a depressional wetland system. The wetland design elements will be constructed and the wetland plantings will be placed during Construction Season 2, throughout the summer and fall of 2018. The plan view of the wetland design is provided in Drawing CG10.1 in Appendix N, and cross sections of the wetland surface hummocks, drainage channels, and wetland plantings in the former lake footprint are provided in Drawings CG10.3 and CG10.5 in Appendix N.

5.4.3.1 Wetland Design and Construction

Based on the wetland design requirements and other considerations described in Section 5.4.1 and the analyses performed to evaluate various wetland designs described in Section 5.4.2 and Appendix H, a wetland design was developed and selected for implementation.

To achieve the design objective, the wetland rehabilitation design includes a number of elements intended to build a wetland surface that interacts with groundwater and Miller Creek to result in a shrub-dominated floodplain and wetland surface (Appendix N, Drawing CG10.1). A perimeter ditch around the edge of the wetland will capture groundwater discharged from the base of the slope and route it into a series of shallow swales, which will carry the water downgradient through the wetland toward an outlet to Miller Creek. These swales are separated by broad hummocks with gently sloping sides to provide variable elevations from the soil surface to groundwater and support a range of wetland vegetation. Additional details of the design elements are provided in Appendix H.

Various elements were included in the design to improve connectivity between the rehabilitated wetland and Miller Creek during flood conditions. These elements include the removal of a portion of the existing eastern lake berm. Additionally, a new outlet channel will connect from the wetland to Miller Creek via openings in the existing southern lake berm and the Miller Creek relocation berm adjacent to the Enhanced Existing Wetland portion of Vacca Farm. This channel will serve as a focused drainage point to connect this area to the creek, reduce groundwater levels, and minimize filling within the floodplain. The location of the proposed outlet is shown in Drawing CG10.1 in Appendix N. Additional details of the hydroperiod and design elements for the wetland that are required to meet the key design objectives and the CAP requirements are provided in the Lora Lake Parcel Remedial Action Mitigation Plan (Appendix H).

Similar to the lake fill material, the topsoil material to be used for wetland construction will be tested before its placement on the LL Parcel. It will be analyzed for the Site soil COCs and the MTCA 5 metals to ensure that this material has chemical concentrations less than the LL Parcel soil cleanup levels and applicable MTCA cleanup levels for metals that are protective of plants, soil biota, and wildlife. The analyses to be conducted on this material and the acceptance criteria are provided in Table 5.1. The Contractor selected to complete the work will be required to provide confirmation that the wetland topsoil meets these requirements.

At the beginning of Construction Season 2, after the initial lake fill has settled, additional fill will be placed to bring the lake surface up to an average elevation of 266.0 feet NAVD 88. Wetland topsoil varying from 1.5 to 3.0 feet in depth will be placed over the fill to create hummocks. The finished wetland surface will be covered in coir fabric and hydroseeded to prevent erosion. The swale system and the toes of the hummocks will be surfaced with 6 inches of stream gravel and bounded by coir logs to prevent slumping of the newly placed topsoil and encourage drainage through the Site and to Miller Creek.

The new outlet will be constructed south of the current lake to connect the wetland swale system to Miller Creek. This location was chosen to provide the maximum drainage head to the swale system, provide adaptive management for the Existing Enhanced Wetland portion of Vacca Farms, which is not currently meeting its mitigation goals, and minimize impacts on Miller Creek and the surrounding successful restoration areas. The outlet is also sited to avoid larger trees. The outlet channel will cut through the southern lake berm, meander through the Existing Enhanced Wetland (this portion will be fit in the field), and open a portion of the existing Miller Creek restoration berm to connect with the creek. All grading work within the existing wetland areas south of the lake will be completed while the floodplain area is dewatered. Pumped water will be conveyed to the on-site water treatment system and treated prior to discharge and infiltration at the SR 518 Construction Stormwater Pond (refer to Section 3.2). No grading will occur in the Miller Creek low-flow channel, and a temporary sandbag dewatering dam will be constructed to separate the creek from the work site.

Additionally, an 80-foot section of the eastern lake berm will be removed to increase hydraulic connectivity between Miller Creek and the rehabilitated wetland. Coir logs and coir fabric will be installed to provide immediate erosion protection and vegetation planted along the banks will provide long-term bank stability, and a key trench of large stone will be buried along the length of the opening to prevent Miller Creek from avulsing into the rehabilitated wetland during high flows. At the northern end of the proposed opening, the key trench will connect to a low (less than 2 feet) rock berm, which will extend an additional 20 feet parallel to Miller Creek in order to halt existing bank erosion in this location. The rock berm will be set back from the bank of the creek, and willow live stakes will be planted through the rock in order to preserve ecological function.

Before the placement of the wetland topsoil and final grading, sediment cap monitoring wells will be installed in the higher elevation “hummock” areas of the wetland. The wells will be installed before topsoil is placed and the wetland surface is planted to avoid compaction of the surface soils and impacts on the new vegetation. Further details of the well installation and compliance monitoring program are included in Section 5.7.

5.4.3.2 Wetland Planting and Seeding

The goal of the plantings is to develop a scrub shrub vegetation community over the rehabilitated wetland. After final grading is completed, a wetland seed mix will be applied to all topsoil placement areas to promote soil stability. Four vegetation communities consisting of native upland and wetland tree, shrub, and emergent species will be installed in planting pits according to the density and quantities provided in project design and specifications. Mulch mats will be placed on plantings installed in the upper portion of the hummocks to provide additional weed control. A site inspection will be conducted after all the planting activities are completed as part of construction final acceptance and the beginning of the Site monitoring period.

The Port will conduct monitoring and maintenance of the newly planted wetland that is consistent with the ongoing monitoring of the Port Mitigation Area per the Mitigation Area Restrictive Covenant. Wetland monitoring will be conducted for a minimum of 10 years.

5.5 CONTAMINATED SHALLOW SOIL EXCAVATION AND AREA RESTORATION

The horizontal and vertical extents of the shallow soil excavation areas on the LL Parcel were developed on the basis of data collected during the RI. The two excavation areas have been named Excavation Areas 5 and 6, according to the naming convention used for the four excavation areas on the LL Apartments Parcel (Excavation Areas 1 through 4).

Excavation Area 5 is the northern excavation area on the LL Parcel; it varies in width from approximately 25 feet (at the south end) to 65 feet (at the north end) and has a length of approximately 155 feet (Appendix N, Drawing CG06.1). Excavation Area 5 requires excavation at two different depths. The northern portion of this excavation area requires the removal of the top 1.5 foot of contaminated surface soil, and the southern portion of this excavation area requires the removal of the upper 6 feet of contaminated soil, because the depth of soil contamination was not bounded in this southern portion of Excavation Area 5 during the RI. The width of this excavation area ranges from approximately 25 to 65 feet wide, and the excavation is 160 feet long.

Excavation Area 6 is the southern excavation area on the LL Parcel (Appendix N, Drawing CG06.1) and requires the removal of the top 1.5 foot of contaminated surface soil. The excavation is 25 feet wide and 90 feet long.

Both of the excavation areas extend to the sidewalk along Des Moines Memorial Drive, and these areas will be accessed during construction from the sidewalk and shoulder of Des Moines Memorial Drive. Operation alongside the right-of-way will require traffic control and temporary removal of fences. The contaminated shallow soil excavation areas slope steeply eastward toward the lake; therefore, temporary high-visibility construction fencing and straw waddles will be installed before work begins along the downslope boundaries of the soil excavation areas to control erosion and minimize impacts on the surrounding vegetation. An excavator will be used to remove the existing vegetation and contaminated soils and load them directly onto adjacent dump trucks for transport to an off-site appropriately permitted upland landfill for disposal. Alternatively, if possible to remove larger vegetation without disturbing underlying contaminated soil, vegetation may be cleared by cutting stumps as close as possible to the ground surface and transported for composting or recycling rather than Subtitle D landfill disposal, as described in Section 4.2.1 for clearing and grubbing activities on the LL Apartments Parcel.

After completion of the excavations, the excavation extents will be verified by survey or GPS consistent with the methods described in Section 4.3.6. Additionally, soil performance monitoring samples will be collected from the western sidewalls of the two excavation areas to assess the remaining concentrations of dioxins/furans and lead beneath the City of SeaTac sidewalk. Sidewall samples for dioxins/furans and lead analysis will be collected from Excavation Area 5 and from Excavation Area 6. In the northern portion of Excavation Area 5, the sidewall sample will be analyzed for only dioxins/furans, because lead was not detected at concentrations greater than the soil cleanup levels in this portion of the excavation. A soil performance monitoring sample will also be collected from the bottom of the excavation in the southern portion of Excavation Area 5, where the contamination depth was previously unbounded, to document the remaining concentration of dioxins/furans in this area. Further details of this performance monitoring are provided in Section 7.1.6 and in the Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) Addendum (Appendix J).

5.5.2 Backfill, Grading, and Planting

After excavation, the excavation areas will be backfilled and graded. Select fill will be a naturally occurring sandy gravel and placed up to 6 inches bgs. Topsoil material will be a mixture of naturally occurring sandy loam soil that consists of a maximum of 20 percent composted organic material. The composition of the topsoil is intended to provide sufficient fines for soil structure, while retaining moisture and nutrients for plant growth. All excavated areas will be overlaid with 6 inches of the approved topsoil material after compaction and before seeding or planting activities begin.

Similar to other fill materials, the soil used to backfill the shallow soil excavation areas will be tested before its placement on the LL Parcel. The soil will be analyzed for the Site soil COCs and MTCA 5 metals to ensure that this material has chemical concentrations less than the LL Parcel soil cleanup levels and applicable MTCA cleanup levels for metals that are protective of plants, soil biota, and wildlife. The analyses to be conducted on this material and the acceptance criteria are provided in Table 5.1. The Contractor selected to complete the work will be required to provide confirmation that the backfill soil meets these requirements.

Once backfilling and grading have been completed in the excavation areas, the excavation areas will be replanted in accordance with the NRMP planting schedule, with adjustments based on the historical performance of the plant species and the site conditions. An erosion control seed mix will be applied to all excavated areas after topsoil placement to increase stabilization. Planting materials of the same size and density will be installed accordingly to the original planting zones identified in the NRMP. These replanted areas will be managed in accordance with the requirements and management goals of the NRMP.

5.6 OFF-SITE DISPOSAL OF CONTAMINATED SOIL

Contaminated soil from the LL Parcel shallow soil excavations will be managed and disposed of according to the methods described for the contaminated soil excavated from the LL Apartments Parcel. Because the concentrations of Site COCs in soil to be excavated from the

LL Parcel are less than the dioxins/furans TEQ remediation level and the lead cleanup level applicable to the LL Apartments Parcel, soil excavated from the LL Parcel may be used as backfill at the LL Apartments Parcel if the material is found to be geotechnically suitable. The excavated soil may also be disposed of off-site at a permitted and approved Subtitle D landfill.

5.7 SEDIMENT CAP MONITORING WELL INSTALLATION

Confirmation monitoring of the sediment remedy will begin after construction of the new wetland within the former lake footprint to assess whether contamination from the isolated and immobilized lake sediment is migrating through the sediment cap or horizontally away from the constructed wetland. Consistent with the WSDOE-approved CMP, four sediment cap performance monitoring locations ("monitoring wells") will be installed within the former lake footprint (MW-CP1 through MW-CP4), and three will be installed between the former lake footprint and Miller Creek (MW-CP5 through MW-CP7). Additionally, the proposed confirmation monitoring well network for the sediment remedy includes two wells that will be installed as part of the project construction (MW-C1/VB1 and MW-VB2) and two existing upgradient background wells (HC00-B312 and HC00-B311), all referred to as "site vicinity" wells (Appendix J, Figure J.2. Post-construction groundwater samples will be collected from the monitoring wells and the site vicinity wells to provide a baseline for comparison. For additional details of the sediment cap confirmation monitoring after construction, refer to Section 7.1.5.

This section provides the rationale for the updated well locations based on the remedial design, construction sequence, and vehicle access conditions. Summaries of the well installation methods and well construction details are also provided.

5.7.1 Monitoring Well Locations

The locations of the proposed sediment cap monitoring wells are shown in Drawing CU03.1 in Appendix N. Several monitoring well locations have been adjusted from the preliminary locations described in the CMP (Floyd|Snider 2015b), after the wetland was designed and additional hydrologic data were collected. As described in Section 5.4.2, the lake filling and wetland design have involved the development and use of a comprehensive groundwater model that has been calibrated and verified with Site empirical data. The four wells within the former lake footprint (MW-CP1 through MW-CP4) have been relocated to the higher elevation "hummock" areas of the wetland between the wetland drainage channels and situated to obtain adequate horizontal representation of the capped area. These wells have also been spread out slightly to provide horizontal coverage that is more representative of the area and allow the collection of data from locations closer to the POC at the edges of the former lake.

One of the three monitoring wells located south of the former lake footprint, along the Miller Creek berm, MW-CP5, has been relocated to the southern edge of the former lake. This location change was made for several reasons. The coverage provided by the new location is in coordination with the revised layout of monitoring wells within the former lake footprint and is more protective of Miller Creek because it will provide an earlier indication of potential horizontal migration of contaminants. In addition, the new location has a greater likelihood of being outside of an area of peat deposits and elevated concentrations of naturally occurring arsenic in soil and groundwater that borders the former lake footprint to the southeast (Papadopulos 2006) than the preliminary location indicated in the CMP. Based on the available information, MW-CP6 remains in the area of peat and elevated concentrations of arsenic in soil and groundwater (Figure 5.1). These conditions should be considered when evaluating monitoring results for both MW-CP5 and MW-CP6. The location of the third monitoring well, MW-CP7, will provide an assessment of groundwater conditions east of the former lake footprint, near Miller Creek.

The two newly installed site vicinity wells (MW-C1/VB1 and MW-VB2) and the two existing site vicinity wells (HC00-B312 and HC00-B311) located hydraulically upgradient of Lora Lake are shown in Appendix J, Figure J.2. The location and construction of these wells are appropriate for the confirmation monitoring goals of the site vicinity wells. The purpose of the site vicinity wells is to provide groundwater data that are unaffected by the capped sediment contamination in Lora Lake, as a basis for statistical comparison with the confirmation monitoring results. This statistical comparison with the confirmation monitoring results will provide a measurable method to determine whether samples collected immediately above the sediment cap and between the former lake footprint and Miller Creek are different from samples collected from the site vicinity wells, which are representative of background. This comparison is needed to evaluate confirmation results because data from upgradient and cross-gradient groundwater wells indicate that the background groundwater concentrations of dioxins/furans in the vicinity of the Site currently exceed the practical quantitation limit. Similarly, arsenic is a known regional background contaminant and has been detected in upgradient and cross-gradient groundwater wells, in addition to the area of peat and elevated arsenic concentrations in soil and groundwater south and east of Lora Lake.

The site vicinity wells will be located northwest and west (MW-C1/VB1 and MW-VB2, respectively) of Lora Lake on the LL Apartments Parcel and northeast of the lake (HC00-B312 and HC00-B311). Upon review of the confirmation and site vicinity well monitoring data, the installation of new site vicinity wells may be proposed as substitute site vicinity wells if the results indicate that they would be more suitable for the statistical comparison.

5.7.2 Construction Sequencing and Vehicle Access for Monitoring Well Installation

The sediment cap monitoring wells will be installed during Construction Season 2. After capping, filling, and rough grading but before the placement of the wetland topsoil, final grading, and planting of the wetland surface, four sediment cap monitoring wells will be constructed within the filled lake area above the minimum required sediment cap thickness of 18 inches, based on numerical sediment cap design modeling. This sequence will be used to avoid compaction of the wetland topsoil that would occur if the wells were installed after topsoil placement. The monitoring wells within the former lake footprint will be constructed with a concrete surface seal at the lake fill grade, and wetland topsoil will be placed around them. The monitoring well depths and the monument and riser height will be determined after the filling of the lake using the estimated amount of future settlement in the lake fill based on the settlement monitoring point closest to each monitoring well and the planned thickness of the wetland topsoil to be placed after well installation.

To minimize potential damage to the surrounding wetlands, drilling and support vehicles will access the monitoring well locations in the LL Parcel Sediment Cleanup Area (MW-CP1, MW-CP2, MW-CP3, and MW-CP4) and south of the LL Parcel Sediment Cleanup Area (MW-CP5 and MW-CP6) via the temporary construction lake access road and across the former lake on rough-graded lake fill. Monitoring wells MW-CP5 and MW-CP6, located outside the former lake footprint, will be installed by positioning the drill end of the rig and the borehole outside the lake fill area, while keeping the remainder of the drill rig and support vehicles on lake fill. Drilling and support vehicles will access the location of MW-CP7 from the east, via a north-south-trending trail east of Lora Lake. A limited-access drill rig will be deployed if needed to navigate the slope, vegetation, and obstacles in this area.

5.7.3 Well Installation and Development Methods and General Well Construction

The monitoring wells will be installed according to the Minimum Standards for Construction and Maintenance of Wells (Chapter 173-160 WAC). The well installation and construction, as described in the following text, will be consistent with that described in Section 7.1.2 of the CMP (Floyd|Snider 2015b). The wells will be installed using hollow-stem auger technologies. During well installation, soil samples will be collected for visual classification, using a split-spoon sampler and will be logged and recorded by a field technician under the supervision of a licensed geologist. During installation of monitoring wells located in the former lake footprint, soil will be sampled continuously with the split-spoon sampler, from 2 feet bgs to 0.5 foot above the cap. For all other monitoring wells, except those that replace existing monitoring wells, a maximum of 2.5 feet of unsampled interval will separate the split spoon samples. The monitoring well soil borings will be classified according to the Unified Soil Classification System.

The monitoring wells will be constructed of a 2-inch-diameter, flush-threaded, Schedule 40 PVC well casing and screen. Well screen assemblies will consist of a 5- to 20-foot length of 0.020-inch (20-slot) machine-slotted PVC with a 0.5-foot-long sump and threaded end cap. Monitoring wells within the former lake footprint will have a 2- to 2.5-foot screen length to selectively monitor groundwater near the remediation cap. Two of the monitoring wells outside the former lake footprint will have a 5- to 15-foot screen length and the third monitoring well will have a 5- to 20-foot screen length to better monitor groundwater from preferential pathways in native soils. The screen will be set in a 10/20 (or equivalent) silica sand filter pack, which will extend a minimum of 1 foot and up to 2 feet above the top of the screened interval. A minimum 2-foot-thick seal of hydrated bentonite chips will be installed in the annular space immediately above the sand filter pack and hydrated with potable water if installed above the water table. Monitoring wells will be secured with a locking, aboveground steel protective monument with a drain hole and an expansion seal on the well casing to minimize the potential for rain/surface water to enter the monument.

Well development will be performed according to standard industry practice to remove water and fines from the well casing, filter pack, and surrounding formation disrupted by well installation. All purge water and decontamination water generated during well development activities will be collected in 55-gallon drums that will be labeled to indicate the date of generation, monitoring well source, and volume of contents and properly disposed of according to state and federal regulations.

5.7.4 Well Screen Intervals

The monitoring wells located within the former lake footprint (MW-CP1, MW-CP2, MW-CP3, and MW-CP4) will be installed so that the total depth of each boring does not penetrate the 18-inch-thick sediment cap and so that each well has a 2- to 2.5-foot screened interval extending up from the surface of the sediment cap. This screened interval is intended to focus monitoring on groundwater flowing upward through the sediment cap. Several steps will be taken to ensure that drilling does not penetrate the sediment cap. Total boring depths will be determined based on lake fill depths measured during sediment cap and lake fill material placement and adjusted to account for the estimated amount of future settlement. During installation of monitoring wells within the former lake footprint, soil (fill material) will be sampled continuously with the split-spoon sampler, from 2 feet bgs to 0.5 foot above the sediment cap. The borehole will be advanced no deeper than 0.5 foot above the sediment cap, and the monitoring well end cap will be set at this depth.

The sediment cap monitoring wells located between the former lake footprint and Miller Creek (MW-CP5, MW-CP6, and MW-CP7) will have screened intervals extending from the water table to the equivalent depth of the up- and cross-gradient contaminated sediment capped beneath the former lake (approximately 252 feet NAVD 88). This screened interval is intended to monitor for potential horizontal migration of contaminants from the capped sediments. For MW-CP5 and MW-CP6, the estimated total well depth is 15 feet, and the screened interval will be approximately 5 to 15 feet bgs. For MW-CP7, which is expected to be installed from a higher elevation, the estimated total well depth is 20 feet, and the screened interval will be approximately 5 to 20 feet bgs.

5.8 INSTITUTIONAL CONTROLS

The Port will work with WSDOE to determine whether a new environmental covenant is required or if the Port's existing Mitigation Area Restrictive Covenant can be amended to include conditions for any contamination left in place within the LL Parcel Sediment Cleanup Area, in addition to covering long-term maintenance and monitoring of the newly rehabilitated wetland. A draft environmental covenant or amendment to the Mitigation Area Restrictive Covenant for the LL Parcel Sediment Cleanup Area will be submitted to WSDOE for consideration with the as-built reports for the work on the LL Parcel.

Environmental covenants or restrictive covenant amendments may also be needed after construction in the contaminated shallow soil excavation areas. The necessity for covenants will depend on the results from the performance monitoring samples collected from the sidewalls of the two excavation areas (Excavation Areas 5 and 6) abutting the east side of the paved sidewalk along Des Moines Memorial Drive on City of SeaTac right-of-way and a performance monitoring sample collected from the bottom of Excavation Area 5, where prior RI sampling did not vertically bound the contamination. An environmental covenant may be placed on the City of SeaTac right-of-way if concentrations of dioxins/furans and/or lead exceed the LL Parcel cleanup levels. Additionally, if the concentrations of dioxins/furans exceed the LL Parcel cleanup level in the sample from the bottom of Excavation Area 5, then a conditional POC will be established at a depth of 6 feet bgs, and an environmental covenant or amendments to the Mitigation Area Restrictive Covenant will be established to regulate any disturbance of deeper soil within this area. The necessity of environmental covenants and the restrictions they include will be determined in coordination with the City of SeaTac, WSDOE, and the attorney general's office, as appropriate.

6.0 1982 Dredged Material Containment Area Construction Activities

The area of the DMCA qualifies as an industrial area pursuant to WAC 173-340-745(1). Within the DMCA, the soil COCs do not exceed the industrial cleanup levels based on direct contact, and they are not affecting groundwater. Institutional controls are required when soil cleanup levels are based on industrial land use. The selected remedial action at the DMCA is the implementation of institutional controls in the area and the construction of a wildlife barrier. The barrier will prevent the exposure of plants and wildlife to contamination and can also be used in the future by the Port as a temporary construction laydown or equipment storage area. The preferred alternative and WSDOE-selected remedy as described in the CAP, included the option for consolidation of soils excavated from the LL Apartments Parcel at the DMCA to support redevelopment at the LL Apartments Parcel; however, based on the grading analysis conducted during project design, it has been determined that no soil from the LL Apartments Parcel excavation will be consolidated at the DMCA. A portion of the DMCA is expected to be used during construction of the LL Parcel remedial action for staging and stockpiling of lake fill materials, as described in Section 5.2.1.

The DMCA is within the XOFA (FAA 2014). The DMCA is expected to remain in Port ownership in perpetuity and is already subject to deed restrictions, access restrictions, and institutional controls for FAA and airport operational purposes. Because the DMCA is located in a Port-secured area, there is no public access.

6.1 PERMITTING AND REGULATORY REQUIREMENTS

The installation of the wildlife barrier in the DMCA is part of the site-wide MTCA remedial action being performed under a CD with WSDOE and, therefore, is exempt from certain procedural and permitting requirements of select Washington laws and regulations and all local permits (WAC 173-340-710(9)(b)). However, the wildlife barrier installation and associated work elements described below must still comply with the substantive requirements of any otherwise applicable permits. All work performed in the DMCA will meet the substantive requirements of applicable regulations and standards and will comply with all action-, chemical-, and location-specific ARARs, as identified in the CAP.

SEPA compliance is required for any state or local agency action. WSDOE reviewed the Port-prepared SEPA checklist for the project, as well as the information presented in the RI/FS and CAP, and determined that a MDNS is warranted for this Site, including the DMCA, as described in Section 5.1.

At the time of this report, the Port is pursuing a NPDES CSWGP, administered by WSDOE, to allow for potential contingency overflow of treated construction water from the SR 518 Construction Stormwater Pond to an existing vegetated swale that discharges to Miller Creek. While not discussed further in this report given that coordination with WSDOE is ongoing, this option will be available to the Contractor in the event that WSDOE issues a NPDES CSWGP. In the event the Port secures a NPDES CSWGP as part of the final design process before construction, the Port will transfer the permit to the selected contractor and the Contractor will comply with permit conditions and discharge requirements. A Draft SWPPP prepared for the work to be implemented at the LL Apartments Parcel and the DMCA and for the soil excavation work at the LL Parcel describes how stormwater will be managed during construction. This Draft SWPPP will be updated by the selected contractor as part of the required pre-construction submittals. Additional information regarding construction water management and treatment is presented in Section 3.2.

Local permitting requirements for construction activities conducted in the DMCA fall within the jurisdiction of the City of SeaTac and will comply with the applicable substantive requirements of the City of SeaTac Clearing and Grading Permit, Maintenance of Traffic Plan, and Haul Permit Regulations of the SeaTac Municipal Code.

6.1.1 100-Year Floodplain

As part of the remedial design process in February 2016, a site-specific topographic survey was conducted and control points, positioned approximately every 100 feet around the approximate extent of the LL Parcel Sediment Cleanup Area, were staked by the Port survey crew. As part of this effort, the 100-year floodplain boundary, the southern and eastern boundaries of the DMCA, and the western edge of Wetland 8, which is located east of the DMCA, were also surveyed and staked. Approximately 1,000 square feet (0.7 percent) of the DMCA along its southern boundary is located within the 100-year floodplain (FEMA 1989a, 1989b, 1989c). The site preparation and installation of the wildlife barrier within the DMCA does not extend into the 100-year floodplain, and a planting filter strip will be installed between the wildlife barrier and the floodplain as a protective measure.

6.1.2 Wetland 8 East of the 1982 Dredged Material Containment Area

Wetland 8, located east of the DMCA, is a depressional and riverine wetland that covers approximately 4.5 acres and is associated with Miller Creek. According to the Cowardin system, Wetland 8 contains palustrine forested (PFO), palustrine scrub-shrub (PSS), and palustrine emergent (PEM) classes of wetlands (Cowardin et al. 1979). The main source of hydrology for Wetland 8 is a high groundwater table, overbank flooding from Miller Creek, and precipitation. The wetland was originally delineated in 2012. To update the wetland rating, an Environmental Science Associates biologist conducted an additional site visit in March 2016. The updated rating was based on the *Washington State Wetland Rating System for Western Washington—2014 Update* (Hruby 2014). Wetland 8 received an overall score of 20 points, which results in a Category II rating (Appendix K).

Wetland 8 received a high score for water quality improvement functions (8 points); the wetland has a highly constricted outlet and a high coverage of persistent plants. Both characteristics aid in the trapping and filtering of sediments. However, this score is less than the maximum due to seasonal ponding in just a small portion (less than 25 percent) of the wetland. Wetland 8 received a moderate score for hydrologic functions (7 points). The wetland provides water storage due to its highly constricted outlet but this function is limited due to a low depth of storage (0.5 foot to less than 2 feet). This function is further limited by the size of the contributing basin, which is more than 100 times the size of the wetland. Wetland 8 received a moderate score for habitat function (5 points). The wetland has diverse and interspersed plant communities that provide an increase in ecological niches and habitat functions. However, because of the wetland location in a largely urban and developed area, there is limited potential for the landscape to support the habitat functions of the Site.

The SeaTac Municipal Code defines wetland buffer requirements based on the size, vegetation cover, and special characteristics of the wetland. Under the City of SeaTac Critical Areas Code, a Class 2 wetland requires a 50-foot protective buffer (SeaTac Municipal Code, Section 14.30.290.A).

All work in the DMCA is currently designed to be outside the City of SeaTac–required wetland buffer of 50 feet for a Class 2 wetland. Temporary erosion and sediment controls and high-visibility fencing will be installed around the work site to prevent construction impacts on the wetland and the 50-foot buffer area. Because this project will not affect Wetland 8, no mitigation is planned. Currently, the western edge of Wetland 8 is an ecologically low-functioning buffer dominated by Himalayan blackberry. After the completion of construction activities in the DMCA, a 10-foot-wide filter strip of native grasses and shrubs will be planted within the eastern and southern boundaries of the DMCA, where it borders the Wetland 8 buffer. This action is expected to expand the buffer zone and improve its ecological functioning.

6.2 SITE PREPARATION

The DMCA has an area of approximately 2.75 acres. The eastern half of the DMCA is an approximately 1.5-acre vegetated area covered by a few trees and a mix of grasses and invasive and pioneering plant species, including Scotch broom, alder saplings, Himalayan blackberry, and butterfly bush. The remaining approximately 1.25 acre of land is the location of the approach lighting system for the STIA 3rd Runway, which was constructed in 2006. This area has been regraded and covered with gravel and is kept free of vegetation by the Port. The DMCA is located outside the Port Mitigation Area.

Site preparation activities include clearing and grubbing of existing vegetation, rough grading, installation of temporary erosion and sediment control BMPs, construction of the wildlife barrier, and installation of the planted filter strip, which are described in further detail in the following subsections.

6.2.1 Site Access

The DMCA is currently enclosed within a perimeter fence, which prevents access to this parcel by unauthorized persons and the general public. This fence will be maintained and relocated or repaired if necessary by the Contractor for the duration of the DMCA construction activities and the subsequent use of a portion of the DMCA for staging and stockpiling of fill materials for the LL Parcel remedial action. An existing access gate and Port access road is located off Des Moines Memorial Drive provides access to the northern portion of the LL Parcel and the DMCA. This gate and road will be used by the Contractor for accessing the LL Parcel and DMCA (Appendix N, Drawing G05.1).

6.2.2 Stormwater, Erosion, and Sediment Controls

During construction, the Site will be maintained and graded as needed to provide for continued infiltration of stormwater to the maximum extent. Stormwater that does not infiltrate in the DMCA will be directed to the adjacent SR 518 Construction Stormwater Pond for treatment and infiltration.

Temporary erosion and sediment control BMPs will be installed and maintained by the Contractor for the duration of the project. These BMPs are discussed in greater detail in the Draft SWPPP (Appendix E) and shown in Drawing CE02.1 in Appendix N. The Contractor will be responsible for finalizing the Draft SWPPP (Appendix E) to be specific to the Contractor personnel, identification of any other BMPs that may be implemented, and construction methods planned. The Contractor will also be responsible for providing a CESCL who can inspect and repair, as necessary, and implement additional BMPs as needed on a regular schedule. These measures, particularly the installation and maintenance of silt fencing and the protection of the 50-foot buffer zone, are expected to provide adequate sediment and erosion protection for Wetland 8.

In addition to these BMPs, a Spill Prevention, Control, and Countermeasures Plan will be prepared by the Contractor detailing how to prevent spills of petroleum products and hazardous materials and how to provide efficient and timely cleanup if a spill occurs during construction activities.

6.2.3 Clearing and Grubbing

The majority of the DMCA, which is outside the 100-year floodplain, will be cleared and grubbed (Appendix N, Drawing CG03.1) so that no trees, shrubs, or plants remain. All vegetation that is removed from above ground will be cut flush with the ground and taken off-site by the Contractor for reuse as compost or for disposal at a permitted landfill facility. The root masses of trees and shrubs will also be removed and must be disposed of at a permitted and approved Subtitle D landfill, consistent with the disposal of root masses excavated from the other areas of the Site.

6.2.4 Rough Grading

Upon completion of clearing and grubbing activities, the DMCA will be regraded to the elevations shown in Drawing CG03.1 in Appendix N, and the subgrade will be prepared for construction of the wildlife barrier by compacting the subsurface and grading the area for placement of the surfacing material.

6.3 WILDLIFE BARRIER

After clearing, grading, and use of the DMCA for construction staging and stockpiling during Construction Season 1 for the LL Parcel remedial action, a barrier to wildlife will be installed within the DMCA and outside the floodplain (Appendix N, Drawing CG03.1). The hillside area east of an ecology block wall on the eastern side of the DMCA will be overlain with a non-woven geotextile followed by a minimum of 12 inches of crushed rock. The geotextile will be secured behind the ecology block wall and by an anchor trench running along the wildlife barrier perimeter. The remaining DMCA will be covered by a minimum of 12 inches of sand, a geotextile barrier, 6 inches of crushed rock, and finally a 6-inch-thick layer of porous asphalt. Again, the geotextile barrier will be secured by a key trench along the barrier perimeter. The geotextile fabric will not be visible in any area of the DMCA after the completion of the wildlife barrier construction.

6.4 1982 Dredged Material Containment Area Planted Filter Strip

Upon completion of construction of the wildlife barrier, a 10-foot-wide planted filter strip will be constructed in the DMCA, as shown in Drawings CG03.1 and LZ01.1 in Appendix N. A 6-inch-minimum thickness of topsoil-compost mix will be installed before the area is hydroseeded with a native seed mix and planted the following fall with native shrubs and potentially trees. After the initial hydroseeding, an erosion control fabric will be installed over the filter strip area and secured with landscape staples.

6.5 STAGING AND STOCKPILING

Prior to the construction of the wildlife barrier, a small stockpile area, underlined with a liner, will be prepared in the DMCA to accommodate a few thousand cubic yards of imported fill material for the LL Parcel remedial action. This area will provide access and turnaround space for dump trucks and allow stockpiling of fill material during periods of heavy highway traffic or if and when truck unavailability may result in delays of fill importation. It will also allow the Contractor to take advantage of lighter traffic periods to accumulate material on-site. The wildlife barrier will be constructed by the Contractor at the end of Construction Season 2, after additional fill placement as needed, and the construction of the rehabilitated wetland.

6.6 INSTITUTIONAL CONTROL

An environmental covenant will be placed on the DMCA for the maintenance of the wildlife barrier and to require the area to remain in industrial use. A draft environmental covenant will be submitted to WSDOE for consideration with the as-built reports for the work.

7.0 Compliance and Cultural Resources Monitoring

7.1 COMPLIANCE MONITORING REQUIREMENTS

Compliance monitoring requirements for all three parcels of the Site are presented in detail in the CMP (Floyd|Snider 2015b). The CMP describes the methods for protection monitoring, performance monitoring, and confirmation monitoring to be implemented with the remedy to comply with the requirements of WAC 173-340-410. It also describes the contingency actions to be taken if monitoring indicates that the cleanup standards have not been attained after remedy construction. The required compliance monitoring and monitoring of cultural resources at the Site are summarized in the following subsections.

7.1.1 Protection Monitoring during Remedy Implementation

Protection monitoring will be conducted during both remedy construction and operations and maintenance (O&M) activities on the Site to confirm the protection of human health and the environment. Protection monitoring outlined in the CMP and described in this section focuses specifically on protection monitoring to be performed during remedy implementation. After completion of the remedial action, an O&M Plan will be prepared to detail the protection monitoring requirements during post-construction O&M activities (refer to Section 9.2.2).

Protection monitoring requirements addressing worker activities during construction are described in the Health and Safety Plan (HASP), which is discussed in more detail in Section 8.0 and Appendix L.

All appropriate erosion and sediment control and stormwater BMPs will be implemented and maintained during remedy construction, in accordance with the Draft SWPPP (Appendix E), which will be updated by the selected contractor as part of the required pre-construction submittals. The SWPPP will be maintained on-site until completion of construction and will be updated to reflect changes in the field as appropriate, in coordination with WSDOE. The Contractor will also submit a separate SWPPP specifically applicable to the lake capping and filling activities and the wetland rehabilitation, which will be reviewed the Port and WSDOE project manager. At the time of this report, the Port is pursuing a NPDES CSWGP, administered by WSDOE, to allow for potential contingency overflow of treated construction water from the SR 518 Construction Stormwater Pond to an existing vegetated swale that discharges to Miller Creek. While not discussed further in this report given that coordination with WSDOE is ongoing, this option will be available to the Contractor in the event that WSDOE issues a NPDES CSWGP. Site inspections will be conducted by a CESCL throughout the duration of the remedial action construction. Further details of the CESCL inspections and their frequency are included in the Draft SWPPP (Appendix E). The SWPPP covering the lake capping and filling activities and the wetland rehabilitation to be prepared by the Contractor will also provide details of the CESCL inspections and their frequency. Additional information regarding construction water management and treatment is presented in Section 3.2.

During construction activities within the former lake footprint and during the wetland rehabilitation work in Construction Season 2, as a precautionary measure to confirm effectiveness of sediment erosion control BMPs, water quality turbidity monitoring may be performed by the Port within Miller Creek.

During and after the completion of construction, BMPs will be implemented to control dust generation and contaminant migration and to reduce short-term construction impacts on air quality. These dust control BMPs are described in further detail in the CMP and in Sections 4.2.3, and 5.2.4. Fugitive dust monitoring will also be performed during construction to verify the protection of human health and the environment. This includes continuous monitoring for the presence of fugitive dust during any earth-disturbing activities along the downwind Site boundary and within the work zone by project personnel. Any observation of fugitive dust will be recorded and will require the construction contractor to control dust generation by means of the application of water or other Engineer-approved methods.

Documentation for the erosion control and fugitive dust monitoring (copies of the fugitive dust control monitoring log) will be submitted to WSDOE weekly during remedy construction.

7.1.2 Lora Lake Apartments Parcel Soil Performance and Confirmation Monitoring

As described in Section 2.5.1, soil performance monitoring was conducted on the LL Apartments Parcel, in accordance with the CMP, in September 2015, November 2015, and February 2016 to fully delineate the horizontal and vertical extent of contaminated soil on this parcel before implementation of the remedial design. This soil performance monitoring was performed before the beginning of remedial activities because of the lengthy laboratory turn-around time required for dioxins/furans analysis. The 2015 and 2016 soil performance monitoring data (presented in Appendix C) and the existing RI/FS data, along with corresponding surveyed sampling locations and depths, were used to determine the extent of excavation required for implementation of the LL Apartment Parcel remedial action, as described in Section 4.3. During construction, the excavation extent will be confirmed in the field by survey. The excavation plans will provide the Contractor with survey coordinates for control points on a grid across the excavation areas, as well as an elevation base depth for each grid cell. During excavation, the Contractor will excavate horizontally to the control points and vertically to the specified excavation base depth. Once the excavation has been conducted to the extents specified, the extents will be verified to a horizontal and vertical accuracy of within 0.1 foot by either survey or GPS and provided to the Engineer for confirmation and approval.

Additional soil performance monitoring samples will be collected after the excavation work along the eastern sidewall abutting Des Moines Memorial Drive in order to document any dioxins/furans TEQ concentrations (or other COC concentrations in select areas along the eastern sidewall) remaining in place beneath the City of SeaTac right-of-way. All additional soil performance monitoring sampling to be conducted on the LL Apartments Parcel will be performed per the sampling methodology outlined in the CMP and in the SAP/QAPP Addendum (Appendix J).

7.1.3 Lora Lake Apartments Parcel Wildlife Barrier/Cap and 1982 Dredged Material Containment Area Wildlife Barrier Confirmation Monitoring

After construction of the LL Apartments Parcel wildlife barrier/cap and the DMCA wildlife barrier, performance monitoring will be performed to verify the physical integrity and performance of these barriers (by effective isolation of the underlying soils). Monitoring activities and objectives include visual inspections of the barrier conditions to ensure that the barriers are intact and coverage has been maintained (i.e., underlying soil is not exposed).

On the LL Apartments Parcel, the wildlife barrier/cap will cover the entire extent of the parcel, and inspection observations of the barrier/cap will be documented using an approximate 150-foot monitoring grid along the parcel boundary and throughout the parcel. For the DMCA, the planned extent of the wildlife barrier includes the portion of the DMCA located outside the 100-year floodplain (Appendix N, Drawing CG03.1). Inspection observations of the DMCA wildlife barrier will also be documented using approximate 150-foot monitoring intervals along the boundary of the wildlife barrier and throughout the central area of the DMCA.

The physical integrity of these barriers will be inspected annually; however, the inspection frequency will be revisited after the first 5-year periodic review. Additional physical integrity inspections of these barriers may also be conducted after an occurrence that has a potential to adversely affect the integrity of these barriers, as further described in the CMP. If a physical integrity inspection of a barrier indicates that significant areas of the barrier are not intact, then a determination of appropriate contingency actions will be coordinated with WSDOE. Potential contingency actions to be taken are described in the CMP.

7.1.4 Lora Lake Apartments Parcel Groundwater Performance and Confirmation Monitoring

After remedy construction, groundwater monitoring will be performed on the LL Apartments Parcel to demonstrate that Site groundwater is in compliance with the cleanup standards. As described in Section 2.5.2, groundwater contamination at the Site is limited to two shallow wells on the LL Apartments Parcel: one located in the central portion of this parcel and one located along the eastern boundary of this parcel. The proposed groundwater confirmation monitoring well network consists of four wells (Appendix N, Drawing CU02.1). Further details summarizing the four confirmation monitoring well locations and their installation are included in Section 4.10.1.

The confirmation monitoring wells will be sampled using low-flow procedures to achieve the least turbidity possible. Groundwater samples will be analyzed for dioxins/furans, arsenic, and PCP, which are the chemicals that exceeded their respective cleanup levels during the previous RI groundwater monitoring. Compliance with the groundwater cleanup levels for dioxins/furans TEQ, arsenic, and PCP during each monitoring event will be determined by direct comparison of the detected concentrations to the cleanup levels.

Groundwater confirmation monitoring will include the collection of groundwater samples from all wells in the confirmation monitoring network for four quarterly events per year, consisting of two wet season monitoring events and two dry season monitoring events. Once the groundwater cleanup levels have been met for an individual analyte (dioxins/furans TEQ, arsenic, or PCP) in four consecutive monitoring events, the Port will request approval from WSDOE that confirmation monitoring for that analyte is considered complete and will no longer be required. Groundwater monitoring will continue until four consecutive monitoring events have documented that chemical concentrations in groundwater are less than the Site cleanup levels for all groundwater COCs.

If COC concentrations are greater than the applicable cleanup levels for more than 5 years after Site remedy implementation, then contingency actions will be evaluated by the Port in coordination with WSDOE. Potential contingency actions are described in the CMP.

7.1.5 Lora Lake Parcel Sediment Cap Performance and Confirmation Monitoring

As described in the CAP, the constructed sediment cap must have the isolation capacity of an 18-inch sand cap with a minimum organic carbon content of 0.1 percent. Carbon-amended sand will be used to fill the lake to the Construction Season 1 final design elevations, which will ensure the minimum thickness of 18 inches. To confirm the extent of sediment cap placement, the surface of the sediment cap will be surveyed to document the horizontal extents (refer to Section 5.3.3 for further details). To ensure that the sand cap material has sufficient carbon content, the cap material will be tested. If the cap material is found to contain less than the necessary 0.1 percent carbon, a carbon amendment, such as granular activated carbon, will be blended with the sand. Before the delivery of cap material and placement of the cap, approximately one sample per 1,000 cubic yards of material will be collected and tested for organic carbon to confirm the presence of a sufficient amount. Additional details of this sampling and analysis are provided in Section 5.3.1 and Table 5.1.

After remedy implementation, confirmation monitoring of the sediment remedy will be performed to assess whether contamination from the isolated and immobilized Lora Lake sediment is migrating through the sediment cap. Groundwater confirmation samples will be collected just above the required minimum sediment cap thickness of 18 inches and between the former lake footprint and Miller Creek to assess whether contaminants (i.e., dioxins/furans and arsenic) are moving from the isolated Lora Lake sediment. Confirmation monitoring data for dioxins/furans and arsenic will be evaluated for a statistical difference between them and a data set from site vicinity background samples collected from Port-owned property or the public right-of-way. This statistical comparison method was selected for determining compliance because groundwater data from wells in the vicinity of the Site show that background dioxins/furans TEQ concentrations in groundwater currently exceed the laboratory practical quantitation limit of approximately 3.5 pg/L dioxins/furans TEQ (which is also greater than the dioxins/furans TEQ surface water quality criterion of 0.005 pg/L). Similarly, arsenic is a known regional background contaminant and has been detected in upgradient and cross-gradient groundwater wells. Further details of the statistical comparison of the confirmation monitoring data to the site vicinity background data are provided in the CMP.

The proposed confirmation monitoring well network for the sediment cap consists of four existing upgradient background wells (site vicinity wells), four monitoring wells within the footprint of the sediment cap (formerly Lora Lake), and three monitoring wells between the former lake footprint and Miller Creek (Appendix N, Drawing CU03.1). Further details of the 11 confirmation monitoring wells and their installation are provided in Section 5.7. Confirmation cap confirmation monitoring will include the collection of groundwater samples from all wells of the in the confirmation monitoring network during five annual events after wetland construction. The first 5-year periodic review will assess the appropriate monitoring frequency for the next 5 years, and subsequent 5-year periodic reviews will set the frequency for the subsequent 5-year period.

If more than 20 percent of the confirmation groundwater sample results exceed the background concentration, or a detected result exceeds 2 times the background concentration, the sediment cap confirmation monitoring data will be considered to exceed the site vicinity background concentration, and contingency actions may be necessary. Additionally, if dioxins/furans TEQ concentrations in the confirmation monitoring groundwater samples exceed the Site groundwater dioxins/furans cleanup level of 6.7 pg/L, contingency actions may be required. The Port, in coordination with and at the direction of WSDOE, will determine what contingency actions may be necessary and appropriate. Potential contingency actions to be considered are described in the CMP.

7.1.6 Lora Lake Parcel Shallow Soil Cleanup Area Performance and Confirmation Monitoring

In the LL Parcel shallow soil excavation areas, the excavation extents will be verified by survey to document that excavation has occurred at the locations of existing contaminated soil data (Appendix N, Drawing CG06.1). One of the areas to be excavated, defined as the southern portion of Excavation Area 5, will be excavated to a depth of 6 feet bgs, because prior sampling did not vertically bound the dioxins/furans contamination in this area. After excavation in the LL Parcel Shallow Soil Cleanup Area, a soil sample will be collected from the excavation base at 6 feet bgs in the southern portion of Excavation Area 5 to document whether elevated dioxins/furans TEQ concentrations remain in place at the conditional POC. Additionally, two soil samples will be collected along the western sidewall abutting the Des Moines Memorial Drive paved sidewalk in Excavation Areas 5 and 6. These performance monitoring soil samples will be used to document whether any dioxins/furans TEQ or lead concentrations remain in place beneath the right of-way at concentrations in excess of the cleanup levels (refer to Section 5.5.1 for further sampling details). Environmental covenants or an amendment to the Mitigation Area Restrictive Covenant will be necessary if the soil samples collected at 6 feet bgs or the soil samples collected from the excavation sidewall adjacent to the roadway contain concentrations that exceed the LL Parcel soil cleanup levels. The Port will work with WSDOE and the City of SeaTac to determine whether a new environmental covenant is required or if the Port's existing Mitigation Area Restrictive Covenant can be amended to include conditions for any contamination left in place in these locations.

7.2 CULTURAL RESOURCES MONITORING

There are no places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the Site. A search of the Washington State System for Architectural and Archaeological Records revealed no archaeological sites or historic (or potentially historic) structures in the vicinity of the Site. The project area has been historically disturbed by farming, peat mining, industrial activities, and construction of apartments (in the northern portion). Historical documentation has confirmed that Lora Lake was created by peat mining processes in the 1940s and 1950s. Therefore, it is a human-made lake with a fairly low potential for the presence of archaeological resources.

Although no impacts on archaeological/cultural resources are expected during construction, an Inadvertent Discovery Plan was prepared to address the potential discovery of archaeological materials during construction activities (Appendix M). It details procedures that must be followed should archaeological resources and/or human skeletal remains be discovered during any ground-disturbing activity.

8.0 Health and Safety

8.1 HEALTH AND SAFETY

The project work described in this EDR will comply with the health and safety standards prescribed by the Occupational Safety and Health Act and the Washington Industrial Safety and Health Act. A project-specific HASP covering the work to be performed by the project consulting Engineer and its representatives is provided as Appendix L. The selected contractor will also prepare a HASP for its specific activities after the contract award and before mobilization. Emergency contact information will be provided in the HASPs. Copies of the HASPs will be available on-site at all times, and visitors entering the work area will be required to review and sign the project-specific HASP.

As described in the HASP, chemical exposure hazards include exposure to the Site COCs (listed in Section 2.3) in contaminated soil, groundwater, and sediment. The potential routes of chemical exposure include inhalation, ingestion, dermal contact, and eye contact. In general, the chemicals that may be encountered at the Site are not expected to be present at concentrations that could result in significant exposures. The use of appropriate personal protective equipment (PPE), protective monitoring, and decontamination procedures will assist in controlling the chemical exposure hazards. Physical hazards and recommended preventive measures are also identified in the HASP. The physical hazards at the Site include falling, lifting, electrical, mechanical, noise, heat stress, cold stress, sunburn, biohazards, traffic, and drowning hazards. Work activities may generate visible dust, and controls will be used to minimize worker exposure to contaminated dust and to prevent dust from leaving the site. Water may be used to suppress any dust clouds generated during work activities.

All work involving heavy equipment will be performed by workers wearing modified Level D PPE, including hard hat, steel-toed boots, hearing protection, eye protection, gloves, and high-visibility vests. For all work involving potential exposure to soil, sediment, or groundwater, workers will wear nitrile gloves and Level D PPE. Lora Lake capping and filling oversight will be performed by workers wearing modified Level D PPE, including steel-toed rubber boots, eye protection, gloves, and water-protective outer work clothing, and a personal flotation device, when necessary. All personnel will be properly fitted and trained in the use of PPE.

Appropriate site control measures will be maintained in all work areas to limit access to designated personnel during and after work hours. These include the perimeter fence. Activities conducted off-site in the public roadway shoulders will be controlled by the use of temporary construction fence, barricades, flagging, or similar measures.

8.2 DECONTAMINATION PROCEDURES

Decontamination procedures will be strictly followed to prevent the spread of contaminated soil, sediment, and groundwater. All construction equipment will be decontaminated before it leaves the Site. Equipment and vehicle decontamination generally consists of sweeping (if dry) and/or pressure washing with detergent solution followed by a potable water rinse.

Equipment decontamination wash water will be contained such that it does not flow onto uncontaminated portions of the Site. If decontamination wash water is collected in a containment area, it will be managed according to the procedures for handling and disposing of contaminated groundwater.

9.0 Schedule and Reporting

9.1 SCHEDULE

A general schedule for the major deliverables and work tasks associated with the remedial actions at the Site is included in the CD (State of Washington 2015, Exhibit C). Since that schedule was developed, the Port has developed a plan for concurrently implementing the construction work on the three Site parcels, rather than phasing work on the LL Parcel to occur a year after construction on the LL Apartments Parcel and DMCA. Any changes to the remedial action implementation schedule ultimately chosen by the Port will be conducted within the schedule included in the CD (State of Washington 2015, Exhibit C). The Port's current construction implementation plan has allowed the Port to combine many of the major deliverables that covered either one or two of the Site parcels (originally listed in the Exhibit C schedule) into major deliverables that now cover the entire Site. Based on these noted changes, an amended schedule for the Site's major deliverables and work tasks is included in Table 9.1; however, the schedule included in the CD remains the enforceable project schedule unless the CD is amended. Additionally, Figure 3.1 depicts a conceptual summary of when construction activities are expected to occur on each of the Site parcels.

One additional proposed variation from the schedule in Exhibit C of the CD is to defer the submittal of the O&M Plans for the Site until after the remedial action construction has been completed, when final site conditions after construction are better known and as-built drawings can be included. This schedule modification is reflected in Table 9.1. This is not considered a substantial change to the CD that would require a CD amendment. Submittal of the Site O&M Plans after construction completion is described further in Section 9.2.2.

Table 9.1
Remedial Action Implementation Schedule

Deliverable/Milestone	Completion/Due Date
Progress Reports	Monthly on the 15th of the month, beginning after effective date of CD
Cost Estimate for CD Implementation (per CD, Section XXI)	60 days after effective date of CD *(Due November 9, 2015)*
Proof of Financial Assurances (per CD, Section XXI)	60 days after WSDOE approval of the Cost Estimate for CD Implementation
Annual Financial Assurance Report (per CD, Section XXI)	Annually, within 30 days of the anniversary date of CD *(Due October 8, annually)*
Draft CMP for the Lora Lake Apartments Site	Submitted to WSDOE within 60 days of effective date of CD *(Due November 9, 2015, submitted August 21, 2015)*

Deliverable/Milestone	Completion/Due Date
Final CMP for the Lora Lake Apartments Site	Submitted to WSDOE within 30 days of receipt of WSDOE comments on the Draft CMP *(Due October 10, 2015, submitted September 23, 2015)*
Final Data from LL Apartments Parcel Soil Performance Monitoring Event	Submitted to WSDOE within 120 days of submittal of Final CMP[1] *(Due January 18, 2016, submitted April 25, 2016)*
Draft 60% Lora Lake Apartments Site EDR *(Combined Deliverable)*	Submitted to WSDOE within 6 months of receipt of final data from the Soil Performance Monitoring Event *(Due August 22, 2016, submitted April 28, 2016)*
Draft 100% Lora Lake Apartments Site EDR and Project Plans and Specifications *(Combined Deliverable)*	Submitted to WSDOE within 6 months of WSDOE review of the Draft 60% EDR *(Due December 28, 2016, submitted August 23, 2016)*
Final 100% Lora Lake Apartments Site EDR and Project Plans and Specifications *(Combined Deliverable)*	Submitted to WSDOE within 30 days after receipt of WSDOE comments on the Draft 100% EDR *(fall 2016)*
Completion of Lora Lake Apartments Parcel and DMCA Cleanup Construction	Within 2 years of WSDOE approval of the 100% Project Plans and Specifications *(Due date anticipated fall 2018, completion anticipated winter 2017)*
Draft LL Apartments Parcel and DMCA As-Built Report (includes Environmental Covenants for LL Apartments Parcel and DMCA) and Draft LL Apartments Parcel and DMCA O&M Plan	Submitted to WSDOE within 90 days of completion of LL Apartments Parcel Cleanup Construction *(Due date anticipated spring 2018)*
Final LL Apartments Parcel and DMCA As-Built Report (includes Environmental Covenants for LL Apartments Parcel and DMCA) and Final LL Apartments Parcel and DMCA O&M Plan	Submitted to WSDOE within 30 days of receipt of WSDOE comments on the draft versions *(Due date anticipated summer 2018)*
Submit proof of recording of LL Apartments Parcel and DMCA Environmental Covenants to WSDOE	Submitted to WSDOE within 90 days of Final LL Apartments Parcel and DMCA As-Built Report *(Due date anticipated fall 2018)*

Deliverable/Milestone	**Completion/Due Date**
Completion of LL Parcel Cleanup Construction	Within 2 years of WSDOE approval of the 100% Project Plans and Specifications *(Due date anticipated fall 2018, completion expected late fall 2018)*[2]
Draft LL Parcel As-Built Report (includes Environmental Covenant for LL Parcel and Draft LL Parcel O&M Plan)	Submitted to WSDOE within 90 days of completion of LL Parcel Cleanup Construction *(Due date anticipated winter 2018/2019)*
Final LL Parcel As-Built Report (includes Environmental Covenant for LL Parcel and Final LL Parcel O&M Plan)	Submitted to WSDOE within 30 days of receipt of WSDOE comments on the draft versions *(Due date anticipated spring 2019)*
Submit Proof of Recording of LL Parcel Environmental Covenants to WSDOE	Submitted to WSDOE within 90 days of Final LL Parcel As-Built Report *(Due date anticipated summer 2019)*
Installation of Final Barrier to Wildlife on the LL Apartments Parcel	Within 4 years of construction completion at the LL Apartments Parcel *(Due date anticipated winter 2021)*
As-Built Report for Final Barrier to Wildlife on the LL Apartments Parcel	Submitted to WSDOE within 90 days of completion of construction *(Due date anticipated spring 2022)*
Groundwater Compliance with Cleanup Levels Achieved throughout the Site	Within 5 years of construction completion at the LL Apartments Parcel *(Due date anticipated winter 2022)*
Periodic Reviews Conducted by WSDOE	At least every 5 years from the effective date of CD *(first review due September 9, 2020)*

Note:

1. Due to the necessity of follow-on field data collection events to fully delineate the extent of contamination, final data from all phases of the compliance monitoring event were not available 120 days after submittal of the Final CMP. WSDOE provided approval for submittal of final data within 5 days of receipt.
2. In the CD Schedule of Deliverables, plans and specifications for the LL Parcel, and associated construction activities were planned to occur following development of design documents and construction at the LL Apartments Parcel. Due to the two-season construction period required for construction at the LL Parcel, it is anticipated that construction may not be completed within 2 years of WSDOE approval of the 100% project plans and specifications. Project schedule will be confirmed once a Contractor has been identified, and construction schedules are developed.

9.2 REPORTING

9.2.1 Construction Completion Reports

Draft Construction Completion Reports (or as-built reports) will be prepared and submitted to WSDOE within 90 days after completion of the construction on each of the parcels. As shown in Table 9.1, one Construction Completion Report is expected to be completed after construction on the LL Apartments Parcel and the DMCA, and a second Construction Completion Report will be completed after construction on the LL Parcel. An addendum or additional Construction Completion Report will then be submitted after the wildlife barrier construction on the LL Apartments Parcel.

Information provided in the Construction Completion Reports will include an opinion from the Engineer, based on testing results and inspections, as to whether the cleanup action has been constructed in substantial compliance with the plans and specifications and related documents (WAC 173-340-400(6)(b)(ii)) providing the following, as appropriate:

- Description of remedial activities, including deviations from this EDR
- Photo-documentation of construction activities and the finished construction
- Information on the horizontal and vertical limits of all excavations, including survey data confirming contaminated soil removal, maps illustrating excavation areas and other pertinent information
- Information on the horizontal extent and thickness of cap material placement within Lora Lake, including maps illustrating the capped area and other pertinent information
- Information on the LL Parcel constructed wetland, including maps illustrating the final constructed wetland surface and other pertinent information
- Detailed sampling and analysis information, including location, matrix, analytical methods, and data quality review findings for the performance monitoring
- Disposal documentation, including quantities of soil removed and disposed of and landfill certificates of disposal
- Copies of weekly construction reports

Additionally, all analytical data collected for the Site during construction of the remedial actions must be submitted to WSDOE's Environmental Information Management (EIM) System within 30 days of receipt of validated data.

9.2.2 Operations and Maintenance Plans

Draft O&M Plans will also be prepared and submitted to WSDOE within 90 days after completion of the construction on each of the parcels. The O&M Plan for the LL Apartments Parcel and DMCA will include an inspection schedule for the wildlife barriers, preapproved means of repair, and preapproved procedure for removal of the barrier for needed subsurface work and replacement once the surface has been completed. Per the CMP, the physical inspections of the wildlife barriers on the LL Apartments Parcel and DMCA will begin within 1 year of construction completion and will occur annually through the first 5-year review period. The frequency of these inspections will then be reassessed in coordination with WSDOE for the following 5-year review period (Floyd|Snider 2015b). The O&M Plan for the LL Apartments Parcel and DMCA will also include preapproved designs for future work, such as landscaping units, and subsurface infrastructure, such as storm drains and underground utilities, that may be installed subsequent to the completion of remedial action construction. The use of preapproved procedures requires that WSDOE be notified 30 days in advance of the work and the submittal of as-built reports at the completion of work. Work that does not follow preapproved procedures requires prior approval from WSDOE. If future proposed work does not follow the preapproved plans within the O&M Plan, WSDOE will be contacted as early as possible to discuss the work and time frame for review and approval.

The O&M Plans will also include a description of the minimum scope of periodic reviews required for the Site, the template for the periodic review report, and the 5-year report of post-cleanup site conditions and monitoring data to the Port. All work performed during the 5-year review period must be summarized in the periodic review report.

9.2.3 Post-Remedy Construction Compliance Monitoring Reporting

Data collected during LL Apartments Parcel groundwater confirmation monitoring and the LL Parcel sediment cap performance monitoring will be reported in annual compliance monitoring reports. These annual compliance monitoring results will include results of quarterly groundwater monitoring, sediment cap performance monitoring, and wildlife barrier inspections at the LL Apartments Parcel and DMCA.

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Port of Seattle
Lora Lake Apartments Site

Engineering Design Report

Tables

Table 4.1
Lora Lake Apartments Parcel Fill Analytical Requirements, Methods, and Standards

Chemical	Method	Maximum Level (Applicable Site Cleanup Level)
Metals		
Arsenic	USEPA Method 6010	20 mg/kg
Cadmium	USEPA Method 6010	2 mg/kg[1]
Chromium III	USEPA Method 6010	2,000 mg/kg[1]
Lead	USEPA Method 6010	250 mg/kg
Mercury	USEPA Method 7471	2 mg/kg[1]
Petroleum Hydrocarbons		
Gasoline range	NWTPH-Gx	100 mg/kg
Ethylbenzene	USEPA Method 8260C	8,000 mg/kg
Toluene	USEPA Method 8260C	6,400 mg/kg
Diesel and heavy oil range	NWTPH-Dx	2,000 mg/kg
Organochlorine		
Pentachlorophenol	USEPA Method 8041	2,500 µg/kg
Polycyclic Aromatic Hydrocarbons		
cPAHs TEQ	USEPA Method 8270D	137 µg/kg
Dioxins/Furans		
Dioxins/Furans TEQ	USEPA Method 1613B	13 pg/g

Note:

1 Maximum levels for cadmium, chromium, and mercury are based on the Model Toxics Control Act (MTCA) Method A Soil Cleanup Levels for Unrestricted Land Use.

Abbreviations:

cPAHs Carcinogenic polycyclic aromatic hydrocarbons
µg/kg Micrograms per kilogram
mg/kg Milligrams per kilogram
pg/g Picograms per gram
TEQ Toxicity equivalent

Table 5.1
Lora Lake Parcel Cap, Fill, and Topsoil Analytical Requirements, Methods, and Standards

Chemical	Method	Maximum Level (Applicable Site Cleanup Level)
Conventionals		
Total organic carbon (%)	Plumb 1981	NA[1]
Grain size - sieve analysis of fine and course	ASTM C136	Must meet specification requirements
Grain size - particle size analysis of soils	ASTM D422	
Metals		
Arsenic	USEPA Method 6010	20 mg/kg
Cadmium		4 mg/kg [2]
Chromium (total)		42 mg/kg [2]
Lead		50 mg/kg
Mercury	USEPA Method 7471	0.1 mg/kg [2]
Petroleum Hydrocarbons		
Gasoline range	NWTPH-Gx	100 mg/kg
Ethylbenzene	USEPA Method 8260C	8,000 mg/kg
Toluene		6,400 mg/kg
Diesel and heavy oil range	NWTPH-Dx	200 mg/kg
Organochlorine		
Pentachlorophenol	USEPA Method 8041	2,500 µg/kg
Polycyclic Aromatic Hydrocarbons		
cPAHs TEQ	USEPA Method 8270D	137 µg/kg
Dioxins/Furans		
Dioxins/Furans TEQ	USEPA Method 1613B	5.2 pg/g

Notes:

NA Not applicable.

1 The sand cap material must contain at least 0.1 percent carbon, or a carbon amendment must be added to the cap material. For the other materials to be used at the LL Parcel, there is no defined cleanup level for total organic carbon; however, elevated concentrations of organic carbon will require approval by the Port of Seattle and the Engineer.

2 For constituents that are not Site COCs, maximum levels represent the most stringent of the soil concentrations that are expected to be protective of terrestrial plants and animals (Table 749-3 of the Model Toxics Control Act).

Abbreviations:

cPAHs Carcinogenic polycyclic aromatic hydrocarbons
µg/kg Micrograms per kilogram
mg/kg Milligrams per kilogram
pg/g Picograms per gram
TEQ Toxicity equivalent

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Figures

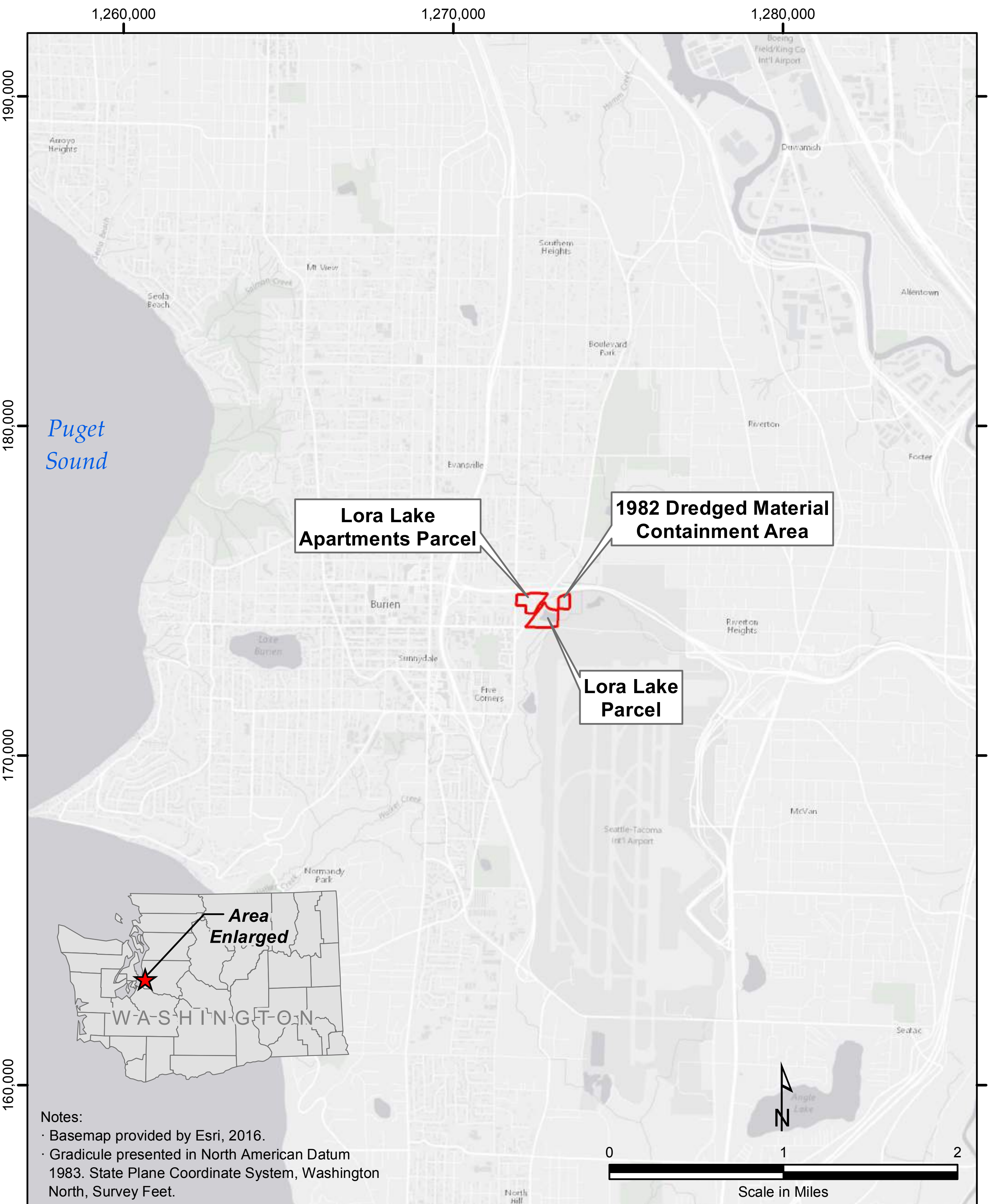

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Figure 1.1
Vicinity Map

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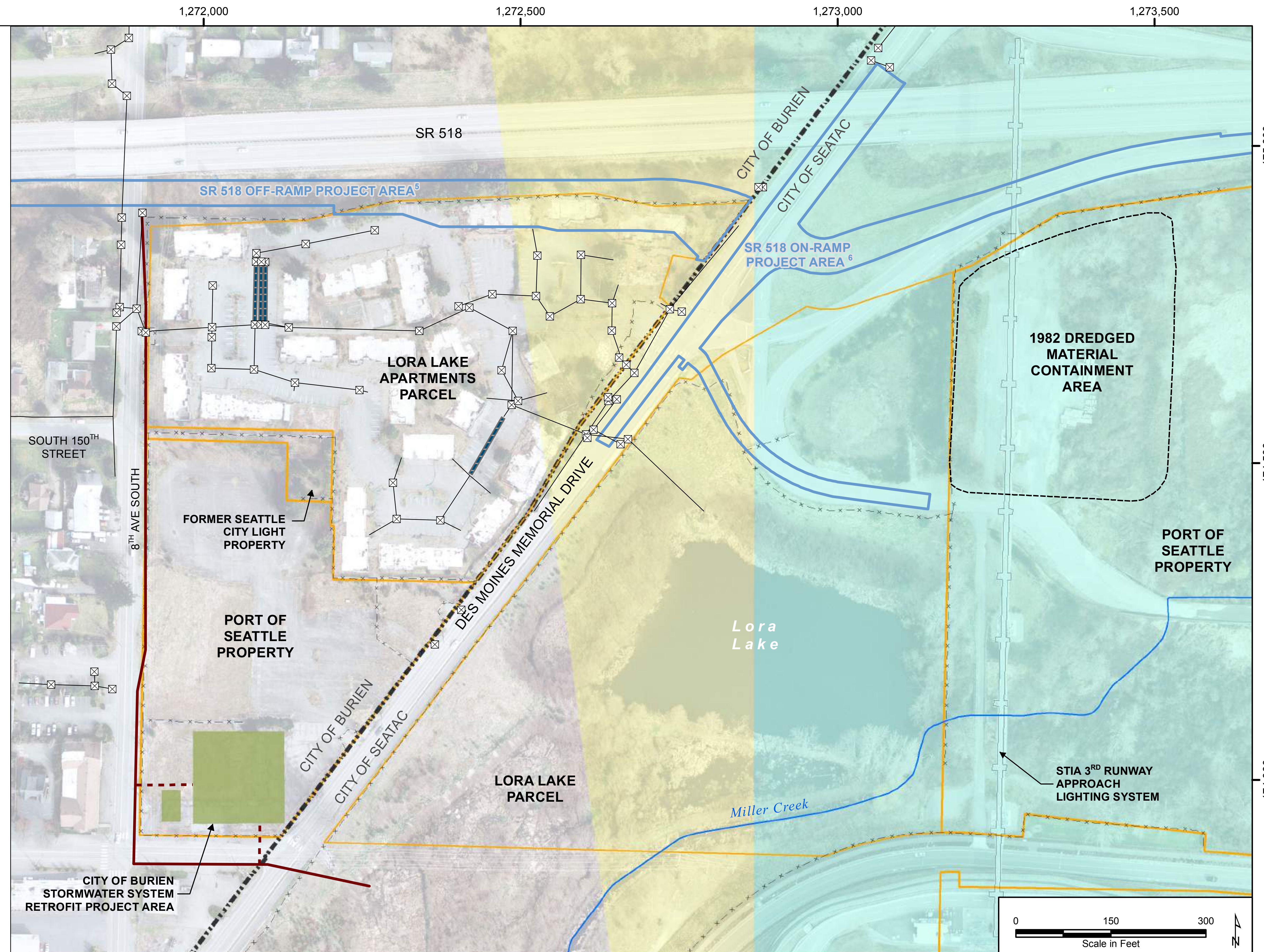
8/30/2016



Legend

- City Boundary
- Approximate Fence Location
- Tax Parcel Boundary
- Runway Protection Zones[1]
  - Controlled Activity Area [2]
  - Extended Object Free Area [3]
- Proposed Water Quality Vault [4]
- 8th Avenue Stormwater Trunkline [4]
- Proposed Stormwater Pipe [4]
- Approximate Extent of 1982 Dredged Material Containment Area
- SR 518 Project Area [5,6]
- Existing Stormwater Catch Basin
- Existing Stormwater Conveyance System
- Detention Tank

Notes:

1. Runway Protection Zones (RPZs) based on Port of Seattle data.
2. The Controlled Activity Area is the zone outside of and adjacent to the Extended Object Free Area (XOFA) in which land use is restricted by the Federal Aviation Administration (FAA) and excludes the construction of residences and public gathering places such as shopping centers, offices, or hospitals (FAA 2014).
3. The XOFA must be kept clear of objects including structures, equipment, and terrain, except for those objects necessary for air navigation or aircraft ground-maneuvering purposes (FAA 2014).
4. Stormwater system retrofit work scheduled to occur prior to site remedial action construction. Water Quality Vault facilities will be constructed following site construction in coordination with site redevelopment. Storm drain alignment shown is approximate and preliminary; final location of storm system may change.
5. Off-ramp construction scheduled to occur concurrent with Lora Lake Apartments Parcel remedial action construction.
6. On-ramp construction scheduled to occur prior to and concurrent with Lora Lake Parcel remedial action construction. Storm drain alignment shown is approximate and preliminary. Final location of storm drain may change.

· Tax parcels were downloaded from King County on 2/16/2016.
· City boundary data provided by King County.
· Locations of fences were digitized based on aerial image cited below and Google Earth Street View.
· Aerial image provided by Port of Seattle and dated March 20, 2011.
· Coordinate grid presented in North American Datum 1983 High Accuracy Reference Network. State Plane Coordinate System, Washington North Zone, in units of Survey Feet.

Abbreviation:
· STIA = Seattle-Tacoma International Airport

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Figure 1.2
Site Map

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Figure 2.1
Points of Compliance

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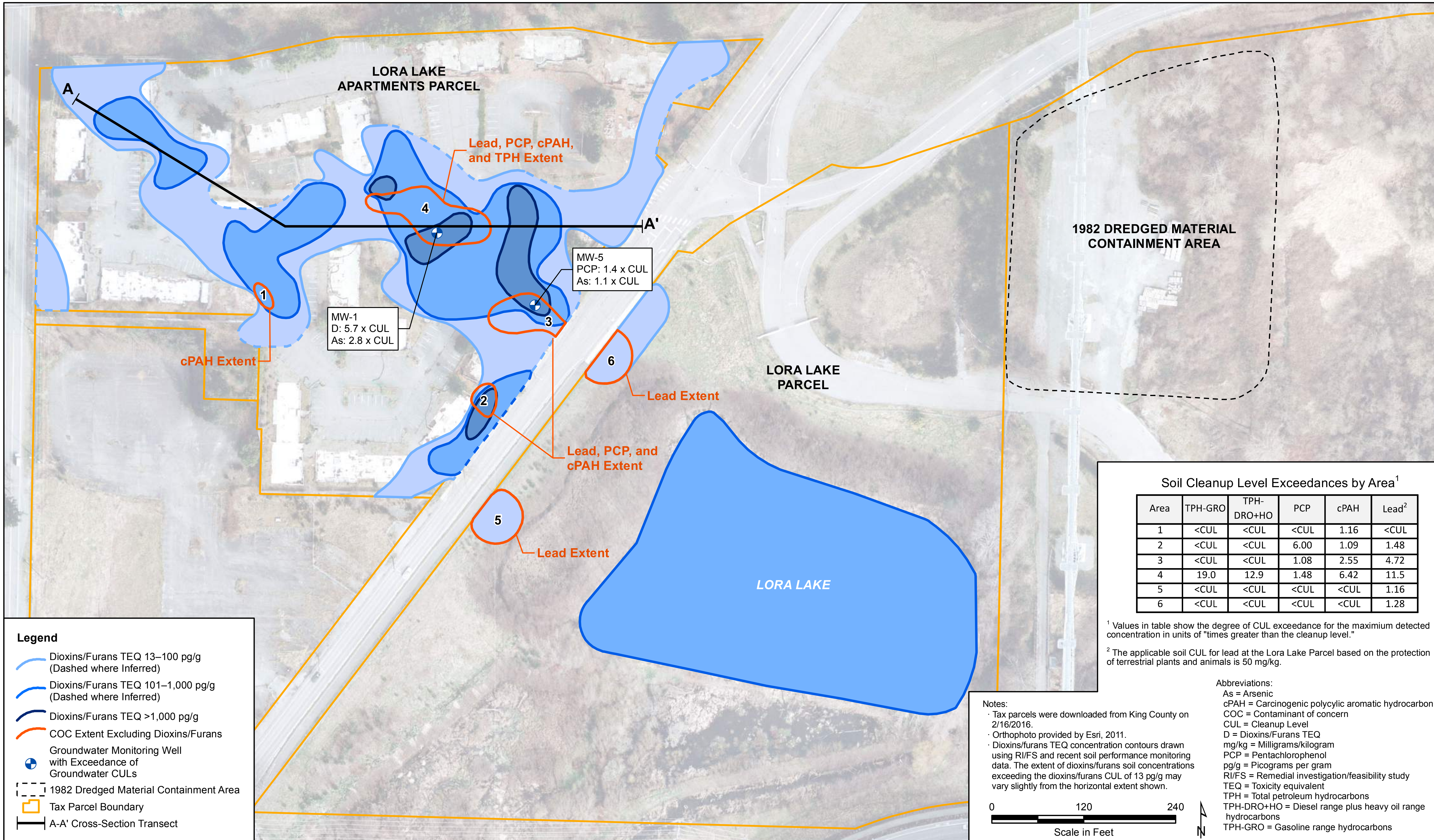
8/30/2016



Soil Cleanup Level Exceedances by Area[1]

Area	TPH-GRO	TPH-DRO+HO	PCP	cPAH	Lead[2]
1	<CUL	<CUL	<CUL	1.16	<CUL
2	<CUL	<CUL	6.00	1.09	1.48
3	<CUL	<CUL	1.08	2.55	4.72
4	19.0	12.9	1.48	6.42	11.5
5	<CUL	<CUL	<CUL	<CUL	1.16
6	<CUL	<CUL	<CUL	<CUL	1.28

[1] Values in table show the degree of CUL exceedance for the maximium detected concentration in units of "times greater than the cleanup level."

[2] The applicable soil CUL for lead at the Lora Lake Parcel based on the protection of terrestrial plants and animals is 50 mg/kg.

Notes:
- Tax parcels were downloaded from King County on 2/16/2016.
- Orthophoto provided by Esri, 2011.
- Dioxins/furans TEQ concentration contours drawn using RI/FS and recent soil performance monitoring data. The extent of dioxins/furans soil concentrations exceeding the dioxins/furans CUL of 13 pg/g may vary slightly from the horizontal extent shown.

Abbreviations:
As = Arsenic
cPAH = Carcinogenic polycylic aromatic hydrocarbon
COC = Contaminant of concern
CUL = Cleanup Level
D = Dioxins/Furans TEQ
mg/kg = Milligrams/kilogram
PCP = Pentachlorophenol
pg/g = Picograms per gram
RI/FS = Remedial investigation/feasibility study
TEQ = Toxicity equivalent
TPH = Total petroleum hydrocarbons
TPH-DRO+HO = Diesel range plus heavy oil range hydrocarbons
TPH-GRO = Gasoline range hydrocarbons

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Figure 2.2
Horizontal Distribution of Contamination

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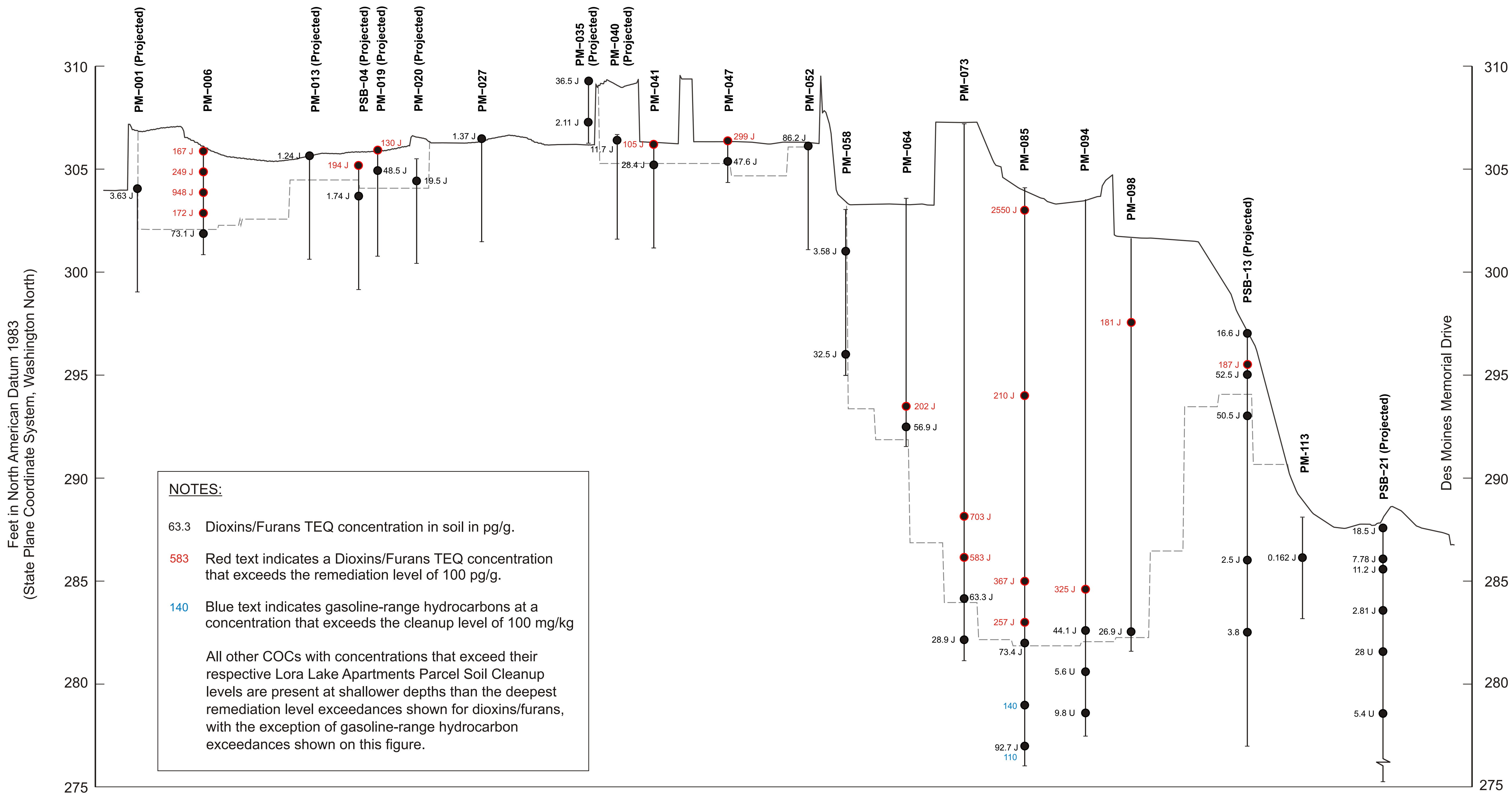
8/30/2016



NOTES:

63.3 Dioxins/Furans TEQ concentration in soil in pg/g.

583 Red text indicates a Dioxins/Furans TEQ concentration that exceeds the remediation level of 100 pg/g.

140 Blue text indicates gasoline-range hydrocarbons at a concentration that exceeds the cleanup level of 100 mg/kg

All other COCs with concentrations that exceed their respective Lora Lake Apartments Parcel Soil Cleanup levels are present at shallower depths than the deepest remediation level exceedances shown for dioxins/furans, with the exception of gasoline-range hydrocarbon exceedances shown on this figure.

Boring — Exploration Location

Sample Location

Sample Location where Dioxins/Furans TEQ Concentration Exceeds the Remediation Level of 100 PG/G

Excavation Limits

ABBREVIATIONS

COC = Contaminants of Concern

mg/kg = milligrams per kilogram

pg/g = Picograms per gram

TEQ = Toxicity Equivalent

Horizontal Scale in Feet: 0, 60, 120

Vertical Scale in Feet: 0, 5, 10

Vertical Exaggeration X 12

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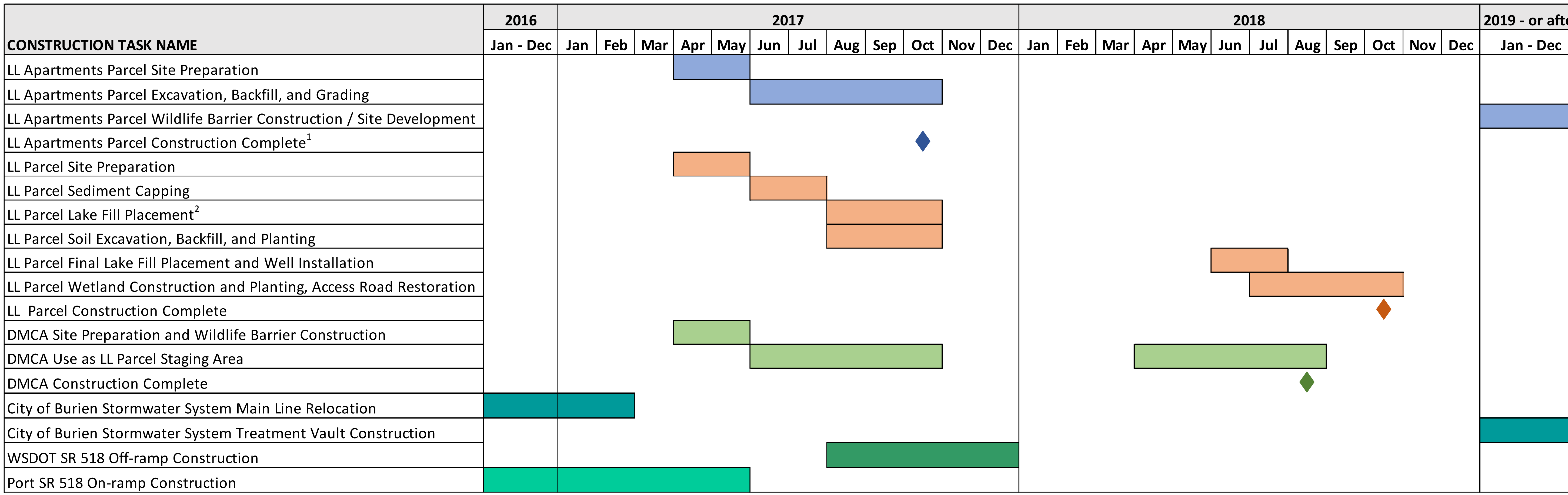
Figure 2.3
Lora Lake Apartments Parcel
Vertical Distribution of Soil Contamination



Notes:

All construction dates shown are conceptual and are subject to change based on Contractor's proposed schedule.

1 Construction complete with the exception of construction of the wildlife barrier/cap (to be completed within four years of grading).

2 Following the placement of the majority of the fill within Lora Lake, this fill material will be allowed to settle over the winter of 2017/2018

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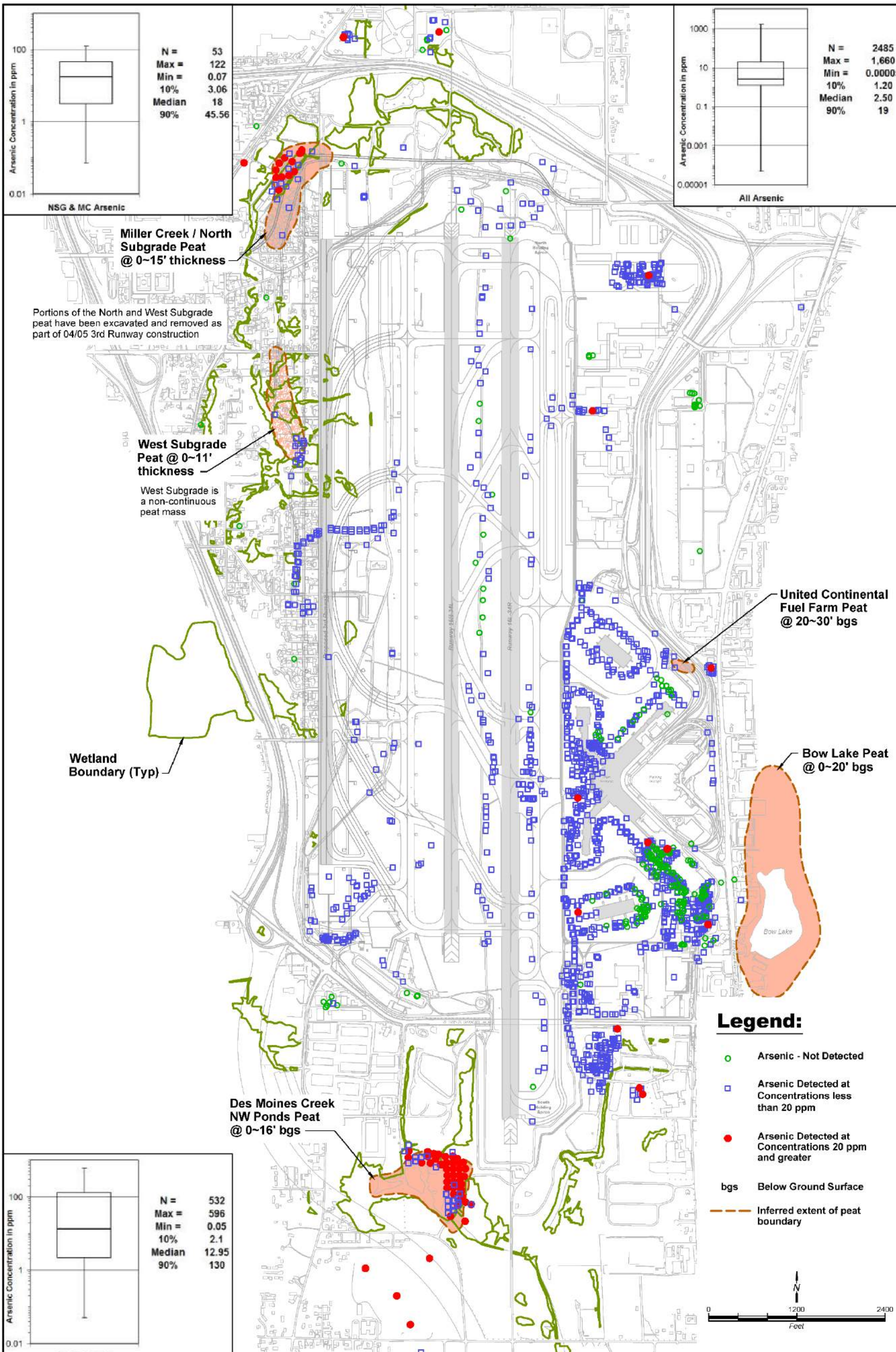
Figure 3.1
Lora Lake Apartments Site Conceptual Construction Schedule



Source: Figure 4.1 from *Additional Arsenic Study* (Papadopulos 2006).
Abbreviations: ppm = parts per million, mg/kg = milligrams per kilogram.

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Burien, Washington

Figure 5.1
Area of Peat and Elevated Arsenic

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Appendix A
Lora Lake Parcel Groundwater Modeling—Support for Remedial Action Design Memoranda

Aspect CONSULTING

MEMORANDUM

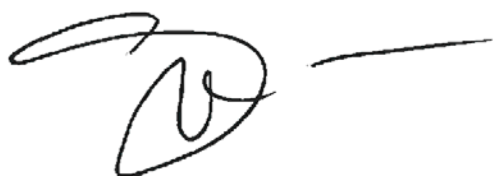
Project No.: 110125

July 21, 2016

To: Jessi Massingale, Floyd|Snider

cc: Eleanor S. Bartolomeo, ESA

From:



Peter Bannister, PE
Associate Engineer

Seann McClure, LHG
Project Hydrogeologist

Re: **Lora Lake Groundwater Modeling—Support for Remedial Action Design**

Introduction

This technical memorandum documents groundwater modeling performed by Aspect Consulting, LLC (Aspect) to support the design phase of the Cleanup Action Plan (CAP) for the sediment cleanup area on the Lora Lake Parcel of the Lora Lake Apartments Cleanup Site, as defined in the Consent Decree between Washington State Department of Ecology (Ecology) and the Port of Seattle (Ecology, 2015). Groundwater modeling and supplemental field data collection and analysis were conducted by Aspect under contract with Floyd|Snider, and in cooperation with ESA, on behalf of the Port of Seattle (hereafter Port). Geotechnical design support was also conducted by Aspect under contract with Floyd|Snider (Aspect, 2016).

This memorandum focuses on the results of Lora Lake groundwater modeling which incorporates information from field data collection efforts, including baseline monitoring and the Lora Lake drawdown test. Details on the information from field collection efforts are provided in separate memoranda. Baseline groundwater and surface water monitoring was conducted from August 2013 through October 2014 (Aspect, 2015a), and provides aquifer parameter, boundary condition, and calibration data for the model. A drawdown test of Lora Lake was conducted in September and October 2015 (Aspect, 2015b), and provides information on groundwater inflow to Lora Lake.

Based on the groundwater model results, project objectives will be met by placing a medium-to-coarse sand fill material in Lora Lake and controlling groundwater levels with the final grade surface and swale network designed by ESA. These features work collaboratively to maintain upward groundwater flow direction through the remediation cap and maintain the hydroperiod observed during baseline monitoring. The following sections provide additional detail on the groundwater model construction, calibration, and utilization.

Background Summary

A focused summary of the project background provides context for the Lora Lake groundwater modeling approach. The remediation design objectives described in the CAP for the sediment cleanup area include:

- Lake sediment will be isolated through capping, and wetland conditions will be rehabilitated through open-water filling of Lora Lake. This will eliminate the potential for aquatic exposure or transport of lake sediments impacted by contaminants of concern.
- The sand cap will provide a physical and chemical barrier between the contaminated sediments and water flowing into Miller Creek, addressing the human exposure pathways.
- The design requires placement of high conductivity fill material (relative to the adjacent wetland soils) to maintain the current upward groundwater flow path beneath Lora Lake.
- Following remedy implementation, compliance monitoring of the sediment remedy will be performed to assess whether contamination from the isolated and immobilized Lora Lake sediment is migrating through the sediment cap. Groundwater samples will be collected just above the sediment cap and between the former lake footprint and Miller Creek to assess whether contaminants are moving from the isolated Lora Lake sediment.

Additional detail of the project background is provided in the CAP and the *Remedial Investigation/Feasibility Study* (RI/FS) (Ecology, 2015; Floyd|Snider, 2015).

Other remediation design objectives include minimizing open water area and minimizing the fill volume. These additional remediation design objectives are further discussed in the 60-percent design report by ESA (ESA, 2015b).

Modeling Objectives

The Lora Lake groundwater modeling objectives include the following:

- Simulate baseline groundwater flow and groundwater/surface water conditions to provide confidence in applying the model to post-remediation conditions; and
- Evaluate alternative scenarios (e.g., alternative fill specifications and wetland designs) to achieve the following design objectives:
  - Minimize fill elevation necessary to establish wetland scrub-shrub vegetation;
  - Ensure that the remedial design maintains current upward groundwater flow paths; and
  - Assess the rate and the timing of groundwater seepage to Miller Creek, as part of ESA's analysis to ensure the remedy does not adversely impact flood frequencies or base flow conditions of the creek.

Summary of Findings

The groundwater model accurately simulates baseline conditions observed in the Lora Lake vicinity from October 2013 through October 2014. The results of model calibration demonstrate that the groundwater model is an appropriate tool to evaluate changes in groundwater conditions for alternative fill specifications and wetland designs.

Multiple remediation scenarios were evaluated using the Lora Lake groundwater model during pre-design, 30-percent design, and 60-percent design efforts, and included alternative fill materials (sandy soil versus gravelly soil) and alternative wetland designs (configuration of drainage swales). The groundwater model results indicate the following:

- Post-remediation groundwater levels in the former lake footprint will generally be maintained below baseline lake levels as a result of the drainage design and filling Lora Lake;
- Medium-to-coarse sand fill will support groundwater drainage controlled by the designed swale configuration;
- The selected remediation design maintains the current upward groundwater flow paths; and
- Minor changes in the Lora Lake water balance after remediation can be expected, primarily associated with potentially relocating the City of Burien stormwater outfall and increasing evapotranspiration associated with wetland vegetation.

Groundwater model results were provided to ESA for analysis of flow conditions on Miller Creek. Refinements to the Lora Lake groundwater model are anticipated to support the final stages of engineering design for the sediment cap, fill, and swale alternatives.

Modeling Approach Summary

The modeling approach included the following steps:

- Construct the groundwater model to represent baseline conditions in the Lora Lake vicinity;
- Calibrate the groundwater model using observed baseline water levels and flow conditions;
- Modify the groundwater model to represent post-remediation conditions; and
- Utilize the model for alternative scenarios to achieve remediation design objectives.

The balance of this memorandum provides additional detail of the modeling steps listed above.

Groundwater Model Construction

This section provides detailed discussion of the Lora Lake groundwater model construction. The groundwater model simulates three-dimensional transient flow using the U.S. Geological Survey's groundwater modeling code MODFLOW 2005 (Harbaugh, 2005) with a specialized solver to allow calculation of partially saturated conditions. Groundwater Vistas (ESI, 2015) modeling software was used to construct the model and interpret results. The model was constructed using feet and days as units of length and time, relative to the NAD83 Washington State Plane horizontal datum and the NAVD88 vertical datum.

Grid and Layering

The model grid resolution was based on available topographic data, and consists of uniform 6-foot by 6-foot cells in 340 rows and 374 columns. Groundwater flow was simulated for 405,228 active model cells across the model extent shown on Figure 1.

Figure 2 shows a representative cross section through Lora Lake in the model, with a 5x vertical exaggeration. The top layer in the model represents open water in Lora Lake during pre-remediation (baseline) conditions, and fill in Lora Lake following remediation. The bottom elevation of Layer 1 is based on the combined ground surface elevation and Lora Lake bathymetry surface as compiled by ESA (ESA, 2015a). The other model layers represent the following (from top to bottom):

- The lake sediment thickness is based on cores reported in the Lora Lake RI/FS (Floyd|Snider, 2015), and the assumption that sediment thickness is inversely proportional to lake depth. Post-remediation lake sediment thickness reflects settlement based on geotechnical estimates (Aspect, 2016);
- Wetland peat is simulated with a thickness of up to 15 feet outside of Lora Lake based on the thickness observed in boring HC99-B31 and in the cross section presented in a peat survey of the Miller Creek Wetland (Rigg, 1958). In the vicinity of Lora Lake, the bottom of peat was extended to near the bottom of Lora Lake sediment reflecting historic peat mining activities within the Lora Lake footprint. The extent of peat shown on Figure 1 was based on the Miller Creek Wetland map presented by Rigg (1958), topography, and boring logs;
- Recessional outwash deposits (Qvr) are simulated between the bottom of the peat and the top of glacial till, where peat is present. Where peat is inferred to be absent based on available data, the recessional outwash deposits are simulated between ground surface and the top of glacial till.
- Glacial till deposits (Qvt) were simulated with a 20-foot uniform thickness across the model extent. The thickness was calculated from review of boring logs within a 2-mile radius of Lora Lake. The upper glacial till contact elevation was based on information from the Seattle-Tacoma International Airport (STIA) Regional Groundwater Model (Aspect, 2008); and
- Advance outwash deposits (Qva), located beneath the glacial till, represent a specified-head boundary condition in the model.

Aquifer Parameters

Aquifer parameters define characteristics for groundwater flow and storage, and include hydraulic conductivity (horizontal and vertical) and storage coefficient (“specific yield” for unconfined storage coefficient and “specific storage” for confined storage coefficient). For modeling purposes, aquifer parameters are assumed to be uniform within a hydrostratigraphic unit, and parameter values were first estimated based on literature values for soil types and available slug test results (see Table 1). Model calibration involved adjusting aquifer parameter values to maximize agreement between measured and modeled groundwater levels at select locations.

The initial horizontal hydraulic conductivity estimate for peat, recessional outwash deposits, and glacial till were based on the geometric mean of previously reported slug test results from piezometers screened in the respective units (Aspect, 2015a; and Hart Crowser, 2003). For native soils, the horizontal hydraulic conductivity is greater than the vertical conductivity as a result of natural stratification, and the ratio of horizontal to vertical hydraulic conductivity is assumed to be 10:1.

The initial estimates of specific storage and specific yield were based on literature values reported for similar aquifer materials (Anderson, et al., 2015) and are presented in Table 1. Storage values were initially estimated for each hydrostratigraphic zone and then adjusted during calibration to match measured groundwater levels.

Boundary Conditions

Boundary conditions were assigned to reflect the understanding of groundwater flow conditions at the edges of the model. Boundary conditions include assigning rates of incident precipitation and evapotranspiration, stormwater outfall discharge to Lora Lake, groundwater underflow from upland areas, the potentiometric surface for the advance outwash deposits, and drainage of groundwater and surface water. Locations with data used to inform boundary conditions are shown on Figure 3. The types of boundary conditions included (as referred to in groundwater modeling code): *recharge*, *evapotranspiration*, *well*, *specified head*, *river*, and *drain*. The distribution of boundary conditions in the groundwater model is depicted on Figures 1 and 4. Additional detail for each type of boundary condition is provided below.

Precipitation and Evapotranspiration

Daily precipitation data presented in the baseline monitoring memo (Aspect, 2015a) was applied directly to the highest active model layer as *recharge*. A portion of Table 5 from the baseline monitoring memo is reproduced here to show the range of monthly precipitation totals compared to historical averages. Notably, relatively wet conditions were observed from February through May 2014, following relatively dry conditions.

	Monthly Precipitation Totals (in)											
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
2013	-	-	-	-	2.4	1.3	0.0	1.3	5.1	2.6	3.3	1.9
2014	3.3	5.6	9.1	4.2	3.2	0.7	0.8	1.6	2.2	6.5	4.7	4.7
1945-2003 Avg.	5.6	4.2	3.8	2.6	1.7	1.5	0.8	1.0	1.8	3.6	5.9	5.8
Difference 2013 from Avg.	-	-	-	-	0.7	-0.2	-0.8	0.3	3.3	-1.0	-2.6	-3.9
Difference 2014 from Avg.	-2.3	1.4	5.3	1.6	1.5	-0.8	0.1	0.6	0.5	3.0	-1.2	-1.1

Excess precipitation ponding above ground surface was simulated in the model as overland runoff toward a drainage feature (described below).

Evapotranspiration is the amount of water that is transferred from the water table to the atmosphere by evaporation or transpiring plants. Daily *evapotranspiration* was applied to the top layer based on monthly average pan evaporation data for Seattle, Washington (Western Regional Climate Center, 2015). The data were then adjusted using reference factors that represented the wetland scrub-shrub vegetation versus open water (Allen, et al., 1998).

Stormwater Outfall

The City of Burien stormwater outfall currently discharges directly to Lora Lake, as reported during baseline monitoring (Aspect, 2015a). In the pre-remediation model, the daily average discharge rate was applied to the northwest corner of Lora Lake using the *well* boundary condition (see Figure 4). It is our understanding that stormwater from approximately 80 acres of the City of Burien will no longer discharge to Lora Lake. Thus, the stormwater outfall was not simulated in the post-remediation model.

Groundwater Underflow from Upland Areas

The water table in the recessional outwash deposits was simulated along the western model boundary, which runs parallel with Des Moines Memorial Drive South and along the toe of the Third Runway Embankment (Figure 1). Along the western model boundary, the water table was assigned the average of historically measured water levels in monitoring wells MW-14 and MW-3. Along the Third Runway Embankment, the water table was assigned the average water level measured during embankment monitoring (Pacific Groundwater Group [PGG], 2015). These *specified heads* were held at constant values during the model timeframe[1].

Potentiometric Surface in the Advance Outwash Deposits

The potentiometric surface in the advance outwash deposits was assigned based on model results from the Seattle Tacoma International A regional groundwater model (Aspect, 2008) offset to match water levels measured for the Third Runway Embankment Monitoring project (PGG, 2015). These *specified heads* were held at constant values during the model timeframe.

Groundwater and Surface Water Drainage

Miller Creek was simulated in the model using the *river* boundary condition, which allows both gaining and losing conditions. The alignment and elevation of Miller Creek was assigned in the model based on topographic data provided by ESA (ESA, 2015a). Miller Creek was simulated with daily-specified stage, calculated by adding the daily average stream depth (averaged across stream gauges SG-MC-1, SG-MC-2, and SG-MC-3) to the stream bottom elevation. Miller Creek was simulated with a high conductance value, reflecting good hydraulic continuity with the adjacent groundwater system.

Drainage from Lora Lake to Miller Creek was simulated at the culvert (see Figure 4) using daily average water levels from gauge SG-LL-1 in Lora Lake. The culvert was simulated using the *drain* boundary condition with a high conductance value, reflecting the effectiveness of the culvert at maintaining water levels in Lora Lake.

The remaining drainage features were simulated using the *drain* boundary condition with heads specified at the topographic elevation, and include the following:

- The ditch west of Lora Lake that drains the west hillslope and discharges into Lora Lake (the West Ditch in Figure 4); and
- The Vacca Farms ditch in the rehabilitated wetlands south of Lora Lake (see Figure 4).

---

[1] Specified heads used to simulate groundwater underflow from upland areas were held constant. This assumption was considered appropriate for the purposes of this analysis based on results of model calibration.

Model Calibration

The groundwater model was calibrated to water level data collected from October 1, 2013 to October 26, 2014 during the Lora Lake Baseline Surface Water and Groundwater Monitoring (Aspect, 2015a). A map of calibration locations is shown on Figure 3. The groundwater inflow observed during the Lora Lake drawdown test (Aspect, 2015b) and King County stream gaging along Miller Creek also supported model calibration by providing information on groundwater contributions to Miller Creek streamflow. During calibration, aquifer parameter values were adjusted to improve the match between modeled and measured hydraulic head. The calibration process was supported using the automated parameter estimation code, PEST (Doherty, 2005).

Calibration Results

Based on calibration results, the Lora Lake model is considered an appropriate tool to assess changes in groundwater conditions for alternative fill specifications and wetland design as part of the Lora Lake CAP. The general findings based on model calibration results include the following:

- The aquifer parameter values that resulted from calibration are listed in Table 1, and are within the range of measured or literature values for the soil types. The hydraulic conductivity values for unconsolidated peat (approximately 10 feet per day) and recessional outwash deposits (approximately 30 feet per day) were within a similar range of magnitude based on model calibration, reducing the effect of inferred peat extent on modeled groundwater inflow to Lora Lake.
- A potentiometric surface map produced by the model using the calibrated parameter set is provided on Figure 5, and compares closely with potentiometric surface maps generated from baseline data (Aspect, 2015a).
- Calibration statistics (see Table 2) show good agreement between measured and modeled groundwater level elevations (Anderson, et al., 2015).

A common way to graphically evaluate the model calibration is to generate a scatter plot of modeled values vs. measured values. The scatter plot of the Lora Lake model calibration comparison is provided as Figure 6, and shows both daily and quarterly monitoring data. This graph, and the statistics of the difference between modeled and measured groundwater levels, support the conclusion that the model is “good” for simulating seasonally variable water levels. The overall average and standard deviation of the differences between modeled and measured values is approximately 0 feet and 0.5 feet, respectively. The agreement is very good for the focus area in the near vicinity of Lora Lake—those locations with daily monitoring data collected during the baseline monitoring program.

Locations further from Lora Lake, with fewer measured water levels, and closer to the model boundary may reflect model artifacts associated with boundary condition assumptions and model setup. Specifically, locations along Des Moines Memorial Drive South show modeled water levels that are greater than measured heads. This difference reflects model artifacts which are the effects of model assumptions on the simulation as described below.

Model Artifacts

Differences between measured and modeled groundwater level elevations can be attributed to model artifacts, and model results should be interpreted appropriately. A couple types of model artifacts are explained below:

- Modeled water levels near specified-head boundaries may be overconstrained. Where the boundary condition is assigned a constant value over time, modeled water levels will not reflect the natural variability. The Lora Lake model was designed to maintain an adequate distance between the sediment cleanup area and the model boundaries to prevent this type of model artifact within the focus area.
- Modeled water levels may be influenced by simplifications in the model, compared to the actual system. The Lora Lake model simulates different groundwater levels than observed at many upland monitoring well locations. Additional model complexity would likely improve comparison of modeled and measured groundwater levels at upland locations, but these changes would not likely improve the simulation of post-remediation groundwater inflow to the Lora Lake fill or water levels within the Lora Lake wetland.

Model artifacts help explain the differences between measured and modeled groundwater levels. The Lora Lake groundwater model avoids model artifacts within the sediment cleanup area, and provides good calibration. Therefore, the model is considered an appropriate tool to evaluate changes in groundwater conditions for alternative fill and wetland design as part of the Lora Lake CAP.

Modifications for Post-Remediation Model

To simulate post-remediation conditions in the Lora Lake vicinity, the groundwater model was modified through 60-percent design with the following changes:

- Added material representing remediation cap and bulk fill above the lake sediment to post-remediation grade and assigned appropriate aquifer parameters based on alternative fill materials;
- Modified peat and lake sediment characteristics (thickness and hydraulic conductivity) to reflect the anticipated effects of settlement due to fill placement within Lora Lake based on geotechnical estimates (Aspect, 2016); and
- Modified boundary conditions (modified evapotranspiration rates across Lora Lake wetland, removed City of Burien stormwater outfall, removed culvert from Lora Lake to Miller Creek, and added Lora Lake wetland swales).

These modifications are described in more detail below.

Remediation Cap and Bulk Fill in Lora Lake

The groundwater model was used to assess the post-remediation water table elevations for different types of fill, ranging from sandy soil to gravel. For the purposes of groundwater modeling, the remediation cap and the bulk fill material were simulated in separate layers. Alternative fill specifications included the following:

- Alternative 1 fill—The assigned bulk fill hydraulic conductivity was 1,500 feet per day, which is in the middle of the range of literature values for gravels. Alternative 1 soils were approximately 50 times as conductive as the calibrated value representing recessional outwash deposits in the model.
- Alternative 2 fill—The assigned hydraulic conductivity was 150 feet per day, which is near the middle of the range of literature values for clean, coarse sands. Alternative 2 soils were approximately 5 times as conductive as the recessional outwash deposits in the model.
- Alternative 3 fill—The assigned hydraulic conductivity was 50 feet per day, which is in the middle of the range of literature values for clean, medium sands. Alternative 3 soils were approximately 1.7 times as conductive as the recessional outwash deposits in the model.

The vegetative soil layer at ground surface is not anticipated to influence the water table elevation, and was not simulated in the model.

Effects of Settlement due to Filling Lora Lake

Peat and lake sediments will settle as a result of filling Lora Lake. The magnitude and duration of settlement was estimated based on select sediment core locations using geotechnical analysis (Aspect, 2016). The distribution of settlement was estimated across the remediation area based on the relationships between fill thickness, initial and 10-year estimated lake sediment thickness, and initial and 10-year estimated peat thickness. Settlement of lake sediment is estimated to be greatest near the center of the sediment cleanup area, where the thickness of lake sediment is considered greatest. Settlement of peat is estimated to be greatest along the southern portion of the sediment cleanup area, where the thickness of peat is considered greatest. Figure 7 shows a representative cross section through Lora Lake with the adjusted thicknesses of lake sediment and peat due to settlement from the overlying fill materials.

In areas of settlement, the peat hydraulic conductivity was reduced proportional to the change in thickness. The peat hydraulic conductivities assigned in the model are shown in Table 1, and are based on literature values (Wong et al, 2009). A map showing the relative changes in peat thickness is shown on Figure 8, and reflects the following magnitudes of settlement after 10 years:

- Minimum settlement (greater than 5 percent and less than or equal to 15 percent of initial peat thickness), located along current lake shoreline where fill thickness will be minimum and near lake bottom where current peat thickness is minimum;
- Intermediate settlement (greater than 15 percent and less than 25 percent of initial peat thickness), located where fill or peat represent an average thickness; and
- Maximum settlement (greater than 25 percent of initial peat thickness), located where fill and peat thicknesses are maximum.

Literature sources for the effects of settlement on lake sediment hydraulic conductivity were not identified. For the purposes of post-remediation modeling, the lake sediment hydraulic conductivity was not adjusted from the value used in the baseline model.

Post-Remediation Boundary Conditions

Boundary conditions were modified to reflect post-remediation conditions, and included the following changes:

- Evapotranspiration was modified across Lora Lake to reflect the wetland scrub-shrub environment;
- The City of Burien stormwater outfall to Lora Lake was not simulated, based on the understanding that this discharge will be relocated away from the remediation area;
- The culvert between Lora Lake and Miller Creek was not simulated, based on the understanding that this feature will be removed during remediation activities;
- Swales will be part of the Lora Lake wetland design, and were added to control groundwater buildup within the project area (ESA, email communication). The West Ditch and designed swales drain toward a point in the berm along the southern edge of the sediment cleanup area. A map of the designed swales is provided on Figure 9.

Other boundary conditions are consistent with the baseline model because they will not be affected by implementing the Lora Lake CAP. These consistent boundary conditions include the following: groundwater underflow from upland areas, Miller Creek, the West Ditch, and the Vacca Farms ditch.

Post-Remediation Model Utili□ation

The post-remediation model was used to assess alternative Lora Lake design scenarios, including the effectiveness for alternative fill materials (sandy soil vs. gravelly soil) and alternative wetland swale designs. The results of the post-remediation model represent stable conditions anticipated following settlement and filling to design grade. The results of post-remediation model utilization were evaluated based on design objectives, as described below.

Minimize Groundwater Elevation

Minimizing the groundwater elevation and fill volume is one of the remediation design objectives. Based on the Lora Lake groundwater model results, post-remediation groundwater levels in the former lake footprint will generally be lower than baseline observed lake levels. Figure 10 compares hydrographs at proposed cap monitoring well locations and selected existing locations around Lora Lake. Where proposed cap monitoring wells will be within the former lake footprint, graphs also show the designed post-remediation ground surface elevation.

Maintain Current Upward Groundwater Flow Path

Based on model results, current upward flow paths across Lora Lake sediments will be maintained, and groundwater flow will enter the remediation cap as designed for the alternative fill materials. Due to the effects of settlement, lower peat hydraulic conductivity beneath the lake sediments may decrease the rate of groundwater flow into the Lora Lake footprint.

Rate and Timing of Groundwater Seepage to Miller Creek

Groundwater model results indicate minor changes in the rate and timing of discharge to Miller Creek after remediation, associated with the following:

- Relocating the City of Burien stormwater outfall;
- Changes in evapotranspiration associated with wetland vegetation; and
- Changes in bank storage effects.

Figure 11 shows stacked area graphs of the monthly average groundwater seepage to Miller Creek calculated by the baseline (top graph) and post-remediation models. The post-remediation groundwater seepage rates to Miller Creek for the alternative fill materials were similar (within 2 percent of calculated seepage rate). Model results were provided to ESA to ensure the remedy does not adversely impact flood frequencies or base flow conditions of the creek.

Fill Material Specification

Groundwater model results indicate that the alternative fill materials will meet the project objectives. A correction factor of 3 was applied to the fill hydraulic conductivity in the model, based on the ratio of modeled (30 ft/d) to measured (90 ft/d) recessional outwash deposits hydraulic conductivity. The methods used to measure hydraulic conductivity of the recessional outwash deposits, and the results, were described in the Baseline Monitoring Report (Aspect, 2015a). For the fill materials to remain proportionally more conductive than the recessional outwash deposits, the fill hydraulic conductivity should be at least 50 ft/d * 3, or 150 ft/d. Potential sources of fill materials were assessed for meeting this hydraulic conductivity specification during 90-percent design (Aspect, 2016).

Conclusions

Groundwater model results indicate the remediation design objectives relative to groundwater conditions can be met by implementing the Lora Lake CAP as described above. These findings are valid for the 60-percent design post-remediation conditions simulated using the Lora Lake model. If required, groundwater modeling refinements will support the remaining design of the alternatives, and will be documented as an update to this memorandum. Potential refinements to the groundwater model will be coordinated with Floyd|Snider and ESA to optimize how remediation design objectives can be met.

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Limitations

Work for this project was performed for the Floyd|Snider (Client), and this memorandum was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This memorandum does not represent a legal opinion. No other warranty, expressed or implied, is made.

All reports prepared by Aspect Consulting for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Aspect Consulting. Aspect Consulting's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

Attachments

Table 1: Aquifer Parameter Values
Table 2: Model Calibration Results
Figure 1: Map of Model Extent and Extent of Peat
Figure 2: Model Construction Cross Section – Baseline
Figure 3: Map of Groundwater and Surface Water Data Locations
Figure 4: Map of Surface Water Boundary Conditions – Baseline
Figure 5: Modeled Potentiometric Surface Map – Baseline
Figure 6: Model Calibration – Modeled vs. Measured Heads
Figure 7: Model Construction Cross Section – Post-Remediation
Figure 8: Map of Post-Remediation Peat Settlement
Figure 9: Map of Surface Water Boundary Conditions – Post-Remediation
Figure 10: Modeled Hydrographs at Selected Locations
Figure 11: Modeled Groundwater Seepage to Miller Creek

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TABLES

Table 1 - A□uifier Parameter Values

Project #110125 - Lora Lake Apartments, Burien, WA

	A□uifer Parameter Value Used For:			Anisotropy	Data Source	
	Initial Estimate	Pre-Remediation	Post-Remediation	kx:kv		Range of Values
Hydraulic Conductivity (ft/day)						
Lora Lake Fill			1,500	2:1	Anderson et al., 2015 (gravel)	500 - 20,000
Lora Lake Sediments	20	20	20	10:1	Estimated as average of peat and Recessional Outwash	
Peat - No Settlement	7.6	11.1	11.1	10:1	Slug Test Data (Aspect, 2015)	5 - 12
Peat - Minimum Settlement			1.1	10:1	Wong et al., 2009	
Peat - Intermediate Settlement			0.11	10:1	Wong et al., 2009	
Peat - Maximum Settlement			0.011	10:1	Wong et al., 2009	
Recessional Outwash	91	30	30	10:1	Slug Test Data (Aspect, 2015)	22-263
Glacial Till	2.1	0.2	0.2	10:1	Slug Test Data (Hart Crowser, 2003)	0.54 - 5.4
Specific Storage (1/ft)						
Lora Lake Fill			0.0002	-	Anderson et al., 2015 (loose sand)	0.0003 - 0.0002
Lora Lake Sediments	0.0002	0.0002	0.0002	-	Anderson et al., 2015 (loose sand)	0.0003 - 0.0002
Peat	0.0002	0.0002	0.0002	-	Anderson et al., 2015 (loose sand)	0.0003 - 0.0002
Recessional Outwash	0.000023	0.000023	0.000023	-	Anderson et al., 2015 (dense sand and gravel)	0.00003 - 0.00002
Glacial Till	0.00034	0.00062	0.00062	-	Anderson et al., 2015 (medium hard clay)	0.0004 - 0.0003
Specific Yield (Unitless)						
Lora Lake Fill			0.3	-	Anderson et al., 2015 (sand)	0.01 - 0.5
Lake Sediments	0.2	0.21	0.21	-	Anderson et al., 2015 (silt)	0.01 - 0.4
Peat	0.2	0.21	0.21	-	Anderson et al., 2015 (silt)	0.01 - 0.4
Recessional Outwash	0.3	0.21	0.21	-	Anderson et al., 2015 (sand)	0.01 - 0.5
Glacial Till	0.2	0.2	0.2	-	Anderson et al., 2015 (silt)	0.01 - 0.4

Notes

1 - Initial estimate based on available data and/or literature values

2 - Lora Lake Fill and Peat with settlement simulated in post-remediation model only.

3 - Peat settlement expected due to filling Lora Lake:

Minimum settlement reflects settlement of greater than 5% and less than or equal to 15% by volume;

Intermediate settlement reflects settlement of greater than 15% and less than or equal to 25% by volume; and

Maximum settlement reflects settlement of greater than 25% by volume.

4 - Calibration was not sensitive to parameter value. Initial estimate was used.

Table 2 - Model Calibration Results

Project # 110125 - Lora Lake Apartments, Burien, WA

Calibration Statistic	Value	Units
Residual Mean	-0.04	feet
Absolute Residual Mean	0.33	feet
Residual Std. Deviation	0.53	feet
Sum of Squares	1235	ft^2
Root Mean Square (RMS) Error	0.53	feet
Minimum Residual	-4.53	feet
Maximum Residual	2.36	feet
Number of Observations	4352	
Range in Observations	19.11	feet
Scaled Residual Mean	0%	
Scaled Residual Std. Deviation	3%	
Scaled Absolute Residual Mean	2%	
Scaled RMS Error	3%	

Notes:

1. Residual is calculated as the measured minus modeled head.
2. The number of observations is calculated from transient observations at each location.
3. The range in observations is calculated as the maximum minus minimum head elevations.
4. Scaled statistics are calculated as the statistic divided by the range in observations.
5. The goal for model calibration is to minimize the residual mean, standard deviation, and RMS.
6. A scaled residual standard deviation of less than 10% reflects a well-calibrated model.

FIGURES

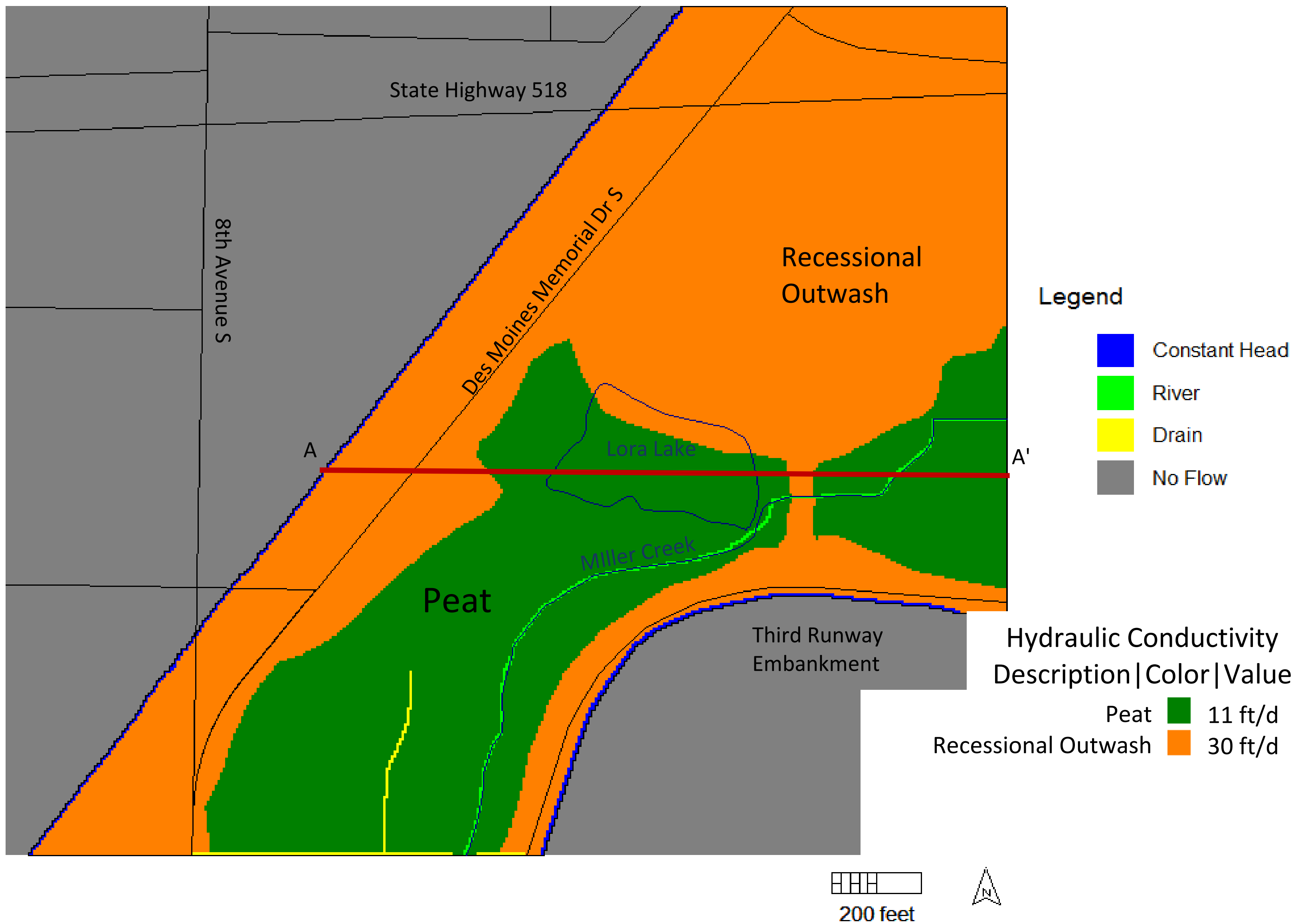

Figure 1
Map of Model Extent and Extent of Peat
Lora Lake Groundwater Modeling
110125 - Lora Lake Apartments, Burien, WA

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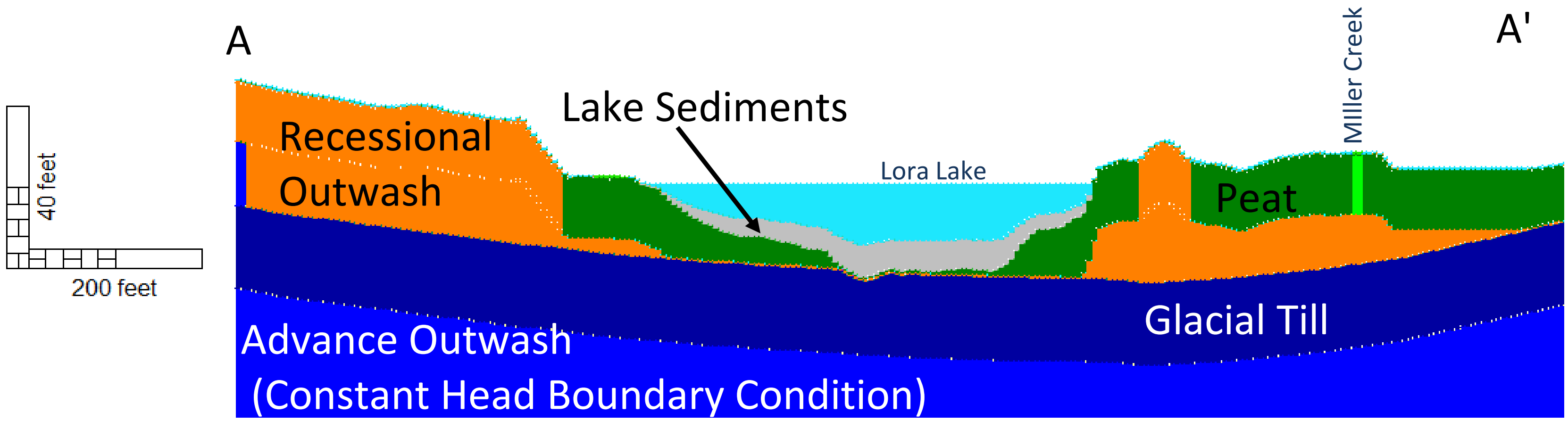

Notes:
Vertical scale is exaggerated 5:1.

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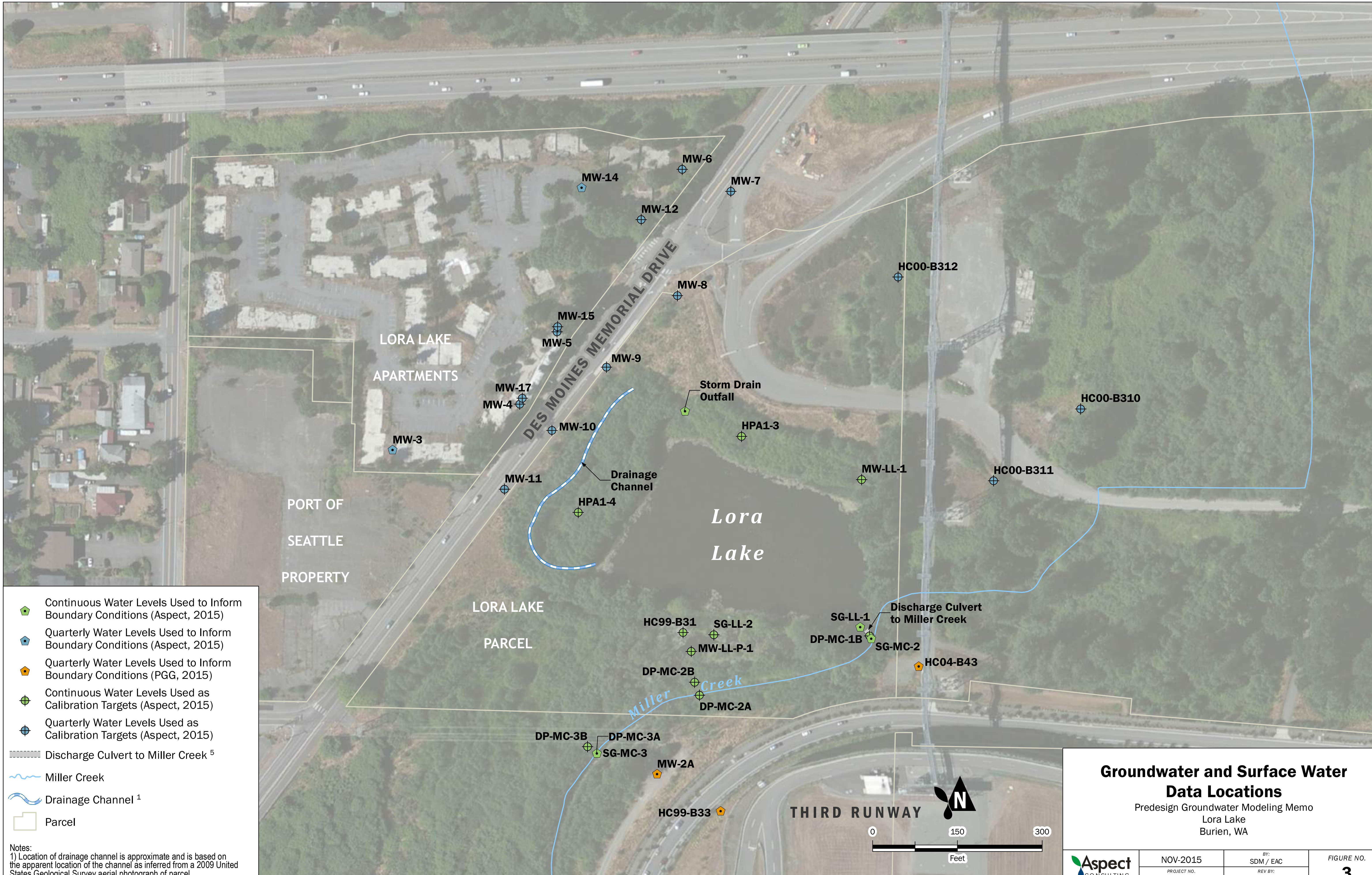
Figure 2
Model Construction Cross Section - Baseline
Lora Lake Groundwater Modeling
110125 - Lora Lake Apartments, Burien, WA



Notes:
1) Location of drainage channel is approximate and is based on the apparent location of the channel as inferred from a 2009 United States Geological Survey aerial photograph of parcel.

Groundwater and Surface Water Data Locations

Predesign Groundwater Modeling Memo
Lora Lake
Burien, WA

Aspect CONSULTING	NOV-2015	BY: SDM / EAC	FIGURE NO.
	PROJECT NO. 110125-003-02	REV BY: - - -	3

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

GIS Path: T:\projects_8\Port_of_Seattle\LoraLake\Delivered\Predesign Groundwater Modeling Memo\Groundwater and Surface Water Data Locations.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 11/9/2015 || User: ecrumbaker || Print Date: 11/9/2015

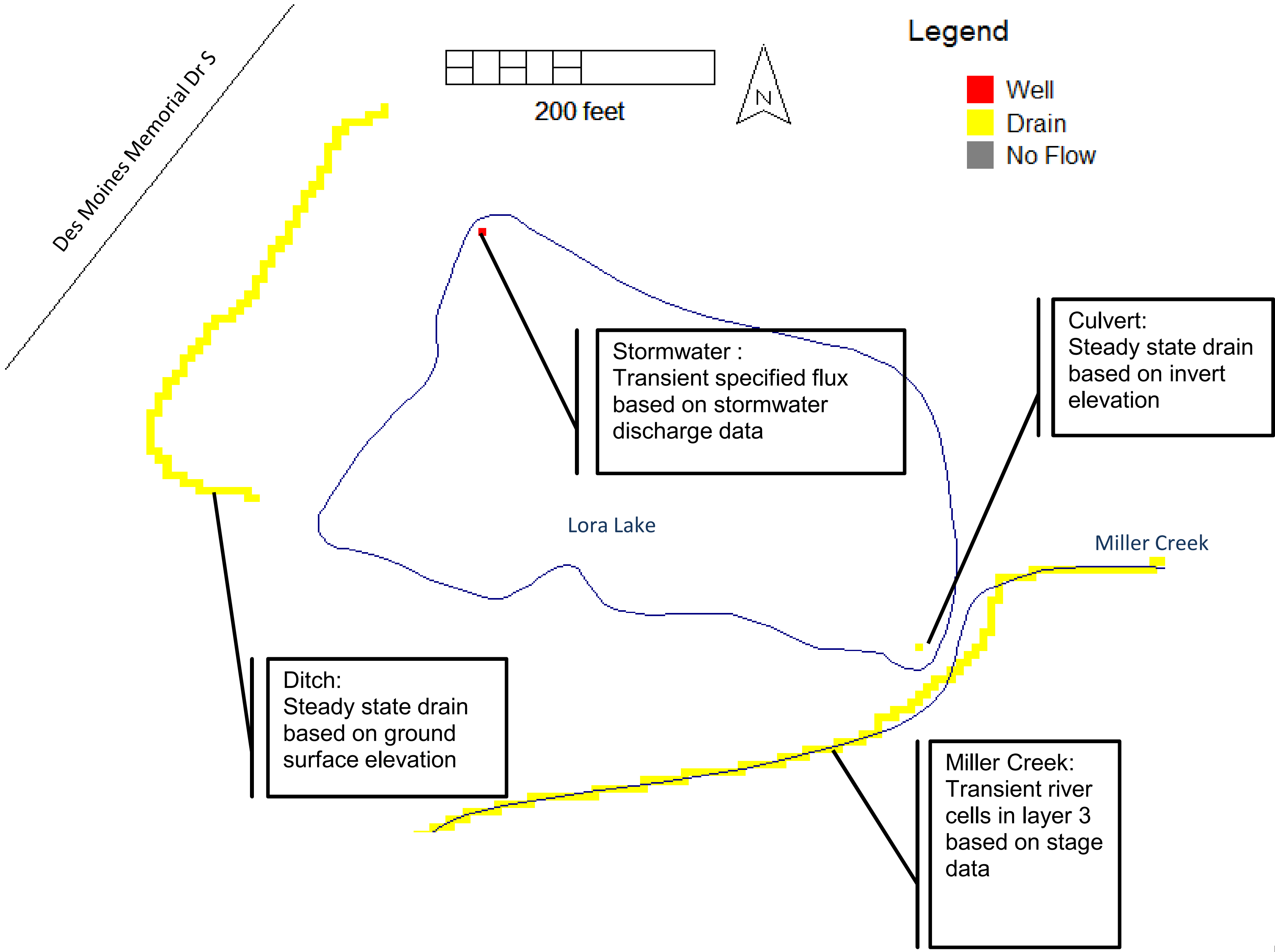


Figure 4

Map of Surface Water Boundary Conditions - Baseline

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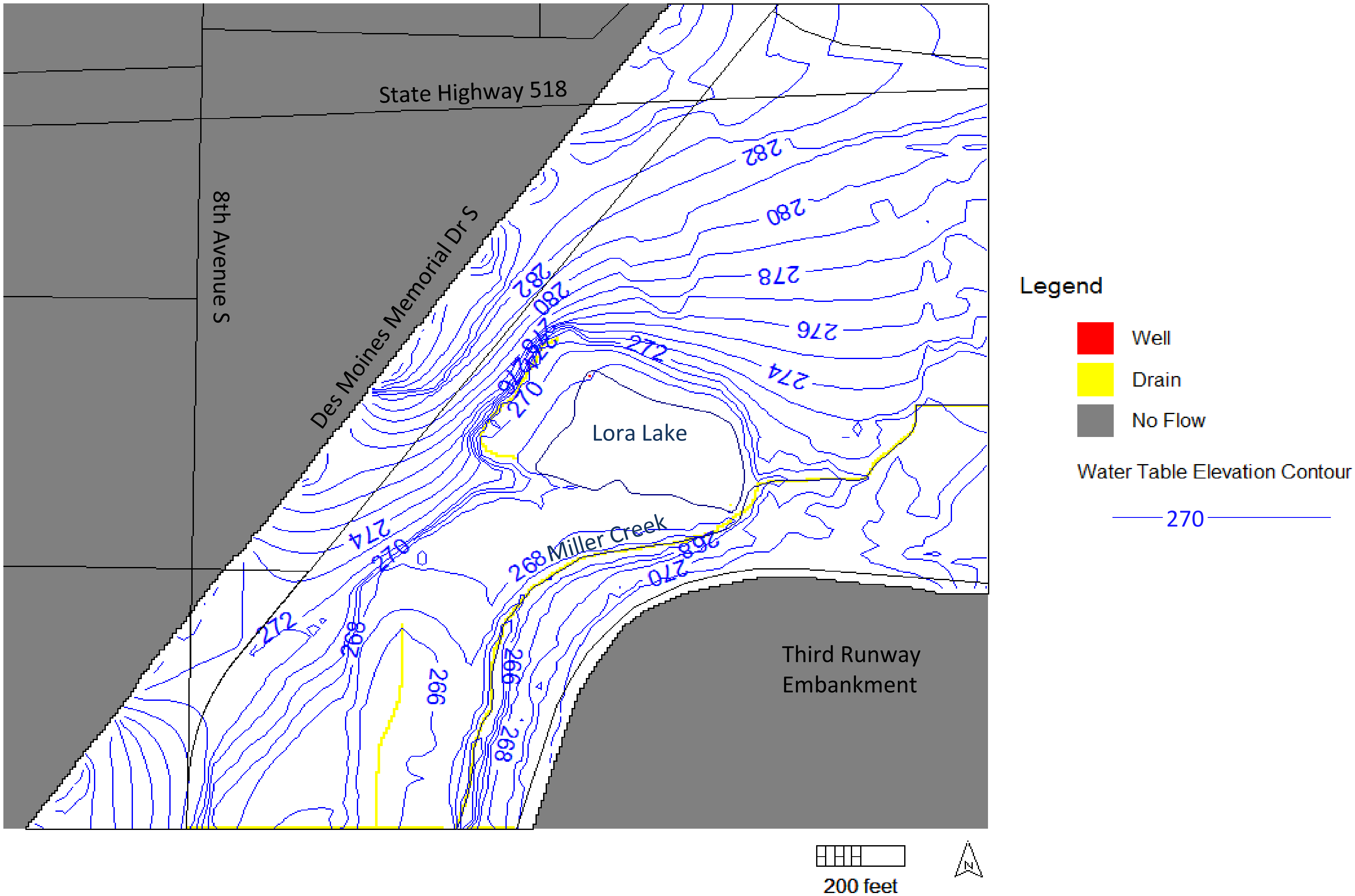

Notes:
Water level contours represent high-water conditions.
Elevations are reported in feet NAVD 88

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Figure 5
Modeled Potentiometric Surface Map - Baseline
Lora Lake Groundwater Modeling
110125 - Lora Lake Apartments, Burien, WA

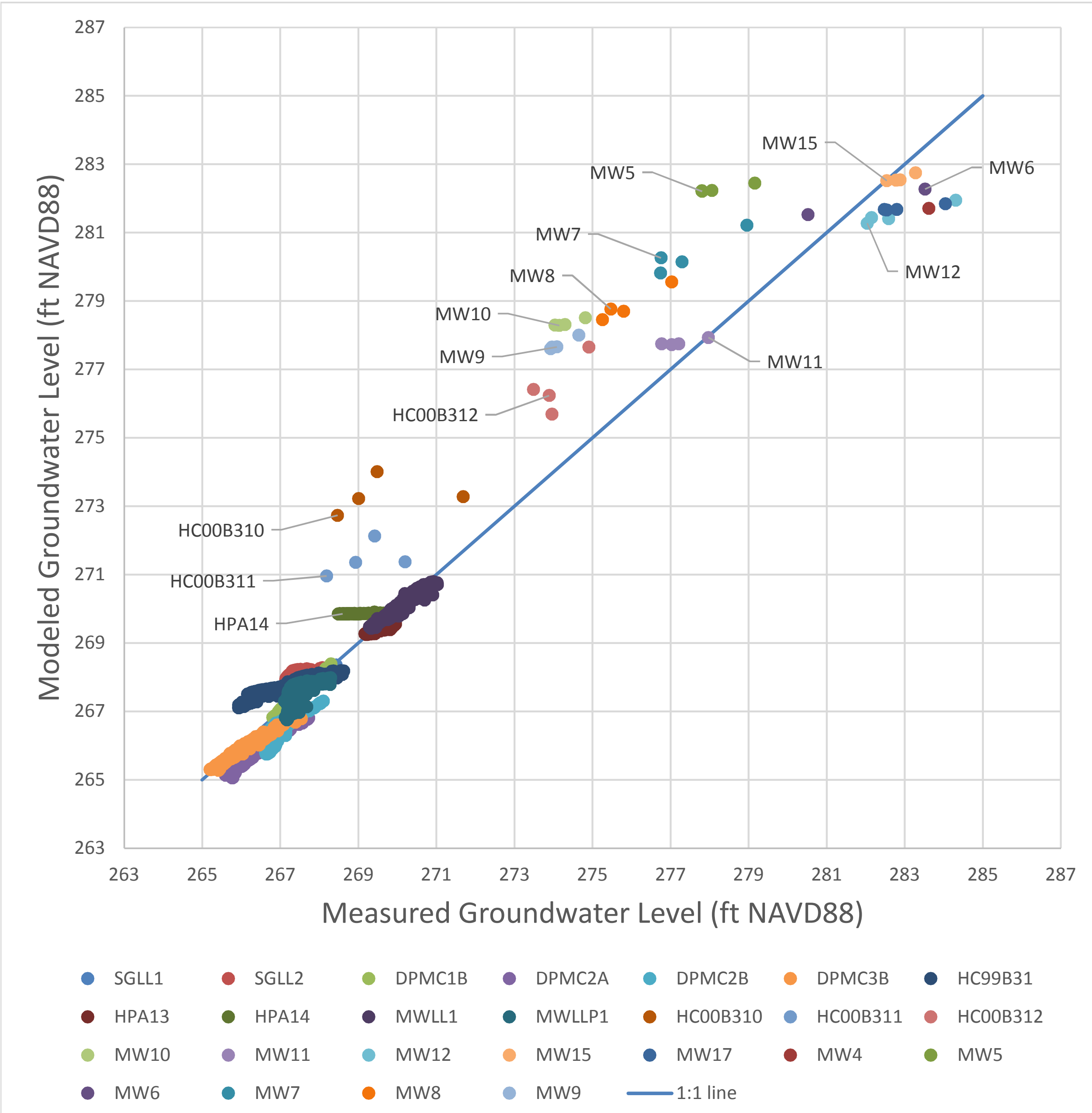

Figure 6

Model Calibration - Modeled vs. Measured Heads

Lora Lake Groundwater Modeling

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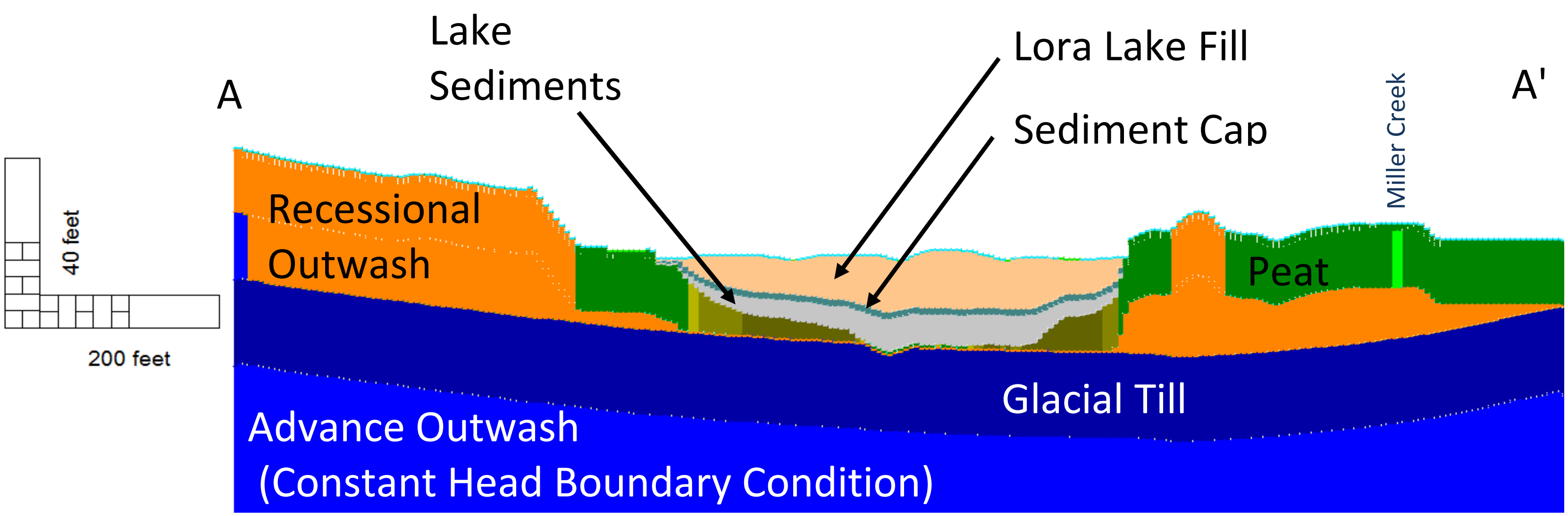

Notes:
Vertical scale is exaggerated 5:1.

Figure 7
Model Construction Cross Section - Post-Remediation
Lora Lake Groundwater Modeling
110125 - Lora Lake Apartments, Burien, WA

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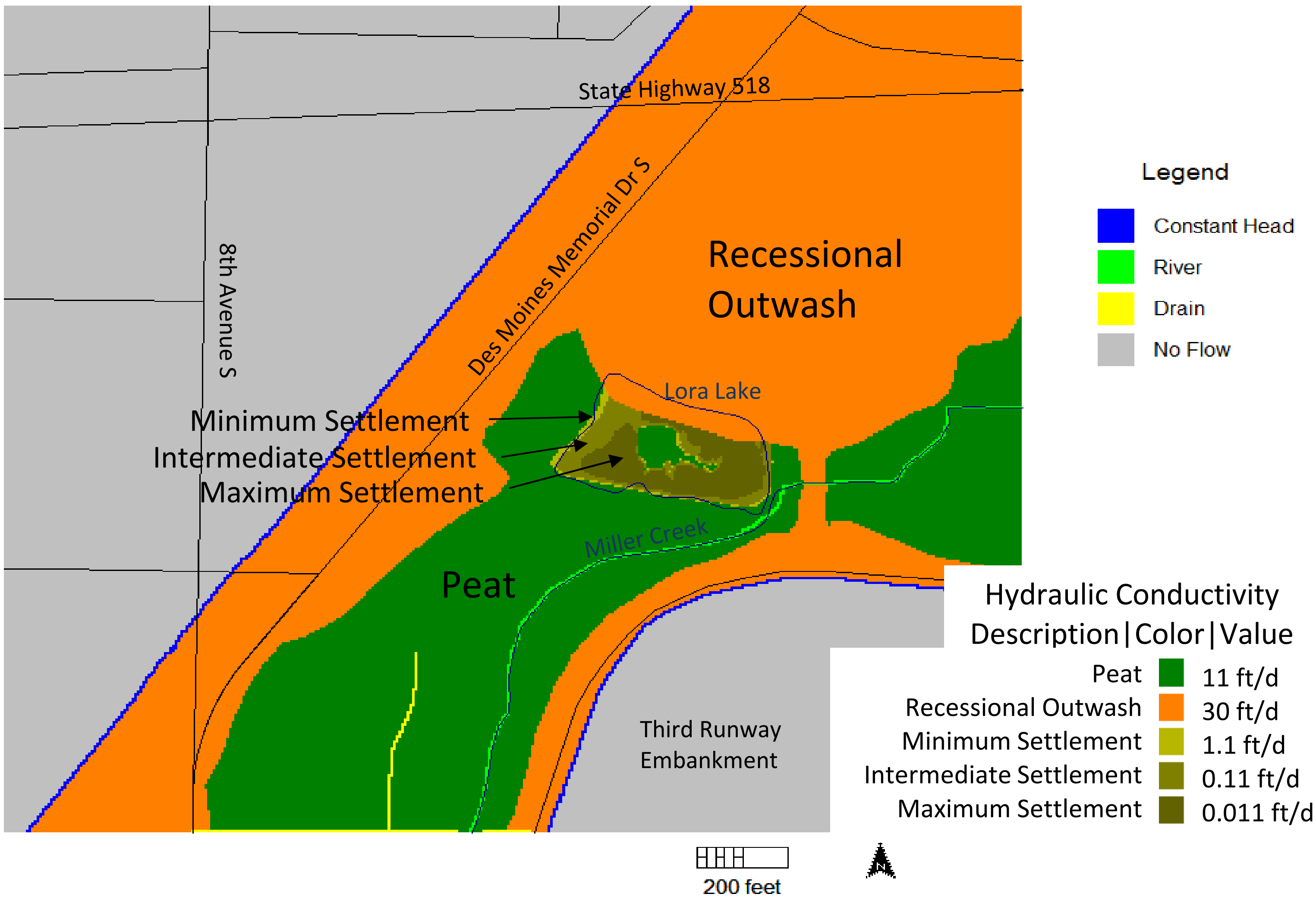

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Figure 8
Plan of Post-Remediation Peat Settlement
Lora Lake Groundwater Modeling
110125 - Lora Lake Apartments, Burien, WA

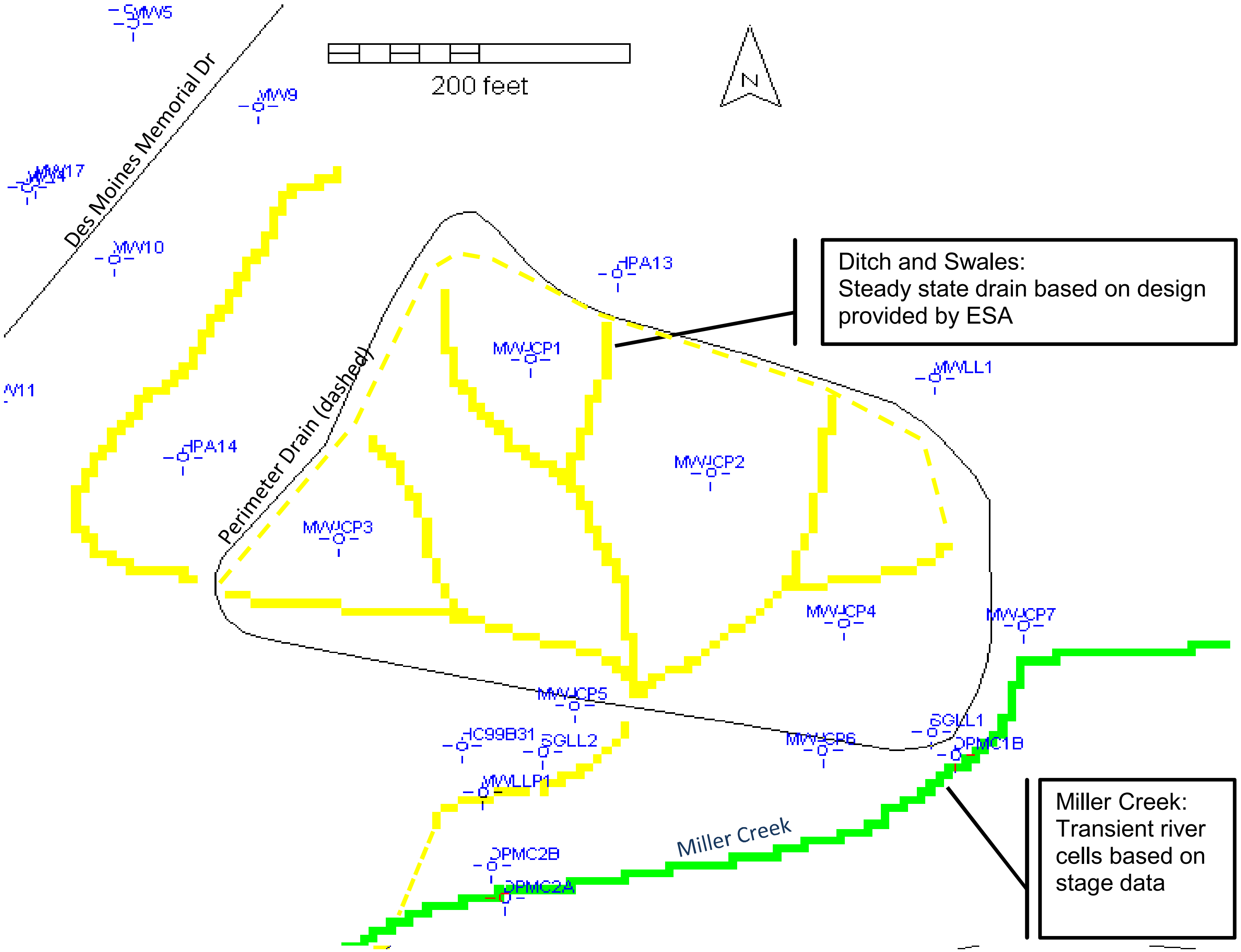

Figure 9

Map of Surface Water Boundary Conditions - Post-Remediation

Lora Lake Groundwater Modeling

110125 - Lora Lake Apartments, Burien, WA

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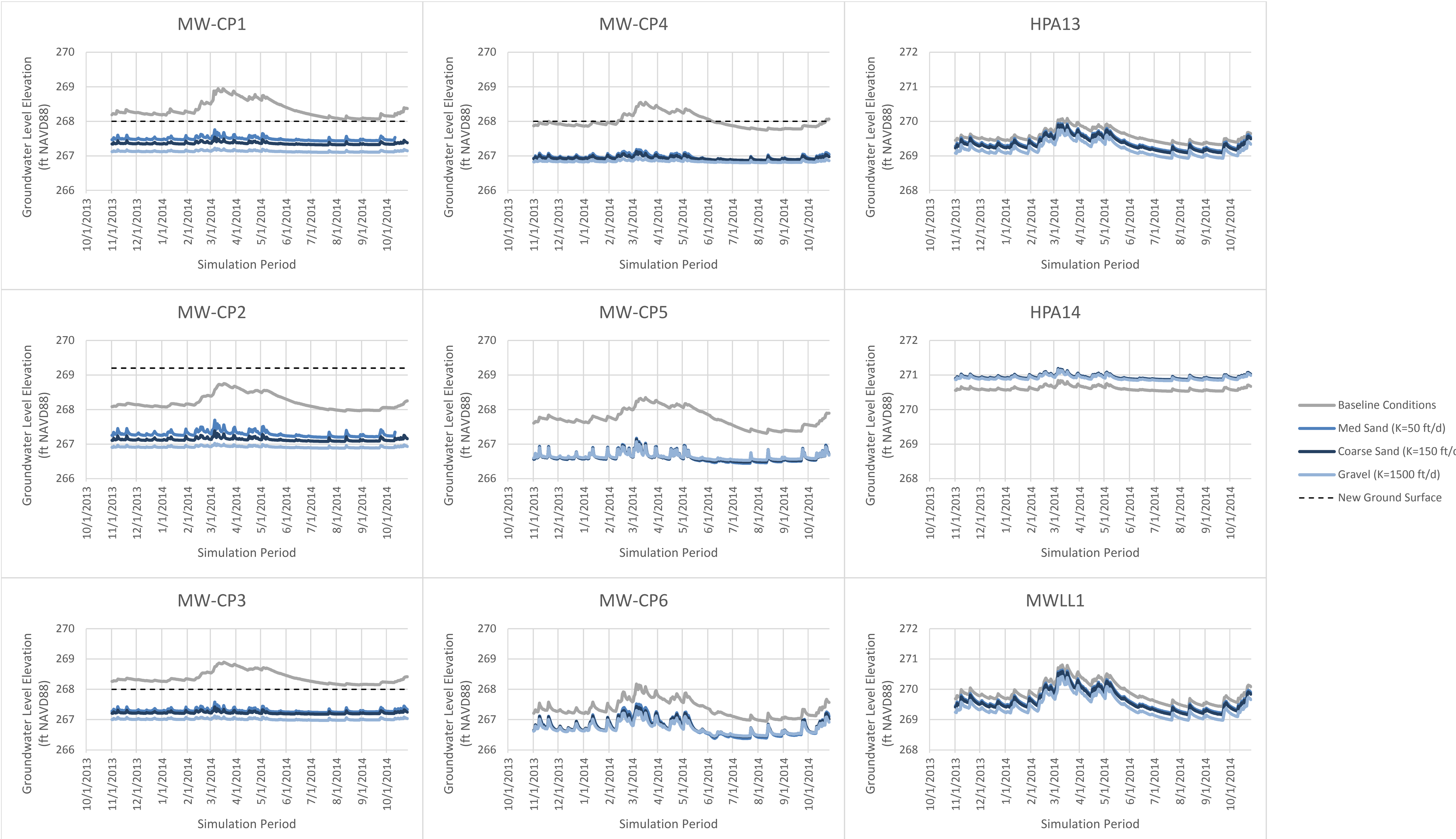

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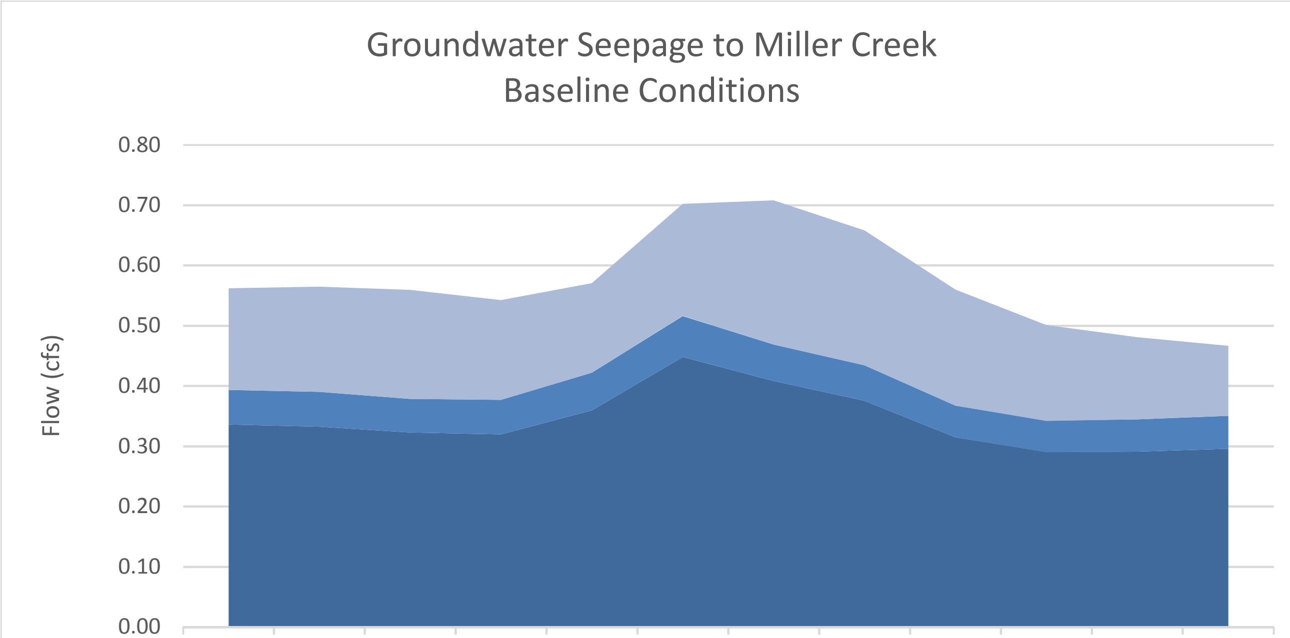
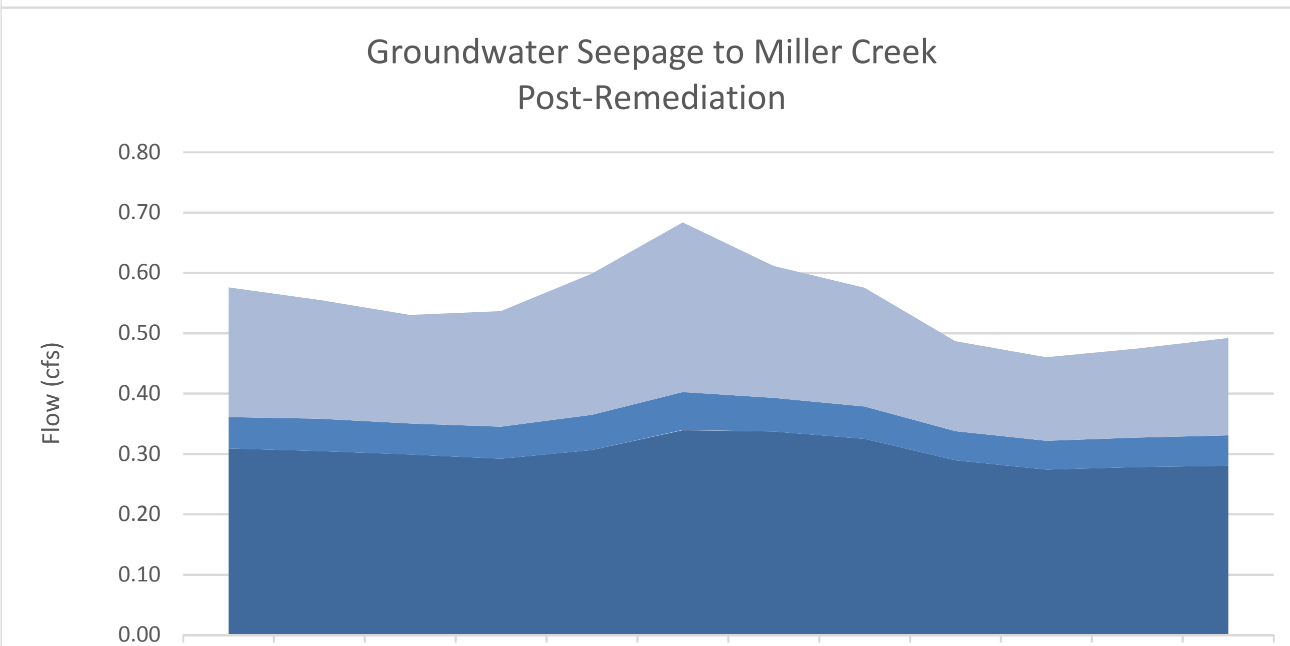
Figure 10
Modeled Hydrographs at Selected Locations
Lora Lake Groundwater Modeling
110125 - Lora Lake Apartments, Burien, WA



	10/1/13	11/1/13	12/1/13	1/1/14	2/1/14	3/1/14	4/1/14	5/1/14	6/1/14	7/1/14	8/1/14	9/1/14
Culvert	0.17	0.17	0.18	0.17	0.15	0.19	0.24	0.22	0.19	0.16	0.14	0.12
West Ditch	0.06	0.06	0.06	0.06	0.06	0.07	0.06	0.06	0.05	0.05	0.05	0.05
Miller Creek	0.34	0.33	0.32	0.32	0.36	0.45	0.41	0.38	0.31	0.29	0.29	0.30



	10/1/13	11/1/13	12/1/13	1/1/14	2/1/14	3/1/14	4/1/14	5/1/14	6/1/14	7/1/14	8/1/14	9/1/14
Swales	0.21	0.20	0.18	0.19	0.23	0.28	0.22	0.20	0.15	0.14	0.15	0.16
West Ditch	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05
Miller Creek	0.31	0.30	0.30	0.29	0.31	0.34	0.34	0.32	0.29	0.27	0.28	0.28

Figure 11

Modeled Groundwater Seepage to Miller Creek

Lora Lake Groundwater Modeling

110125 - Lora Lake Apartments, Burien, WA

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MEMORANDUM

March 21, 2016 Project No.: 110125

Revised Final: May 10, 2016

To: Jessi Massingale, Floyd|Snider

From:

Peter Bannister, PE
Associate Engineer

John Strunk, LHG
Principal Geologist

Re: **SR 518 Construction Stormwater Pond Infiltration Assessment: Lora Lake Remediation Implementation—Revised Final**

This memorandum describes an infiltration assessment of the SR 518 Construction Stormwater Pond (518 Pond) during implementation of the Lora Lake Cleanup Action Plan. The 518 Pond will be used to infiltrate water pumped from Lora Lake during cap and fill (fill) placement to maintain the lake stage safely below the level where discharge could impact Miller Creek. The 518 Pond may also be used to infiltrate dewatering discharge from soil excavations on the Lora Lake Apartment (LLA) parcel.

It is the Contractor's responsibility to manage all water within construction specifications. This analysis shows separate hypothetical schedules for pumping Lora Lake water during filling and dewatering at the LLA site—with discharge to the SR 518 Construction Stormwater Pond up to the pond storage capacity. However, all lake water and the LLA excavation water that will be pumped will be treated to reduce suspended solids. Based on information provided by Floyd|Snider, treatment will be provided by a Chitosan-Enhanced Sand Filtration system approved by Washington State Department of Ecology (WSDOE) under the Chemical Technology Assessment Protocol-Ecology program, and meeting requirements of enhanced treatment specified in Chapter 3 of Volume V of the 2014 *Stormwater Management Manual for Western Washington* (SWMMWW; WSDOE, 2014). Meeting this treatment requirement enables treated stormwater to be discharged to fresh water designated for aquatic-life use, according to criteria specified in the SWMMWW, and will satisfy requirements for treatment present in the Construction Stormwater General Permit.

Therefore, all lake water and the LLA excavation water that will be pumped may be discharged to either to the SR 518 Construction Stormwater Pond or to fresh water designated for aquatic-life use.

The 518 Pond was recently surveyed by the Port of Seattle (Port), revising previous infiltration rates and storage volumes estimated from the pump down and pump-back tests in October 2015 (Aspect, 2015). The revised low-end infiltration capacity is approximately 100 gallons per minute (gpm), and the 518 Pond storage is approximately 800,000 gallons at a stage of 4.3 feet above the lowest pond floor elevation. The overflow spill stage is approximately 4.62 feet based on the difference between the surveyed elevations of the pond floor and the top of a stormwater flow control structure located at the southeast corner of the 518 Pond.

Based on results of the assessment, it appears feasible to use the 518 Pond during construction for a reasonable range of expected fill rates and dewatering rates without overtopping storage capacity. Acceptable pumping rates from Lora Lake to the 518 Pond will depend on antecedent soil moisture conditions, seasonally variable infiltration capacity, groundwater inflow to Lora Lake, fill rate, and fill moisture content. Acceptable dewatering discharge rates from the LLA parcel excavations to the 518 Pond will depend on groundwater inflow to the excavations, and the feasibility of infiltrating a portion of the volume of dewatering discharge on the LLA parcel.

A schematic of the Lora Lake/518 Pond system is provided on Figure 1 below:

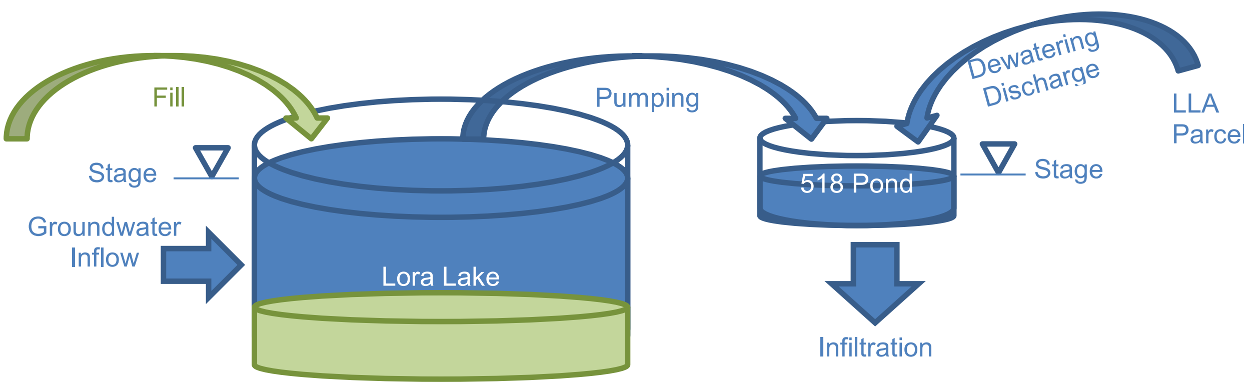

Figure 1. Lora Lake/518 Pond System Schematic.

The projected 518 Pond water balance was used to assess daily changes in 518 Pond volume, which was calculated using the following equation:

$$V_{pond}(t) = V_{pond}(t-1) + Q_{LL}(t) + Q_{LLA}(t) - I(t)$$

Where:

$V_{pond}(t)$ is the pond volume on day “t”

$V_{pond}(t-1)$ is the previous day’s pond volume

$Q_{LL}(t)$ is the daily pumped volume from Lora Lake on day “t”

$Q_{LLA}(t)$ is the daily pumped volume from the LLA parcel on day “t”

$I(t)$ is the daily infiltration volume on day “t”

Three pumping scenarios were evaluated for the 518 Pond water balance, as presented in Table 1. All scenarios assumed the 518 Pond is initially empty and Lora Lake filling begins on Monday, June 12, 2017, although the infiltration analysis is not sensitive to this particular start date. The fill placement rate was adjusted to avoid overtopping the 518 Pond storage capacity. The end of filling and pumping was determined based on the total volume of fill reaching approximately 40,000 cubic yards. These scenarios did not include simultaneous contributions from Lora Lake pumping and LLA parcel dewatering.

Table 1—Scenario Descriptions for 518 Pond Water Balance

Scenario	Pumping during	Fill Placement Rate	End of Filling/Pumping
1	5-day work week	446 cy/d	October 13, 2017 (90 work days)
2	7-day work week, with temporary breaks	644 cy/d	October 11, 2017 (63 work days)
3	7-day work week	333 cy/d	October 10, 2017 (121 work days)

Notes: cy/d – cubic yards per day.

Figure 2 presents the projected 518 Pond water balance volumes during the course of the fill placement phase. The positive water balance components represent water pumped to the 518 Pond, including Lora Lake groundwater inflow and displaced lake volume from filling. The negative water balance component represents infiltration from the 518 Pond. The water balance elements were similar for the alternative scenarios evaluated.

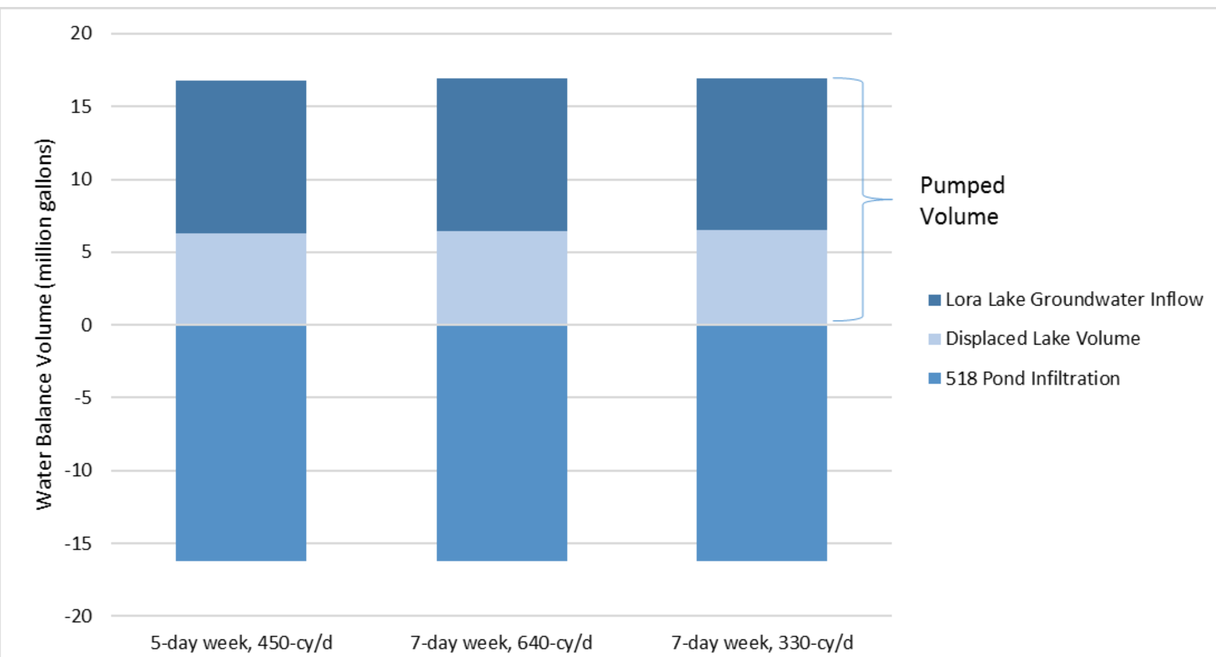

Figure 2. Projected 518 Pond Water Balances for Pumping Scenarios.

Figure 3 shows the projected daily 518 Pond stage for the three scenarios during the fill placement schedule. The projected stage is relative to the gage installed in the middle of the 518 Pond by the Port just prior to the Pump-back Test conducted in October 2015 (Aspect, 2015). The maximum observed stage resulting from discharge for a separate construction project to the 518 Pond was approximately 4.4 feet in November 2015 (see Figure 4) which appears to be about 0.2 feet below the top of the flow control structure. This level is roughly equivalent to the maximum storage volume of the 518 Pond.

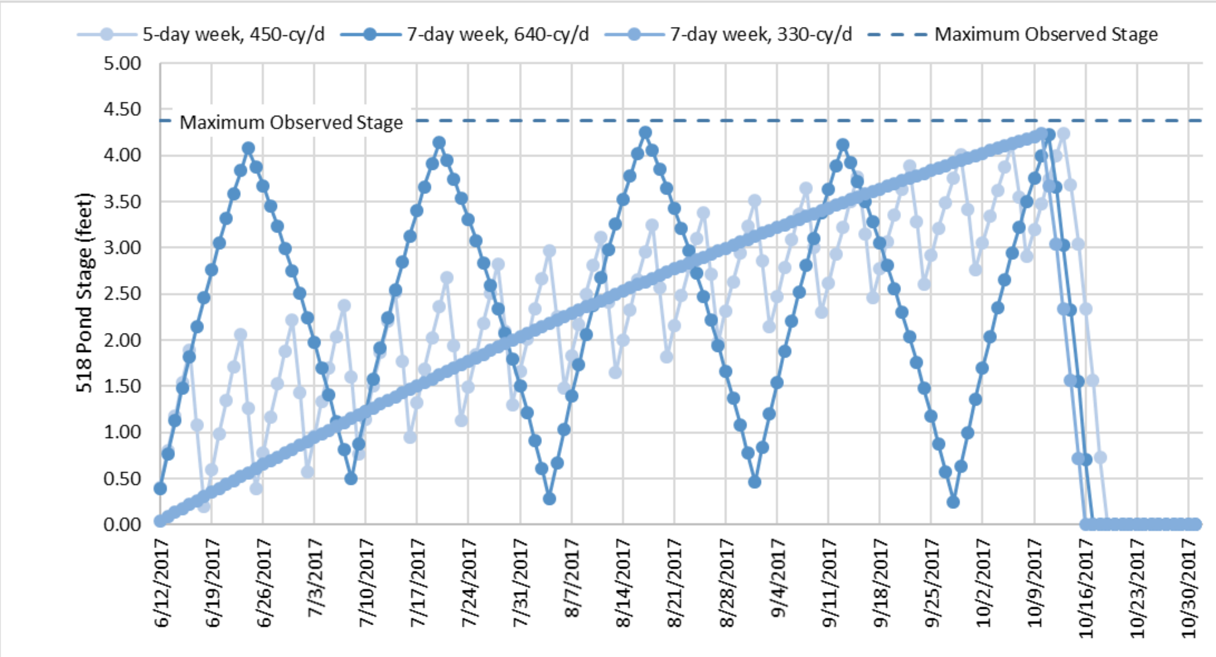

Figure 3. Projected Daily Stage in 518 Pond during Lora Lake Filling.

The following sections of this memorandum provide additional detail on the assumptions used in the water balance analysis and the findings.

Minimum Infiltration Rate

An elevated infiltration rate of 1.7 feet per day was associated with dry soil conditions observed during the Pump-back Test (Aspect, 2015) conducted before the onset of wet season precipitation events. During this test, approximately 840,000 gallons of water were infiltrated at the 518 Pond in 63 hours, equivalent to approximately 320,000 gallons per day (gpd) or approximately 222 gallons per minute (gpm). These values were revised[1] from those originally reported based on the 518 Pond volume calculated from a survey completed by the Port. The stage in the 518 Pond peaked at approximately 2.9 feet during the test, and fell at approximately 1.7 feet per day after pumping stopped according to transducer and manual stage data. Figure 4 shows stage data for the 518 Pond (read off left axis) and cumulative precipitation data observed at the King County Lake Reba station (read off right axis).

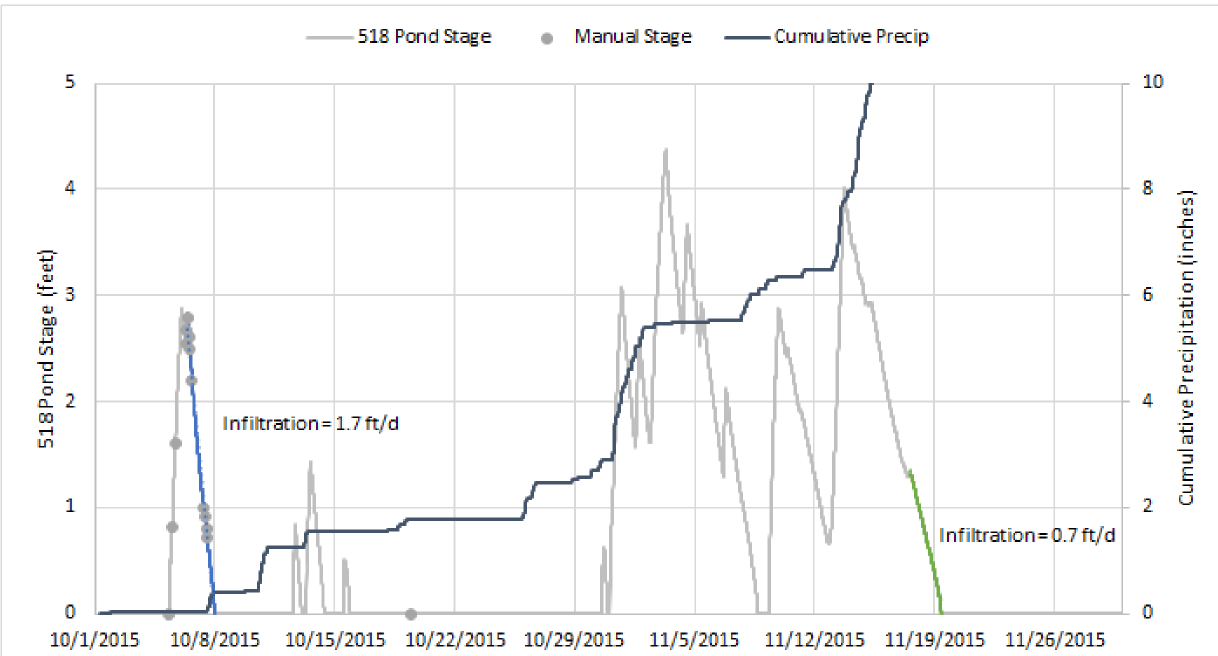

Figure 4. Observed 518 Pond Stage and Precipitation.

After the Pump-back Test in early October (Aspect, 2015), water from a separate construction project was discharged into the 518 Pond in November and the stage was recorded with a transducer. The maximum stage recorded in the 518 Pond was approximately 4.4 feet. By mid-November, over six inches of cumulative precipitation had fallen since October 1, and the stage fell at slower infiltration rates. After November 13, the stage fell at approximately 0.7 feet per day, approximately 42 percent of the infiltration rate observed during the Pump-back Test. The calculated infiltration rate for the mid-November period was approximately 134,000 gpd or 93 gpm.

[1] The volume of the pond was originally estimated based on flow meter readings measured during the Pump-back Test during October 2015. The flow meter correction factor was approximately 67.5 percent based on pond volume calculated from survey data.

The lower infiltration rate of 0.7 feet per day was associated with saturated soil conditions observed in mid-November, and was used for the water balance analysis assuming wet season conditions leading up to fill placement.

Pumped Volume Per Work Day

The daily acceptable pumped volume from Lora Lake to the 518 Pond will depend on antecedent soil moisture and infiltration rate (described above), fill material moisture content, fill placement rate, and groundwater inflow to Lora Lake.

Initial Lake Pump Down

For this analysis, it was assumed that all water from Lora Lake will be pumped to the 518 Pond for infiltration. This analysis does not reflect initial lake pump down before filling to prevent discharge to Miller Creek or surrounding wetlands. The minimum Lora Lake stage during the Pump-back Test was approximately 1.5 feet[2] below the culvert to Miller Creek. It will be the Contractor's responsibility to meet all of the construction specifications, possibly including achieving a target lake stage before filling.

Effect of Fill Moisture Content

The estimated Lora Lake volume is approximately 25 acre feet, or 8.1 million gallons, based on available bathymetric information and other lake configuration information provided by Floyd|Snider. The volume of water displaced by fill will depend on the moisture content of the fill. Assuming a moist sand is placed, the remaining porosity was estimated as 20 percent (based on a porosity of 40 percent and moisture content of 20 percent). The volume of water displaced by fill was calculated to be approximately 6.5 million gallons[3]. If fill material is placed with a lower moisture content, the volume of water displaced by fill will be smaller.

Effect of Fill Placement Rate

To maintain the stage in Lora Lake, it was assumed the rate of pumping to the 518 Pond will be proportional to the rate of filling to Lora Lake. The rate of filling will be dependent on haul rate (truck loads per day) and/or the method of fill placement (Telebelt or equivalent). A haul rate of 900 to 1,125 cubic yards (cy) of fill could be achieved with trucks arriving every 8 to 10 minutes. The Telebelt system could place up to 1,000 cubic yards per day (cy/d) based on Floyd|Snider estimates. For this analysis, the maximum fill rate was assumed to be 1,000 cy/d, and the fill rate was adjusted downward to between 330 and 640 cy/d, depending on the scenario, to avoid overtopping the 518 Pond storage capacity.

Effect of Groundwater Inflow to Lora Lake

To maintain the stage in Lora Lake, it was assumed that the rate of pumping will also be proportional to the rate of groundwater discharge to Lora Lake. During the Pump-back Test in October 2015 (Aspect, 2015), groundwater discharge to Lora Lake was calculated to be approximately 40 gpm. Short-circuiting of flow between the 518 Pond and Lora Lake was not

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[2] A greater amount of initial lake pump down prior to fill placement could allow temporary periods of filling without pumping. However, greater drawdown may reduce the sediment slope stability, and was not evaluated.
[3] Aside from moisture content of the fill, these volumes will increase with settlement of lake sediments and underlying peat. The magnitude and extent of settlement is uncertain, and was not included in this analysis.

observed during the Pump-back Test. For this analysis, the assumed rate of groundwater discharge to Lora Lake was 60 gpm or 86,400 gpd.

Three Pumping Scenarios

The following three pumping scenarios were analyzed to estimate the amount of time required to place the required fill given the water management constraints including the estimated 518 Pond infiltration rate and calculated storage volume.

Scenario 1—Pumping rates were assumed to be approximately 193,000 gpd for 5 days per week, which accounts for the volume displaced by 446 cy/d fill placement and groundwater inflow to Lora Lake during the work week and the weekends. For Scenario 1, the following schedule was assumed:

- Filling and pumping commence on Monday, June 12;
- Filling and pumping do not occur on weekends; and
- Filling and pumping end Friday, October 13, after 123 calendar days.

Scenario 2—Pumping rates were assumed to be approximately 190,000 gpd for 7 days per week, which accounts for the volume displaced by 644 cy/d fill placement and daily groundwater inflow to Lora Lake. After the pond stage reached 4.3 feet, filling was temporarily halted and pumping was reduced to avoid overtopping the 518 Pond and allow the pond stage to decrease. Pumping was reduced to approximately 86,000 gpd to account for groundwater inflow and maintain the stage in Lora Lake. Filling was resumed, and pumping rates were increased, once the 518 Pond stage was less than 0.5 foot. For Scenario 2, the following schedule was assumed:

- Filling and pumping commence on Monday, June 12;
- Filling is temporarily halted, and pumping is reduced, on Sunday, June 25;
- Filling resumes, and pumping is increased, on Sunday, July 9;
- Filling is temporarily halted, and pumping is reduced, on Friday, July 21;
- Filling resumes, and pumping is increased, on Saturday, August 5;
- Filling is temporarily halted, and pumping is reduced, on Friday, August 18;
- Filling resumes, and pumping is increased, on Saturday, September 2;
- Filling is temporarily halted, and pumping is reduced, on Thursday, September 14;
- Filling resumes, and pumping is increased, on Friday, September 29; and
- Filling and pumping end Wednesday, October 11, after 121 calendar days.

Scenario 3—Pumping rates were assumed to be approximately 140,000 gpd for 7 days per week which accounts for the volume displaced by 333 cy/d fill placement and daily groundwater inflow to Lora Lake. For Scenario 3, the following schedule was assumed:

- Filling and pumping commences on Monday, June 12; and
- Filling and pumping ends Tuesday, October 10, after 120 calendar days.

Figure 5 shows the projected pumping rates for the three scenarios. The vertical axes show pumping rate in gpd on the left axis, and daily average pumping rate in gpm on the right axis (assuming pumping 8 hours per day on work days).

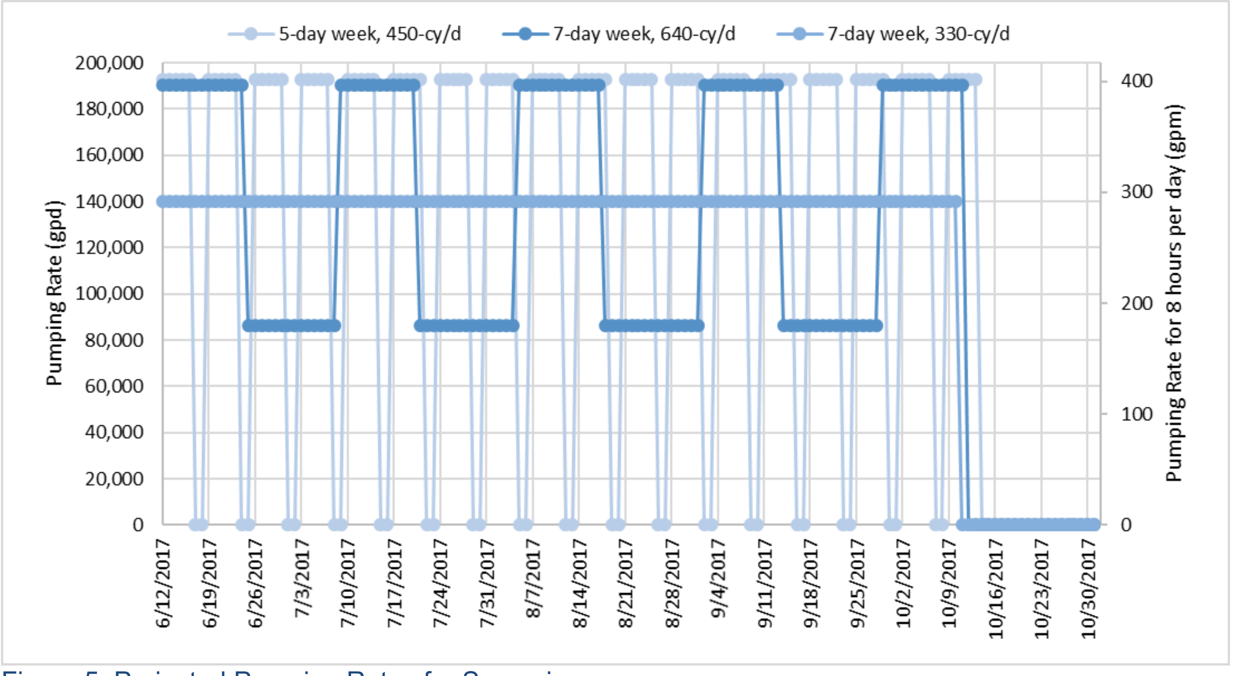

Figure 5. Projected Pumping Rates for Scenarios.

Dewatering

The 518 Pond may also be used to infiltrate dewatering discharge from the LLA excavations. For this analysis, it was assumed that the 518 Pond was initially dry (no stored water) and the dewatering rate was 120 gpm continuously for three weeks. Figure 6 shows the 518 Pond stage assuming dewatering starts the week of October 22, 2017 after the lake filling is complete. The results indicate the 518 Pond stage will approach the top of the overflow structure toward the end of the dewatering effort. The total duration for the dewatering effort represents approximately 28 days total (21 days for filling the 518 Pond and seven days for infiltration). This analysis shows separate schedules for filling Lora Lake and dewatering at the LLA site. It is the Contractor's responsibility to manage all water within construction specifications and not overtop the capacity of the 518 Pond if schedules overlap.

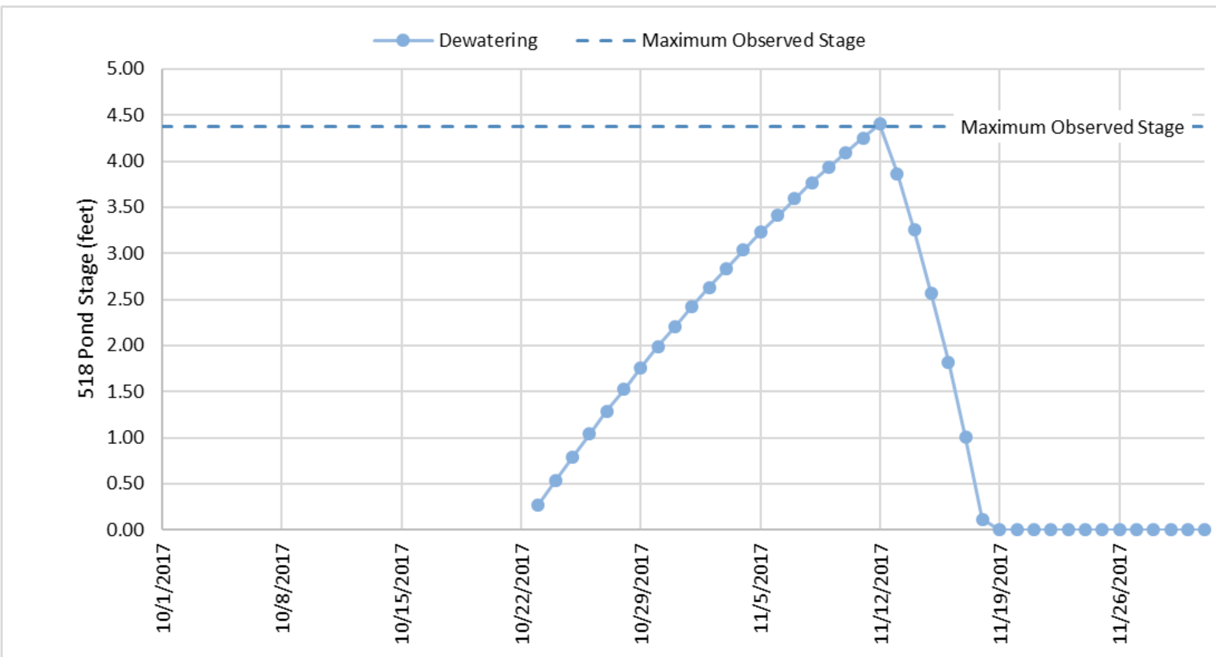

Figure 6. Projected Daily Stage in 518 Pond during Dewatering.

518 Pond Maximum Volume and Stage

The storage limit of the 518 Pond was assessed using observed stage values measured during the Pump-back Test in early October (Aspect, 2015) and the calculated 518 Pond volumes derived from the Port survey, as shown on Figure 7. The stage versus volume relationship was calculated for half-foot contours provided with the survey. The observed stage during the Pump-back Test peaked at approximately 2.9 feet, and the correlated 518 Pond volume was approximately 520,000 gallons. The maximum observed stage in November was 4.4 feet, and the correlated 518 Pond volume was approximately 820,000 gallons. The overflow spill stage is approximately 4.62 feet based on the difference between the surveyed elevations of the pond floor and the top of a stormwater flow control structure located at the southeast corner of the 518 Pond. For this analysis, a stage of 4.3 feet, with a corresponding storage volume of approximately 800,000 gallons, was treated as a safe threshold to prevent potential overflow spills.

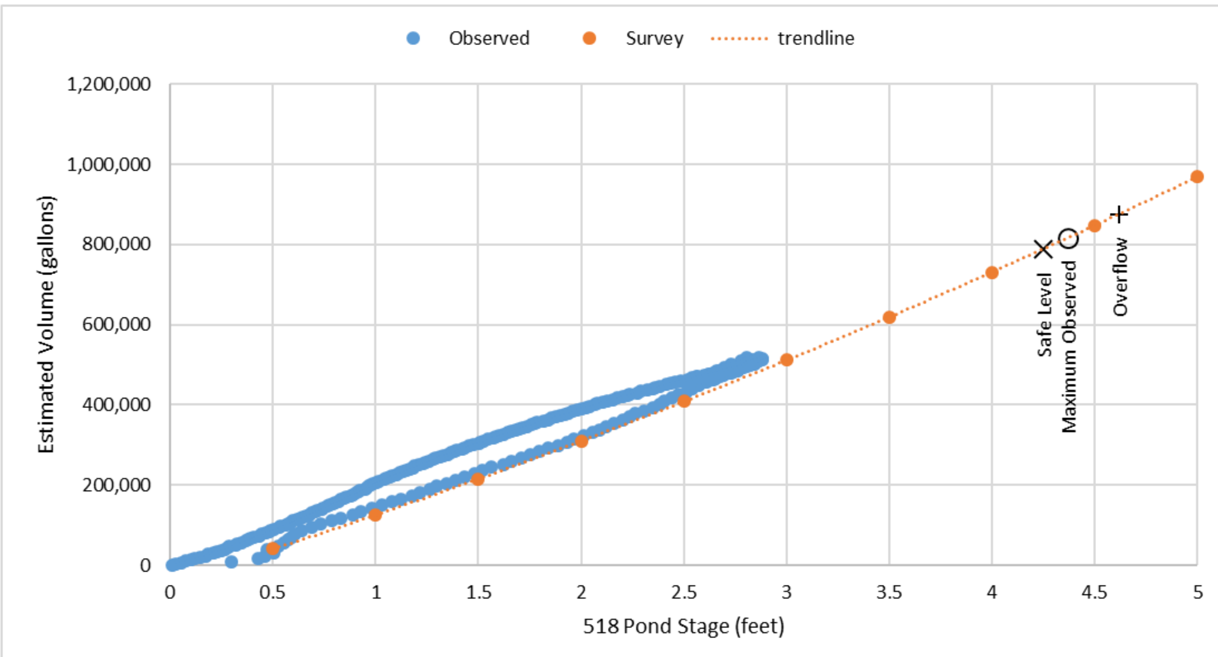

Figure 7. 518 Pond Stage vs. Volume.

Monitoring and Mitigation

This analysis was based on the best information available, and includes multiple levels of conservative assumptions. Limitations of this analysis are largely centered around applying observed conditions and estimated 518 Pond infiltration rates during October and November 2015 to the construction season starting in May 2017. If additional information is collected or provided that informs one or more of the assumptions described above, this water balance assessment should be reviewed and revised.

Monitoring

Focused monitoring will support the construction schedule with early warning of potential challenges with water management. Monitoring during construction should include the following:

- Daily pumped volume to 518 Pond;
- Daily maximum 518 Pond stage (not to exceed 4.3 feet, or safe level to prevent overtopping); and
- Daily maximum Lora Lake stage (safely maintained below discharge elevation to Miller Creek).

These data should be reviewed regularly to ensure operations within thresholds. If Lora Lake water management is limiting the construction schedule, this water balance should be reviewed and revised based on monitoring data collected during construction.

Mitigating Plugging in the 518 Pond

The effect of infiltrating turbid water at the 518 Pond may result in plugging of the pond bottom by fine-grained sediment over time. The infiltration analysis assumes a minimum infiltration rate of 0.7 feet per day is maintained during discharge to the 518 Pond. If plugging is suspected, the following actions could be implemented:

- Review available monitoring data to confirm the low and/or decreasing infiltration rate.
- Collect a round of groundwater levels to distinguish plugging from the influence of groundwater mounding in the vicinity of the 518 Pond.
- Excavate the top layer of the 518 Pond surface, or rework the top layer, to break up fine-grained layers and increase the infiltration rate. Ensure a 20-foot buffer around the existing staff gage is in place to prevent damage.

Mitigating Greater Groundwater Inflow Rates

Groundwater flow to Lora Lake will represent a significant portion of the total pumped water to the 518 Pond. During construction, groundwater flow to Lora Lake will likely be greater than was observed in October 2015 due to anticipated wetter conditions and higher surrounding groundwater levels. In addition, short-circuiting between the 518 Pond and Lora Lake was not observed during the relatively short Pump-back Test and monitoring period, but may be an issue during the longer construction season. Mitigation of greater groundwater inflow rates may require alternative storage or alternative infiltration locations to the 518 Pond.

References

Aspect Consulting, LLC (Aspect), 2015, Lora Lake Pump Down/Pump-back Test Memorandum, December 2, 2015.

Washington State Department of Ecology (WSDOE), 2014, Stormwater Management Manual for Western Washington, Publication Number 14-10-055, December 2014.

Limitations

Work for this project was performed for Floyd|Snider (Client), and this memorandum was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This memorandum does not represent a legal opinion. No other warranty, expressed or implied, is made.

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Port of Seattle
Lora Lake Apartments Site

Engineering Design Report

Appendix B
Lora Lake Parcel Pump-Down/Pump-Back Test Memorandum

MEMORANDUM

Project No.: 110125

December 2, 2015

To: Jessi Massingale, Floyd Snider

From:

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Re: **Lora Lake Pump Down/Pump-back Test Memorandum**

This memorandum summarizes the Lora Lake pump down/pump-back test activities performed by Aspect Consulting, LLC (Aspect) and Port of Seattle (Port) representatives, and describes observed groundwater and surface water conditions in the vicinity of Lora Lake. This memorandum was revised to incorporate additional information provided by Port representatives.

The test was conducted at the request of Port representatives to support design efforts for implementing the Cleanup Action Plan for the Lora Lake parcel. The test objectives were to determine groundwater inflow to Lora Lake, which will be used to support pre-remediation and post-remediation groundwater level simulations, as well as construction planning. The test was proposed during a meeting with the project team and Port representatives on August 11, 2015. The proposed test was vetted with the Washington State Department of Ecology (Ecology), Washington State Department of Natural Resources, and the US Army Corps of Engineers (USACE), and approved in a joint agency letter from the USACE and Ecology dated September 10, 2015 (USACE and Ecology, 2015). The test was implemented in late September and early October 2015, and results indicated a minimum groundwater inflow rate to Lora Lake of approximately 30 gallons per minute (gpm), and a storage capacity for the 518 Pond of approximately 1.2 million gallons (MG).

Test Planning, Setup, and Operations

Aspect and Port representatives developed the test plan to pump surface water from Lora Lake, temporarily store the water in Port of Seattle stormwater Pond M, and finally pump the water back into the 518 Pond to infiltrate. The Site map on Figure 1 shows the location of Lora Lake, Pond M, and the 518 Pond. Groundwater and surface water levels were monitored before, during, and after the test. The test was conducted in phases, summarized in Table 1 below.

Table 1 - Lora Lake Test Phase Dates and Durations

Phase	Start	End	Duration (days)
Pre-test Monitoring	8/29/15 0:00	9/28/15 8:00	30.3
Lora Lake Drawdown	9/28/15 8:00	9/30/15 8:00	2.0
Lora Lake Recovery	9/30/15 8:00	10/5/15 8:20	5.0
Pump-back to 518 Pond	10/5/15 8:20	10/6/15 11:30	1.1
Post-test Monitoring	10/6/15 11:30	10/19/15 10:45	13.0

In consultation with the Department of Ecology, Port representatives determined that it was possible to have zero discharge to receiving waters by infiltrating all water from the drawdown phase into either Pond M or the 518 stormwater facility. Consistent with the Port's monitoring plan (Port of Seattle, 2015), water from the Lora Lake drawdown was settled prior to infiltration in accordance with Best Management Practice C241 -Temporary Sediment Pond (Ecology, 2014) and was monitored for water quality parameters while it was in Pond M.

Water Level Monitoring

Prior to the test, Port representatives installed datalogging pressure transducers at selected monitoring locations to collect continuous water level data. Aspect and Port representatives also performed manual water level measurements at selected locations to supplement the continuous water level data. During the test, Port representatives moved transducers to optimize monitoring. The Site map on Figure 1 shows locations for monitoring wells, mini piezometers, and staff gages installed at the Site. Table 2 summarizes the selected pump down/pump-back monitoring locations, reference elevation source (i.e., survey versus LiDAR estimate), and monitoring frequency.

Due to the relatively shallow installation of staff gage SG-LL-1, Aspect representatives installed supplemental staff gages to monitor the Lora Lake stage during the drawdown phase. Thus, all data reported for SG-LL-1 accurately reflect Lora Lake stage.

Port representatives installed a staff gage in the 518 Pond (SG-518) to monitor water levels during the pump-back phase. SG-518 was installed near the low point of the pond, and the observed stage was converted to elevation based on ground surface elevation from LiDAR.

Miller Creek Monitoring

Aspect and Port representatives measured flow in Miller Creek to supplement existing stage/discharge relationships. Flows at SG-MC-2 and SG-MC-3 were approximately 0.1 cubic foot per second based on measurements using a Flowtracker instrument. These measurements appear consistent with the stage discharge rating curves developed in the *Lora Lake 2013-2014 Surface Water - Groundwater Baseline Monitoring Data Summary Memorandum* (Aspect, 2015).

Water quality monitoring was conducted by Port representatives to ensure the pumping operations did not impact Miller Creek or other receiving waters and wetlands. Water pumped to Pond M was monitored for pH, temperature and turbidity.

Pumps and Pipelines

Port representatives installed, tested, and operated two temporary Godwin CD150M pumps (6-inch inlet and outlet; maximum pumping rate of 2,300 gpm with no suction or pressure head) and 6-inch conveyance pipelines. During the drawdown phase, pumps were set up in parallel and piping was set up to convey water from Lora Lake to Pond M. Port representatives selected the path for the suction pipe to minimize impacts to natural resources in the area. The suction pipe was placed predominantly outside of the restrictive covenant and crossed a minimal distance of shoreline. In addition, the suction pipe followed the access path for a previously approved groundwater monitoring well installed in June 2013, where invasive weeds had been cleared and vegetation had been trimmed.

The suction pipe intake in Lora Lake was set up to float offshore in water that was greater than six feet deep. To prevent fish passage, Port representatives constructed and attached a fish exclusion device to the pipe intake. To prevent disturbing lake sediment, the pipe intake was set at two feet below the lake surface, which was greater than four feet above sediment. During the drawdown phase, the device was monitored to ensure it was functioning properly and remained in place. As an additional check, a Port Biologist conducted a walkthrough of the Pond M site to ensure no fish were present.

During the pump-back phase, pumps were set up in parallel and piping was rearranged to convey water from Pond M to the 518 Pond. Aspect and the Port collaboratively monitored pump discharge via an analog flow meter. The Site map on Figure 1 shows the approximate location for the temporary pumps and the conveyance pipeline.

Test Observations

The top graph on Figure 2 presents hydrographs of water level elevations and trends observed during the test, as well as the invert elevation of the culvert between Lora Lake and Miller Creek. The middle graph on Figure 2 shows the cumulative volume of water pumped during the drawdown and pump-back phases. The bottom graph on Figure 2 shows daily precipitation reported at the Seattle-Tacoma International Airport. Precipitation before the test was limited, and no precipitation or stormwater discharge to Lora Lake occurred during the drawdown, recovery, and pump-back phases.

Pre-Test Monitoring

During pre-test monitoring, water levels were relatively consistent, including stages in Miller Creek. Several groundwater monitoring locations were found to be dry, including HPA1-3, HPA1-4, MW-8, and MW-10. Figure 3 shows the pre-test groundwater elevation contour map, and reflects lower water levels due to drier conditions than observed during baseline monitoring in 2013 and 2014 (Aspect, 2015).

Lora Lake Drawdown Phase

The drawdown phase commenced on 9/28/2015 at 8:00 and ended 48 hours later on 9/30/2015 at 8:00. Aspect recommended a maximum Lora Lake drawdown of 2 feet (ft) during the drawdown phase. During the drawdown phase, pumping rates were relatively steady with an average of 580 gpm and a total of 1.68 MG of lake water was pumped into Pond M. There was no surface water discharge from Pond M into receiving waters. The water in Pond M had the following water quality parameters: the pH measured 8.77; the temperature was 16.02 degrees C; and the turbidity was 12.1 NTUs. As described below, approximately 0.4 MG of pumped water infiltrated at Pond M.

During the drawdown phase, the Lora Lake stage decreased steadily to about 1.84 ft below the initial stage, or about 1.48 ft below the culvert invert elevation. Groundwater levels decreased by less than 0.1 ft, except at wells MW-LL-1 and HC99-B31 which exhibited decreases of 0.61 ft and 0.47 ft, respectively. Miller Creek stages appeared relatively stable during the drawdown phase, and there were no notable changes in flow rates.

The lake buffer vegetation was observed during the drawdown phase. While water levels were drawn down during the two days of pumping, the soils in the area appeared to stay moist and there was no observed erosion or vegetation mortality associated with the test.

Lora Lake Recovery Phase

The recovery phase commenced on 9/30/2015 at 8:00 and ended 5 days later on 10/5/2015 at 8:20. During the recovery phase, the Lora Lake stage increased approximately 0.22 ft, for a residual drawdown of 1.64 ft. Based on a comparison of the Lora Lake stage during drawdown and recovery, the average groundwater inflow during recovery was calculated at approximately 30 gpm. Groundwater levels continued to decrease during the recovery phase. Most groundwater levels decreased less than 0.5 ft from initial pre-drawdown levels, except at MW-LL-1 and HC99-B31 where decreases were measured at 0.95 ft and 0.70 ft, respectively. Miller Creek stages appeared relatively stable during the recovery phase, and there were no notable changes in flow rates.

Pump-Back to 518 Pond Phase

The pump-back phase commenced on 10/5/2015 at 8:20 and ended 27 hours later on 10/6/2015 at 11:30. Aspect recommended a maximum stage height in the 518 Pond of 4 feet during the pump-back phase before shutting off the pumps to avoid overflowing the 518 Pond. During the pump-back phase, pumping rates were approximately 900 gpm, on average, and a total of 1.25 MG was transferred from Pond M back into the 518 Pond. Approximately 0.4 MG less water was pumped back to the 518 Pond than was pumped from Lora Lake, likely due to infiltration and evaporation at Pond M. A temporary pause in pumping occurred between 4:00 and 8:00 on 10/5/2015 because the discharge pipe inlet broke suction and had to be repositioned.

During the pump-back phase, the 518 Pond stage reached about 3.53 feet above the bottom of the pond before the temporary pause in pumping occurred. There was no surface water discharge from the 518 Pond into receiving waters. The maximum 518 Pond stage was about 22 feet above the initial groundwater level in the vicinity of the pond. The Lora Lake stage increased approximately 0.05 ft during the pump-back phase to the 518 Pond, for a residual drawdown of 1.59 ft. Based on a comparison of the Lora Lake stage during drawdown and pump-back, the average groundwater inflow during pump-back was calculated at 40 gpm. Groundwater levels continued to decrease during the pump-back phase, except at those wells located in close proximity to the 518 Pond including HC00-B312 and MW-LL-1. Water levels in HC00-B312 and MW-LL-1 increased 2.5 ft and 0.45 ft, respectively, from minimum levels during the pump-back phase. The observed time lag in water level increases (see Figure 2) after the pump-back phase commenced reflects filling storage in the soil column beneath the 518 Pond. Miller Creek stages appeared relatively stable during the pump-back phase, and there were no notable changes in flow rates.

Post-Test Monitoring

Post-test monitoring commenced on 10/6/2015 at 11:30. During post-test monitoring, the 518 Pond stage decreased to the pond bottom within 18 hours. Subsequent stages in the 518 Pond on and after 10/12/2015 are associated with stormwater input by Port representatives for airport stormwater management purposes. An estimated maximum infiltration rate of approximately 0.9 inch per hour was calculated for the 518 Pond based on the pump-back volume of 1.25 MG, the estimated 35,000-square-foot area of the 518 Pond, and the 63 hours required for infiltration. Figure 2 shows maximum water levels at HC00-B312 and MW-LL-1 occurred more than 24 hours after the pump-back phase ended. The extent of groundwater mounding was observed based on maximum water levels in HC00-B312, MW-LL-1, and MW-7. Figure 4 shows the maximum extent of groundwater mounding as a result of the pump-back phase.

Water levels observed during the post-test monitoring were influenced by precipitation. On 10/7/2015 and 10/10/2015, 0.4 inch and 1.1 inches respectively of precipitation increased the Lora Lake stage, groundwater levels, and Miller Creek gage stages. The precipitation event on 10/10/2015 alone resulted in about 40 percent total recovery of Lora Lake stage following the drawdown phase. The Lora Lake stage reached the culvert discharging to Miller Creek on 10/16/2015.

Summary of Findings

The findings from the Lora Lake drawdown, recovery, and pump-back phases of this effort include the following:

- Lora Lake was drawn down below the discharge culvert invert elevation over a two-day period.

- The Lora Lake stage was slow to recover, indicating that groundwater recharge to Lora Lake is limited.

- During the pump-back phase, the observed infiltration rate, groundwater mounding, and limited connection with Lora Lake identified the 518 Pond as a potential infiltration facility during remediation efforts or for other Port stormwater management efforts.

- During implementation of the Cleanup Action Plan, pumping surface water from Lora Lake to the 518 Pond will provide an effective water management option. Pumping will control the Lora Lake stage during fill operations and prevent construction-related impacts to Miller Creek.

Limitations

Work for this project was performed for Floyd Snider (Client), and this memorandum was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This memorandum does not represent a legal opinion. No other warranty, expressed or implied, is made.

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References

Aspect Consulting LLC, 2015, Lora Lake 2013-2014 Surface Water – Groundwater Baseline Monitoring, Data Summary Memorandum.

Ecology, 2014, Stormwater Management Manual for Western Washington, December 2014.

Port of Seattle, 2015, Dewatering Monitoring Plan, Lora Lake Drawdown Test, September 2015.

U.S. Army Corps of Engineers (USACE) and Washington State Department of Ecology (Ecology), 2015, Letter correspondence between agencies and Port of Seattle, September 10, 2015.

Attachments

Table 1—Lora Lake Test Phase Dates and Durations (*in text)*
Table 2—Hydrologic Monitoring Point Inventory
Figure 1—Site Map
Figure 2—Observed Hydrologic Conditions
Figure 3—Pre-Test Groundwater Elevation Contour Map
Figure 4—Maximum Groundwater Mound Resulting from Pump-Back Test

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TABLES

Table 2 - Hydrologic Monitoring Point Inventory

Project No. 110125, Lora Lake RI/FS Support
Burien, WA

	Station Name	Reference Elevation Source[1]	Location	Monitoring	
				Manual[2]	Datalogger[3]
Surface Water	SG-MC-2	Survey	Miller Creek	X	X
	SG-MC-3	Survey	Miller Creek	X	X
	SG-LL-1	Survey	Lora Lake	X	X
	SG-LL-2	Survey	Wetland	X	X
	SG-518[4]	LiDAR	518 Pond	X	X
Groundwater	MW-8	Survey	Des Moines Memorial Drive	X	
	MW-9	Survey	Des Moines Memorial Drive	X	
	MW-10	Survey	Des Moines Memorial Drive	X	
	MW-11	Survey	Des Moines Memorial Drive	X	X
	HPA1-1	Survey	Bank of Lora Lake	X	X
	HPA1-3	Survey	Bank of Lora Lake	X	X
	HPA1-4	Survey	Bank of Lora Lake	X	X
	HC99-B31	Survey	Wetland	X	X
	HC00-B311	LiDAR	East of Lora Lake	X	
	HC00-B312	LiDAR	North of Lora Lake	X	X
	MW-LL-P1	Survey	Wetland	X	X
	MW-LL-1	Survey	North of Lora Lake	X	X

Notes:

[1] All elevations referenced to vertical datum NAVD88.

"Survey" indicates monitoring point reference elevation measured by professional surveyors.

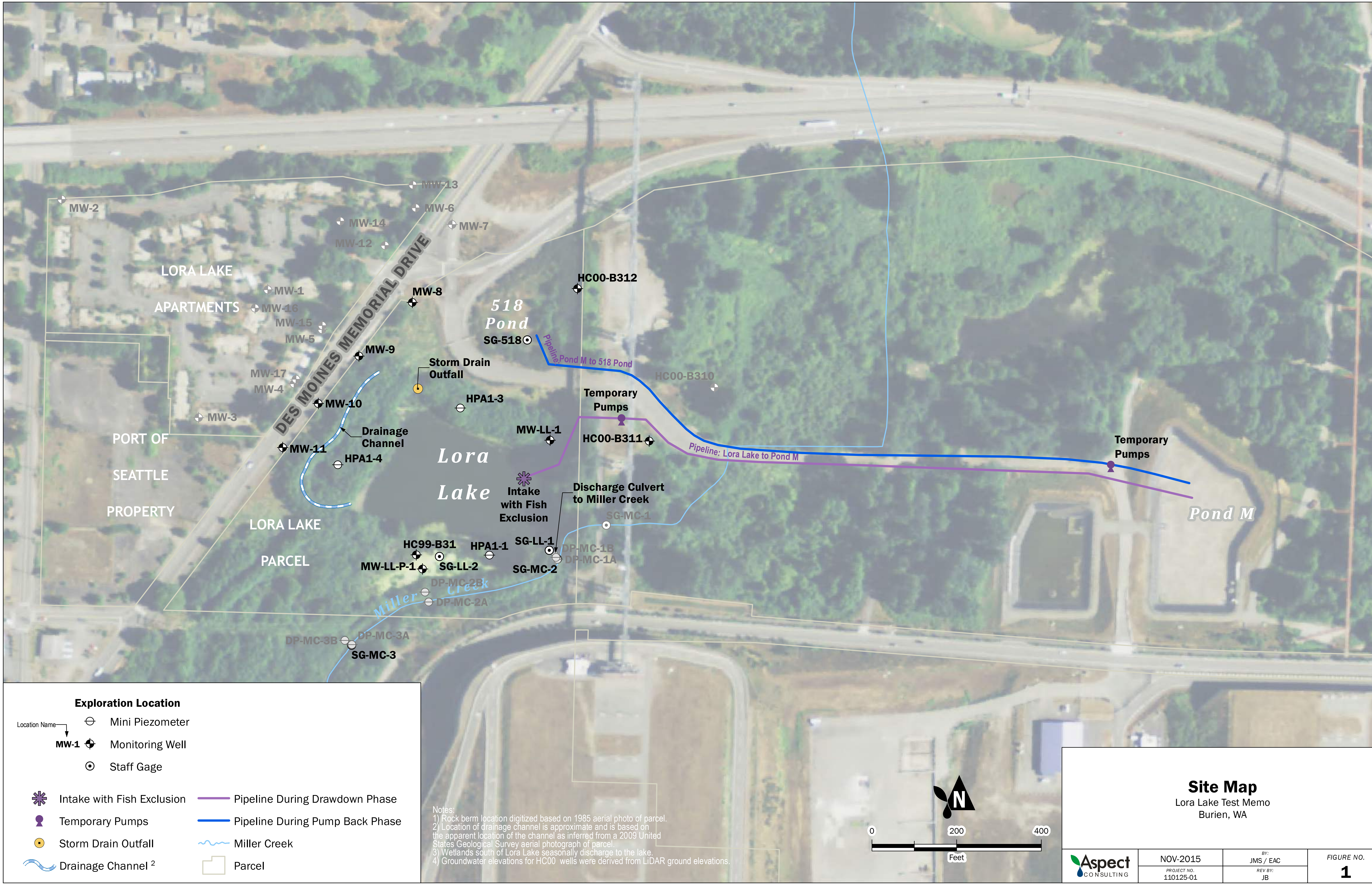
"LiDAR" indicates monitoring point reference elevation based on 2007 LiDAR ground surface measurement and monitoring point dimensions (i.e. well stickup).

[2] Manual water level measurements were made periodically during test.

[3] Datalogger recorded pressure transducer water level measurements every 15 minutes.

[4] SG-518 was installed by Port representatives in the 518 Pond before the pump-back phase.

FIGURES


LORA LAKE
APARTMENTS
PORT OF
SEATTLE
PROPERTY
LORA LAKE
PARCEL
DES MOINES MEMORIAL DRIVE
518 Pond
Lora Lake
Pond M
Miller Creek
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-8
MW-9
MW-10
MW-11
MW-12
MW-13
MW-14
MW-15
MW-16
MW-17
HC00-B312
HC00-B310
HC00-B311
SG-518
MW-LL-1
HPA1-3
HPA1-4
HPA1-1
HC99-B31
MW-LL-P-1
SG-LL-2
SG-LL-1
SG-MC-2
SG-MC-1
SG-MC-3
DP-MC-1B
DP-MC-1A
DP-MC-2B
DP-MC-2A
DP-MC-3A
DP-MC-3B
Storm Drain Outfall
Drainage Channel
Intake with Fish Exclusion
Discharge Culvert to Miller Creek
Temporary Pumps
Temporary Pumps
Pipeline: Pond M to 518 Pond
Pipeline: Lora Lake to Pond M
Exploration Location
Location Name
MW-1
Mini Piezometer
Monitoring Well
Staff Gage
Intake with Fish Exclusion
Temporary Pumps
Storm Drain Outfall
Drainage Channel 2
Pipeline During Drawdown Phase
Pipeline During Pump Back Phase
Miller Creek
Parcel
Notes:
1) Rock berm location digitized based on 1985 aerial photo of parcel.
2) Location of drainage channel is approximate and is based on the apparent location of the channel as inferred from a 2009 United States Geological Survey aerial photograph of parcel.
3) Wetlands south of Lora Lake seasonally discharge to the lake.
4) Groundwater elevations for HC00 wells were derived from LiDAR ground elevations.
N
0
200
400
Feet
Site Map
Lora Lake Test Memo
Burien, WA
Aspect CONSULTING
NOV-2015
PROJECT NO.
110125-01
BY:
JMS / EAC
REV BY:
JB
FIGURE NO.
1

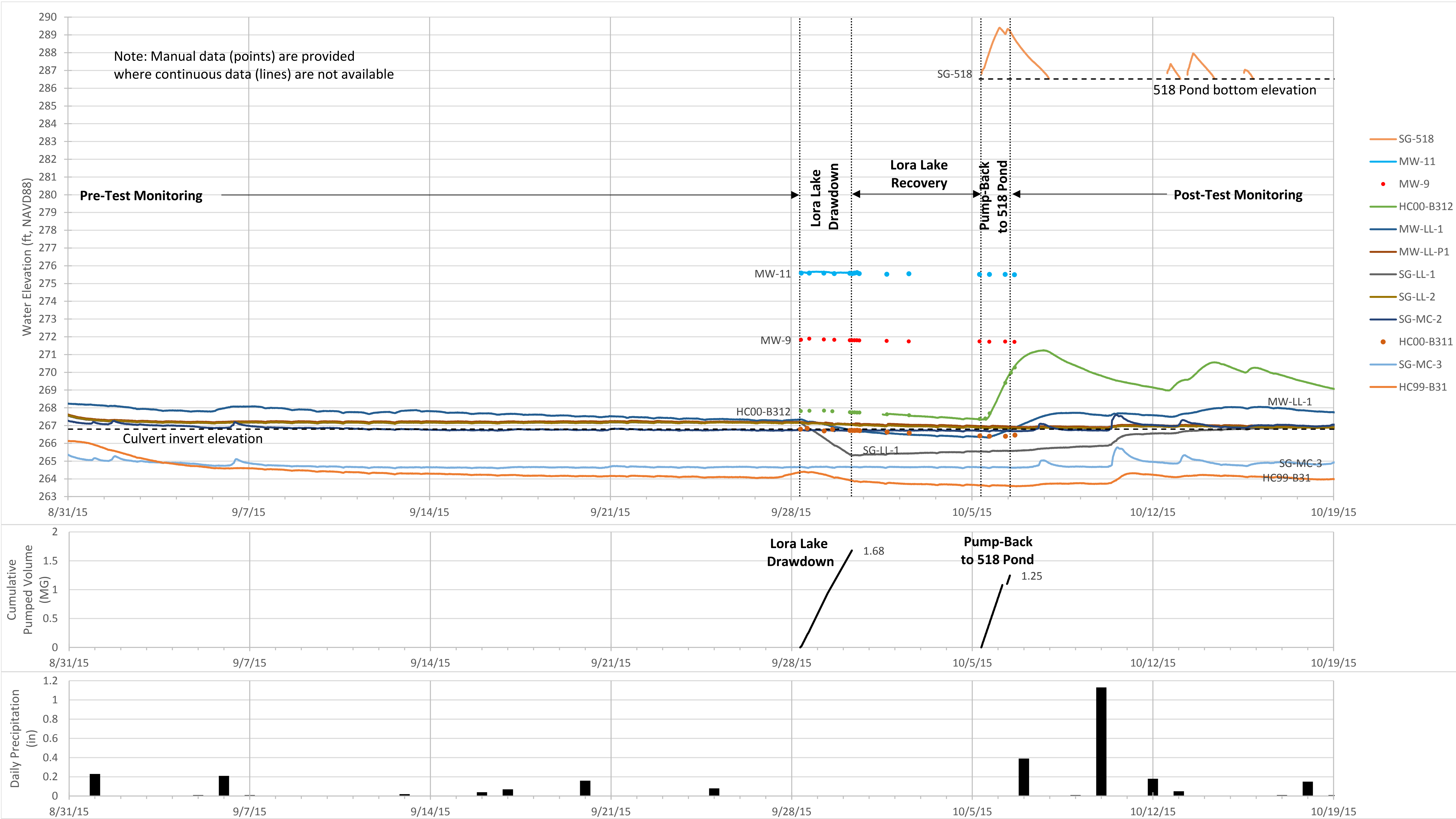


Figure 2

Observed Hydrologic Conditions

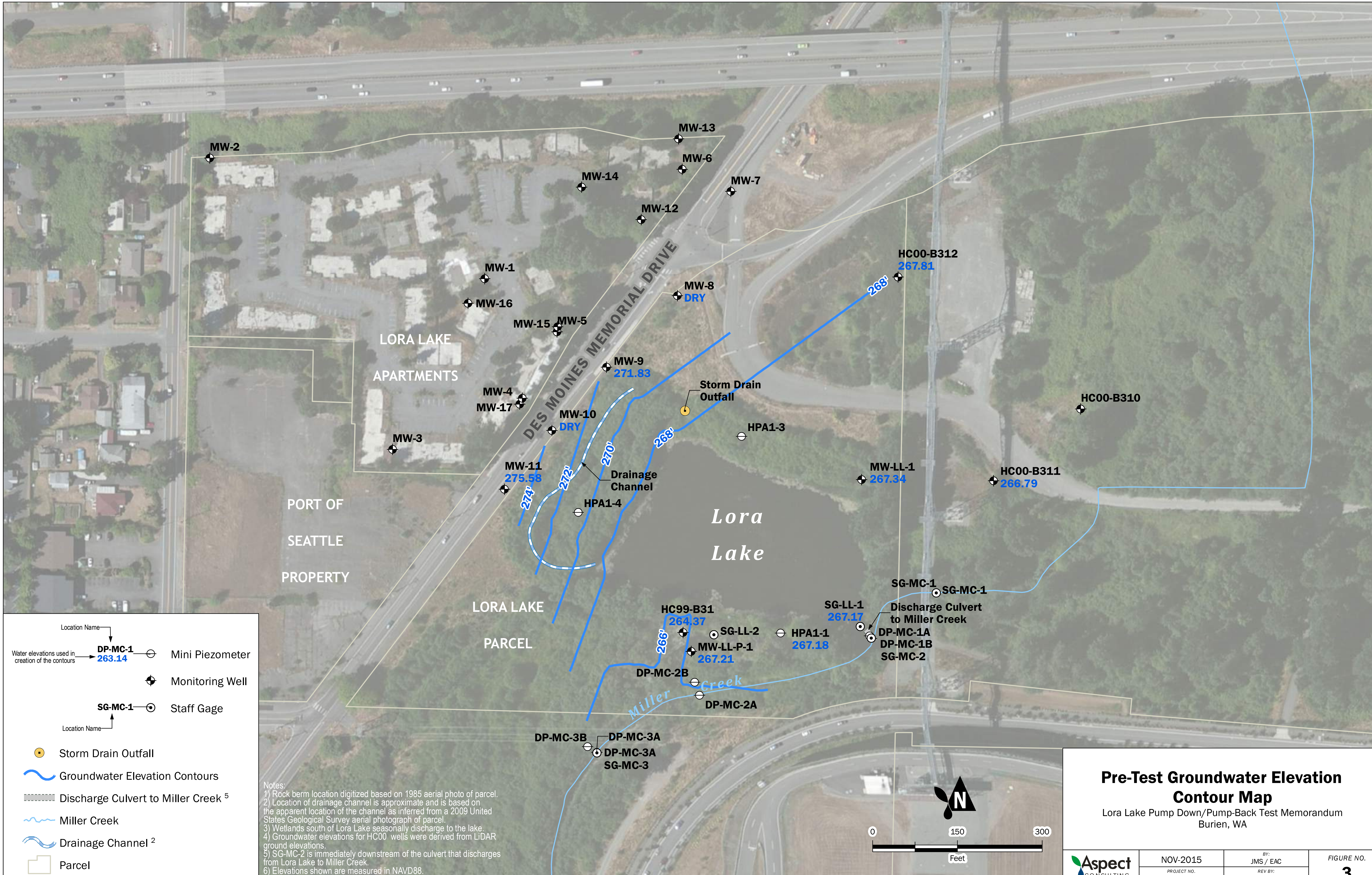
Lora Lake Pump Down/Pump-BackTest Memorandum

Lora Lake RI-FS Support, Burien, WA

Aspect Consulting

10/30/2015

\\biserver1.aspect.local\projects\Port of Seattle\Lora Lake\Lake Fill Baseline Data\Field data\Lake drawdown test\Lora Lake drawdown test - compiled data.xlsx



Location Name
Water elevations used in creation of the contours
DP-MC-1 263.14 — Mini Piezometer
Monitoring Well
SG-MC-1 — Staff Gage
Location Name

- Storm Drain Outfall
- Groundwater Elevation Contours
- Discharge Culvert to Miller Creek [5]
- Miller Creek
- Drainage Channel [2]
- Parcel

Notes:
1) Rock berm location digitized based on 1985 aerial photo of parcel.
2) Location of drainage channel is approximate and is based on the apparent location of the channel as inferred from a 2009 United States Geological Survey aerial photograph of parcel.
3) Wetlands south of Lora Lake seasonally discharge to the lake.
4) Groundwater elevations for HC00 wells were derived from LiDAR ground elevations.
5) SG-MC-2 is immediately downstream of the culvert that discharges from Lora Lake to Miller Creek.
6) Elevations shown are measured in NAVD88.

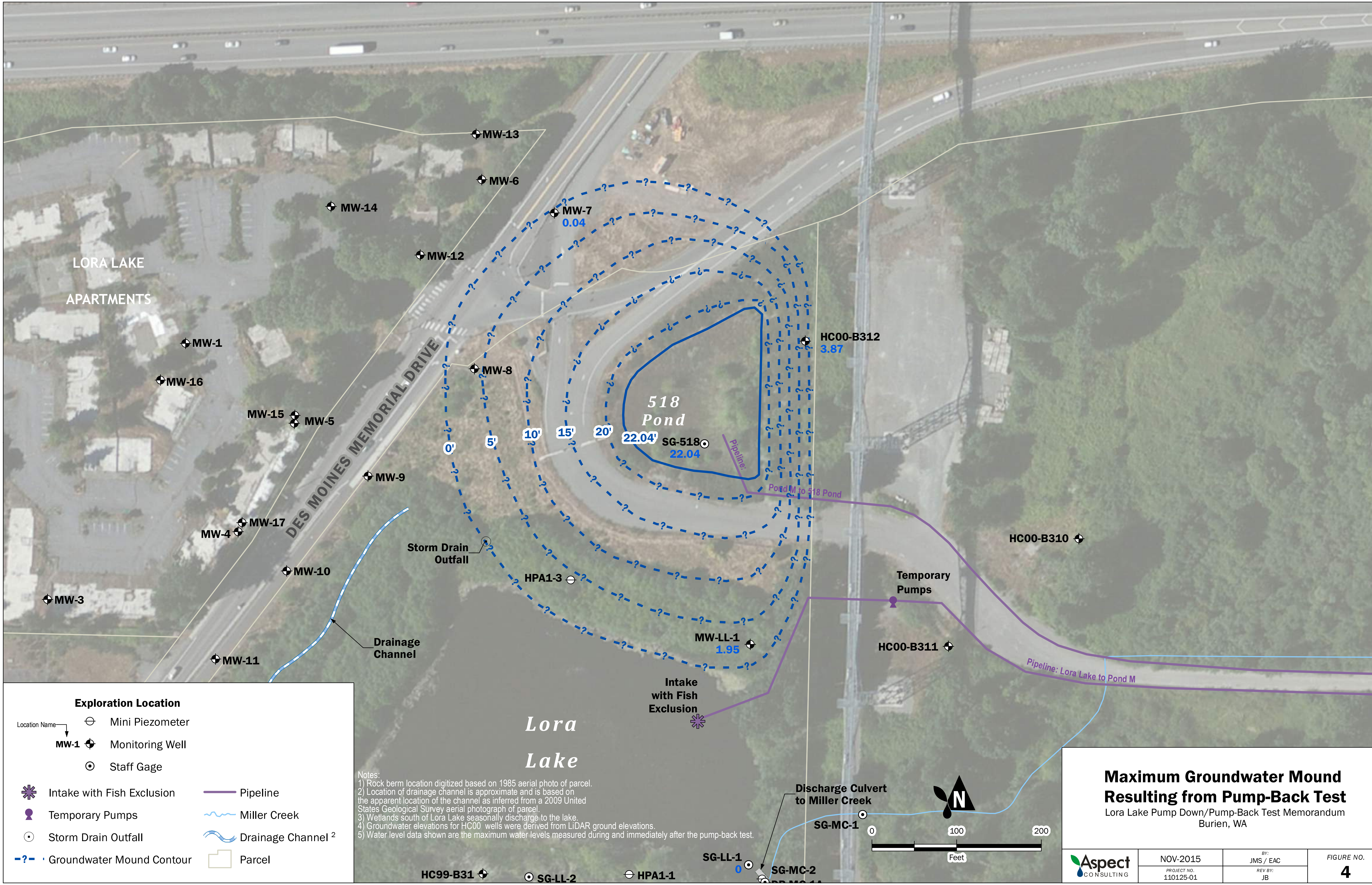
Pre-Test Groundwater Elevation Contour Map

Lora Lake Pump Down/Pump-Back Test Memorandum
Burien, WA

Aspect CONSULTING	NOV-2015	BY: JMS / EAC	FIGURE NO.
	PROJECT NO. 110125-01	REV BY: JB / EAC	3

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

GIS Path: T:\projects_8\Port_of_Seattle\LoraLake\Delivered\Lora Lake Test Memo\03_PreTestGroundwaterElevation.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 11/2/2015 || User: ecrumbaker || Print Date: 11/2/2015



Maximum Groundwater Mound Resulting from Pump-Back Test

Lora Lake Pump Down/Pump-Back Test Memorandum

Burien, WA

Aspect CONSULTING | NOV-2015 | PROJECT NO. 110125-01 | BY: JMS / EAC | REV BY: JB | FIGURE NO. 4

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

GIS Path: T:\projects_8\Port_of_Seattle\LoraLake\Delivered\Lora Lake Test Memo\04 MaximumGWMoundPumpBackTest.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 11/2/2015 || User: ecrumbaker || Print Date: 11/2/2015

Port of Seattle
Lora Lake Apartments Site

Engineering Design Report

Appendix C
Lora Lake Apartments Parcel Soil Performance Monitoring Data Report

Table of Contents

List of Tables

List of Figures

List of Attachments

List of Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
bgs	Below ground surface
CAP	Cleanup Action Plan
CMP	Compliance Monitoring Plan
COC	Contaminant of concern
cPAH	Carcinogenic polycyclic aromatic hydrocarbon
CUL	Cleanup level
EDR	Engineering Design Report
EIM	Environmental Information Management
LCS	Laboratory control sample
LCSD	Laboratory control sample duplicate
LL Apartments Parcel	Lora Lake Apartments Parcel
LL Parcel	Lora Lake Parcel
µg/kg	Micrograms per kilogram
mg/kg	Milligrams per kilogram
MS	Matrix spike
MSD	Matrix spike duplicate
MTCA	Model Toxics Control Act
PCP	Pentachlorophenol
pg/g	Picograms per gram
Port	Port of Seattle
QAPP	Quality Assurance Project Plan
RI/FS	Remedial Investigation and Feasibility Study
SAP	Sampling and Analysis Plan
Site	Lora Lake Apartments Site
TEQ	Toxicity equivalent
USCS	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency
WAC	Washington Administrative Code
WSDOE	Washington State Department of Ecology

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1.0 Introduction

1.1 DATA REPORT OBJECTIVES

The purpose of this Soil Performance Monitoring Data Report is to present the methodology and results of the soil performance monitoring activities conducted at the Lora Lake Apartments Parcel (LL Apartments Parcel) of the Port of Seattle (Port) Lora Lake Apartments Site (Site; Figure C.1). The first soil sampling event was conducted in September 2015, with supplemental sampling events conducted in November 2015 and February 2016. The data collection activities were originally proposed in the Compliance Monitoring Plan (CMP; Floyd|Snider 2015a), which was approved by the Washington State Department of Ecology (WSDOE) and is described in further detail in this data report.

The objective of the data collection activities was to provide the necessary information to comply with the Model Toxics Control Act (MTCA) cleanup requirements for remedy performance monitoring in a constructible and implementable manner (Chapter 173-340 of the Washington Administrative Code [WAC]). Contaminated soil will be excavated as part of the remedial action at the LL Apartments Parcel. The excavation extent will based on surveyed coordinates (northing, easting, and elevation) established on the basis of the soil data presented in this data report and previously collected soil data presented in the *Final Lora Lake Apartments Site Remedial Investigation/Feasibility Study* (RI/FS; Floyd|Snider 2015b). The remedial action construction at the LL Apartments Parcel is expected to be conducted in 2017.

1.2 SITE BACKGROUND

Before this soil performance monitoring was conducted, the nature and extent of contamination at the Site was defined on the basis of data presented in the RI/FS. The Site was divided into three parcels: the LL Apartments Parcel (the subject of this data report), the Lora Lake Parcel (LL Parcel), and the 1982 Dredged Material Containment Area (DMCA). The configuration of the Site is shown in Figure C.2. The RI/FS also describes a feasibility study evaluation of remedial alternatives and the proposed preferred cleanup actions.

A Cleanup Action Plan (CAP; State of Washington 2015, Exhibit B) was developed using information presented in the RI/FS. The selected remedy for the LL Apartments Parcel is the excavation and off-site disposal of soil with contaminants of concern (COCs), including dioxins/furans, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), pentachlorophenol (PCP), lead, gasoline range hydrocarbons, diesel range hydrocarbons, and heavy oil range hydrocarbons, that have been detected at concentrations exceeding their respective cleanup levels (CULs) or remediation level. A remediation level based on soil protection of groundwater was developed for dioxins/furans only.

After the development of the CAP, the CMP was prepared, as required by WAC 173-340-410. The CMP describes monitoring activities to be performed for all three Site parcels. However, this data report relates to the sampling and performance monitoring conducted on the LL Apartments Parcel only. Future performance monitoring described in the CMP will be conducted on the LL Parcel and select areas of the LL Apartments Parcel during implementation of the remedial action and will be reported in a Construction Completion Report.

The CMP identified soil performance monitoring samples to be collected before the remedial action was designed for the LL Apartments Parcel to further delineate and refine the horizontal and vertical extents of the excavations. These samples also represent the performance monitoring samples, as required by MTCA, used to confirm that all contamination in soil at concentrations greater than the CUL or remediation level will be excavated. This soil performance monitoring was performed before the remedial activities began because of the lengthy laboratory turnaround time required for the dioxins/furans analysis. The sampling locations for the soil performance monitoring samples proposed in the CMP were based on existing LL Apartments Parcel soil data and included sampling in areas beyond the expected extent of contamination to ensure that the performance monitoring data were sufficient to identify the extent of contaminated soil requiring removal. Sampling locations and depths were designed to delineate both the horizontal and vertical extent of contamination within the Central and Eastern Sources Areas and within the shallow soil areas, referred to as Cleanup Areas A and B, respectively (Figure C.3).

After the analytical results from the September and November 2015 soil performance monitoring were evaluated, it was determined that five locations remained where the vertical and horizontal extent of contaminated soil had not been fully delineated: four locations for dioxins/furans and one location for lead. Two additional performance monitoring sampling events were conducted in February 2016 to delineate the vertical and horizontal extents of contamination in these locations. The February 2016 sampling events were designed to both fully delineate the vertical and horizontal extent in the five locations and to potentially decrease the horizontal extent of the excavation in areas with less data density. Details of each sampling event are presented in Section 4.0. The results of the February 2016 sampling indicated that the extent of contaminated soil was fully delineated. The February 2016 additional samples also successfully decreased the horizontal extent of the excavation in the areas with less data density.

1.3 REPORT ORGANIZATION

The remainder of this data report is organized as follows:

- **Section 2.0—Soil Investigation Procedures.** This section describes field methods, documentation procedures, and deviations from the CMP for soil investigation activities.
- **Section 3.0—Analytical Methods and Data Quality Review.** This section describes laboratory analytical methods and requirements and compliance with data quality objectives.

- **Section 4.0—Soil Cleanup Levels and Analytical Results.** This section provides the soil CULs that pertain to the LL Apartments Parcel and a summary of soil analytical results compared to these CULs.
- **Section 5.0—Survey Methods and Results.** This section describes survey activities for the soil boring locations.
- **Section 6.0—Investigation-Derived Waste Management.** This section summarizes the handling and disposal of investigation-derived wastes.
- **Section 7.0—Reporting.** This section describes data required to be submitted to WSDOE.
- **Section 8.0—References.** This section provides references for source materials cited in this report.

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2.0 Soil Investigation Procedures

Performance monitoring soil sampling activities were conducted at the LL Apartments Parcel in September 2015, November 2015, and February 2016 (two events). The field activities and sample collection were generally in accordance with the procedures described in the RI/FS Sampling and Analysis/Quality Assurance Project Plan (SAP/QAPP) (Appendix B of the RI/FS Work Plan (Floyd|Snider 2010) and the CMP (Floyd|Snider 2015a). These include field procedures, analytical methods, reporting limits, data quality objectives, and data validation levels as presented in the RI/FS SAP/QAPP. Minor deviations from the CMP are described in Section 2.4.

A total of 119 soil borings and test pits (PM-001 through PM-119) were advanced to various depths below ground surface (bgs) between the September and November 2015 sampling events. An additional 15 soil borings (PM-120 to PM-134) were advanced as part of the February 2016 sampling events.

All borings were monitored by a field technician, and geologic logging of the soil cores was conducted for each boring. Soil lithology was described and classified according to the Unified Soil Classification System (USCS) by a geologist. The soil boring logs are included as Attachment C.1.

2.1 SAMPLING LOCATIONS

Samples were collected in locations representing the anticipated base and sidewalls of future excavation, based on existing data in the RI/FS. The cleanup areas for future excavation were developed on the basis of the RI/FS data and presented in the CMP (CMP cleanup areas are shown on Figure C.3). The base and sidewall samples analyzed by the laboratory immediately after sample collection were designated as Tier 1 samples. Samples were also collected from "stepped-out" Tier 2 locations, anticipating that some Tier 1 sample data would not define excavation limits that achieve the remediation level. Tier 2 samples were archived by the laboratory, and selected samples were analyzed for dioxins/furans, lead, and gasoline range hydrocarbons, based on the Tier 1 results, as described further in Section 4.0. The final soil sampling locations are shown in Figure C.4.

2.1.1 Cleanup Area A: Sampling and Analysis Scheme

CMP Cleanup Area A (Figure C.3) includes the Central and Eastern Source Areas (Areas A1, A2, and A3) where deep contamination (i.e., 10 to 20 feet bgs or deeper) of dioxins/furans, cPAHs, PCP, gasoline range hydrocarbons, diesel range hydrocarbons, heavy oil range hydrocarbons, and shallow contamination (i.e., less than 4 feet bgs) of lead are present. To confirm the horizontal and vertical extents of the contaminants within Cleanup Area A, performance monitoring sampling included advancing 53 soil borings by direct-push or hollow-stem auger drill rigs to a maximum depth of 28 feet bgs (this maximum depth is a deviation from the required depth in the CMP and is described further in Section 2.4). Maximum depth was based on the known extent of contamination and on field screening observations. All samples were collected from 1-foot intervals. A total of 162 discrete samples (including Tier 1 and Tier 2 samples but excluding field duplicates) were collected in Cleanup Area A.

2.1.2 Cleanup Area B: Sampling and Analysis Scheme

Cleanup Area B (Figure C.3) was drawn to encompass all shallow dioxins/furans-contaminated areas outside the Central and Eastern Source Areas with dioxins/furans TEQ concentrations greater than 100 pg/g (Areas B1, B2, B3, B4, and B5). In addition to dioxins/furans, limited cPAH contamination is present in Area B2. Before this investigation, the data indicated that the vertical extent of contamination with dioxins/furans TEQ concentrations greater than 100 pg/g in Cleanup Area B was a maximum of 4 feet bgs, with the majority of the contamination limited to the upper 0.5 foot bgs. To delineate the horizontal and vertical extents of the contamination within Cleanup Area B, performance monitoring sampling activities included advancing 81 soil borings by either direct-push or test pit excavation. All samples were collected from 1-foot intervals. A total of 217 discrete samples (including Tier 1 and Tier 2 samples but excluding field duplicates) were collected within or adjacent to Cleanup Area B.

2.2 FIELD PROCEDURES

2.2.1 Hollow-Stem Auger Soil Borings

Between September 15 and September 16, 2015, seven soil borings (PM-071, PM-072, PM-073, PM-084, PM-086, PM-094, and PM-095) were advanced by Cascade Drilling (Cascade) of Woodinville, Washington, under the direction of Floyd|Snider, using a hollow-stem auger drill rig, On February 24, and additional eight soil borings (PM-006, PM-058, PM-070, PM-071, PM-082, PM-084, PM-121, and PM-123) were advanced. The samples were collected from an 18-inch split-spoon sampler for geologic logging in accordance with the procedures described in the RI/FS SAP/QAPP (Floyd|Snider 2010, Appendix B). A split-spoon sampler was used to ensure recovery of sufficient sample volume for analysis at depths greater than 20 feet bgs. The borings were advanced from the ground surface to the required depths presented in Table 5.1 of the CMP (Floyd|Snider 2015a). All down-hole drilling equipment was decontaminated before use and between drilling locations. Soil lithology was logged and classified according to the USCS by a field geologist and photographed.

2.2.2 Direct-Push Soil Borings

2.2.2.1 September 2015

Between September 17 and September 25, 2015, 104 soil borings were advanced by Cascade under the direction of Floyd|Snider, using direct-push technology. The borings were advanced from the ground surface to the required depths presented in Table 5.1 of the CMP (Floyd|Snider 2015a). The samples were collected continuously in 5-foot-long drill rods with disposable liners for geologic logging in accordance with the procedures described in the RI/FS SAP/QAPP

(Floyd|Snider 2010, Appendix B). Soil lithology was described and classified according to the USCS by a geologist and photographed.

2.2.2.2 November 2015

On November 23, 2015, 16 additional borings were advanced by Cascade under the direction of Floyd|Snider, using direct-push technology. These additional borings included 15 existing soil sampling locations that were reoccupied to collect samples from additional depth intervals and 1 new boring location (PM-119).

2.2.2.3 February 2016

On February 1, 2016, and February 24, 2016, 19 additional borings were advanced by Cascade under the direction of Floyd|Snider, using direct-push technology. These additional borings included 4 existing soil sampling locations that were reoccupied to collect samples from additional depth intervals, and 15 new boring locations (PM-120 to PM-134).

2.2.3 Test Pits

Seven of the shallow soil sampling locations were sampled by means of test pits using an excavator operated by the Port. These test pits allowed geotechnical information required for the remedial design to be collected simultaneous with the collection of analytical samples. Geotechnical logging was completed by Aspect Consulting and is not included in this data report. Geotechnical information is presented in Appendix G of the Engineering Design Report (EDR). The test pits were excavated to a maximum depth of 3 feet bgs. The depth of each test pit was measured to verify that the target depth was reached. A sidewall sample from each test pit was collected by field staff using a decontaminated spoon. Soil lithology was logged according to the USCS by a geologist and photographed.

2.2.4 Sample Collection

Soil was removed from the split-spoon sampler, disposable direct-push liner, or the sidewall of the test pit within the sample interval of interest and placed into a decontaminated stainless steel bowl for homogenization. After homogenization, the sample material was placed into laboratory-supplied glass sample containers. The sample containers were tightly sealed, labeled, and immediately placed in a cooler maintained at a temperature of approximately 4 degrees Celsius (°C) using crushed ice. If a particular sample was to be analyzed for gasoline range hydrocarbons, it was collected directly from the sampling core or test pit sidewall using U.S. Environmental Protection Agency (USEPA) Method 5035A for volatile compounds before sample homogenization. Samples were delivered to Analytical Resources, Inc., in Tukwila, Washington, under standard chain-of-custody procedures.

2.3 FIELD OBSERVATIONS AND DOCUMENTATION

As part of the sample collection, the following information was recorded on the soil boring logs:

- Date, time, and name of person logging the sample
- Sampling location number
- Soil sample depth and soil description
- Sample recovery
- Presence of debris
- Field screening observations, such as the presence of odor, sheen, staining, or any other indications of contamination

The soil boring logs are included as Attachment C.1.

2.4 COMPLIANCE MONITORING PLAN DEVIATIONS

2.4.1 Deeper Sample Collection at PM-085

Soil boring PM-085 is located adjacent to borings PM-073, PM-086, and PM-094. Field screening observations from these borings indicated hydrocarbon and/or solvent odor in soil between 22 and 24 feet bgs. The original proposed depth for boring PM-085 was 20 feet bgs. Due to the screening observations in these adjacent boring locations, boring PM-085 was advanced to a depth of 28 feet bgs. To delineate vertical hydrocarbon contamination within this area, additional samples were collected in boring PM-085, from the following intervals: 21 to 22 feet bgs, 23 to 24 feet bgs, 25 to 26 feet bgs, and 27 to 28 feet bgs. In addition, to more specifically delineate the vertical extent of dioxins/furans, PM-085 was reoccupied during the November 2015 sampling event, and samples were collected from two intervals: 22 to 23 feet bgs and 24 to 25 feet bgs.

2.4.2 Delineation of Hydrocarbon Contamination in Location PM-057

During field screening, a hydrocarbon odor was noted in the deepest sampling interval (11 to 12 feet bgs) in boring PM-057. In addition, laboratory analytical data confirmed the detection of gasoline range hydrocarbons within this interval at a concentration of 270 milligrams per kilogram (mg/kg), which exceeds the CUL of 100 mg/kg. As a result, the sampling scheme was adjusted in the field to delineate the contamination both vertically and horizontally.

To delineate the vertical extent of contamination encountered in location PM-057, samples were collected from deeper intervals, including 12 to 13 feet bgs, 14 to 15 feet bgs, 17 to 18 feet bgs, and 19 to 20 feet bgs. Gasoline range hydrocarbons was detected at a concentration of 620 mg/kg in the sample from 12 to 13 feet bgs and at a concentration less than the CUL in the same from 14 to 15 feet bgs. No additional intervals were analyzed.

To delineate the contamination horizontally in the vicinity of boring PM-057, samples were collected from deeper intervals in locations PM-051, PM-062, PM-063, and PM-064. Borings at these locations were advanced to 20 feet bgs to ensure that the vertical extent of hydrocarbon contamination was also delineated.

2.4.3 Relocation of Soil Borings

Some boring locations were slightly adjusted in the field (generally less than 10 feet from their target locations) because of the presence of utilities, accessibility issues with the drill rig or excavator, or sample recovery issues in the former swimming pools filled with backfill. All changes in location were measured in the field and noted in the field notebook. Additionally, all adjusted locations were resurveyed by a Port surveyor once all boring activities had been completed. The boring locations shown in Figure C.4 reflect the results of the final survey.

2.4.4 November 2015 and February 2016 Sampling Events

The data from the September 2015 sampling event did not fully delineate the extent of dioxins/furans and lead contamination. Therefore, additional sampling events were conducted in November 2015 and February 2016. Results of these sampling events are presented in Section 4.2.

2.4.5 Moisture Content

Moisture content of soil samples was added to the sampling plan to help determine the suitability of on-site material for use as backfill in the excavations and to evaluate the dewatering and shoring design. Soil samples for moisture content analysis were collected from six direct-push borings (PM-028, PM-036, PM-042, PM-043, PM-055, and PM-059), one test pit (PM-038), and four hollow-stem auger borings (PM-084, PM-086, PM-094, and PM-095). Samples from the direct-push borings and the test pit were collected from 1-foot intervals at shallow depths ranging from 1 to 3 feet bgs. Samples collected from the hollow-stem auger borings within the Central Source Area, with the exception of PM-084, were collected from the following intervals: 5 to 6 feet bgs, 10 to 11 feet bgs, and 19 to 20 feet bgs. One sample was collected from PM-084 from a depth of 25 to 26 feet bgs.

Geotechnical samples to determine the optimal soil moisture content for soil compaction were also collected from four test pit locations by Aspect Consulting. Samples for Proctor testing and moisture/wash/sieve testing were collected from locations PM-038, PM-044, PM-047, and PM-049. Samples were collected for moisture/wash/sieve testing from locations PM-035 and PM-045. The results of this testing are included and discussed in Appendix G of the EDR.

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3.0 Analytical Methods and Data Quality Review

3.1 ANALYTICAL METHODS

Consistent with previous investigations at the Site, soil samples were transported to the Analytical Resources, Inc., laboratory in Tukwila, Washington, for chemical analysis of the Site COCs using the following methods:

- Dioxins/furans: USEPA Method 1613
- cPAHs: USEPA Method 8270D
- PCP: USEPA Method 8041
- Lead: USEPA Method 6010
- Gasoline range hydrocarbons: NWTPH-Gx
- Diesel and heavy oil range hydrocarbons: NWTPH-Dx

The analyses were conducted to achieve a reporting limit less than the applicable soil CULs identified in the CMP. EcoChem of Seattle, Washington reviewed the laboratory reports for internal consistency, transmittal errors, consistency with laboratory protocols, and adherence to the USEPA analytical methods and data validation guidance. The laboratory analytical reports are provided in Attachment C.2.

3.2 DATA QUALITY REVIEW

A Level III Data Quality Review (Summary Validation) was performed on all the analytical data, except dioxins/furans for which a Level IV, Tier III Data Quality Review (Full Validation) was performed. All data validation was performed by EcoChem. The complete EcoChem Data Validation Report is provided in Attachment C.3.

Data validation was based on the quality control criteria as recommended in the methods identified in the SAP/QAPP for the RI/FS (Floyd|Snider 2010, Appendix B), the *National Functional Guidelines for Superfund Organic Methods Data Review* (USEPA 2014a), the *National Functional Guidelines for Inorganic Superfund Data Review* (USEPA 2014b), and the *National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review* (USEPA 2011).

As determined by EcoChem's evaluation, the laboratory followed the specified analytical methods. Generally, accuracy was acceptable as demonstrated by the labeled compound and on-going precision and recovery (OPR) for dioxins/furans, and the surrogate, laboratory control sample/laboratory control sample duplicate (LCS/LCSD), and matrix spike/matrix spike duplicate (MS/MSD) recoveries for all other analytes. Precision was acceptable as demonstrated by the LCS/LCSD, MS/MSD, and field duplicate relative percent difference values, with some exceptions noted in the complete EcoChem Data Validation Report. Some detection limits were elevated due to ion ratio outliers and method blank contamination. Estimated results were due to labeled compound outliers, results exceeding the calibration range of the instrument, surrogate recovery outliers, or interference by diphenyl ether for dioxins/furans. All of the data, as qualified, are acceptable for use.

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4.0 Soil Cleanup Levels and Analytical Results

4.1 CONTAMINANT OF CONCERN CLEANUP LEVELS AND DIOXINS/FURANS REMEDIATION LEVEL

The COCs for the LL Apartments Parcel are presented in Table C.1, along with their respective CULs and the remediation level for dioxins/furans TEQ. The data obtained during this investigation were compared to these criteria to determine the final extent of the excavations. Dioxins/furans TEQ data were compared against the remediation level only.

Table C.1
Lora Lake Apartments Parcel Contaminants of Concern

Contaminant of Concern	Cleanup Level	Remediation Level
Dioxins/Furans TEQ	13 pg/g	100 pg/g
cPAH TEQ	137 µg/kg	--
Pentachlorophenol	2,500 µg/kg	--
Lead	250 mg/kg	--
Gasoline range hydrocarbons	100 mg/kg	--
Sum of Diesel and heavy oil range hydrocarbons	2,000 mg/kg	--

Note:
-- Not applicable.

Abbreviation:
µg/kg Micrograms per kilogram

4.2 ANALYTICAL RESULTS

As described in Section 2.1 and the CMP, the samples were analyzed in a tiered approach. Tier 1 samples were those analyzed immediately after field collection in September 2015, and Tier 2 samples were collected from "stepped-out" locations and depths and archived by the laboratory for future analysis. In addition, for dioxins/furans and lead, the samples originally collected were not sufficient to delineate the excavation extents, and additional sampling events in November 2015 and February 2016 were required.

4.2.1 Dioxins/Furans

All of the locations from which samples were analyzed for dioxins/furans and the corresponding results for locations in which the dioxins/furans TEQ concentrations exceeded the remediation level are shown in Figure C.5. A total of 176 samples (excluding field duplicates) from 93 locations were analyzed for dioxins/furans. Dioxins/furans TEQ concentrations ranged from 0.0940 to 3,040 pg/g. All of the analytical results for dioxins/furans are provided in Table C.2.

4.2.1.1 September 2015 Sampling Event

During the September 2015 sampling event, samples were collected from 118 locations and analyzed for dioxins/furans. A total of 74 Tier 1 samples were analyzed for dioxins/furans immediately after sample collection. The results of the Tier 1 sample analysis indicated that the excavation limits had not yet been delineated because 35 samples had dioxins/furans TEQ concentrations greater than the remediation level (100 pg/g). A total of 53 Tier 2 samples were subsequently analyzed by the laboratory.

4.2.1.2 November 2015 Sampling Event

Because the excavation limits were not delineated by the results of the September 2015 sampling event and the existing RI data, an additional sampling event was conducted in November 2015. This event included reoccupying 15 existing locations (PM-036, PM-040, PM-046, PM-048, PM-078, PM-085, PM-087, PM-090, PM-096, PM-098, PM-100, PM-102, PM-104, PM-109, and PM-114) and adding a new boring location (PM-119). A total of 18 Tier 1 samples were analyzed for dioxins/furans immediately after sample collection. The results of the Tier 1 sample analysis indicated that the excavation limits still had not been delineated because seven samples had dioxins/furans TEQ concentrations greater than the remediation level (100 pg/g). Three Tier 2 samples were subsequently analyzed by the laboratory.

4.2.1.3 February 2016 Sampling Events

The additional samples collected during the November 2015 sampling event again did not delineate the extent of the dioxins/furans contamination, with five locations remaining that were not delineated. In February 2016, additional samples were collected to define the excavation extent. Seven existing locations (PM-006, PM-036, PM-070, PM-071, PM-082, PM-084, and PM-102) were reoccupied, and 10 new boring locations (PM-125 to PM-134) were added. The objective of collecting samples from these 10 additional locations was to potentially decrease the horizontal extent of the excavation in select areas with less data density (sampling locations are shown on Figure C.5). A total of 20 Tier 1 samples (excluding field duplicates) were analyzed immediately after collection, and 44 Tier 2 samples were archived. The results of the Tier 1 sample analysis indicated that the excavation limits still had not been delineated). Eight Tier 2 samples were subsequently analyzed by the laboratory. The data from the additional samples analyzed were used to fully delineate the contamination extent of dioxins/furans.

4.2.1.4 Data Summary

The performance monitoring data collected in 2015 and 2016 was adequate to fully delineate the horizontal and vertical extents of the dioxins/furans contamination in excess of the remediation level. These data provide compliance monitoring points for the base of the excavation and excavation sidewalls for each excavation area. The final excavation extents have changed substantially from the cleanup areas presented in the CAP (Figure C.3) and are presented in Figure 4.5 of the main text of the EDR. In summary, the shallow excavation in the western portion of the parcel is smaller in terms of its horizontal extent and deeper than the vertical extent estimated in the CAP. In the source area, the horizontal extent of excavation is larger and stretches to the east and south farther than that estimated in the CAP (Figure C.3 and Figure 4.5 of the main text of the EDR).

4.2.2 Carcinogenic Polycyclic Aromatic Hydrocarbons

Thirty-nine samples (excluding field duplicates) from 19 locations were analyzed for cPAHs. The cPAH TEQ results for all of these samples were less than the CUL of 137 µg/kg. The detected cPAH TEQ concentrations ranged from 3.4 to 130 µg/kg. Based on the performance monitoring and existing RI data, the extent of cPAH contamination has been fully delineated.

The sampling locations for all of the performance monitoring samples analyzed for cPAHs are shown in Figure C.6, and the performance monitoring analytical results are provided in Table C.3.

4.2.3 Pentachlorophenol

Twenty-nine samples (excluding field duplicates) from 13 locations were analyzed for PCP. All detected PCP concentrations were less than the CUL of 2,500 µg/kg, with detected results ranging from 4.1 to 660 µg/kg. Based on the performance monitoring and existing RI data, the extent of PCP contamination has been fully delineated.

The sampling locations from which samples were analyzed for PCP are shown in Figure C.7, and all of the performance monitoring analytical results are provided in Table C.3.

4.2.4 Lead

4.2.4.1 September 2015 Sampling Event

Eight samples (excluding field duplicates) from five locations were collected as part of the September 2015 sampling event and analyzed to delineate the extent of lead contamination. Six Tier 1 samples were analyzed immediately after collection and had detected lead concentrations ranging from 1.8 to 340 mg/kg. The sample from boring PM-101 at 1 to 2 feet bgs had a concentration of 340 mg/kg, greater than the CUL of 250 mg/kg (Figure C.8). Therefore, two additional Tier 2 samples were analyzed to delineate the horizontal extent of lead contamination east and south of PM-101.

4.2.4.2 February 2016 Sampling Events

Ten additional samples from the same five boring locations were collected in February 2016 in order to better delineate the vertical extent of contamination. As described in Section 4.2.4.1, a lead exceedance was previously observed at a sample depth of 1 to 2 feet bgs at location PM-101.

However, no deeper samples had been collected in this boring to vertically delineate the contamination, with the exception of a clean sample collected at a depth of 9 to 10 feet bgs. Therefore, PM-101 was reoccupied to collect samples between 2 and 9 feet bgs to shallow the vertical extent of lead contamination. The horizontal extent of lead contamination south of PM-101 also had not been sufficiently delineated; therefore, five additional sampling locations (PM-120 to PM-124) were added as part of the February 2016 sampling events. Lead concentrations in the samples from two locations (PM-121 at 1 to 2 feet bgs and PM-123 at 1 to 2 feet bgs) exceeded the lead CUL, with concentrations of 768 and 1,180 mg/kg, respectively. Therefore, based on the sampling design (Figure C.8) the horizontal extent of lead contamination in shallow soil was delineated. However, because the vertical extent of contamination at locations PM-121 and PM-123 was not delineated, additional samples were analyzed. The concentrations of lead at a depth of 2 to 3 feet bgs in both locations were less than the lead CUL, thereby fully delineating the vertical extent of lead contamination on the parcel.

4.2.4.3 Summary

Based on the performance monitoring and existing RI data, the extent of lead contamination has been fully delineated. At locations where lead concentrations exceed the CUL, the vertical extent of contamination has been confirmed by deeper samples. The depth and concentration of these delineation data are shown in Figure C.8. While lead does not appear to be fully delineated in Figure C.8, further lead analysis was not required, because these non-delineated areas are co-located with dioxins/furans contamination, and will be excavated to address dioxins/furans. The performance monitoring analytical results are provided in Table C.3.

4.2.5 Gasoline Range Hydrocarbons

Forty-one samples (excluding field duplicates) from 15 locations were analyzed for gasoline range hydrocarbons. Detected gasoline range hydrocarbons concentrations ranged from 5.7 to 1,300 mg/kg. A total of 29 Tier 1 samples were analyzed immediately after collection, but the results of these samples did not fully delineate the vertical and horizontal extents of contamination. Therefore, an additional 12 Tier 2 samples were analyzed.

After the evaluation of the Tier 2 sample data, it was determined that the gasoline range hydrocarbons contamination has been fully delineated horizontally and vertically, with the exception of two base locations: PM-063 and PM-085. However, no additional samples were collected to further delineate the depth of this limited gasoline range hydrocarbon contamination because it was located below the soil point of compliance for direct contact (15 feet bgs), and empirical data at the Site has confirmed that soil leaching to groundwater is not a pathway at the Site. The EDR includes a discussion of the rationale for excavation extent in this area.

The performance monitoring locations from which samples were analyzed for gasoline range hydrocarbons are shown in Figure C.9, and all of the performance monitoring analytical results are provided in Table C.3.

4.2.6 Sum of Diesel Range and Heavy Oil Range Hydrocarbons

Thirty samples (excluding field duplicates) from 12 locations were analyzed for diesel range and heavy oil range hydrocarbons. All of the results of the sum of diesel range and heavy oil range hydrocarbons were less than the CUL of 2,000 mg/kg, with detected concentrations ranging from 6.4 to 840 mg/kg. Based on the performance monitoring and existing RI data, the extent of contamination for diesel range and heavy oil range hydrocarbons has been fully delineated.

The sampling locations for all of the performance monitoring samples analyzed for diesel and heavy oil range hydrocarbons are shown in Figure C.10, and all of the performance monitoring analytical results are provided in Table C.3.

4.2.7 Summary

Based on the performance monitoring data and the existing RI data, the horizontal and vertical extents of contamination have been delineated. These additional performance monitoring data have been used to redefine the original cleanup areas and excavation extents presented in the CAP and the CMP, and along with previously collected data were used to determine the excavation extents for compliance with cleanup standards, as discussed in the EDR. The excavation areas, drawn on the basis of these data, are presented in Figure 4.5 of the EDR and described in detail in Appendix F of the EDR.

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5.0 Survey Methods and Results

All soil boring locations were surveyed to document the horizontal location and vertical elevation of the ground surface. This survey is necessary for accurate delineation of the excavation extent during remedial design and provides the basis for excavation control points that will be verified by survey during construction. Soil borings were surveyed to a horizontal and vertical accuracy within 0.1 foot.

The sampling locations were surveyed before the September 2015 sampling event. Resurveying was required for the locations that were moved during sampling and for the locations that were added during the November 2015 and February 2016 sampling events.

Site surveying was conducted using the Washington State Plane North Coordinate System. The vertical datum used is the North American Vertical Datum of 1988.

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6.0 Investigation-Derived Waste Management

All soil and water generated by soil boring installation and equipment decontamination were collected and transferred to new, U.S. Department of Transportation-approved 55-gallon steel drums. The drums were lidded, sealed, labeled as non-hazardous waste with an indelible marker, and stored on-site while material profiling was conducted. Waste profiling and disposal was coordinated by the Port. Twenty-three drums containing soil and water investigation-derived waste generated during the sampling events were transported on April 27, 2016 from the Site as non-Resource Conservation and Recovery Act, non-Washington state dangerous waste. The drums were transported to the Clean Harbors Environmental Services Grassy Mountain Landfill in Grantsville, Utah, for disposal, and received on May 1, 2016. The non-hazardous waste manifest is included in Attachment C.4.

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7.0 Reporting

Chemical data collected during the soil performance monitoring activities have been submitted to WSDOE in the Environmental Information Management (EIM) system format, in accordance with current WSDOE requirements. Data from the September and November 2015 events were uploaded to the EIM database on February 19, 2016, and successfully loaded by WSDOE on April 5, 2016. Data from the February 2016 sampling events were submitted to the EIM database on April 25, 2016, and have not yet been fully uploaded by WSDOE.

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8.0 References

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Port of Seattle
Lora Lake Apartments Site

Engineering Design Report

Appendix C
Lora Lake Apartments Parcel Soil Performance Monitoring Data Report

Tables

Table C.2
Analytical Results for Dioxins/Furans

			Area	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
			Location	PM-071	PM-071	PM-071	PM-071	PM-071	PM-071	PM-072	PM-072	PM-072	PM-072	PM-073	PM-073	PM-073	PM-073	PM-073
			Sample ID	PM-071-01.0-02.0	PM-071-03.0-04.0	PM-071-07.0-08.0	PM-071-09.0-10.0	PM-071-19.0-20.0	PM-071-21.0-22.0	PM-072-19.0-20.0	PM-072-21.0-22.0	PM-072-23.0-24.0	PM-072-25.0-26.0	PM-073-19.0-20.0	PM-073-19.0-20.0-D	PM-073-21.0-22.0	PM-073-23.0-24.0	PM-073-25.0-26.0
			Sample Date	02/24/2016	02/24/2016	02/24/2016	02/24/2016	09/15/2015	09/15/2015	09/15/2015	09/15/2015	09/15/2015	09/15/2015	09/15/2015	09/15/2015	09/15/2015	09/15/2015	09/15/2015
			Depth (ft bgs)	1–2	3–4	7–8	9–10	19–20	21–22	19–20	21–22	23–24	25–26	19–20	19–20	21–22	23–24	25–26
Analytes	CAS Number	Remedial Action Level	Units															
Dioxins/Furans by USEPA 1613B																		
2,3,7,8-TCDD	1746-01-6	--	pg/g	11.1	14.7 J	1.15 J	0.458 U	0.166 U	0.16 U	25.7	6.55	0.277 U	0.804 J	18.4	18.6	16.1	1.79 U	0.916 U
1,2,3,7,8-PeCDD	40321-76-4	--	pg/g	67.2	68.1 J	6.53 J	2.03 J	0.109 J	0.209 U	49.1	14.5	0.291 J	1.05	55.2	55.7	47.3	5.16	2.63
1,2,3,4,7,8-HxCDD	39227-28-6	--	pg/g	99.2	108	7.77 J	2.69 U	0.176 J	0.324 J	85 J	14.5	0.241 J	1.1	71.7	71.4	62.8	7.06	3.54
1,2,3,6,7,8-HxCDD	57653-85-7	--	pg/g	983	816	45.8	19.8	1.11	2.48	990 J	180	2.14	6.57	801	794	687	70.1	31.4
1,2,3,7,8,9-HxCDD	19408-74-3	--	pg/g	331	286	21.2	8.47 J	0.584 J	1	463	84	1.2	3.35	257	254	239	22	10.7
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	pg/g	33,700	35,800	1,580	725	12.2 U	64.6	29,700	5,790	64.8	210	26,400	26,900	23,600	2,550	1,100
OCDD	3268-87-9	--	pg/g	363,000 J	434,000 J	17,600 J	8,030 J	68.5 U	678 U	235,000 J	52,800 J	770 J	2,600	296,000 J	276,000 J	209,000 J	25,900 J	11,400 J
2,3,7,8-TCDF	51207-31-9	--	pg/g	3.93	4 U	1.03 J	0.34 U	0.0339 U	0.0319 U	3.28	0.751 J	0.0455 U	0.0519 U	1.38 U	1.24	1.08 U	0.198 U	0.162 U
1,2,3,7,8-PeCDF	57117-41-6	--	pg/g	8.63	7.4 U	1.24 U	0.44 U	0.116 J	0.106 U	4.13	1.31 U	0.0653 U	0.0778 U	4.18	4.18	3.68	0.354 U	0.454 J
2,3,4,7,8-PeCDF	57117-31-4	--	pg/g	53.3	57.1 U	3.24 J	1.15 U	0.0559 U	0.104 U	10.8	2.99	0.0812 U	0.254 J	20.8	23.1	21	2.63 U	1.62
1,2,3,4,7,8-HxCDF	70648-26-9	--	pg/g	230	275	14.3 J	5.86 J	0.0868 J	0.383 U	80.3 J	20.4	0.346 J	1.04	140	146	130	16.5	7.92
1,2,3,6,7,8-HxCDF	57117-44-9	--	pg/g	91	102 U	7.31 U	2.57 J	0.0918 U	0.233 U	47.6 J	13.1	0.241 J	0.833 J	66	67	60.2 J	6.97	3.69
1,2,3,7,8,9-HxCDF	72918-21-9	--	pg/g	62.4	93.6 U	7.53 J	1.97 U	0.168 U	0.306 J	11.6	3.39	0.115 U	0.352 J	12.6	13.6	11.5	1.8	1.3
2,3,4,6,7,8-HxCDF	60851-34-5	--	pg/g	147	149	10.6 U	4.77 U	0.0846 J	0.219 U	86.1	26.9	0.481 J	1.66	114	113	99.3	12.2	5.93
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	pg/g	11,600	10,200	593	250	1.3	16	3,420	1,070	17	63	9,020	9,060	6,850	861	385
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	pg/g	374	40 U	12.2 J	6.63 U	0.154 J	0.651 J	181	55	1.05 J	3.08 U	318	310	263	33.8	15.3 J
OCDF	39001-02-0	--	pg/g	74,900	44,800	2,190	1,060	4.41 U	63.8	22,500	3,570 J	54.3 J	150	101,000 J	79,000 J	46,500	3,340	1,450
Summed Dioxins/Furans TEQ[1,2]	--	100	pg/g	**877 J**	**850 J**	46.2 J	18.2 J	0.331 J	1.24 J	**665 J**	**142 J**	1.83 J	6.98 J	**703 J**	**697 J**	**583 J**	62 J	28.4 J
Summed Dioxins/Furans TEQ with One-half of the Detection Limit[1,3]	--	100	pg/g	**877 J**	**869 J**	47.1 J	19.1 J	0.509 J	1.59 J	**665 J**	**142 J**	1.99 J	6.99 J	**703 J**	**697 J**	**583 J**	63.3 J	28.9 J

Notes:

BOLD Detected concentration exceeds the cleanup level.
1 World Health Organization 2005 Toxic Equivalency Factors used for calculation of dioxins/furans TEQ (Van den Berg et al. 2006).
2 Calculated using detected dioxins/furans concentrations.
3 Calculated using detected dioxins/furans concentrations plus one-half the detection limit for dioxins/furans that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
ft bgs Feet below ground surface
HpCDD Heptachlorodibenzo-p-dioxin
HpCDF Heptachlorodibenzofuran
HxCDD Hexachlorodibenzo-p-dioxin
HxCDF Hexachlorodibenzofuran
OCDD Octachlorodibenzo-p-dioxin
OCDF Octachlorodibenzofuran
PeCDD Pentachlorodibenzo-p-dioxin
PeCDF Pentachlorodibenzofuran
pg/g Picograms per gram
TCDD Tetrachlorodibenzo-p-dioxin
TCDF Tetrachlorodibenzofuran
TEQ Toxicity equivalent
USEPA United States Environmental Protection Agency

Qualifiers:

J Analyte was detected; concentration is considered to be an estimate.
U Analyte was not detected; concentration given is the reporting limit.
UJ Analyte was not detected; concentration given is the reporting limit, which is considered to be an estimate.

Table C.2
Analytical Results for Dioxins/Furans

			Area	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
			Location	PM-074	PM-074	PM-074	PM-083	PM-083	PM-084	PM-084	PM-084	PM-084	PM-084	PM-084	PM-085	PM-085	PM-085	PM-085
			Sample ID	PM-074-01.0-02.0	PM-074-10.0-11.0	PM-074-19.0-20.0	PM-083-01.0-02.0	PM-083-10.0-11.0	PM-084-01.0-02.0	PM-084-03.0-04.0	PM-084-07.0-08.0	PM-084-09.0-10.0	PM-084-19.0-20.0	PM-084-21.0-22.0	PM-085-01.0-02.0	PM-085-10.0-11.0	PM-085-19.0-20.0	PM-085-21.0-22.0
			Sample Date	09/17/2015	09/17/2015	09/17/2015	09/22/2015	09/22/2015	02/24/2016	02/24/2016	02/24/2016	02/24/2016	09/16/2015	09/16/2015	09/23/2015	09/23/2015	09/23/2015	09/23/2015
			Depth (ft bgs)	1–2	10–11	19–20	1–2	10–11	1–2	3–4	7–8	9–10	19–20	21–22	1–2	10–11	19–20	21–22
Analytes	CAS Number	Remedial Action Level	Units															
Dioxins/Furans by USEPA 1613B																		
2,3,7,8-TCDD	1746-01-6	--	pg/g	126 J	0.322 U	0.461 U	1.66 U	2.5 U	7.41	4.16 U	2.73 U	3.5 J	1.12 U	0.913 U	29.2	7.7 U	14.6	10.8 U
1,2,3,7,8-PeCDD	40321-76-4	--	pg/g	656	1.93 U	2.14	4.6 UJ	8.99 J	42.3	23.6	13.4 J	26.4	1.48 J	0.687 U	181	21.4	30.6	25.4
1,2,3,4,7,8-HxCDD	39227-28-6	--	pg/g	615	2.99 U	3.33	6.1 J	7.8 U	66.3	30.7	16 J	13.2 J	2.28 J	1.5 J	302	22	30.8	26.8
1,2,3,6,7,8-HxCDD	57653-85-7	--	pg/g	2,790	11.7	17.3	37.1	78.4	547	209	103	86.8	13.5	7.99	2,870	236	381	288
1,2,3,7,8,9-HxCDD	19408-74-3	--	pg/g	1,710	8.41	10.1	16.4 J	30.1 J	214	87.1	74.5	228	5.96	3.54 J	989	81.1	138	107
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	pg/g	105,000	518	569	1,370 J	3320	18,900	7690	4,010	3,400	516	277	105,000	8,530	13,300	9,270
OCDD	3268-87-9	--	pg/g	994,000 J	12,600	5780 J	14,900 J	43,600 J	231,000 J	90,600 J	44,100 J	38,300 J	5,900	2,520 J	1,080,000 J	94,600 J	179,000 J	106,000 J
2,3,7,8-TCDF	51207-31-9	--	pg/g	24.7 U	0.273 U	0.0818 U	1.08 U	1.8 U	2.39	1.37 U	1.56 U	0.996 U	0.149 U	0.174 U	11.5	1.34 J	1.89 U	1.49 U
1,2,3,7,8-PeCDF	57117-41-6	--	pg/g	59 J	0.507 U	0.118 U	2.38 J	3.4 U	4.79	2.56 J	2.91 U	1.83 U	0.468 U	0.421 U	20.5	2.7 J	3.69 U	3.07 U
2,3,4,7,8-PeCDF	57117-31-4	--	pg/g	111 U	1.09 U	1.57	3.25 U	5.74 U	24.1	12.4 J	7.77 U	7.14 J	0.677 J	0.287 U	117	11.3	30.3	25.9
1,2,3,4,7,8-HxCDF	70648-26-9	--	pg/g	472 U	5.57	7.95	7.64 U	28.3 U	143	63.2	28	21.2	3.92 J	1.1 U	683	60.9	170	124
1,2,3,6,7,8-HxCDF	57117-44-9	--	pg/g	276 U	2.48 J	2.39	9.4 U	11.1 U	56.1	27.8	14.2 J	21.1 U	1.6 U	0.831 U	256	18.8	41.2	32.2
1,2,3,7,8,9-HxCDF	72918-21-9	--	pg/g	140 J	2.74 J	0.698 J	7.99 UJ	9.14 U	25.8	16.2 J	19.6 J	59	0.756 J	0.338 U	63	8.06 U	8.54 J	8.31 J
2,3,4,6,7,8-HxCDF	60851-34-5	--	pg/g	381	6.02 U	3.13	12.6 J	11 U	81.9	43	22.4 U	18.3 J	2.29 J	1.88 J	393	29.9 U	63.4	45.1
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	pg/g	25,000	111	180	453 J	882	5,840	2,440	1,300	898	142	38.5	32,100	1,950	3,620	2,640
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	pg/g	870	7.93 U	5.84 U	10.5 UJ	29.5 J	206	58.7 U	37.8 U	39.5	5.54	3.41 J	996	78.2	140	104 U
OCDF	39001-02-0	--	pg/g	115,000 J	479	695	1,740	4,270	28,200	9,830	5,610	4,150	580	137 J	129,000	9,710	17,300	12,500
Summed Dioxins/Furans TEQ[1,2]	--	100	pg/g	**2,990 J**	13.3 J	16.5 J	30.5 J	76.5 J	**498 J**	**207 J**	**107 J**	**131 J**	13.1 J	5.48 J	**2,550 J**	**204 J**	**367 J**	**251 J**
Summed Dioxins/Furans TEQ with One-half of the Detection Limit[1,3]	--	100	pg/g	**3,040 J**	15.1 J	16.8 J	35.5 J	82.1 J	**498 J**	**209 J**	**111 J**	**132 J**	13.8 J	6.45 J	**2,550 J**	**210 J**	**367 J**	**257 J**

Notes:

BOLD Detected concentration exceeds the cleanup level.
1 World Health Organization 2005 Toxic Equivalency Factors used for calculation of dioxins/furans TEQ (Van den Berg et al. 2006).
2 Calculated using detected dioxins/furans concentrations.
3 Calculated using detected dioxins/furans concentrations plus one-half the detection limit for dioxins/furans that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
ft bgs Feet below ground surface
HpCDD Heptachlorodibenzo-p-dioxin
HpCDF Heptachlorodibenzofuran
HxCDD Hexachlorodibenzo-p-dioxin
HxCDF Hexachlorodibenzofuran
OCDD Octachlorodibenzo-p-dioxin
OCDF Octachlorodibenzofuran
PeCDD Pentachlorodibenzo-p-dioxin
PeCDF Pentachlorodibenzofuran
pg/g Picograms per gram
TCDD Tetrachlorodibenzo-p-dioxin
TCDF Tetrachlorodibenzofuran
TEQ Toxicity equivalent
USEPA United States Environmental Protection Agency

Qualifiers:

J Analyte was detected; concentration is considered to be an estimate.
U Analyte was not detected; concentration given is the reporting limit.
UJ Analyte was not detected; concentration given is the reporting limit, which is considered to be an estimate.

Table C.2
Analytical Results for Dioxins/Furans

			Area	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
			Location	PM-085	PM-085	PM-086	PM-086	PM-086	PM-087	PM-087	PM-087	PM-087	PM-094	PM-094	PM-095	PM-095	PM-095	PM-098
			Sample ID	PM-085-22.0-23.0	PM-085-27.0-28.0	PM-086 19.0-20.0	PM-086 19.0-20.0-D	PM-086 21.0-22.0	PM-087-01.0-02.0	PM-087-10.0-11.0	PM-087-11.0-12.0	PM-087-19.0-20.0	PM-094-19.0-20.0	PM-094-21.0-22.0	PM-095-01.0-02.0	PM-095-10.0-11.0	PM-095-19.0-20.0	PM-098-04.0-05.0
			Sample Date	11/23/2015	09/23/2015	09/16/2015	09/16/2015	09/16/2015	09/22/2015	09/22/2015	11/23/2015	09/22/2015	09/16/2015	09/16/2015	09/16/2015	09/16/2015	09/16/2015	11/23/2015
			Depth (ft bgs)	22–23	27–28	19–20	19–20	21–22	1–2	10–11	11–12	19–20	19–20	21–22	1–2	10–11	19–20	4–5
Analytes	CAS Number	Remedial Action Level	Units															
Dioxins/Furans by USEPA 1613B																		
2,3,7,8-TCDD	1746-01-6	--	pg/g	2.22 UJ	2.39 U	0.036 U	0.0398 U	0.166 U	1.84 U	5.67	1.26 U	0.0478 U	12.1 U	2.71 U	0.802 UJ	1.16 U	0.228 U	3.24
1,2,3,7,8-PeCDD	40321-76-4	--	pg/g	6.9 J	5.33 U	0.104 U	0.129 J	0.144 U	9.91	19.5	7.64	0.0517 U	24.9	3.24 J	4.27 J	6.82	0.33 U	19.9
1,2,3,4,7,8-HxCDD	39227-28-6	--	pg/g	5.82	6.35 U	0.13 U	0.135 U	0.0858 U	16.2	15.9	8.7	0.0876 U	27.9	3.78 J	5.9 J	10.6	1.15	32
1,2,3,6,7,8-HxCDD	57653-85-7	--	pg/g	80.8 J	74.1	0.736 J	0.837 J	0.762 U	111	157	78	0.249 U	393	46.2	27.1 J	63.8	3.42	188
1,2,3,7,8,9-HxCDD	19408-74-3	--	pg/g	24.6	24.5	0.428 J	0.418 J	0.503 J	49.6	97.7	45.4	0.197 U	106	12.7	13.9	28.4	1.19	99.1
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	pg/g	2,880 J	4,160	17.7	22.7	24.4	4,480	5,360	3,040	3.52	13,700	1,930	888 J	2,170	135	6,550
OCDD	3268-87-9	--	pg/g	39,600 J	74,000 J	201	280	264	45,300 J	54,300 J	32,800 J	31 U	145,000 J	24,400	8,850 J	21,800 J	1,440 J	69,500 J
2,3,7,8-TCDF	51207-31-9	--	pg/g	0.51 UJ	0.51 U	0.028 U	0.0279 U	0.0319 U	0.89 U	1.25 U	0.868 J	0.0299 U	2.11 U	0.33 U	1.36 UJ	0.351 J	0.032 U	1.23 U
1,2,3,7,8-PeCDF	57117-41-6	--	pg/g	0.916 J	0.902 J	0.036 U	0.0398 U	0.0379 U	2.73 J	2.11 U	0.459 J	0.0318 U	2.71 U	0.462 U	0.792 J	0.541 J	0.0639 U	2.17
2,3,4,7,8-PeCDF	57117-31-4	--	pg/g	2.96 J	0.863 U	0.054 J	0.0857 U	0.0659 U	11	27.7	9.53	0.0398 U	8.55 J	0.951 U	2.11 J	2.14	0.102 J	14
1,2,3,4,7,8-HxCDF	70648-26-9	--	pg/g	15.8 J	13	0.26 U	0.301 J	0.347 J	43.4	123	45.9	0.0458 U	48.4	5.88 U	6.05 J	10.7	0.555 J	63.8
1,2,3,6,7,8-HxCDF	57117-44-9	--	pg/g	8.68 J	8.94 J	0.076 U	0.0797 U	0.102 U	13.6	37.4	11.7	0.0458 U	23 U	3.66 J	4.96 UJ	6.13	0.232 U	24.2
1,2,3,7,8,9-HxCDF	72918-21-9	--	pg/g	2.3 UJ	2.22 J	0.068 U	0.0538 U	0.0559 U	4.66 J	10 U	4.12	0.0577 U	9.38 J	0.813 U	0.886 J	1	0.0639 U	23.1
2,3,4,6,7,8-HxCDF	60851-34-5	--	pg/g	25.2 J	24.9	0.094 U	0.0737 U	0.11 U	21.6	47.4	14.4	0.0458 U	59.8	13.8 U	7.84 J	10.3	0.521 J	36.4
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	pg/g	661 J	849	3.78	5.51	6.07	1230	1,750	756	0.299 J	3,840	430	235 J	539	25.7	1,750
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	pg/g	41.9 J	42.5	0.218 U	0.307 J	0.329 J	49.6	92.4	35 J	0.0557 U	132	16.7	7.97 J	17.7 J	1.05 UJ	67
OCDF	39001-02-0	--	pg/g	1,770 J	2,780	16.5	23.8	25.2	4,640	7,740	3,880 J	0.88 U	17,800	2,050	918 J	2,030 J	116 J	6,600
Summed Dioxins/Furans TEQ[1,2]	--	100	pg/g	72.1 J	88.3 J	0.413 J	0.661 J	0.48 J	**112 J**	**172 J**	80.7 J	0.0382 J	**317 J**	41.6 J	25.3 J	55 J	2.79 J	**181 J**
Summed Dioxins/Furans TEQ with One-half of the Detection Limit[1,3]	--	100	pg/g	73.4 J	92.7 J	0.517 J	0.713 J	0.703 J	**113 J**	**173 J**	81.4 J	0.137 J	**325 J**	44.1 J	26.1 J	55.6 J	3.09 J	**181 J**

Notes:

BOLD Detected concentration exceeds the cleanup level.
1 World Health Organization 2005 Toxic Equivalency Factors used for calculation of dioxins/furans TEQ (Van den Berg et al. 2006).
2 Calculated using detected dioxins/furans concentrations.
3 Calculated using detected dioxins/furans concentrations plus one-half the detection limit for dioxins/furans that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
ft bgs Feet below ground surface
HpCDD Heptachlorodibenzo-p-dioxin
HpCDF Heptachlorodibenzofuran
HxCDD Hexachlorodibenzo-p-dioxin
HxCDF Hexachlorodibenzofuran
OCDD Octachlorodibenzo-p-dioxin
OCDF Octachlorodibenzofuran
PeCDD Pentachlorodibenzo-p-dioxin
PeCDF Pentachlorodibenzofuran
pg/g Picograms per gram
TCDD Tetrachlorodibenzo-p-dioxin
TCDF Tetrachlorodibenzofuran
TEQ Toxicity equivalent
USEPA United States Environmental Protection Agency

Qualifiers:

J Analyte was detected; concentration is considered to be an estimate.
U Analyte was not detected; concentration given is the reporting limit.
UJ Analyte was not detected; concentration given is the reporting limit, which is considered to be an estimate.

Table C.2
Analytical Results for Dioxins/Furans

			Area	A1	A1	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2
			Location	PM-098	PM-132	PM-051	PM-051	PM-051	PM-056	PM-056	PM-057	PM-058	PM-058	PM-060	PM-060	PM-061	PM-061	PM-062
			Sample ID	PM-098-19.0-20.0	PM-132-01.5-02.0	PM-051-01.0-02.0	PM-051-01.0-02.0-D	PM-051-07.0-08.0	PM-056-01.0-02.0	PM-056-07.0-08.0	PM-057-10.0-11.0	PM-058-02.0-03.0	PM-058-07.0-08.0	PM-060-01.0-02.0	PM-060-07.0-08.0	PM-061-01.0-02.0	PM-061-07.0-08.0	PM-062-10.0-11.0
			Sample Date	09/18/2015	02/01/2016	09/23/2015	09/23/2015	09/23/2015	09/22/2015	09/22/2015	09/18/2015	02/24/2016	09/18/2015	09/22/2015	09/22/2015	09/21/2015	09/21/2015	09/22/2015
			Depth (ft bgs)	19–20	1.5–2	1–2	1–2	7–8	1–2	7–8	10–11	2–3	7–8	1–2	7–8	1–2	7–8	10–11
Analytes	CAS Number	Remedial Action Level	Units															
Dioxins/Furans by USEPA 1613B																		
2,3,7,8-TCDD	1746-01-6	--	pg/g	1.13	0.565 U	1.58 U	1.64 U	0.615 U	0.18 U	0.0498 U	5.39 U	0.418 U	1.1	0.287 U	0.0577 U	6.31 U	0.329 U	4.22 U
1,2,3,7,8-PeCDD	40321-76-4	--	pg/g	3.8	4.63 J	7.33	8.04	2.71	0.218 J	0.0896 U	6.62 J	0.462 J	5.73	0.812 U	0.145 U	41.3	1.09	14.7
1,2,3,4,7,8-HxCDD	39227-28-6	--	pg/g	4.21	6.07	10	11.6	3.46	0.184 J	0.104 U	4.33 J	0.522 J	3.04	0.74 J	0.165 U	82.5	0.914 J	21.4
1,2,3,6,7,8-HxCDD	57653-85-7	--	pg/g	24.1	26.9	78.6	91.2	22.8	0.517 U	0.179 U	33.8	2.96	31.6	3.44	0.143 U	633	2.66	210
1,2,3,7,8,9-HxCDD	19408-74-3	--	pg/g	13.4	10.9	28.7	32.8	12.4	0.497 U	0.179 U	22.5	1.63 U	17.7	1.64	0.0955 J	234	1.94	73.9
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	pg/g	855	755	2,730	3,370	898	19.6	7.03	1,140	107	1,040	98	1.48	25,200	53.6	7,950
OCDD	3268-87-9	--	pg/g	8,140 J	4,770 J	27,300 J	34,200 J	8,580 J	194 J	37.2 U	12,500	1,330 J	12,500 J	969 J	15.1 U	257,000 J	366 J	82,100 J
2,3,7,8-TCDF	51207-31-9	--	pg/g	0.103 J	0.498 J	0.337 U	0.318 U	0.341 U	0.0479 U	0.0438 U	0.474 U	0.241 J	0.087 U	0.603 U	0.0338 U	1.71 U	1.18	0.604 U
1,2,3,7,8-PeCDF	57117-41-6	--	pg/g	0.334 J	0.519 J	1.48 J	1.42 U	0.534 U	0.136 J	0.0618 U	0.68 U	0.118 U	0.461 J	0.511 J	0.0577 U	5.3 U	1.13 U	2.63 U
2,3,4,7,8-PeCDF	57117-31-4	--	pg/g	3.2	1.36	3.82 J	4.61 J	2.12 U	0.0798 U	0.0657 U	17.8 U	0.455 J	1.63 U	1.1 U	0.0577 J	22.8	1.18 U	10.2 U
1,2,3,4,7,8-HxCDF	70648-26-9	--	pg/g	15.2	3	19.8	24.6	5.24 U	0.214 J	0.106 J	6.62 J	0.952 U	6.61	2.36	0.0776 U	146	1.59	58.8
1,2,3,6,7,8-HxCDF	57117-44-9	--	pg/g	4.58	3.06	10.2	11.8	2.9 U	0.194 U	0.12 U	4.97 J	0.611 J	3.57	1.79 U	0.0716 U	56.7	1.23	20.9 U
1,2,3,7,8,9-HxCDF	72918-21-9	--	pg/g	0.962 J	2	4.2 U	4.42 J	1.94	0.0898 U	0.0996 U	3.56 J	2.21	5.88	0.521 J	0.185 J	15.5 U	0.367 J	7.08 U
2,3,4,6,7,8-HxCDF	60851-34-5	--	pg/g	5.77	5.63	16.9 U	20.2	4.59	0.383 U	0.0936 U	7.4 J	0.942 J	6.29	2.52	0.105 U	84.8	1.54	16.6 U
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	pg/g	282	284	920	1,250	345	6.75	1.69	346	37.2 J	341	105	0.384 J	6,850	30.9	2,310
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	pg/g	9.14	8.07	32.4	45.1	11.1	0.347 U	0.195 J	13.1	1.6 J	14.1	1.38	0.203 U	243	0.799 J	83.4
OCDF	39001-02-0	--	pg/g	977	1,070 J	3,360	4,570	960	33 J	4.38	1,200	130 J	931	121 J	1.33 U	30,500	58.7 J	10,600
Summed Dioxins/Furans TEQ[1,2]	--	100	pg/g	26.9 J	23.1 J	69.3 J	87.4 J	22.6 J	0.593 J	0.101 J	34 J	3.24 J	32.3 J	3.51 J	0.064 J	**581 J**	3.21 J	**182 J**
Summed Dioxins/Furans TEQ with One-half of the Detection Limit[1,3]	--	100	pg/g	26.9 J	23.4 J	71.1 J	88.2 J	23.7 J	0.784 J	0.228 J	39.4 J	3.58 J	32.5 J	4.34 J	0.199 J	**585 J**	3.57 J	**188 J**

Notes:

BOLD Detected concentration exceeds the cleanup level.

1 World Health Organization 2005 Toxic Equivalency Factors used for calculation of dioxins/furans TEQ (Van den Berg et al. 2006).

2 Calculated using detected dioxins/furans concentrations.

3 Calculated using detected dioxins/furans concentrations plus one-half the detection limit for dioxins/furans that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
ft bgs Feet below ground surface
HpCDD Heptachlorodibenzo-p-dioxin
HpCDF Heptachlorodibenzofuran
HxCDD Hexachlorodibenzo-p-dioxin
HxCDF Hexachlorodibenzofuran
OCDD Octachlorodibenzo-p-dioxin
OCDF Octachlorodibenzofuran
PeCDD Pentachlorodibenzo-p-dioxin
PeCDF Pentachlorodibenzofuran
pg/g Picograms per gram
TCDD Tetrachlorodibenzo-p-dioxin
TCDF Tetrachlorodibenzofuran
TEQ Toxicity equivalent
USEPA United States Environmental Protection Agency

Qualifiers:

J Analyte was detected; concentration is considered to be an estimate.
U Analyte was not detected; concentration given is the reporting limit.
UJ Analyte was not detected; concentration given is the reporting limit, which is considered to be an estimate.

Table C.2
Analytical Results for Dioxins/Furans

			Area	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A3
			Location	PM-062	PM-063	PM-063	PM-064	PM-064	PM-065	PM-065	PM-065	PM-070	PM-070	PM-075	PM-075	PM-082	PM-082	PM-088
			Sample ID	PM-062-11.0-12.0	PM-063-10.0-11.0	PM-063-11.0-12.0	PM-064-10.0-11.0	PM-064-11.0-12.0	PM-065-01.0-02.0	PM-065-07.0-08.0	PM-065-07.0-08.0-D	PM-070-01.0-02.0	PM-070-10.0-11.0	PM-075-01.0-02.0	PM-075-07.0-08.0	PM-082-01.0-02.0	PM-082-10.0-11.0	PM-088-01.0-02.0
			Sample Date	09/22/2015	09/18/2015	09/18/2015	09/18/2015	09/18/2015	09/18/2015	09/18/2015	09/18/2015	02/24/2016	09/22/2015	09/18/2015	09/18/2015	02/24/2016	09/22/2015	09/17/2015
			Depth (ft bgs)	11–12	10–11	11–12	10–11	11–12	1–2	7–8	7–8	1–2	10–11	1–2	7–8	1–2	10–11	1–2
Analytes	CAS Number	Remedial Action Level	Units															
Dioxins/Furans by USEPA 1613B																		
2,3,7,8-TCDD	1746-01-6	--	pg/g	2.13 U	2.69 U	1.77 U	12 U	3.94 U	0.464 U	0.0565 U	0.187 U	0.541 U	0.0439 U	2.53	0.084 U	0.249 U	0.169 U	0.0472 U
1,2,3,7,8-PeCDD	40321-76-4	--	pg/g	8.99	9.7	6.06	24.2	9.37 J	0.859 J	0.0651 U	0.0856 U	3.1	0.0957 J	23.7	0.164 J	0.73 J	0.117 U	0.0727 U
1,2,3,4,7,8-HxCDD	39227-28-6	--	pg/g	12.3	13.2	5.57	15.5	4.75 U	1.42	0.102 U	0.0615 U	5.09	0.0738 U	33.2	0.252 U	0.893 J	0.0995 J	0.0629 U
1,2,3,6,7,8-HxCDD	57653-85-7	--	pg/g	106	109	43.8	197	49.9	10.1	0.152 U	0.11 U	27.2	0.12 J	183	0.736 J	4.42	0.149 J	0.0668 U
1,2,3,7,8,9-HxCDD	19408-74-3	--	pg/g	38.5	44.7	27.7	142	36.2	4.55	0.178 U	0.105 U	14.1	0.211 U	94.3	0.512 U	2.13	0.213 U	0.124 U
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	pg/g	3,970	4,210	1,690	7,220	1,840	359	7.85	7.93	818	2.22	7,300	27.6	116	2.27	1.56 U
OCDD	3268-87-9	--	pg/g	43,400 J	43,600 J	17,100 J	100,000 J	33,500	3,590 J	4,050	4,530 J	8,220 J	22.8 U	67,000 J	490 J	1,260 J	22.8 UJ	19 UJ
2,3,7,8-TCDF	51207-31-9	--	pg/g	0.441 U	0.719 U	0.424 J	0.705 U	0.804 U	0.134 U	0.0369 U	0.0461 U	0.55 J	0.0299 U	0.421 U	0.0469 U	0.428 J	0.0318 U	0.0354 U
1,2,3,7,8-PeCDF	57117-41-6	--	pg/g	1.59 J	1.37 J	0.708 J	2.95 J	1.12 U	0.228 U	0.126 U	0.103 U	0.632 J	0.0359 U	1.9	0.0938 J	0.322 J	0.0378 U	0.055 U
2,3,4,7,8-PeCDF	57117-31-4	--	pg/g	6.04 U	4.75 J	2.93	5.2 J	1.18 U	0.512 J	0.0369 U	0.0483 J	1.82	0.0538 J	14.7	0.0879 U	0.758 J	0.0398 U	0.057 U
1,2,3,4,7,8-HxCDF	70648-26-9	--	pg/g	29.5	26.1	8.48	25.9	8.12 U	2.38	0.063 U	0.0812 U	6.52	0.0897 J	71.1	0.236 U	1.12	0.0438 U	0.0707 U
1,2,3,6,7,8-HxCDF	57117-44-9	--	pg/g	10.9	11.6 U	7.29	36.5	9.55 U	1.12 U	0.0825 U	0.0746 U	4.82	0.0778 U	23.7	0.113 U	0.646 J	0.0418 U	0.0668 U
1,2,3,7,8,9-HxCDF	72918-21-9	--	pg/g	4.41 U	3.2 J	5.08	10.5 U	6.98 U	0.188 U	0.135 U	0.0988 U	1.55	0.0917 J	5.88	0.0879 U	0.485 J	0.0677 J	0.0923 U
2,3,4,6,7,8-HxCDF	60851-34-5	--	pg/g	16.4	17.5	7.71	48.1	18.3	1.7	0.0847 U	0.0834 U	7.16	0.0538 U	32.3	0.0664 U	1.2	0.0358 U	0.0727 U
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	pg/g	1,180	1440	562	1,740	415	102	0.412 J	0.246 J	313 J	0.457 J	1,840	2.85	48.3	0.145 J	0.448 J
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	pg/g	39.3	42.5	18.9	83.9	32.8	3.14 J	0.0803 U	0.09 U	9.75	0.0798 U	62.4	0.209 J	1.32	0.0577 U	0.177 UJ
OCDF	39001-02-0	--	pg/g	4,710	4,760	1,690	7,770	1,660	395 J	3.79	3.69	915	2.03	7,090	12.8 J	140	0.796 UJ	1.75 UJ
Summed Dioxins/Furans TEQ[1,2]	--	100	pg/g	96.7 J	**104 J**	45.9 J	**195 J**	53.2 J	8.86 J	1.3 J	1.46 J	24.5 J	0.169 J	**189 J**	0.698 J	4.18 J	0.0558 J	0.0045 J
Summed Dioxins/Furans TEQ with One-half of the Detection Limit[1,3]	--	100	pg/g	98.9 J	**106 J**	46.8 J	**202 J**	56.9 J	9.17 J	1.41 J	1.63 J	24.8 J	0.218 J	**189 J**	0.819 J	4.3 J	0.227 J	0.115 J

Notes:

BOLD Detected concentration exceeds the cleanup level.
1 World Health Organization 2005 Toxic Equivalency Factors used for calculation of dioxins/furans TEQ (Van den Berg et al. 2006).
2 Calculated using detected dioxins/furans concentrations.
3 Calculated using detected dioxins/furans concentrations plus one-half the detection limit for dioxins/furans that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
ft bgs Feet below ground surface
HpCDD Heptachlorodibenzo-p-dioxin
HpCDF Heptachlorodibenzofuran
HxCDD Hexachlorodibenzo-p-dioxin
HxCDF Hexachlorodibenzofuran
OCDD Octachlorodibenzo-p-dioxin
OCDF Octachlorodibenzofuran
PeCDD Pentachlorodibenzo-p-dioxin
PeCDF Pentachlorodibenzofuran
pg/g Picograms per gram
TCDD Tetrachlorodibenzo-p-dioxin
TCDF Tetrachlorodibenzofuran
TEQ Toxicity equivalent
USEPA United States Environmental Protection Agency

Qualifiers:

J Analyte was detected; concentration is considered to be an estimate.
U Analyte was not detected; concentration given is the reporting limit.
UJ Analyte was not detected; concentration given is the reporting limit, which is considered to be an estimate.

Table C.2
Analytical Results for Dioxins/Furans

			Area	A3	A3	A3	A3	A3	A3	A3	A3	A3	A3	A3	A3	A3	A3	A3
			Location	PM-088	PM-091	PM-091	PM-096	PM-096	PM-097	PM-097	PM-101	PM-101	PM-103	PM-103	PM-107	PM-107	PM-111	PM-111
			Sample ID	PM-088-09.0-10.0	PM-091-01.0-02.0	PM-091-09.0-10.0	PM-096-01.0-02.0	PM-096-02.0-03.0	PM-097-01.0-02.0	PM-097-09.0-10.0	PM-101-01.0-02.0	PM-101-09.0-10.0	PM-103-01.0-02.0	PM-103-09.0-10.0	PM-107-09.0-10.0	PM-107-11.0-12.0	PM-111-01.0-02.0	PM-111-01.0-02.0-D
			Sample Date	09/17/2015	09/17/2015	09/17/2015	09/21/2015	11/23/2015	09/17/2015	09/17/2015	09/17/2015	09/17/2015	09/21/2015	09/21/2015	09/21/2015	09/21/2015	09/21/2015	09/21/2015
			Depth (ft bgs)	9–10	1–2	9–10	1–2	2–3	1–2	9–10	1–2	9–10	1–2	9–10	9–10	11–12	1–2	1–2
Analytes	CAS Number	Remedial Action Level	Units															
Dioxins/Furans by USEPA 1613B																		
2,3,7,8-TCDD	1746-01-6	--	pg/g	0.2 U	0.243 U	0.0499 U	51.4	0.851 J	0.626 U	0.0597 U	1.05	0.297 U	0.502 U	0.341 U	0.835 U	0.267 U	1.97	2.41 U
1,2,3,7,8-PeCDD	40321-76-4	--	pg/g	0.0958 UJ	1.02	0.361 J	363	6.52	2.85	0.121 U	5.49	3.26 J	4.06	1.63	4.6	0.895 J	11.8	10.9
1,2,3,4,7,8-HxCDD	39227-28-6	--	pg/g	0.144 U	1.16	0.251 U	251	7.44	4.27	0.123 U	6.61	4.69 J	5.95	3.02	8.2	1.36 U	13.1	11.8
1,2,3,6,7,8-HxCDD	57653-85-7	--	pg/g	0.321 U	4.62	0.317 U	1,220	29.5	16.4	0.273 J	38.2	22.3	24.1	10.3	41.6	5.36	61.7	61.8
1,2,3,7,8,9-HxCDD	19408-74-3	--	pg/g	0.234 U	3.05	0.526 J	710	19.4	11.7	0.304 U	20.7	14	15.7	7.78	20	3.18	34.3	32.9
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	pg/g	4.67 UJ	129	1.66 U	44,800 J	897	549	9.84 U	1,310	847	783	337	1,560	207	2,030	2,180
OCDD	3268-87-9	--	pg/g	34.4 UJ	1,150	17.2 U	427,000 J	7,510 J	5,100 J	641	13,000 J	8,290	7,440 J	2,840	14,700 J	1,930	20,300 J	23,500 J
2,3,7,8-TCDF	51207-31-9	--	pg/g	2.16	0.475 J	0.0479 U	7.77 U	1.18	0.576 J	0.0517 U	0.845 J	0.396 U	0.294 J	0.353 U	0.616 U	0.244 U	2.25	1.34 U
1,2,3,7,8-PeCDF	57117-41-6	--	pg/g	3.57 J	0.325 U	0.283 U	16.8	1.17 J	0.858 U	0.0736 U	1 J	0.812 U	0.525 J	0.335 J	0.675 J	0.263 U	1.49	1.51 J
2,3,4,7,8-PeCDF	57117-31-4	--	pg/g	1.41 J	1.83	0.179 U	39.8	4.08	2.02	0.0756 U	3.53	1.13 J	1.45	0.921 J	1.77	0.471 J	3.13	2.87 U
1,2,3,4,7,8-HxCDF	70648-26-9	--	pg/g	7.63	1.66	0.211 J	176 U	7.51	5.91	0.0995 U	14.5	4.61 J	5.3	2.73	8.63	1.35	11.1	11 U
1,2,3,6,7,8-HxCDF	57117-44-9	--	pg/g	1.97	2.36	0.156 U	109	6.56	3.6 J	0.0955 U	5.96	4.03 J	4.23 U	2.73	6.71	1.08	7.78	7.26 U
1,2,3,7,8,9-HxCDF	72918-21-9	--	pg/g	1.16 J	0.623 J	0.487 J	37.7	1.37 U	0.722 J	0.209 U	1.19	1.38 J	0.599 J	0.473 U	1.21	0.277 U	1.76 U	2.03 UJ
2,3,4,6,7,8-HxCDF	60851-34-5	--	pg/g	0.321 U	4.73	0.154 U	176	11.7	5.45	0.107 U	8.86	7.13	6.32	4.27	10.8	1.95	11.7	11.7
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	pg/g	4.18 J	42	0.413 U	10,300	298	165	1.28	391	234	220	118	440	57.5	537	582 J
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	pg/g	1.82 J	1.45 U	0.239 U	323	8.49	5.32 U	0.163 U	12.5	8.9	6.47 UJ	3.46	14	2.36	17.2 J	19.1 J
OCDF	39001-02-0	--	pg/g	9.75 UJ	128	1.27 U	31,200	789	535	7.03	1,580	725	661 J	263	1,310	167	1,750	2,020 J
Summed Dioxins/Furans TEQ[1,2]	--	100	pg/g	1.88 J	5.53 J	0.483 J	**1,370 J**	31.5 J	17.1 J	0.235 J	38.8 J	23 J	22.8 J	10.5 J	39.8 J	5.63 J	61.4 J	58.2 J
Summed Dioxins/Furans TEQ with One-half of the Detection Limit[1,3]	--	100	pg/g	2.11 J	5.66 J	0.6 J	**1,380 J**	31.6 J	17.5 J	0.437 J	38.8 J	23.2 J	23.3 J	10.7 J	40.3 J	5.86 J	61.5 J	60.9 J

Notes:

BOLD Detected concentration exceeds the cleanup level.

1 World Health Organization 2005 Toxic Equivalency Factors used for calculation of dioxins/furans TEQ (Van den Berg et al. 2006).

2 Calculated using detected dioxins/furans concentrations.

3 Calculated using detected dioxins/furans concentrations plus one-half the detection limit for dioxins/furans that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
ft bgs Feet below ground surface
HpCDD Heptachlorodibenzo-p-dioxin
HpCDF Heptachlorodibenzofuran
HxCDD Hexachlorodibenzo-p-dioxin
HxCDF Hexachlorodibenzofuran
OCDD Octachlorodibenzo-p-dioxin
OCDF Octachlorodibenzofuran
PeCDD Pentachlorodibenzo-p-dioxin
PeCDF Pentachlorodibenzofuran
pg/g Picograms per gram
TCDD Tetrachlorodibenzo-p-dioxin
TCDF Tetrachlorodibenzofuran
TEQ Toxicity equivalent
USEPA United States Environmental Protection Agency

Qualifiers:

J Analyte was detected; concentration is considered to be an estimate.
U Analyte was not detected; concentration given is the reporting limit.
UJ Analyte was not detected; concentration given is the reporting limit, which is considered to be an estimate.

Table C.2
Analytical Results for Dioxins/Furans

			Area	A3	A3	A3	A3	A3	A3	A3	A3	B1	B1	B1	B1	B1	B1	B1
			Location	PM-111	PM-111	PM-125	PM-125	PM-126	PM-127	PM-130	PM-131	PM-001	PM-005	PM-006	PM-006	PM-006	PM-006	PM-006
			Sample ID	PM-111-09.0-10.0	PM-111-11.0-12.0	PM-125-01.0-02.0	PM-125-09.0-10.0	PM-126-01.0-02.0	PM-127-01.0-02.0	PM-130-09.0-10.0	PM-131-04.0-06.0	PM-001-00.0-01.0	PM-005-00.0-01.0	PM-006-00.0-01.0	PM-006-01.0-02.0	PM-006-02.0-03.0	PM-006-03.0-04.0	PM-006-04.0-05.0
			Sample Date	09/21/2015	09/21/2015	02/01/2016	02/01/2016	02/01/2016	02/01/2016	02/01/2016	02/01/2016	09/24/2015	09/24/2015	09/24/2015	09/24/2015	02/01/2016	02/01/2016	02/01/2016
			Depth (ft bgs)	9–10	11–12	1–2	9–10	1–2	1–2	9–10	4–6	0–1	0–1	0–1	1–2	2–3	3–4	4–5
Analytes	CAS Number	Remedial Action Level	Units															
Dioxins/Furans by USEPA 1613B																		
2,3,7,8-TCDD	1746-01-6	--	pg/g	2.48 U	1.77	1.3 U	0.167 U	0.192 U	0.456 U	0.856 J	0.501 U	0.508 U	2.33	4.15 U	5.79 U	15.7	2.73	1.68 U
1,2,3,7,8-PeCDD	40321-76-4	--	pg/g	9.05	8.85	6.41	0.177 U	0.249 J	3.81	3.54	3.28	0.843 J	8.1	16.6	23.3 J	71.7	12.7 J	6.84
1,2,3,4,7,8-HxCDD	39227-28-6	--	pg/g	17.3	16.1	8.88	0.181 U	0.289 U	4.52	8.72	3.83	0.72 J	10.6	22.2	31.7	113	17.6	8.63
1,2,3,6,7,8-HxCDD	57653-85-7	--	pg/g	102	89.6	39.1	0.238 U	1.06	15.6	43.6	14.4	3.4	85.2	172	251	1,010	150	65.9
1,2,3,7,8,9-HxCDD	19408-74-3	--	pg/g	48.9	43.6	24.3	0.296 U	0.74 U	10.4	21	10.2	2.13	34.4	73.9	117	383	70.4	30.1
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	pg/g	4,100	3,660	1,300	6.93 U	25.6	350	1,750	483	117	3,040	6,430	9,270	35,700	6,890	2,960
OCDD	3268-87-9	--	pg/g	41,200 J	34,200	12,500 J	112 UJ	215 UJ	2,450 J	18,800 J	4,190 J	969 J	31,900 J	70,700 J	104,000 J	409,000 J	83,000 J	31,600 J
2,3,7,8-TCDF	51207-31-9	--	pg/g	1.34 U	0.998	2.1	0.0355 U	0.183 U	3.57	0.463 U	0.507 U	0.0833 U	1.45 U	1.19 J	1.52 U	3.19	1.11	0.894 J
1,2,3,7,8-PeCDF	57117-41-6	--	pg/g	1.33 U	1.18 U	2.01	0.0532 U	0.0962 J	2.88 J	0.48 U	0.505 J	0.179 J	1.17	3.24 J	3 J	8.09	1.91 J	1.19 J
2,3,4,7,8-PeCDF	57117-31-4	--	pg/g	4.5 J	4.96 J	7.12	0.0571 U	0.44 U	11.9	1.16	1.12	0.222 UJ	5.67	11.1	19.6 J	50	15	6.95
1,2,3,4,7,8-HxCDF	70648-26-9	--	pg/g	25.1	24.5	14.2	0.0808 U	0.361 U	5.5	7.3	3.42	0.419 U	24.5	52	81.7	266	49.1	20.9
1,2,3,6,7,8-HxCDF	57117-44-9	--	pg/g	15.2 U	14.7	11.9	0.0749 U	0.367 J	10.7	5.81	2.92	0.444 J	9.74	18.6 U	29.5	105	17.4 U	7.85
1,2,3,7,8,9-HxCDF	72918-21-9	--	pg/g	3.12 J	2.91	3.11	0.0926 U	0.122 U	2.32	2.22	0.971	0.488 J	5	6.38	10.4 J	32.4	11.2	5.34
2,3,4,6,7,8-HxCDF	60851-34-5	--	pg/g	25.1	22.7	21.2	0.0788 U	0.591 U	20.5	9.87	4.77	0.407 U	15.3	26	48.3	164	27	11.4
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	pg/g	1,130	920	460	0.711 UJ	9.12 J	145	463	146	23 J	1,060	1,950 J	3,230 J	12,700	2,080	781 J
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	pg/g	38.3	29.7	13.4	0.185 U	0.281 U	4.49	15.7	4.86	0.98 J	34.4	67 J	105 UJ	402	64.9	25.3 J
OCDF	39001-02-0	--	pg/g	3,660	2,800	1,610 J	4.41 UJ	21.9 J	341 J	1,630 J	472 J	86.5 J	4,290	9,040 J	11,900 J	90,100 J	9,730	3,430 J
Summed Dioxins/Furans TEQ[1,2]	--	100	pg/g	98.7 J	90.8 J	43.1 J	0.167 UJ	0.748 J	20.6 J	43 J	15.4 J	3.29 J	82.8 J	**164 J**	**246 J**	**948 J**	**171 J**	72.2 J
Summed Dioxins/Furans TEQ with One-half of the Detection Limit[1,3]	--	100	pg/g	**101 J**	90.8 J	43.7 J	0.292 UJ	1.06 J	20.8 J	43 J	15.7 J	3.63 J	82.9 J	**167 J**	**249 J**	**948 J**	**172 J**	73.1 J

Notes:

BOLD Detected concentration exceeds the cleanup level.
1 World Health Organization 2005 Toxic Equivalency Factors used for calculation of dioxins/furans TEQ (Van den Berg et al. 2006).
2 Calculated using detected dioxins/furans concentrations.
3 Calculated using detected dioxins/furans concentrations plus one-half the detection limit for dioxins/furans that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
ft bgs Feet below ground surface
HpCDD Heptachlorodibenzo-p-dioxin
HpCDF Heptachlorodibenzofuran
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HxCDF Hexachlorodibenzofuran
OCDD Octachlorodibenzo-p-dioxin
OCDF Octachlorodibenzofuran
PeCDD Pentachlorodibenzo-p-dioxin
PeCDF Pentachlorodibenzofuran
pg/g Picograms per gram
TCDD Tetrachlorodibenzo-p-dioxin
TCDF Tetrachlorodibenzofuran
TEQ Toxicity equivalent
USEPA United States Environmental Protection Agency

Qualifiers:

J Analyte was detected; concentration is considered to be an estimate.
U Analyte was not detected; concentration given is the reporting limit.
UJ Analyte was not detected; concentration given is the reporting limit, which is considered to be an estimate.

Table C.2
Analytical Results for Dioxins/Furans

			Area	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1
			Location	PM-007	PM-011	PM-012	PM-012	PM-013	PM-014	PM-014	PM-015	PM-018	PM-019	PM-019	PM-020	PM-020	PM-021	PM-025
			Sample ID	PM-007-00.0-01.0	PM-011-00.0-01.0	PM-012-00.0-01.0	PM-012-01.0-02.0	PM-013-00.0-01.0	PM-014-00.0-01.0	PM-014-00.0-01.0-D	PM-015-00.0-01.0	PM-018-00.0-01.0	PM-019-00.0-01.0	PM-019-01.0-02.0	PM-020-01.0-02.0	PM-020-01.0-02.0-D	PM-021-00.0-01.0	PM-025-00.0-01.0
			Sample Date	09/24/2015	09/24/2015	09/24/2015	09/24/2015	09/24/2015	09/24/2015	09/24/2015	09/24/2015	09/24/2015	09/24/2015	09/24/2015	09/24/2015	09/24/2015	09/24/2015	09/25/2015
			Depth (ft bgs)	0–1	0–1	0–1	1–2	0–1	0–1	0–1	0–1	0–1	0–1	1–2	1–2	1–2	0–1	0–1
Analytes	CAS Number	Remedial Action Level	Units															
Dioxins/Furans by USEPA 1613B																		
2,3,7,8-TCDD	1746-01-6	--	pg/g	0.418 U	0.764 U	8.91 U	16.3	0.182 U	0.556 U	0.517 U	0.0415 U	0.504 J	4.67	0.955 J	0.787 U	0.687 U	0.789 J	0.817 U
1,2,3,7,8-PeCDD	40321-76-4	--	pg/g	0.342 J	1.49	24.6	2.25	0.418 J	2.95	2.63	0.681 J	2.41	32	3.74	3.54	4.15	3.48	1.33
1,2,3,4,7,8-HxCDD	39227-28-6	--	pg/g	0.344 J	1.68 U	29	2.84	0.392 J	3.94	4.13	0.718 J	2.38	23.2	5.09	3.43	4.55	2.99	1.46
1,2,3,6,7,8-HxCDD	57653-85-7	--	pg/g	1.22	7.64	465	13.3	1.07	26.4	28.9	2.12	11.8	123	49.8	15.5	18.5	16.7	7.38
1,2,3,7,8,9-HxCDD	19408-74-3	--	pg/g	0.693 U	3.27	87.4	6.85	0.894 U	12.8	12.6	1.72	6.49	71.3	13.2	9.79	12.6	9.11	3.96
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	pg/g	36.3 J	225	18,200	411	22.4	847	977 J	27.1	403	4,090 J	1,950	516	602	534 J	233
OCDD	3268-87-9	--	pg/g	412 J	1,840 J	201,000 J	2,830	215 J	8,570 J	9,860 J	197 J	4,310 J	42,200 J	18,900 J	4,900 J	5,460 J	5,220 J	2,090
2,3,7,8-TCDF	51207-31-9	--	pg/g	0.221 J	1.78	1.19 J	1.74	0.163 U	0.377 U	0.232 J	0.413 J	0.276 U	1.06	0.816 U	0.304 J	0.301 J	0.276 J	0.398 U
1,2,3,7,8-PeCDF	57117-41-6	--	pg/g	0.197 UJ	1.04 J	4.2 J	1.21	0.271 J	0.47 J	0.362 U	0.326 U	0.386 U	2.13	0.878 U	0.451 J	0.453 J	0.429 J	0.404 J
2,3,4,7,8-PeCDF	57117-31-4	--	pg/g	0.166 J	1.66	6.44 U	2.12	0.29 J	1.96	2.03	0.582 J	1.33 U	5.27	3.81	1.63	2.08	1.42	1.15
1,2,3,4,7,8-HxCDF	70648-26-9	--	pg/g	0.318 J	3.17	46.6	3.14	0.353 U	8.35	8.53	0.483 J	2.89	17.3	9.64	4.18	4.74	3.96	2.04
1,2,3,6,7,8-HxCDF	57117-44-9	--	pg/g	0.225 J	1.5	20.8	1.76	0.32 J	3.2	3.01	0.457 U	1.68	11	4.78	2.4	2.74	2.1	1.2
1,2,3,7,8,9-HxCDF	72918-21-9	--	pg/g	0.109 UJ	1.23	13.8 U	0.382 J	0.3 U	0.863 U	0.745 U	0.168 U	0.68 U	4.05	2.13	0.654 U	0.821 J	0.692 J	0.349 U
2,3,4,6,7,8-HxCDF	60851-34-5	--	pg/g	0.322 U	2.57	40.8	2.8	0.392 U	5.02	4.6	0.773 J	2.43	16.6	8.97	3.71	4.18	2.96	1.99 U
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	pg/g	7.93 J	81.3	4,720	57.3	5.14	251	292 J	6.19	125	971 J	677	152	166	145 J	71.1
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	pg/g	0.449 J	5.76 J	183	2.87	0.549 J	8.56	9.06 J	0.342 U	3.97 J	31.5 J	22.6	4.85	5.8 U	4.58 J	2.48
OCDF	39001-02-0	--	pg/g	32.9 J	340 J	26,100	204	21.3 J	918 J	1,190 J	17.7 J	476 J	4,290 J	3,540	544	600	566 J	245
Summed Dioxins/Furans TEQ[1,2]	--	100	pg/g	1.2 J	7.91 J	**393 J**	28.1 J	1.04 J	23.4 J	25.5 J	1.88 J	12.4 J	**130 J**	48.4 J	16.3 J	19.1 J	17.2 J	7.06 J
Summed Dioxins/Furans TEQ with One-half of the Detection Limit[1,3]	--	100	pg/g	1.47 J	8.38 J	**399 J**	28.1 J	1.24 J	23.8 J	25.8 J	1.93 J	12.7 J	**130 J**	48.5 J	16.8 J	19.5 J	17.2 J	7.6 J

Notes:

BOLD Detected concentration exceeds the cleanup level.

1 World Health Organization 2005 Toxic Equivalency Factors used for calculation of dioxins/furans TEQ (Van den Berg et al. 2006).

2 Calculated using detected dioxins/furans concentrations.

3 Calculated using detected dioxins/furans concentrations plus one-half the detection limit for dioxins/furans that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
ft bgs Feet below ground surface
HpCDD Heptachlorodibenzo-p-dioxin
HpCDF Heptachlorodibenzofuran
HxCDD Hexachlorodibenzo-p-dioxin
HxCDF Hexachlorodibenzofuran
OCDD Octachlorodibenzo-p-dioxin
OCDF Octachlorodibenzofuran
PeCDD Pentachlorodibenzo-p-dioxin
PeCDF Pentachlorodibenzofuran
pg/g Picograms per gram
TCDD Tetrachlorodibenzo-p-dioxin
TCDF Tetrachlorodibenzofuran
TEQ Toxicity equivalent
USEPA United States Environmental Protection Agency

Qualifiers:

J Analyte was detected; concentration is considered to be an estimate.
U Analyte was not detected; concentration given is the reporting limit.
UJ Analyte was not detected; concentration given is the reporting limit, which is considered to be an estimate.

Table C.2
Analytical Results for Dioxins/Furans

Analytes	CAS Number	Remedial Action Level	Units															
			Area	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1
			Location	PM-026	PM-027	PM-028	PM-029	PM-035	PM-035	PM-035	PM-040	PM-041	PM-041	PM-045	PM-046	PM-046	PM-046	PM-047
			Sample ID	PM-026-00.0-01.0	PM-027-00.0-01.0	PM-028-00.0-01.0	PM-029-00.0-01.0	PM-035-00.0-01.0	PM-035-00.0-01.0-D	PM-035-02.0-03.0	PM-040-00.0-01.0	PM-041-00.0-01.0	PM-041-01.0-02.0	PM-045-00.0-01.0	PM-046-00.0-01.0	PM-046-01.0-02.0	PM-046-02.0-03.0	PM-047-00.0-01.0
			Sample Date	09/25/2015	09/25/2015	09/25/2015	09/24/2015	09/29/2015	09/29/2015	09/29/2015	11/23/2015	09/25/2015	09/25/2015	09/29/2015	11/23/2015	09/22/2015	09/22/2015	09/29/2015
			Depth (ft bgs)	0–1	0–1	0–1	0–1	0–1	0–1	2–3	0–1	0–1	1–2	0–1	0–1	1–2	2–3	0–1
Dioxins/Furans by USEPA 1613B																		
2,3,7,8-TCDD	1746-01-6	--	pg/g	1.88 U	0.184 U	0.908 J	0.98 J	0.586 U	0.614 U	0.183 U	0.572 U	2.86 U	0.695 U	1.51	4	3.1 U	0.753 U	4.97 U
1,2,3,7,8-PeCDD	40321-76-4	--	pg/g	3.54 J	0.385 J	4.95	9.83	4.17	4.64	0.43 J	3.03	9.36 J	3.29	13.2 J	23.6	17.1	3.24	21.2
1,2,3,4,7,8-HxCDD	39227-28-6	--	pg/g	3.8 J	0.367 J	5.63	8.98	5.51	5.67	0.432 J	2.86	12.5	4.05	15.7	33.5	22.1	4.74	30.4
1,2,3,6,7,8-HxCDD	57653-85-7	--	pg/g	27.7	1.25	28.7	47	36.8	40.4	1.91	11.3	112	29.1	92.7	268	209	64.4	307
1,2,3,7,8,9-HxCDD	19408-74-3	--	pg/g	12.2	0.983 U	15	26.4	14.5	16.4	1.1	7.7	40.3	12	48.6	98.5	74.1	14.2	95.3
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	pg/g	994	34.3	986	1,670	1,320	1,470	66.7	337	4,130	1,140	3,470	9,010	7,110	1,940	11,900
OCDD	3268-87-9	--	pg/g	11,900	320 J	9,180 J	17,100 J	13,100 J	14,300 J	647	3170 J	42,000 J	11,800 J	35,600 J	94,300 J	73,800 J	17,000 J	147,000 J
2,3,7,8-TCDF	51207-31-9	--	pg/g	0.479 U	0.0948 J	0.121 U	0.608 J	0.217 U	0.246 J	0.106 U	0.172 U	0.612 U	0.201 J	1 U	1.88	1.37 U	0.489	1.21 J
1,2,3,7,8-PeCDF	57117-41-6	--	pg/g	1.31 U	0.109 J	1 U	0.939 J	0.373 J	0.402 J	0.0729 U	0.275 U	1.91 J	0.433 J	1.83 UJ	3.12	2.31 U	0.578 J	3.77 J
2,3,4,7,8-PeCDF	57117-31-4	--	pg/g	3.84 J	0.156 J	2.66 U	3.08	0.762 U	0.914 J	0.236 J	0.471 U	4.82 J	1.06	10 J	17.4	12.2	3.23	16.5
1,2,3,4,7,8-HxCDF	70648-26-9	--	pg/g	17.5	0.31 U	5	6.51	3.56	3.94	0.374 U	1.98	24.7 U	4.58	27.9	78.6	59.3	13.1	77.5
1,2,3,6,7,8-HxCDF	57117-44-9	--	pg/g	4.62 U	0.253 J	4.2 U	4.9	3.04 U	3.29 U	0.313 J	1.4 U	11.4 U	3.45	12.9	31.7	24.7	6.44	31.4
1,2,3,7,8,9-HxCDF	72918-21-9	--	pg/g	1.59 J	0.0731 U	1.34	1.39 U	1.13 U	1.2 U	0.116 U	0.572 J	6.11 J	1.19 U	8.33	12.1 U	13.9 U	2.13	17
2,3,4,6,7,8-HxCDF	60851-34-5	--	pg/g	5.5 J	0.351 J	7.07	7.71	5.83	6.45	0.534 U	2.38	19.4	5.6	20.2	53	42.4	10.6	52.1
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	pg/g	331	9.06	297	399	355	416	19.6	108	1,580	313	1,130	3,300	2,840	914	4,040
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	pg/g	11.1 U	0.359 J	9.66	12.7 J	10.9	12.6	0.619 U	3.69 J	46	9.79	35.8	114	87.4 J	26.3	138
OCDF	39001-02-0	--	pg/g	1,690	29.5 J	1,000	1,680 J	1,390 J	1,510	65.6	332 J	5,830	1,030	4,160	12,300	10,400 J	4,140 J	14,300
Summed Dioxins/Furans TEQ[1,2]	--	100	pg/g	28.8 J	1.21 J	28.1 J	48.4 J	32 J	36 J	1.95 J	11.2 J	**102 J**	28 J	98.6 J	**246 J**	**190 J**	51 J	**297 J**
Summed Dioxins/Furans TEQ with One-half of the Detection Limit[1,3]	--	100	pg/g	30.1 J	1.37 J	28.7 J	48.5 J	32.6 J	36.5 J	2.11 J	11.7 J	**105 J**	28.4 J	98.7 J	**246 J**	**192 J**	51.4 J	**299 J**

Notes:

BOLD Detected concentration exceeds the cleanup level.

1 World Health Organization 2005 Toxic Equivalency Factors used for calculation of dioxins/furans TEQ (Van den Berg et al. 2006).

2 Calculated using detected dioxins/furans concentrations.

3 Calculated using detected dioxins/furans concentrations plus one-half the detection limit for dioxins/furans that were not detected.

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Table C.2
Analytical Results for Dioxins/Furans

Analytes	CAS Number	Remedial Action Level	Units															
Area				B1	B1	B1	B1	B1	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2
Location				PM-047	PM-052	PM-055	PM-133	PM-134	PM-030	PM-036	PM-036	PM-036	PM-036	PM-036	PM-037	PM-042	PM-043	PM-048
Sample ID				PM-047-01.0-02.0	PM-052-00.0-01.0	PM-055-01.0-02.0	PM-133-00.0-01.0	PM-134-00.0-01.0	PM-030-04.0-05.0	PM-036-02.0-03.0	PM-036-02.0-03.0-D	PM-036-04.0-05.0	PM-036-05.0-06.0	PM-036-06.0-07.0	PM-037-04.0-05.0	PM-042-02.0-03.0	PM-043-02.0-03.0	PM-048-00.0-01.0
Sample Date				09/29/2015	09/25/2015	09/25/2015	02/01/2016	02/01/2016	09/24/2015	09/25/2015	09/25/2015	11/23/2015	11/23/2015	02/01/2016	09/24/2015	09/25/2015	09/25/2015	11/23/2015
Depth (ft bgs)				1–2	0–1	1–2	0–1	0–1	4–5	2–3	2–3	4–5	5–6	6–7	4–5	2–3	2–3	0–1
Dioxins/Furans by USEPA 1613B																		
2,3,7,8-TCDD	1746-01-6	--	pg/g	0.614 J	1.09	1.63	0.0734 U	0.667 U	0.174 U	9.44 U	12.6	3.05	5.86	1.39	0.171 U	0.232 U	0.359 U	0.279 U
1,2,3,7,8-PeCDD	40321-76-4	--	pg/g	2.81	5.31	10.9	0.113 UJ	3.95 J	0.239 U	75.5	75.1	21.7	29.6	8.34	0.335 U	0.35 J	3.37	0.435 U
1,2,3,4,7,8-HxCDD	39227-28-6	--	pg/g	4.02	8.22	10.8	0.109 U	4.21	0.303 U	78.8	72	19.1	21.8	7.94	0.347 U	0.532 J	4.21	0.588 U
1,2,3,6,7,8-HxCDD	57653-85-7	--	pg/g	60.5	100	49.6	0.173 U	29.4	0.495 U	374	423	102	219	39.6	1.05	18.4	44.8	2.23
1,2,3,7,8,9-HxCDD	19408-74-3	--	pg/g	12.4	27.1	29.3	0.143 U	11.7	0.477 U	217	213	56	90.9	23.6	0.731 U	2.2	14.5	1.42
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	pg/g	1,750	3,430	1,450	3.84 U	938	7.91 U	13,600	17,200	3,350 J	7,430	1,350	33.9	508	1,640	69.3
OCDD	3268-87-9	--	pg/g	15,300 J	33,700	12,700 J	72 UJ	8,600 J	78.7 UJ	139,000 J	167,000 J	32,400 J	66,000 J	12,600 J	294	3,640	22,500 J	760 J
2,3,7,8-TCDF	51207-31-9	--	pg/g	0.269 U	0.287 J	1.3	0.0556 U	0.349 U	0.138 U	1.05 J	1.46 J	15.3	0.718 U	0.314 U	0.0374 U	0.0338 U	0.197 J	0.0981 J
1,2,3,7,8-PeCDF	57117-41-6	--	pg/g	0.697 J	1.29	1.08	0.125 U	0.522 J	0.183 U	3.56 U	4.11 J	1.59	1.96 U	0.742 J	0.0433 U	0.0854 J	0.273 J	0.14 U
2,3,4,7,8-PeCDF	57117-31-4	--	pg/g	2.57	5.79 J	4.83	0.0853 U	1.23	0.193 U	7.86 J	8.99 J	5.31 J	4.57	2.14	0.069 U	0.0636 U	1.4 J	0.26 U
1,2,3,4,7,8-HxCDF	70648-26-9	--	pg/g	12.2	21.7	14.9	0.0853 U	4.65	0.22 U	49.4	52.7	18	23.2	8.08	0.223 U	7.88	6.65	0.947 J
1,2,3,6,7,8-HxCDF	57117-44-9	--	pg/g	5.52	9.83	6.37	0.0794 U	2.89	0.22 U	31.1	33.4	12.3	16.2	5.98	0.166 U	1.9	4.29	0.358 U
1,2,3,7,8,9-HxCDF	72918-21-9	--	pg/g	3.85 U	6.78	1.5 U	0.131 J	2.22	0.56 U	11.7	14.3	7.66 J	5.84	3.16	0.144 U	1.24	5.71	0.302 U
2,3,4,6,7,8-HxCDF	60851-34-5	--	pg/g	10.4	16.4	9.25	0.0833 U	5.73	0.22 U	49.1	57.8	19.7	29.6	9.86	0.229 J	3.01 U	8.46	0.529 U
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	pg/g	947	1,300	403	0.685 U	363	1.8 U	3,710	3,980	1,060 J	1,920	452	8.41	376	777	17.8
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	pg/g	28 U	43 J	13.3 J	0.0952 U	10.3	0.183 U	102 U	117	31.1 J	65.7	13.1	0.347 J	25.2	15.1 J	0.804 UJ
OCDF	39001-02-0	--	pg/g	3,130	3,890	1,410	3.74 UJ	1,460 J	6.39 J	12,600	15,400	3,020 J	6,570	1,620 J	31.5	2,300	1,130	70.3 J
Summed Dioxins/Furans TEQ[1,2]	--	100	pg/g	47.2 J	86.2 J	49.1 J	0.0131 J	26.5 J	0.0019 J	**378 J**	**445 J**	**106 J**	**193 J**	42.6 J	0.652 J	14.4 J	44.1 J	1.59 J
Summed Dioxins/Furans TEQ with One-half of the Detection Limit[1,3]	--	100	pg/g	47.6 J	86.2 J	49.1 J	0.192 J	26.9 J	0.433 J	**383 J**	**445 J**	**106 J**	**193 J**	42.6 J	0.999 J	14.7 J	44.3 J	2.08 J

Notes:

BOLD Detected concentration exceeds the cleanup level.

1 World Health Organization 2005 Toxic Equivalency Factors used for calculation of dioxins/furans TEQ (Van den Berg et al. 2006).

2 Calculated using detected dioxins/furans concentrations.

3 Calculated using detected dioxins/furans concentrations plus one-half the detection limit for dioxins/furans that were not detected.

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Table C.2
Analytical Results for Dioxins/Furans

			Area	B2	B3	B3	B3	B3	B3	B3	B3	B3	B3	B4	B4	B4	B4	B4
			Location	PM-049	PM-078	PM-078	PM-078	PM-090	PM-100	PM-100	PM-100	PM-100	PM-119	PM-102	PM-102	PM-102	PM-102	PM-102
			Sample ID	PM-049-02.0-03.0	PM-078-01.0-02.0	PM-078-02.0-03.0	PM-078-07.0-08.0	PM-090-01.0-02.0	PM-100-01.0-02.0	PM-100-02.0-03.0	PM-100-03.0-04.0	PM-100-09.0-10.0	PM-119-01.0-02.0	PM-102-02.0-03.0	PM-102-04.0-05.0	PM-102-07.0-08.0	PM-102-08.0-09.0	PM-102-09.0-10.0
			Sample Date	09/29/2015	09/23/2015	11/23/2015	11/23/2015	09/23/2015	09/23/2015	09/23/2015	11/23/2015	11/23/2015	11/23/2015	09/23/2015	11/23/2015	11/23/2015	02/01/2016	02/01/2016
			Depth (ft bgs)	2–3	1–2	2–3	7–8	1–2	1–2	2–3	3–4	9–10	1–2	2–3	4–5	7–8	8–9	9–10
Analytes	**CAS Number**	**Remedial Action Level**	**Units**															
Dioxins/Furans by USEPA 1613B																		
2,3,7,8-TCDD	1746-01-6	--	pg/g	0.322 U	2.42	2.1	0.0629 U	0.701 U	7.58 UJ	13.2	5.3 U	0.332 U	0.216 U	11.5	3.97	40.8	0.612 U	0.369 U
1,2,3,7,8-PeCDD	40321-76-4	--	pg/g	0.32 U	18.6	16.7	0.847 J	3.29	41.6 J	97.4	40	0.757 J	0.521 J	43.7	27.3	205	1.05 UJ	0.725 J
1,2,3,4,7,8-HxCDD	39227-28-6	--	pg/g	0.324 U	29	26.2	0.672 J	4.94	85.2 J	186	71.5	1.01	0.627 U	53.2	38.7	308	1.89	2.15
1,2,3,6,7,8-HxCDD	57653-85-7	--	pg/g	1.28	168	139	4.54	26.2	608 J	1,320	409	3.26	3.34	477	287	2,360	8.11	6.54
1,2,3,7,8,9-HxCDD	19408-74-3	--	pg/g	0.747 J	76	89.9	2.44	14.3	244 J	516	204	2.48	1.6	177	115	953	11.4	31.9
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	pg/g	41	6,970	4,590	173	919	22,500 J	48,200	13,500	95.7	114	18,300	10,200	86,400	283	241
OCDD	3268-87-9	--	pg/g	409 J	61,400 J	48,500 J	1,660 J	9,580 J	225,000 J	451,000 J	132,000	992 J	1,110 J	208,000 J	119,000 J	906,000 J	5,070 J	3,660 J
2,3,7,8-TCDF	51207-31-9	--	pg/g	0.0751 U	0.952 J	0.978 J	0.0806 U	0.312 J	0.82 UJ	4.12 J	1.86 U	0.298 U	0.0455 U	1.13 J	2	39.1	0.94 J	0.186 U
1,2,3,7,8-PeCDF	57117-41-6	--	pg/g	0.132 J	1.68 J	2.18	0.0905 U	0.734 J	3.66 UJ	6.57 U	2.38 U	0.281 J	0.154 U	4.27 J	3.85 J	36.3	0.555 J	0.692 J
2,3,4,7,8-PeCDF	57117-31-4	--	pg/g	0.15 J	6.45	12.4	0.305 U	2.52 UJ	9.16 J	36	17.2	0.499 J	0.332 U	61	23.4	155	2.96	1.1
1,2,3,4,7,8-HxCDF	70648-26-9	--	pg/g	0.326 J	26.5	49.6	1.1	9.1 U	76.7 J	214	89.9	0.93 U	0.856 J	275	90	750	2.24	1.32
1,2,3,6,7,8-HxCDF	57117-44-9	--	pg/g	0.291 J	16.9	21.9	0.653 U	4.17 U	41.2 J	112	40.8	0.811 J	0.491 U	74	34.8	279	1.21	0.88 J
1,2,3,7,8,9-HxCDF	72918-21-9	--	pg/g	0.14 J	4.38	10.8	0.678 U	2.08	11.8 UJ	29	18.3	0.553 J	0.142 U	15.5	15.1	67.3	13.3	17.7
2,3,4,6,7,8-HxCDF	60851-34-5	--	pg/g	0.148 U	25.8	32.2	1.05	6.45	75.3 J	197	64.3 U	1.42 U	0.706 J	91.1	50.3	400	2.52	2.01
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	pg/g	11.4	1,450	1,430	61.6	297	5,440 J	12,900	3,820	25.2	35.7	5,870	3,020	27,400	70.8	59.9
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	pg/g	0.603 U	47.5	51.8	1.76 UJ	10.5 UJ	198 J	472	131	1.24	1.16 J	192	103	829	4.81	5.27
OCDF	39001-02-0	--	pg/g	41.5 J	5,180	4,970	240 J	925 J	23,300 J	47,500	13,800	74.7 J	114 J	23,700 J	11,400	106,000	333 J	213 J
Summed Dioxins/Furans TEQ[1,2]	--	100	pg/g	0.987 J	**162 J**	**136 J**	4.74 J	24.1 J	**513 J**	**1,140 J**	**347**	3.27 J	3.05 J	**503 J**	**274 J**	**2,260 J**	10.3 J	11.5 J
Summed Dioxins/Furans TEQ with One-half of the Detection Limit[1,3]	--	100	pg/g	1.34 J	**162 J**	**136 J**	4.9 J	25.5 J	**518 J**	**1,140 J**	**353**	3.57 J	3.27 J	**503 J**	**274 J**	**2,260 J**	11.1 J	11.7 J

Notes:

BOLD Detected concentration exceeds the cleanup level.

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U Analyte was not detected; concentration given is the reporting limit.
UJ Analyte was not detected; concentration given is the reporting limit, which is considered to be an estimate.

Table C.2
Analytical Results for Dioxins/Furans

			Area	B4	B4	B4	B4	B4	B4	B4	B4	B4	B4	B4	B4	B4	B4	B4
			Location	PM-104	PM-104	PM-104	PM-104	PM-105	PM-108	PM-108	PM-109	PM-109	PM-109	PM-112	PM-113	PM-114	PM-116	PM-128
			Sample ID	PM-104-02.0-03.0	PM-104-04.0-05.0	PM-104-05.0-06.0	PM-104-07.0-08.0	PM-105-02.0-03.0	PM-108-02.0-03.0	PM-108-04.0-05.0	PM-109-02.0-03.0	PM-109-09.0-10.0	PM-109-09.0-10.0-D	PM-112-02.0-03.0	PM-113-02.0-03.0	PM-114-09.0-10.0	PM-116-02.0-03.0	PM-128-02.0-03.0
			Sample Date	09/18/2015	11/23/2015	11/23/2015	11/23/2015	09/23/2015	09/17/2015	09/17/2015	09/17/2015	11/23/2015	11/23/2015	09/17/2015	09/17/2015	11/23/2015	09/17/2015	02/01/2016
			Depth (ft bgs)	2–3	4–5	5–6	7–8	2–3	2–3	4–5	2–3	9–10	9–10	2–3	2–3	9–10	2–3	2–3
Analytes	CAS Number	Remedial Action Level	Units															
Dioxins/Furans by USEPA 1613B																		
2,3,7,8-TCDD	1746-01-6	--	pg/g	2.35 U	30.7	5.56	4.24	0.276 U	6.72 UJ	0.359 U	2.77 U	1.32	1.36 U	0.0598 U	0.0798 U	0.195 U	0.484 U	1.19
1,2,3,7,8-PeCDD	40321-76-4	--	pg/g	10.4	264 J	33	2.28	0.634 J	38.8	1.26	11.6	6.49	7.16	0.166 J	0.0917 U	0.218 UJ	3.89	7.15
1,2,3,4,7,8-HxCDD	39227-28-6	--	pg/g	14.9	244	27.7	4.28	0.614 U	28.8 J	1.76	11.9	11.2	13	0.122 U	0.0977 U	0.157 U	4.29	8.97
1,2,3,6,7,8-HxCDD	57653-85-7	--	pg/g	138	977	163	19	2.22	159 J	7.17	67.6	60.3	72	0.361 U	0.108 U	0.669 U	26.9	52
1,2,3,7,8,9-HxCDD	19408-74-3	--	pg/g	47	712	89.6	10.4	1.46	105	4.05	38.1	29.8	33.3	0.361 U	0.171 J	0.471 J	14.2	27.3
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	pg/g	5170	28,100	5,590	673	80.5 J	5,450	259	2,900	2,100	2,620	10.1 U	2.84 U	15.8 J	1,000	1710
OCDD	3268-87-9	--	pg/g	69,800 J	263,000 J	58,700 J	6,110 J	1,190 J	50,200 J	2,440 J	27,200 J	21,200	26,400	83.1	23.8 U	161 J	9,850 J	16,700 J
2,3,7,8-TCDF	51207-31-9	--	pg/g	0.739 U	2.47 U	0.574 U	0.38	0.115 J	1.58 U	0.313 U	0.78 U	1.02	0.975 U	0.179 U	0.0379 U	0.0735 U	0.547 U	1.11
1,2,3,7,8-PeCDF	57117-41-6	--	pg/g	1.44 U	13.5 J	0.851 U	0.411	0.158 UJ	3.25 U	0.286 J	1.5 U	1.18	1.02 J	0.171 U	0.0658 U	0.109 UJ	0.633 J	0.95 J
2,3,4,7,8-PeCDF	57117-31-4	--	pg/g	7.34 U	83	19.1	0.93	0.259 J	12.6 U	0.768 J	4.28 J	1.93	1.81	0.201 U	0.0698 U	0.0636 U	2.02	3.08
1,2,3,4,7,8-HxCDF	70648-26-9	--	pg/g	37.4	404	89.3	2.57	0.494 U	58.8 J	1.77 U	17.8 J	8.29	9.3	0.207 J	0.0658 U	0.161 U	8.88 J	11.5
1,2,3,6,7,8-HxCDF	57117-44-9	--	pg/g	13 U	140	26	2.18	0.338 J	22.1 J	0.985 U	8.76 J	6.78	7.34	0.166 U	0.0638 U	0.111 U	3.86 J	6.09
1,2,3,7,8,9-HxCDF	72918-21-9	--	pg/g	3.62 U	31.5 J	7.65	0.743	0.96 U	6.9 J	0.457 U	1.2 U	2.68	2.55	0.146 U	0.0957 U	0.131 UJ	0.971 J	3.58
2,3,4,6,7,8-HxCDF	60851-34-5	--	pg/g	21.2	145	31.7	3.69	0.543 J	33.1 J	1.79	12.7	13.1	14.8	0.293 U	0.0718 U	0.181 U	5.75	9.65
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	pg/g	1,860	6,300	1,630	175	13.7 J	1,580	74.4	773	519	622	1.78	0.403 U	3.08 J	332	452
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	pg/g	49	228 J	51.9 J	5.56	0.616 UJ	54.3	2.68 J	25	17.4	21.4	0.185 J	0.134 U	0.238 UJ	10.6 U	14.4
OCDF	39001-02-0	--	pg/g	5,460	22,900	5,630	635	49.5 J	6,210	236 J	3,520	1,740	2,080	6.26	1.62 U	11.9 J	1,620	1,990 J
Summed Dioxins/Furans TEQ[1,2]	--	100	pg/g	**130 J**	**1,020 J**	**180 J**	21.7 J	2.49 J	**168 J**	7.14 J	74.8 J	55	64.1 J	0.233 J	0.0171 J	0.288 J	27.8 J	48.7 J
Summed Dioxins/Furans TEQ with One-half of the Detection Limit[1,3]	--	100	pg/g	**133 J**	**1,020 J**	**180 J**	21.7 J	2.74 J	**173 J**	7.5 J	76.3 J	55	64.9 J	0.428 J	0.162 J	0.581 J	28.1 J	48.7 J

Notes:

BOLD Detected concentration exceeds the cleanup level.

1 World Health Organization 2005 Toxic Equivalency Factors used for calculation of dioxins/furans TEQ (Van den Berg et al. 2006).

2 Calculated using detected dioxins/furans concentrations.

3 Calculated using detected dioxins/furans concentrations plus one-half the detection limit for dioxins/furans that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
ft bgs Feet below ground surface
HpCDD Heptachlorodibenzo-p-dioxin
HpCDF Heptachlorodibenzofuran
HxCDD Hexachlorodibenzo-p-dioxin
HxCDF Hexachlorodibenzofuran
OCDD Octachlorodibenzo-p-dioxin
OCDF Octachlorodibenzofuran
PeCDD Pentachlorodibenzo-p-dioxin
PeCDF Pentachlorodibenzofuran
pg/g Picograms per gram
TCDD Tetrachlorodibenzo-p-dioxin
TCDF Tetrachlorodibenzofuran
TEQ Toxicity equivalent
USEPA United States Environmental Protection Agency

Qualifiers:

J Analyte was detected; concentration is considered to be an estimate.
U Analyte was not detected; concentration given is the reporting limit.
UJ Analyte was not detected; concentration given is the reporting limit, which is considered to be an estimate.

Table C.2
Analytical Results for Dioxins/Furans

Analytes	CAS Number	Remedial Action Level	Units	B4	B4	B5	B5	B5	B5	B5
			Location	PM-128	PM-129	PM-067	PM-077	PM-079	PM-089	PM-089
			Sample ID	PM-128-02.0-03.0-D	PM-129-02.0-03.0	PM-067-01.0-02.0	PM-077-01.0-02.0	PM-079-01.0-02.0	PM-089-01.0-02.0	PM-089-02.0-03.0
			Sample Date	02/01/2016	02/01/2016	09/23/2015	09/23/2015	09/23/2015	09/23/2015	09/23/2015
			Depth (ft bgs)	2–3	2–3	1–2	1–2	1–2	1–2	2–3
Dioxins/Furans by USEPA 1613B										
2,3,7,8-TCDD	1746-01-6	--	pg/g	1.15	0.884 J	0.917 U	0.0358 U	0.145 U	4.03 U	0.0871 U
1,2,3,7,8-PeCDD	40321-76-4	--	pg/g	6.49	7.91	5.5	0.0557 U	0.251 U	25.1	1.15
1,2,3,4,7,8-HxCDD	39227-28-6	--	pg/g	8.99	11.1	6.1	0.0478 U	0.265 U	22.9	1.68
1,2,3,6,7,8-HxCDD	57653-85-7	--	pg/g	47.6	41.4	19.4	0.0517 U	0.724 J	117	4.24
1,2,3,7,8,9-HxCDD	19408-74-3	--	pg/g	24.8	22.6	16.4	0.151 U	0.677 J	69.7	3.52
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	pg/g	1,490	1,290	574	1.27	17.9	4,020	116
OCDD	3268-87-9	--	pg/g	14,800 J	9,930 J	5,520 J	12.6 U	150 J	38,600 J	914 J
2,3,7,8-TCDF	51207-31-9	--	pg/g	1.09	0.244 U	3.02	0.0259 U	0.0716 U	1.26 J	0.152 U
1,2,3,7,8-PeCDF	57117-41-6	--	pg/g	0.962 J	0.563 J	2.57	0.0358 U	0.0577 U	2.4 U	0.36 U
2,3,4,7,8-PeCDF	57117-31-4	--	pg/g	2.85	2.93	9.89	0.0358 U	0.217 J	4.73 J	0.707 U
1,2,3,4,7,8-HxCDF	70648-26-9	--	pg/g	9.93	13.1	5.69	0.0458 U	0.209 U	17	1.11
1,2,3,6,7,8-HxCDF	57117-44-9	--	pg/g	5.58	6.81	11.5	0.0378 J	0.203 J	13.1 U	1.22
1,2,3,7,8,9-HxCDF	72918-21-9	--	pg/g	3.53	2.83	2.31	0.0816 U	0.0637 U	3.98 U	0.263 J
2,3,4,6,7,8-HxCDF	60851-34-5	--	pg/g	8.28	9.16	20.4	0.0458 U	0.306 J	22.6 U	2.04
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	pg/g	393	336	137	0.213 U	5.45	1,080	41
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	pg/g	12.4	12.7	5.05	0.0617 U	0.191 U	35.2 U	1.09 J
OCDF	39001-02-0	--	pg/g	1,660 J	1,380 J	309	0.814 U	11.5 J	3,640	76.2 J
Summed Dioxins/Furans TEQ[1,2]	--	100	pg/g	43.4 J	40.2 J	25.9 J	0.0165 J	0.538 J	**113 J**	4.44 J
Summed Dioxins/Furans TEQ with One-half of the Detection Limit[1,3]	--	100	pg/g	43.4 J	40.2 J	26.4 J	0.094 J	0.768 J	**117 J**	4.6 J

Notes:

BOLD Detected concentration exceeds the cleanup level.
1 World Health Organization 2005 Toxic Equivalency Factors used for calculation of dioxins/furans TEQ (Van den Berg et al. 2006).
2 Calculated using detected dioxins/furans concentrations.
3 Calculated using detected dioxins/furans concentrations plus one-half the detection limit for dioxins/furans that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
ft bgs Feet below ground surface
HpCDD Heptachlorodibenzo-p-dioxin
HpCDF Heptachlorodibenzofuran
HxCDD Hexachlorodibenzo-p-dioxin
HxCDF Hexachlorodibenzofuran
OCDD Octachlorodibenzo-p-dioxin
OCDF Octachlorodibenzofuran
PeCDD Pentachlorodibenzo-p-dioxin
PeCDF Pentachlorodibenzofuran
pg/g Picograms per gram
TCDD Tetrachlorodibenzo-p-dioxin
TCDF Tetrachlorodibenzofuran
TEQ Toxicity equivalent
USEPA United States Environmental Protection Agency

Qualifiers:

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U Analyte was not detected; concentration given is the reporting limit.
UJ Analyte was not detected; concentration given is the reporting limit, which is considered to be an estimate.

Table C.3
Analytical Results for Carcinogenic Polycyclic Aromatic Hydrocarbons, Pentachlorophenol, Lead, and Total Petroleum Hydrocarbons

			Area	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
			Location	PM-071	PM-071	PM-072	PM-072	PM-072	PM-072	PM-073	PM-073	PM-073	PM-073	PM-073	PM-074	PM-074
			Sample ID	PM-071-19.0-20.0	PM-071-21.0-22.0	PM-072-19.0-20.0	PM-072-21.0-22.0	PM-072-23.0-24.0	PM-072-25.0-26.0	PM-073-19.0-20.0	PM-073-19.0-20.0-D	PM-073-21.0-22.0	PM-073-23.0-24.0	PM-073-25.0-26.0	PM-074-01.0-02.0	PM-074-10.0-11.0
			Sample Date	09/15/2015	09/15/2015	09/15/2015	09/15/2015	09/15/2015	09/15/2015	09/15/2015	09/15/2015	09/15/2015	09/15/2015	09/15/2015	09/17/2015	09/17/2015
			Depth (ft bgs)	19–20	21–22	19–20	21–22	23–24	25–26	19–20	19–20	21–22	23–24	25–26	1–2	10–11
Analytes	CAS Number	Cleanup Level	Units													
Metals by USEPA 6010																
Lead	7439-92-1	250	mg/kg			--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons by NWTPH-Dx/Gx																
Diesel Range Hydrocarbons	68334-30-5	--	mg/kg	5.7 U	5.9 U	89	33	--	--	72	78	75	12	6.4	28	5.6 U
Oil Range Hydrocarbons	--	--	mg/kg	11 U	12 U	150	43	--	--	100	110	100	15	12 U	110	11 U
Sum of Diesel and Oil Range Hydrocarbons	--	2,000	mg/kg	11 U	12 U	240	76	--	--	170	190	180	27	6.4	140	11 U
Gasoline Range Hydrocarbons	86290-81-5	100	mg/kg	7.8	15	**150**	**140**	6.5 U	7.4 U	**410**	**320**	**1,300**	9.2	6.9 U	8.6 U	5.5 U
Semivolatile Organic Compounds by USEPA 8041																
Pentachlorophenol	87-86-5	2,500	µg/kg			180	400 J	--	--	170 J	160	140	--	--	250 J	99
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) by USEPA 8270D																
Benzo(a)anthracene	56-55-3	--	µg/kg	4.7 U	4.9 UJ	11	3.8 JQ	--	--	6.4	6.3	6	--	--	21 J	4.6 UJ
Chrysene	218-01-9	--	µg/kg	4.7 U	4.9 UJ	14	6.3	--	--	7.7	7.3	8.2	--	--	40 J	4.6 UJ
Total Benzofluoranthenes	--	--	µg/kg	4.7 U	4.9 UJ	16	7.6	--	--	9.8	8	7.1	--	--	70 J	4.6 UJ
Benzo(a)pyrene	50-32-8	--	µg/kg	4.7 U	4.9 UJ	7.9	3.3 JQ	--	--	3.8 JQ	3.7 JQ	4.3 JQ	--	--	27 J	4.6 UJ
Indeno(1,2,3-cd)pyrene	193-39-5	--	µg/kg	4.7 U	4.9 UJ	4.4 JQ	4.9 U	--	--	4.6 U	4.6 U	5 U	--	--	22 J	4.6 UJ
Dibenz(a,h)anthracene	53-70-3	--	µg/kg	4.7 U	4.9 UJ	4.9 U	4.9 U	--	--	4.6 U	4.6 U	5 U	--	--	6.8 J	4.6 UJ
Summed cPAH TEQ[1,2]	--	137	µg/kg	4.7 U	4.9 UJ	11 J	4.5 J	--	--	5.5 J	5.2 J	5.7 J	--	--	39 J	4.6 UJ
Summed cPAH TEQ with One-half of the Reporting Limit[1,3]	--	137	µg/kg	3.3 U	3.5 UJ	11 J	5 J	--	--	6 J	5.7 J	6.2 J	--	--	39 J	3.2 UJ

Notes:

BOLD Detected concentration exceeds the cleanup level.
-- Indicates not applicable or not available.
1 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Washington Administrative Code, 173-340-900, Table 708-2.
2 Calculated using detected cPAH concentrations.
3 Calculated using detected cPAH concentrations plus one-half the reporting limit for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbons
ft bgs Feet below ground surface
µg/kg Micrograms per kilogram
mg/kg Milligrams per kilogram
TEQ Toxicity equivalent
USEPA United States Environmental Protection Agency

Qualifiers:

J Analyte was detected; concentration is considered to be an estimate.
JQ Analyte was detected between the method detection limit and reporting limit; concentration is considered to be an estimate.
U Analyte was not detected; concentration given is the reporting limit.
UJ Analyte was not detected; concentration given is the reporting limit, which is considered to be an estimate.

Table C.3
Analytical Results for Carcinogenic Polycyclic Aromatic Hydrocarbons, Pentachlorophenol, Lead, and Total Petroleum Hydrocarbons

			Area	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
			Location	PM-074	PM-084	PM-084	PM-085	PM-085	PM-085	PM-085	PM-085	PM-085	PM-086	PM-086	PM-086	PM-087
			Sample ID	PM-074-19.0-20.0	PM-084-19.0-20.0	PM-084-21.0-22.0	PM-085-01.0-02.0	PM-085-10.0-11.0	PM-085-19.0-20.0	PM-085-21.0-22.0	PM-085-25.0-26.0	PM-085-27.0-28.0	PM-086 19.0-20.0	PM-086 19.0-20.0-D	PM-086 21.0-22.0	PM-087-01.0-02.0
			Sample Date	09/17/2015	09/16/2015	09/16/2015	09/23/2015	09/23/2015	09/23/2015	09/23/2015	09/23/2015	09/23/2015	09/16/2015	09/16/2015	09/16/2015	09/22/2015
			Depth (ft bgs)	19–20	19–20	21–22	1–2	10–11	19–20	21–22	25–26	27–28	19–20	19–20	21–22	1–2
Analytes	CAS Number	Cleanup Level	Units													
Metals by USEPA 6010																
Lead	7439-92-1	250	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons by NWTPH-Dx/Gx																
Diesel Range Hydrocarbons	68334-30-5	--	mg/kg	5.6 U	5.8 U	5.4 U	80	12	50	38	47	--	6.1 U	6.2 U	6 U	5.6
Oil Range Hydrocarbons	--	--	mg/kg	11 U	12 U	11 U	270	63	79	62	58	--	12 U	12 U	12 U	11
Sum of Diesel and Oil Range Hydrocarbons	--	2,000	mg/kg	11 U	12 U	11 U	350	75	130	100	110	--	12 U	12 U	12 U	17
Gasoline Range Hydrocarbons	86290-81-5	100	mg/kg	6.2 U	7.5 U	10 U	5.9 U	6.4 U	**150**	**110**	**140**	**110**	6.9 U	8.7 U	14	5.7
Semivolatile Organic Compounds by USEPA 8041																
Pentachlorophenol	87-86-5	2,500	µg/kg	12	150	130	660	76	40	59	--	--	14	14	10	--
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) by USEPA 8270D																
Benzo(a)anthracene	56-55-3	--	µg/kg	4.7 UJ	4.9 U	5 U	89	4.7 U	8.8	7.2	--	--	4.7 U	4.8 U	4.7 U	4.8 U
Chrysene	218-01-9	--	µg/kg	4.7 UJ	4.9 U	5 U	110	6.8	8.2	9	--	--	4.7 U	2.6 JQ	4.7 U	4.8 U
Total Benzofluoranthenes	--	--	µg/kg	4.7 UJ	4.9 U	5 U	180	11	10	10	--	--	4.7 U	4.8 U	4.7 U	5.9
Benzo(a)pyrene	50-32-8	--	µg/kg	4.7 UJ	4.9 U	5 U	91	3.4 JQ	5.2	4.4 JQ	--	--	4.7 U	4.8 U	4.7 U	2.6 JQ
Indeno(1,2,3-cd)pyrene	193-39-5	--	µg/kg	4.7 UJ	4.9 U	5 U	53	7.4	3.2 JQ	4.8 U	--	--	4.7 U	4.8 U	4.7 U	4.8 U
Dibenz(a,h)anthracene	53-70-3	--	µg/kg	4.7 UJ	4.9 U	5 U	18	4.7 U	4.8 U	4.8 U	--	--	4.7 U	4.8 U	4.7 U	4.8 U
Summed cPAH TEQ[1,2]	--	137	µg/kg	4.7 UJ	4.9 U	5 U	130	5.3 J	7.5 J	6.2 J	--	--	4.7 U	0.026 J	4.7 U	3.2 J
Summed cPAH TEQ with One-half of the Reporting Limit[1,3]	--	137	µg/kg	3.3 UJ	3.5 U	3.5 U	130	5.8 J	7.7 J	6.7 J	--	--	3.3 U	3.4 J	3.3 U	3.9 J

Notes:

BOLD Detected concentration exceeds the cleanup level.
-- Indicates not applicable or not available.
1 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Washington Administrative Code, 173-340-900, Table 708-2.
2 Calculated using detected cPAH concentrations.
3 Calculated using detected cPAH concentrations plus one-half the reporting limit for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbons
ft bgs Feet below ground surface
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mg/kg Milligrams per kilogram
TEQ Toxicity equivalent
USEPA United States Environmental Protection Agency

Qualifiers:

J Analyte was detected; concentration is considered to be an estimate.
JQ Analyte was detected between the method detection limit and reporting limit; concentration is considered to be an estimate.
U Analyte was not detected; concentration given is the reporting limit.
UJ Analyte was not detected; concentration given is the reporting limit, which is considered to be an estimate.

Table C.3
Analytical Results for Carcinogenic Polycyclic Aromatic Hydrocarbons, Pentachlorophenol, Lead, and Total Petroleum Hydrocarbons

			Area	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2
			Location	PM-087	PM-087	PM-094	PM-094	PM-094	PM-094	PM-095	PM-095	PM-095	PM-098	PM-051	PM-051	PM-057
			Sample ID	PM-087-10.0-11.0	PM-087-19.0-20.0	PM-094-19.0-20.0	PM-094-21.0-22.0	PM-094-23.0-24.0	PM-094-25.0-26.0	PM-095-01.0-02.0	PM-095-10.0-11.0	PM-095-19.0-20.0	PM-098-19.0-20.0	PM-051-12.0-13.0	PM-051-14.0-15.0	PM-057-11.0-12.0
			Sample Date	09/22/2015	09/22/2015	09/16/2015	09/16/2015	09/16/2015	09/16/2015	09/16/2015	09/16/2015	09/16/2015	09/18/2015	09/23/2015	09/23/2015	09/18/2015
			Depth (ft bgs)	10–11	19–20	19–20	21–22	23–24	25–26	1–2	10–11	19–20	19–20	12–13	14–15	11–12
Analytes	CAS Number	Cleanup Level	Units													
Metals by USEPA 6010																
Lead	7439-92-1	250	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons by NWTPH-Dx/Gx																
Diesel Range Hydrocarbons	68334-30-5	--	mg/kg	5.3 U	5.7 U	54	11	--	--	89	9.7	5.4 U	--	--	--	79
Oil Range Hydrocarbons	--	--	mg/kg	11 U	11 U	81	14	--	--	750	66	11 U	--	--	--	78
Sum of Diesel and Oil Range Hydrocarbons	--	2,000	mg/kg	11 U	11 U	140	25	--	--	840	76	11 U	--	--	--	160
Gasoline Range Hydrocarbons	86290-81-5	100	mg/kg	7	6.2 U	**110**	57	5.6 U	9.8 U	4.7 U	8.4 U	4.6 U	11 U	5.7 U	5.6 U	**270**
Semivolatile Organic Compounds by USEPA 8041																
Pentachlorophenol	87-86-5	2,500	µg/kg	--	--	--	--	--	--	8.4 J	6.8 U	15	--	--	--	--
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) by USEPA 8270D																
Benzo(a)anthracene	56-55-3	--	µg/kg	4.8 U	4.7 U	12	4.5 JQ	--	--	14	5.8	5 U	--	--	--	--
Chrysene	218-01-9	--	µg/kg	4.8 U	4.7 U	15	6	--	--	67	12	5 U	--	--	--	--
Total Benzofluoranthenes	--	--	µg/kg	4.8 U	4.7 U	15	6.9	--	--	43	13	5 U	--	--	--	--
Benzo(a)pyrene	50-32-8	--	µg/kg	4.8 U	4.7 U	7.4	3.3 JQ	--	--	17	6.3	5 U	--	--	--	--
Indeno(1,2,3-cd)pyrene	193-39-5	--	µg/kg	4.8 U	4.7 U	3.9 JQ	4.9 U	--	--	12	5	5 U	--	--	--	--
Dibenz(a,h)anthracene	53-70-3	--	µg/kg	4.8 U	4.7 U	5 U	4.9 U	--	--	6.3	4.9 U	5 U	--	--	--	--
Summed cPAH TEQ[1,2]	--	137	µg/kg	4.8 U	4.7 U	11 J	4.5 J	--	--	25	8.8	5 U	--	--	--	--
Summed cPAH TEQ with One-half of the Reporting Limit[1,3]	--	137	µg/kg	3.4 U	3.3 U	11 J	5 J	--	--	25	9	3.5 U	--	--	--	--

Notes:
BOLD Detected concentration exceeds the cleanup level.
-- Indicates not applicable or not available.
1 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Washington Administrative Code, 173-340-900, Table 708-2.
2 Calculated using detected cPAH concentrations.
3 Calculated using detected cPAH concentrations plus one-half the reporting limit for cPAHs that were not detected.

Abbreviations:
CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbons
ft bgs Feet below ground surface
µg/kg Micrograms per kilogram
mg/kg Milligrams per kilogram
TEQ Toxicity equivalent
USEPA United States Environmental Protection Agency

Qualifiers:
J Analyte was detected; concentration is considered to be an estimate.
JQ Analyte was detected between the method detection limit and reporting limit; concentration is considered to be an estimate.
U Analyte was not detected; concentration given is the reporting limit.
UJ Analyte was not detected; concentration given is the reporting limit, which is considered to be an estimate.

Table C.3
Analytical Results for Carcinogenic Polycyclic Aromatic Hydrocarbons, Pentachlorophenol, Lead, and Total Petroleum Hydrocarbons

			Area	A2	A2	A2	A2	A2	A2	A2	A2	A3	A3	A3	A3	A3
			Location	PM-057	PM-057	PM-061	PM-061	PM-061	PM-063	PM-064A	PM-070	PM-091	PM-091	PM-097	PM-097	PM-101
			Sample ID	PM-057-12.0-13.0	PM-057-14.0-15.0	PM-061-01.0-02.0	PM-061-01.0-02.0-D	PM-061-07.0-08.0	PM-063-19.0-20.0	PM-064A-19.0-20.0	PM-070-10.0-11.0	PM-091-01.0-02.0	PM-091-09.0-10.0	PM-097-01.0-02.0	PM-097-09.0-10.0	PM-101-01.0-02.0
			Sample Date	09/18/2015	09/18/2015	09/21/2015	09/21/2015	09/21/2015	09/18/2015	09/21/2015	09/22/2015	09/17/2015	09/17/2015	09/17/2015	09/17/2015	09/17/2015
			Depth (ft bgs)	12–13	14–15	1–2	1–2	7–8	19–20	19–20	10–11	1–2	9–10	1–2	9–10	1–2
Analytes	**CAS Number**	**Cleanup Level**	**Units**													
Metals by USEPA 6010																
Lead	7439-92-1	250	mg/kg	--	--	--	--	--	--	--	--	24	1.78 JQ	72	--	**340**
Total Petroleum Hydrocarbons by NWTPH-Dx/Gx																
Diesel Range Hydrocarbons	68334-30-5	--	mg/kg	--	--	--	--	--	60	--	--	--	--	--	--	--
Oil Range Hydrocarbons	--	--	mg/kg	--	--	--	--	--	120	--	--	--	--	--	--	--
Sum of Diesel and Oil Range Hydrocarbons	--	2,000	mg/kg	--	--	--	--	--	180	--	--	--	--	--	--	--
Gasoline Range Hydrocarbons	86290-81-5	100	mg/kg	**620**	7.1 U	--	--	--	**230**	15	--	--	--	--	--	--
Semivolatile Organic Compounds by USEPA 8041																
Pentachlorophenol	87-86-5	2,500	µg/kg	--	--	360	260	7 U	--	--	6.6 U	4.1 JQ	7.5 J	--	--	12 J
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) by USEPA 8270D																
Benzo(a)anthracene	56-55-3	--	µg/kg	--	--	--	--	--	--	--	--	4.8 U	4.8 UJ	2.6 JQ	5 UJ	4.8 U
Chrysene	218-01-9	--	µg/kg	--	--	--	--	--	--	--	--	5	4.8 UJ	5 UJ	5 UJ	4.8 U
Total Benzofluoranthenes	--	--	µg/kg	--	--	--	--	--	--	--	--	8.2	4.8 UJ	5.6 J	5 UJ	5.5
Benzo(a)pyrene	50-32-8	--	µg/kg	--	--	--	--	--	--	--	--	2.7 JQ	4.8 UJ	2.5 JQ	5 UJ	4.8 U
Indeno(1,2,3-cd)pyrene	193-39-5	--	µg/kg	--	--	--	--	--	--	--	--	3.1 JQ	4.8 UJ	5 UJ	5 UJ	4.8 U
Dibenz(a,h)anthracene	53-70-3	--	µg/kg	--	--	--	--	--	--	--	--	4.8 U	4.8 UJ	5 UJ	5 UJ	4.8 U
Summed cPAH TEQ[1,2]	--	137	µg/kg	--	--	--	--	--	--	--	--	3.9 J	4.8 UJ	3.3 J	5 UJ	0.55
Summed cPAH TEQ with One-half of the Reporting Limit[1,3]	--	137	µg/kg	--	--	--	--	--	--	--	--	4.4 J	3.4 UJ	3.8 J	3.5 UJ	3.7

Notes:
BOLD Detected concentration exceeds the cleanup level.
-- Indicates not applicable or not available.
1 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Washington Administrative Code, 173-340-900, Table 708-2.
2 Calculated using detected cPAH concentrations.
3 Calculated using detected cPAH concentrations plus one-half the reporting limit for cPAHs that were not detected.

Abbreviations:
CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbons
ft bgs Feet below ground surface
µg/kg Micrograms per kilogram
mg/kg Milligrams per kilogram
TEQ Toxicity equivalent
USEPA United States Environmental Protection Agency

Qualifiers:
J Analyte was detected; concentration is considered to be an estimate.
JQ Analyte was detected between the method detection limit and reporting limit; concentration is considered to be an estimate.
U Analyte was not detected; concentration given is the reporting limit.
UJ Analyte was not detected; concentration given is the reporting limit, which is considered to be an estimate.

Table C.3
Analytical Results for Carcinogenic Polycyclic Aromatic Hydrocarbons, Pentachlorophenol, Lead, and Total Petroleum Hydrocarbons

			Area	**A3**	**A3**	**A3**	**A3**	**A3**	**A3**	**A3**	**A3**	**A3**	**A3**	**A3**	**A3**	**A3**
			Location	**PM-101**	**PM-101**	**PM-101**	**PM-103**	**PM-103**	**PM-107**	**PM-111**	**PM-111**	**PM-120**	**PM-121**	**PM-121**	**PM-121**	**PM-121**
			Sample ID	**PM-101-02.0-03.0**	**PM-101-09.0-10.0**	**PM-101-09.0-10.0-D**	**PM-103-01.0-02.0**	**PM-103-09.0-10.0**	**PM-107-01.0-02.0**	**PM-111-01.0-02.0**	**PM-111-09.0-10.0**	**PM-120-01.0-02.0**	**PM-121-01.0-02.0**	**PM-121-01.0-02.0-D**	**PM-121-02.0-03.0**	**PM-121-04.0-05.0**
			Sample Date	**02/01/2016**	**09/17/2015**	**09/17/2015**	**09/21/2015**	**09/21/2015**	**09/21/2015**	**09/21/2015**	**09/21/2015**	**02/01/2016**	**02/01/2016**	**02/01/2016**	**02/24/2016**	**02/01/2016**
			Depth (ft bgs)	**2–3**	**9–10**	**9–10**	**1–2**	**9–10**	**1–2**	**1–2**	**9–10**	**1–2**	**1–2**	**1–2**	**2–3**	**4–5**
Analytes	**CAS Number**	**Cleanup Level**	**Units**													
Metals by USEPA 6010																
Lead	7439-92-1	250	mg/kg	53 J	26	17	--	--	26	31 J	39 J	11 J	**768 J**	93 J	56	13
Total Petroleum Hydrocarbons by NWTPH-Dx/Gx																
Diesel Range Hydrocarbons	68334-30-5	--	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
Oil Range Hydrocarbons	--	--	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
Sum of Diesel and Oil Range Hydrocarbons	--	2,000	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
Gasoline Range Hydrocarbons	86290-81-5	100	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds by USEPA 8041																
Pentachlorophenol	87-86-5	2,500	µg/kg	--	6.5 JQ	--	7.3	4.2 JQ	--	28 J	41	--	--	--	--	--
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) by USEPA 8270D																
Benzo(a)anthracene	56-55-3	--	µg/kg	--	4.6 UJ	--	48	2.9 JQ	--	11	4.7 JQ	--	--	--	--	--
Chrysene	218-01-9	--	µg/kg	--	4.6 UJ	--	150	3.9 JQ	--	16	12	--	--	--	--	--
Total Benzofluoranthenes	--	--	µg/kg	--	4.6 UJ	--	80	7.3	--	26	15	--	--	--	--	--
Benzo(a)pyrene	50-32-8	--	µg/kg	--	4.6 UJ	--	24 JQ	3.5 JQ	--	11	5.9	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	193-39-5	--	µg/kg	--	4.6 UJ	--	29 U	4.8 U	--	9.2	5.6	--	--	--	--	--
Dibenz(a,h)anthracene	53-70-3	--	µg/kg	--	4.6 UJ	--	15 JQ	4.8 U	--	3.5 JQ	2.8 JQ	--	--	--	--	--
Summed cPAH TEQ[1,2]	--	137	µg/kg	--	4.6 UJ	--	40 J	4.6 J	--	16 J	8.8 J	--	--	--	--	--
Summed cPAH TEQ with One-half of the Reporting Limit[1,3]	--	137	µg/kg	--	3.2 UJ	--	41 J	5 J	--	16 J	8.8 J	--	--	--	--	--

Notes:
BOLD Detected concentration exceeds the cleanup level.
-- Indicates not applicable or not available.
1 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Washington Administrative Code, 173-340-900, Table 708-2.
2 Calculated using detected cPAH concentrations.
3 Calculated using detected cPAH concentrations plus one-half the reporting limit for cPAHs that were not detected.

Abbreviations:
CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbons
ft bgs Feet below ground surface
µg/kg Micrograms per kilogram
mg/kg Milligrams per kilogram
TEQ Toxicity equivalent
USEPA United States Environmental Protection Agency

Qualifiers:
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Table C.3
Analytical Results for Carcinogenic Polycyclic Aromatic Hydrocarbons, Pentachlorophenol, Lead, and Total Petroleum Hydrocarbons

			Area	A3	A3	A3	A3	A3	B2	B2	B2	B2	B2
			Location	PM-122	PM-123	PM-123	PM-123	PM-124	PM-030	PM-036	PM-036	PM-037	PM-042
			Sample ID	PM-122-01.0-02.0	PM-123-01.0-02.0	PM-123-02.0-03.0	PM-123-04.0-05.0	PM-124-01.0-02.0	PM-030-04.0-05.0	PM-036-02.0-03.0	PM-036-02.0-03.0-D	PM-037-04.0-05.0	PM-042-02.0-03.0
			Sample Date	02/01/2016	02/01/2016	02/24/2016	02/24/2016	02/01/2016	09/24/2015	09/25/2015	09/25/2015	09/24/2015	09/25/2015
			Depth (ft bgs)	1–2	1–2	2–3	4–5	1–2	4–5	2–3	2–3	4–5	2–3
Analytes	**CAS Number**	**Cleanup Level**	**Units**										
Metals by USEPA 6010													
Lead	7439-92-1	250	mg/kg	179 J	**1,180 J**	44	181	157 J	--	--	--	--	--
Total Petroleum Hydrocarbons by NWTPH-Dx/Gx													
Diesel Range Hydrocarbons	68334-30-5	--	mg/kg	--	--	--	--	--	--	--	--	--	--
Oil Range Hydrocarbons	--	--	mg/kg	--	--	--	--	--	--	--	--	--	--
Sum of Diesel and Oil Range Hydrocarbons	--	2,000	mg/kg	--	--	--	--	--	--	--	--	--	--
Gasoline Range Hydrocarbons	86290-81-5	100	mg/kg	--	--	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds by USEPA 8041													
Pentachlorophenol	87-86-5	2,500	µg/kg	--	--	--	--	--	--	--	--	--	--
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) by USEPA 8270D													
Benzo(a)anthracene	56-55-3	--	µg/kg	--	--	--	--	--	4.7 U	3.4 JQ	7.9	4.8 U	4.8 U
Chrysene	218-01-9	--	µg/kg	--	--	--	--	--	4.7 U	8.3	15	4.8 U	4.8 U
Total Benzofluoranthenes	--	--	µg/kg	--	--	--	--	--	4.7 U	13	23	4.8 U	4.8 U
Benzo(a)pyrene	50-32-8	--	µg/kg	--	--	--	--	--	4.7 U	4.2 JQ	9.7	4.8 U	4.8 U
Indeno(1,2,3-cd)pyrene	193-39-5	--	µg/kg	--	--	--	--	--	4.7 U	6.3	7.9	4.8 U	4.8 U
Dibenz(a,h)anthracene	53-70-3	--	µg/kg	--	--	--	--	--	4.7 U	4.9 U	2.9 JQ	4.8 U	4.8 U
Summed cPAH TEQ[1,2]	--	137	µg/kg	--	--	--	--	--	4.7 U	6.6 J	14 J	4.8 U	4.8 U
Summed cPAH TEQ with One-half of the Reporting Limit[1,3]	--	137	µg/kg	--	--	--	--	--	3.3 U	6.8 J	14 J	3.4 U	3.4 U

Notes:
BOLD Detected concentration exceeds the cleanup level.
-- Indicates not applicable or not available.
1 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Washington Administrative Code, 173-340-900, Table 708-2.
2 Calculated using detected cPAH concentrations.
3 Calculated using detected cPAH concentrations plus one-half the reporting limit for cPAHs that were not detected.

Abbreviations:
CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbons
ft bgs Feet below ground surface
µg/kg Micrograms per kilogram
mg/kg Milligrams per kilogram
TEQ Toxicity equivalent
USEPA United States Environmental Protection Agency

Qualifiers:
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Appendix C
Lora Lake Apartments Parcel Soil Performance Monitoring Data Report

Figures

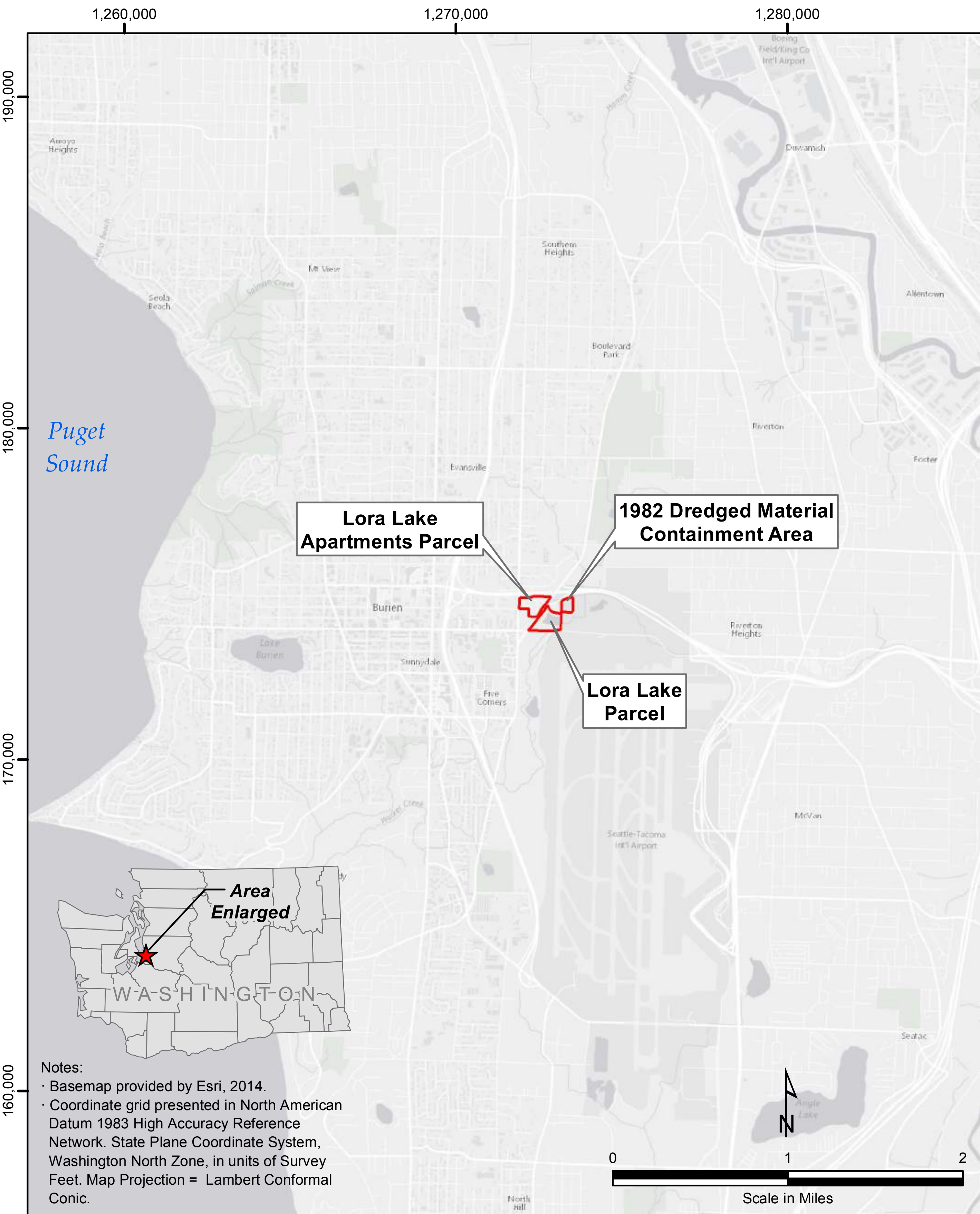

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Figure C.1
Site Vicinity Map

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9/1/2016

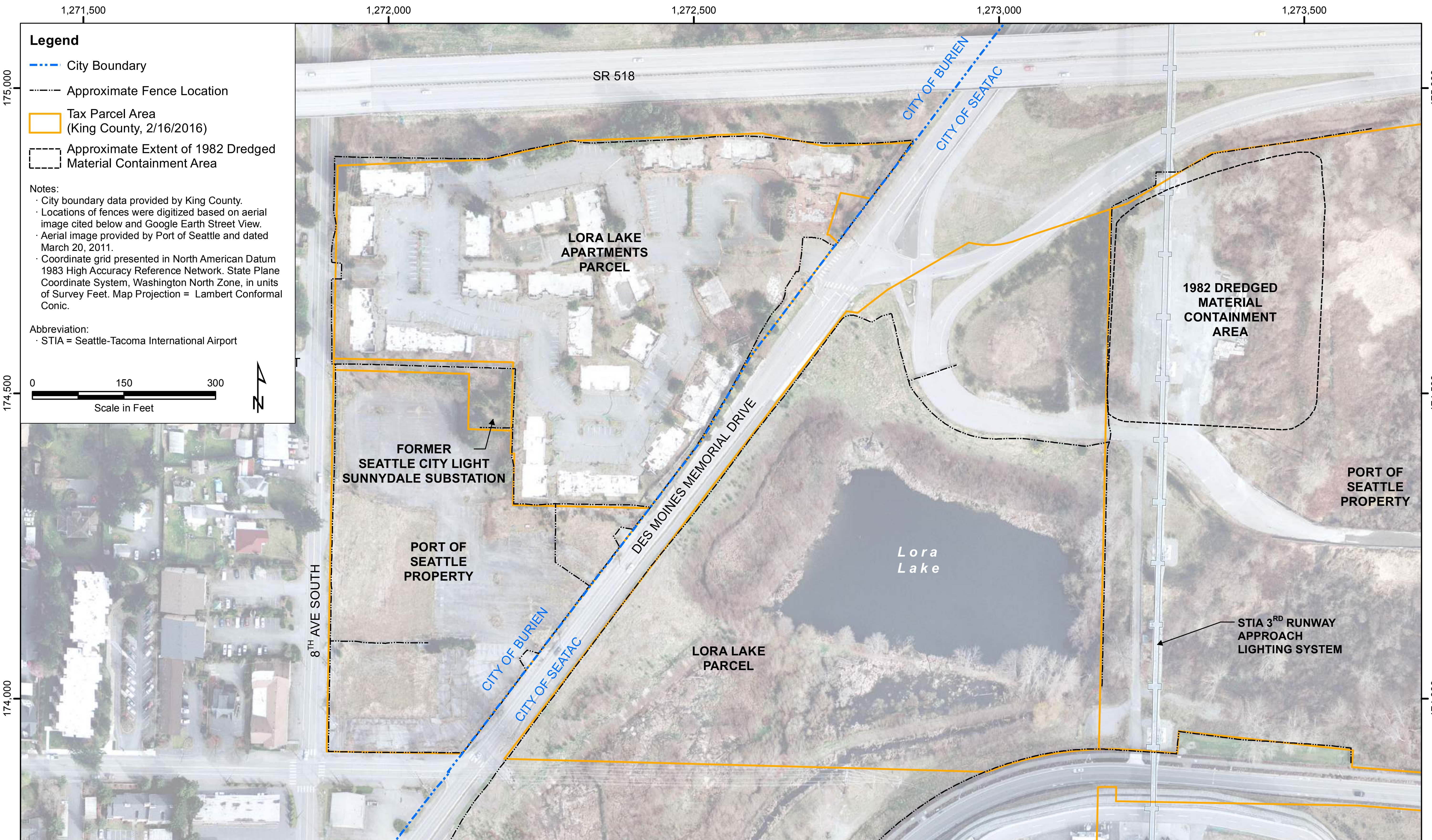

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Figure C.2
Site Map

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9/1/2016

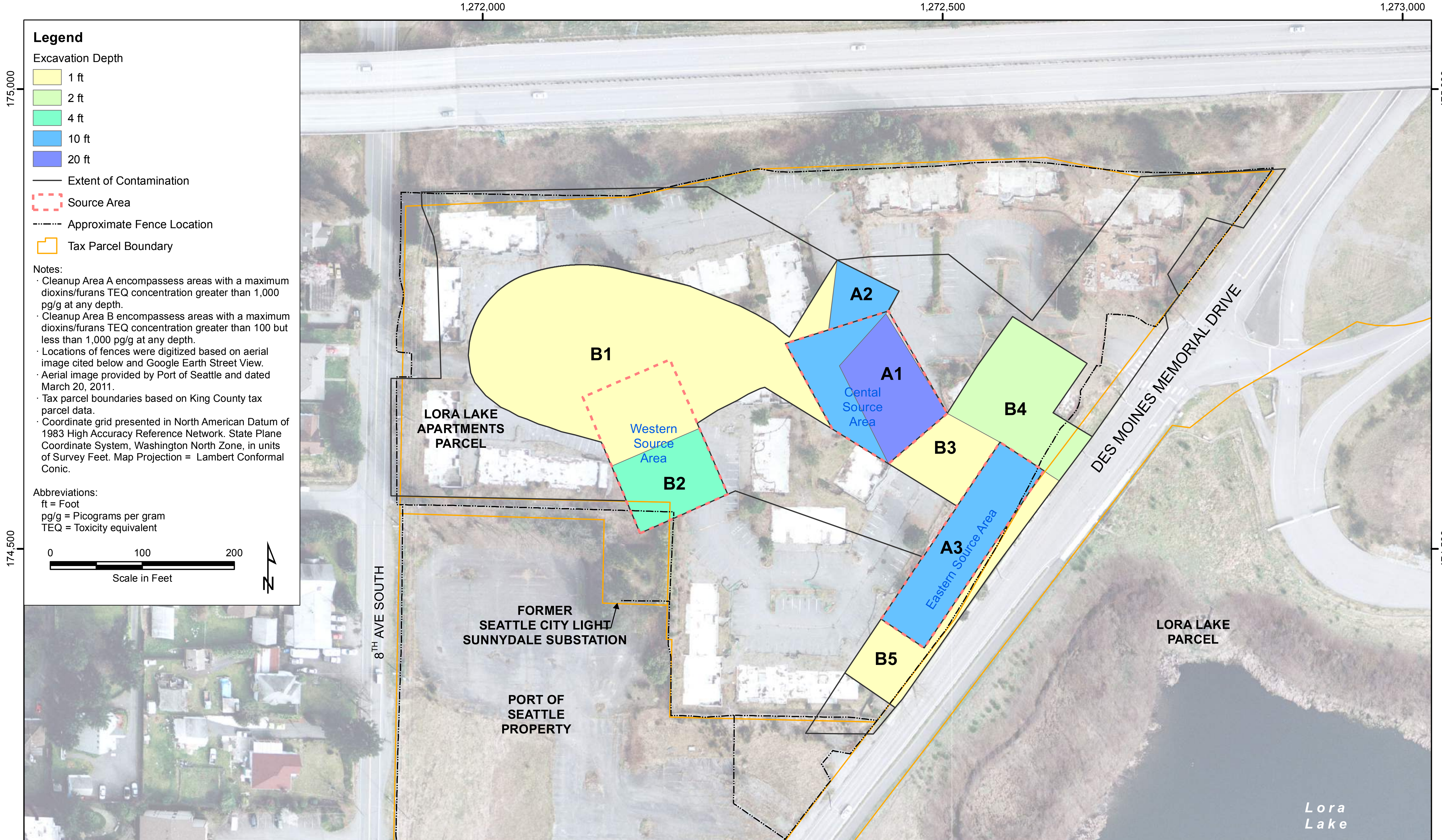

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Figure C.3
Compliance Monitoring Plan Cleanup Areas

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9/1/2016

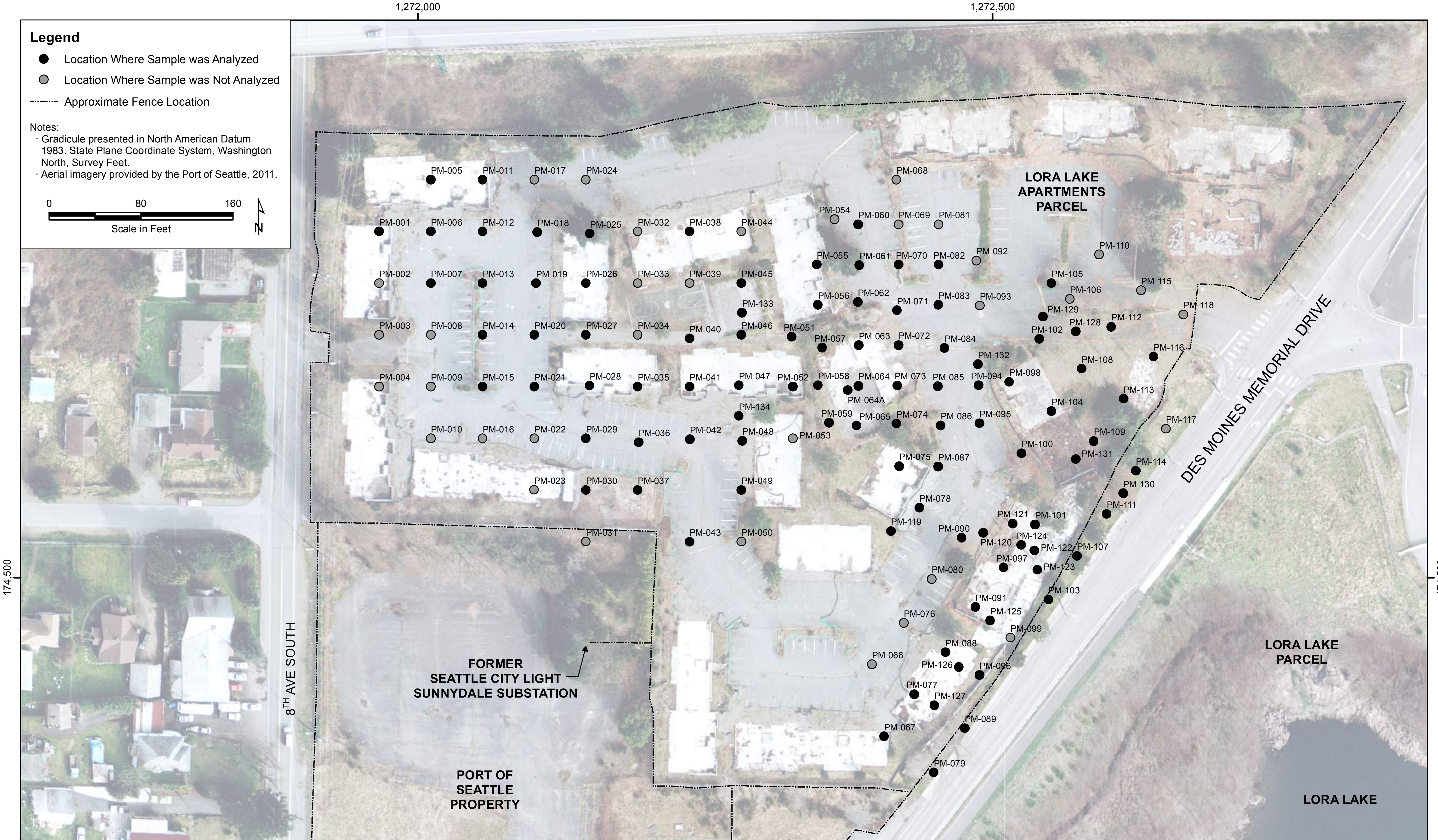

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Figure C.4
Soil Performance Monitoring Sampling Locations

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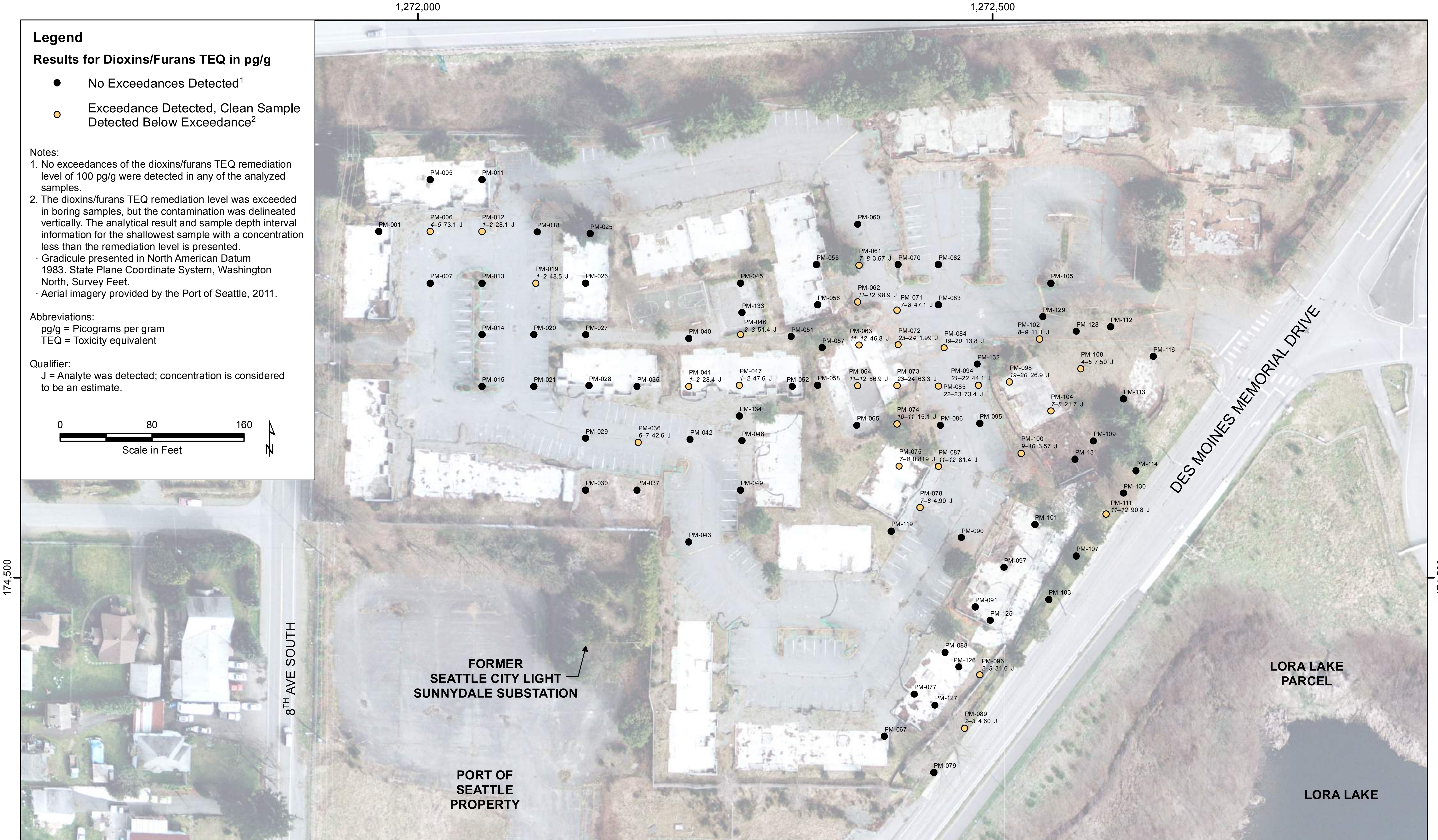
9/1/2016



Legend

Results for Dioxins/Furans TEQ in pg/g

- ● No Exceedances Detected[1]
- ○ Exceedance Detected, Clean Sample Detected Below Exceedance[2]

Notes:
1. No exceedances of the dioxins/furans TEQ remediation level of 100 pg/g were detected in any of the analyzed samples.
2. The dioxins/furans TEQ remediation level was exceeded in boring samples, but the contamination was delineated vertically. The analytical result and sample depth interval information for the shallowest sample with a concentration less than the remediation level is presented.
- Gradicule presented in North American Datum 1983. State Plane Coordinate System, Washington North, Survey Feet.
- Aerial imagery provided by the Port of Seattle, 2011.

Abbreviations:
pg/g = Picograms per gram
TEQ = Toxicity equivalent

Qualifier:
J = Analyte was detected; concentration is considered to be an estimate.

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Figure C.5
Dioxins/Furans TEQ Analytical Results

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9/1/2016

Legend

Results for cPAH TEQ in µg/kg

● No Exceedances Detected[1]

Notes:
1. No exceedances of the cPAH TEQ CUL of 137 µg/kg were detected.
· Gradicule presented in North American Datum 1983. State Plane Coordinate System, Washington North, Survey Feet.
· Aerial imagery provided by the Port of Seattle, 2011.

Abbreviations:
cPAH = Carcinogenic polycyclic aromatic hydrocarbon
CUL = Cleanup level
TEQ = Toxicity equivalent
µg/kg = Micrograms per kilogram

0 80 160
Scale in Feet
N

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Figure C.6
Carcinogenic Polycyclic Aromatic Hydrocarbons TEQ Analytical Results

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Figure C.7
Pentachlorophenol Analytical Results

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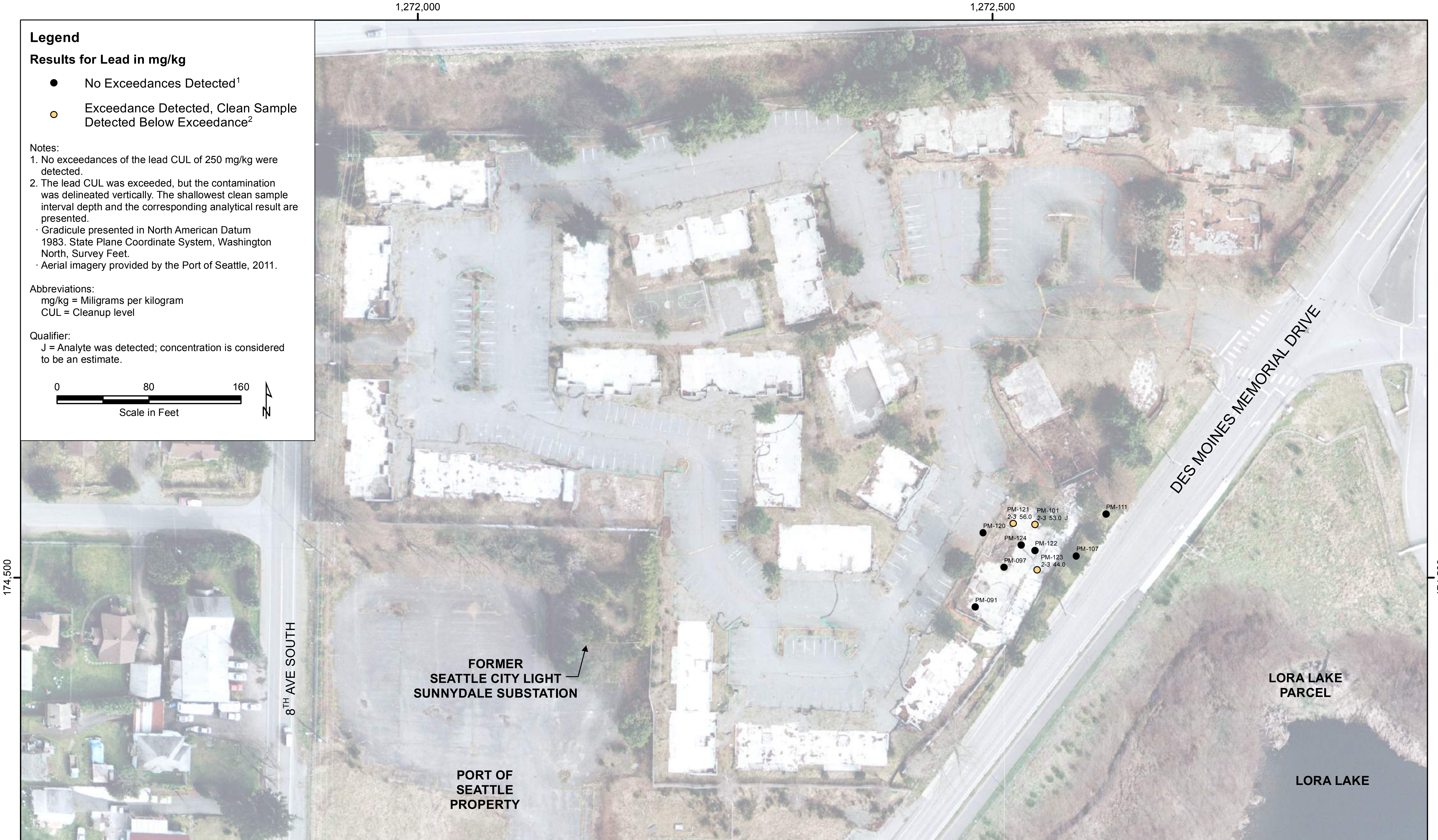

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Figure C.8
Lead Analytical Results

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9/1/2016

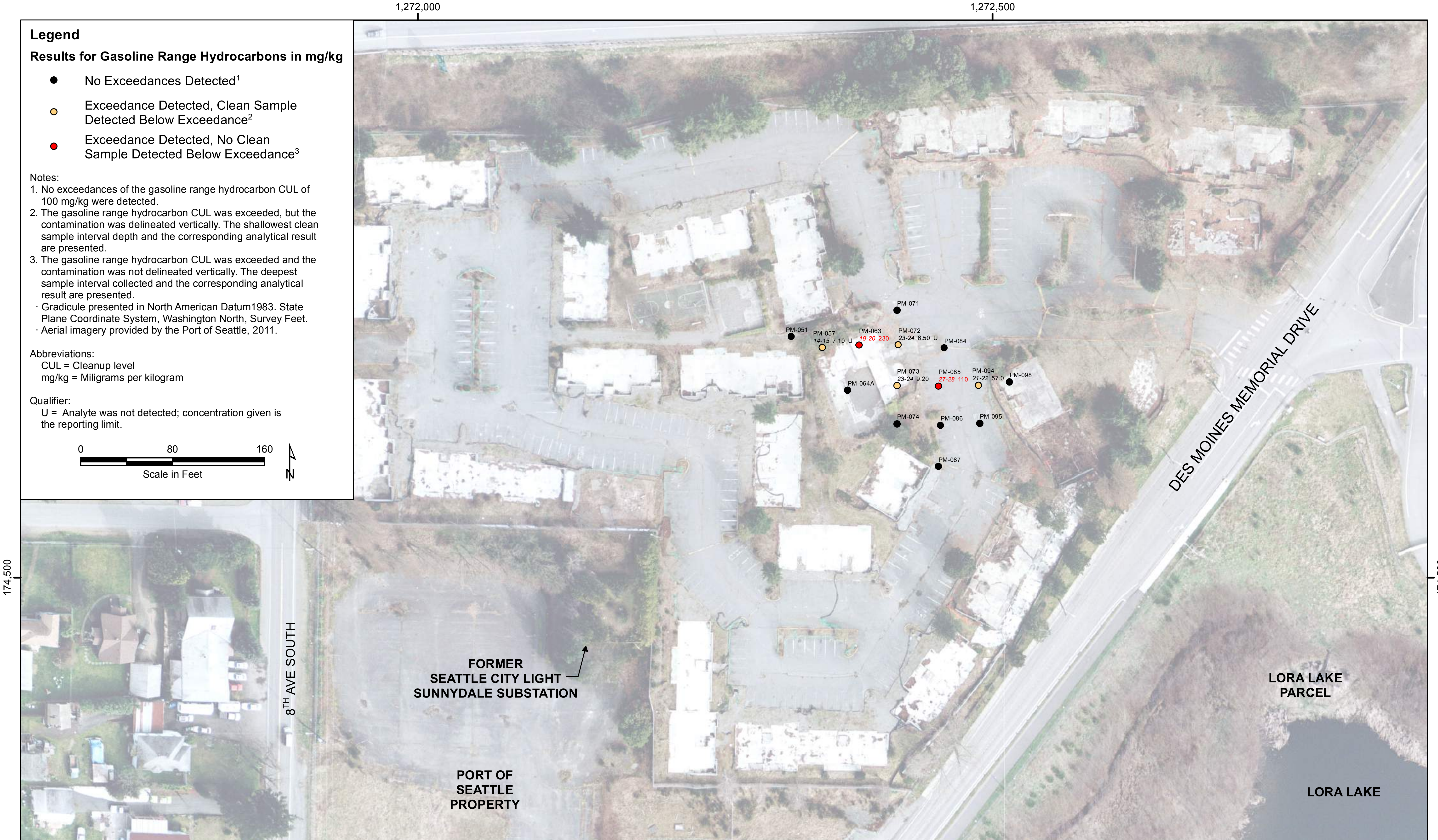

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Figure C.9
Gasoline Range Hydrocarbons
Analytical Results

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9/1/2016

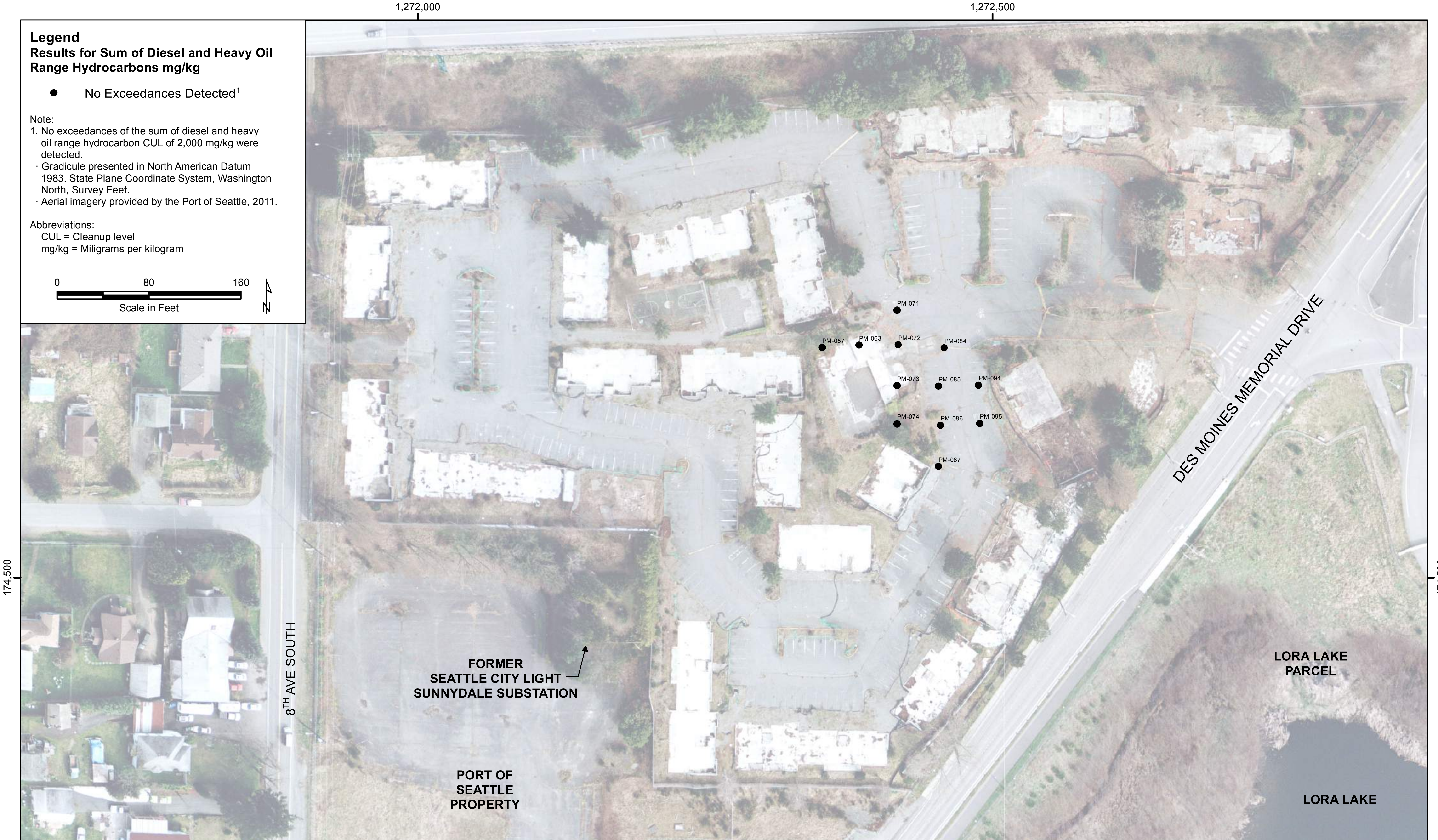

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Figure C.10
Sum of Diesel and Heavy Oil Range Hydrocarbons Analytical Results

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Appendix C
Lora Lake Apartments Parcel Soil Performance Monitoring Data Report

Attachment C.1
Soil Boring Logs

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-001**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174801.089159	**EASTING:** 1271966.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 304.081	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		PM-001-00.0-01.0@0924
0.5–5	SW	Slightly moist, brown well-graded **SAND** with gravel and little silt.		PM-001-01.0-02.0@0926
5		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-002
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174756.089159	**EASTING:** 1271966.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 304.097	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		PM-002-00.0-01.0@0934
1	SW	Moist, brown well-graded **SAND** with gravel and little silt.		PM-002-01.0-02.0@936
2				PM-002-02.0-03.0@938
3	SM-SM	Moist, gray well-graded **SAND** with silt. No odor.		
4				
5	SW-SM	Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-003**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174711.089159	**EASTING:** 1271966.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 304.778	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
	SW	Dry to slightly moist, brown well-graded **SAND** with gravel and little silt.		PM-003-00.0-01.0@944
1				PM-003-01.0-02.0@946
2				
3				
4		At 4 feet, becomes moist.		
		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** PM-004
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174666.089159	**EASTING:** 1271966.44324	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 303.762	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		PM-004-00.0-01.0@954
	SM-SM	Moist, brown well-graded **SAND** with silt and gravel.		
1				PM-004-01.0-02.0@956
		At 1.5 feet, becomes gray. No odor.		
2				
3				
4		At 4 feet, becomes brown.		
		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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PROJECT:	LOCATION:	BORING ID:
POS-LLA		PM-005
LOGGED BY: K. Anderson	BORING LOCATION: Area B1	

DRILLED BY: Kyle Ceruti, Cascade	NORTHING: 174846.089159	EASTING: 1272011.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	SURFACE ELEVATION: 303.751	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	TOTAL DEPTH (ft bgs): 5	DEPTH TO WATER (ft bgs): NA
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 9/24/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		PM-005-00.0-01.0@1055
	SW	Dry to slightly moist, brown well-graded **SAND** with gravel and little silt.		
1				PM-005-01.0-02.0@1057
2				
3		At 3 feet, few red-brown areas present.		
4				
5		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-006**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174801.089159	**EASTING:** 1272011.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 305.898	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		PM-006-00.0-01.0@1039
1	SW	Dry to slightly moist, brown well-graded **SAND** with gravel and little silt.		PM-006-01.0-02.0@1041
2				
3				
4				
5		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-006 rep 2**
LOGGED BY: Kristin Anderson	COORDINATE SYSTEM: SPCS WA N NAD83 FT	
DRILLED BY: Frank Scott, Cascade	NORTHING: 174801.089159	EASTING: 1271966.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	GROUND SURFACE ELEVATION: 299.8719	
DRILLING METHOD: Direct-Push	TOTAL DEPTH (ft bgs): 5	DEPTH TO WATER (ft bgs):
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 2/1/2016

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0	Asphalt	Asphalt ground surface.					
0.5–4.5	SP-SM	Moist, brown poorly graded fine **SAND** with silt and gravel.					
2–3							PM-006-02.0-03.0
3–4							PM-006-03.0-04.0
4–5							PM-006-04.0-05.0
4.5–5	SW	Bottom of boring = 5 feet. Assume recovered intervals compressed for sample collection.					

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** PM-006 rep 3
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B1		
DRILLED BY: Chris, Gregory Drilling	**NORTHING:** 174801.089159	**EASTING:** 1272011.44324	
DRILLING EQUIPMENT: Hollow Stem Auger Truck Rig	**SURFACE ELEVATION:** 305.898	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 8	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD/SAMPLER LENGTH: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 2/24/2016	

Depth (feet)	USCS Symbol	Soil Description and Observations (color, texture, moisture, **MAJOR CONSTITUENT**, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	PID (ppm)	Sample ID
0	Asphalt	Asphalt ground surface.				
0.5–8	SW	Dry to slightly moist, brown well-graded **SAND** with gravel and little silt.				
5–5.5			■	5		PM-006-05.0-06.0 @ 1405
5.5–6			■	4		
6–6.5			■	6		PM-006-06.0-07.0 @ 1407
6.5–7			■	11		
7–7.5			■	11		PM-006-07.0-08.0 @ 1409
7.5–8			■	12		
8		Bottom of boring = 8 feet.				

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-007**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174756.089159	**EASTING:** 1272011.44324	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 305.513	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		PM-007-00.0-01.0@1026
	SW	Slightly moist, brown well-graded **SAND** with gravel and little silt.		
1				PM-007-01.0-02.0@1028
2				PM-007-02.0-03.0@1030
3				
4	SW-SM	Moist, brown well-graded **SAND** with silt.		
		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-008**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174711.089159	**EASTING:** 1272011.44324	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 303.781	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
	SW	Dry to slightly moist, brown well-graded **SAND** with gravel and little silt.		
1				PM-008-01.0-02.0@1016
2				PM-008-02.0-03.0@1018
3	SW-SM	At 3.25 feet, becomes gray-brown with increased silt. No odor.		
4		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-009**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174666.089159	**EASTING:** 1272011.44324	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 303.875	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		PM-009-00.0-01.0@1010
1	SW-SM	Moist, brown well-graded **SAND** with silt and gravel.		PM-009-01.0-02.0@1012
2		Refusal on rock at 3 feet. Assume recovered interval compressed for sample collection.		PM-009-02.0-03.0@1014
3				
4				
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-010**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174621.089159	**EASTING:** 1272011.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 305.944	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		PM-010-00.0-01.0@958
1	SW	Dry to slightly moist, brown well-graded **SAND** with gravel and little silt.		PM-010-01.0-02.0@1000
2				
3				
4		At 4.5 feet, becomes moist.		
5		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-011**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174846.089159	**EASTING:** 1272056.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 303.733	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		PM-011-00.0-01.0@1106
	SW	Dry to slightly moist, brown well-graded **SAND** with little silt.		
1				PM-011-01.0-02.0@1108
2				
		At 2.5 feet, rounded gravel present and color becomes light brown.		
3				
4				
		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-012**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174801.089159	**EASTING:** 1272056.44324	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 305.796	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		PM-012-00.0-01.0@1115
1	SW-SM	Moist, brown well-graded **SAND** with silt and gravel.		PM-012-01.0-02.0@1117
2				PM-012-02.0-03.0@1119
3				
4				
5		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-013**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174756.089159	**EASTING:** 1272056.44324	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 305.676	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		PM-013-00.0-01.0@1131
1	SW	Moist, brown well-graded **SAND** with gravel and little silt. Some gravel larger than core barrel.		PM-013-01.0-02.0@1133
2				PM-013-02.0-03.0@1135
3				
4				
5		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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PROJECT: POS-LLA		**LOCATION:**	**BORING ID:** **PM-014**
LOGGED BY: K. Anderson		**BORING LOCATION:** Area B1	
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174711.089159	**EASTING:** 1272056.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 305.386	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		PM-014-00.0-01.0@1144 PM-014-00.0-01.0-D@1150
	SW	Slightly moist, brown well-graded **SAND** with gravel and little silt.		
1				PM-014-01.0-02.0@1146
		At 1.5 feet, becomes dry.		
2				PM-014-02.0-03.0@1148 PM-014-02.0-03.0-D@1152
	SW-SM	Dry, brown well-graded **SAND** with silt.		
3				
		At 3.5 feet, becomes gray and very firm.		
4				
		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-015**
LOGGED BY: K. Anderson	BORING LOCATION: Area B1	
DRILLED BY: Kyle Ceruti, Cascade	NORTHING: 174666.089159	EASTING: 1272056.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	SURFACE ELEVATION: 306.234	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	TOTAL DEPTH (ft bgs): 5	DEPTH TO WATER (ft bgs): NA
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 9/24/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	SW/OL/OH	Dry to slightly moist, brown well-graded **SAND** and **ORGANIC SOIL**.		PM-015-00.0-01.0@1201
1	SW	Moist, brown well-graded **SAND** with gravel and little silt present.		PM-015-01.0-02.0@1203
2	SW-SM	From 2 to 3.5 feet, grades to moist, brown well-graded **SAND** with silt. SW-SM		PM-015-02.0-03.0@1205
3				
4	ML	Grades to moist, brown firm sandy **SILT**. Sand present at bottom of core. Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** PM-016
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174621.089159	**EASTING:** 1272056.44324	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 306.45	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
	SW	Dry, brown well-graded **SAND** with gravel and little silt.		PM-016-00.0-01.0@1207
1				PM-016-01.0-02.0@1209
2				
3				
4		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-017**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174846.089159	**EASTING:** 1272101.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 306.411	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		PM-017-00.0-01.0@1507
0.5–5	SW	Moist, brown well-graded **SAND** with silt and gravel.		PM-017-01.0-02.0@1509
3.5	SW	At 3.5 feet, becomes dry.		
5	SW	Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		

ABBREVIATIONS:
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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-018**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174800.506	**EASTING:** 1272104.104
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 306.826	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		PM-018-00.0-01.0@1456
	SW	Moist, brown well-graded **SAND** with gravel and little silt.		
1				PM-018-01.0-02.0@1458
		At 1.5 feet, becomes dry.		
2				PM-018-02.0-03.0@1500
3	SW	At 3 feet, few wood fragments present.		
4				
		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-019**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174755.966	**EASTING:** 1272102.83
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 305.834	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		PM-019-00.0-01.0@1436
1	SW	Moist, dark brown well-graded **SAND** with gravel and little silt.		PM-019-01.0-02.0@1438 PM-019-01.0-02.0-D@1442
	ML	At 1.5 feet, 6-inch lense of firm gray sandy **SILT**.		
2	SW-SM	Moist, brown well-graded **SAND** with silt and gravel.		PM-019-02.0-03.0@1440
3				
4		At 4.5 feet, becomes dark brown.		
		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-020**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174711.089159	**EASTING:** 1272101.44324	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 305.463	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
	SW-SM	Moist, brown well-graded **SAND** with silt and gravel.		
1				PM-020-01.0-02.0@1427 PM-020-01.0-02.0-D@1431
2				PM-020-02.0-03.0@1429
3				
4		At 4 feet, becomes gray.		
		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-021**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174666.089159	**EASTING:** 1272101.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 306.294	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		PM-021-00.0-01.0@1411
	SW-SM	Moist, brown well-graded **SAND** with silt and gravel.		
1				PM-021-01.0-02.0@1413
2				PM-021-02.0-03.0@1415 PM-021-02.0-03.0-D@1417
3				
4		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** PM-022
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174621.089159	**EASTING:** 1272101.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 306.336	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface,		
				PM-022-00.0-01.0@1253
1	SW	Slightly moist, brown well-graded **SAND** with gravel and little silt.		PM-022-01.0-02.0@1255
2				
3	SW-SM	Moist, brown well-graded **SAND** with silt.		
4				
5		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-023**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B2		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174576.227	**EASTING:** 1272101.414
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 304.516	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
0.5–5	SW	Dry, brown well-graded **SAND** with gravel and little silt		
2–3				PM-023-02.0-03.0@1315
5		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		

ABBREVIATIONS:
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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-024**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B1	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174846.089159	**EASTING:** 1272146.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 307.278	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/25/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		PM-024-00.0-01.0@0917
1	SW	Moist, light brown, medium dense fine to coarse well-graded **SAND** with trace gravel (~5%) and silt (~5%). No odor or sheen.		PM-024-01.0-02.0@0919
2				
3	SP	Moist, reddish brown to light brown poorly graded fine to medium **SAND**. No sheen or odor		
4				
5		Bottom of boring = 5 feet.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-025**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174799.134	**EASTING:** 1272149.81
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 307.836	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/25/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	**ORGANIC SOIL** and grass.		PM-025-00.0-01.0@0906
1	SW	Moist, brown, medium loose well-graded fine to coarse gravelly **SAND** (15% gravel). No sheen or odor.		PM-025-01.0-02.0@0908
2				PM-025-02.0-03.0@0910
3				
4	SP	Moist, brown to reddish brown, medium dense poorly graded fine to medium **SAND**. No sheen or odor.		
5		Bottom of boring = 5 feet.		

ABBREVIATIONS:
ft bgs = feet below ground surface
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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-026**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B1	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174756.089159	**EASTING:** 1272146.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 306.161	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/25/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	**ORGANIC SOIL** and grass.		PM-026-00.0-01.0@0841
1	SP	Moist, brown to light brown, medium dense poorly graded fine to medium **SAND** with sub-rounded gravel (up to 10%) and silt (up to 10%). No sheen or odor.		PM-026-01.0-02.0@0843
2				PM-026-02.0-03.0@0845 PM-026-02.0-03.0-D@0847
3				
4		Bottom of boring = 5 feet.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

FLOYD | SNIDER strategy ▪ science ▪ engineering	PROJECT: POS-LLA	LOCATION:	BORING ID: PM-027
	LOGGED BY: G. Cisneros	BORING LOCATION: Area B1	
DRILLED BY: Kyle Ceruti, Cascade		NORTHING: 174711.089159	EASTING: 1272146.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		SURFACE ELEVATION: 306.505	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		TOTAL DEPTH (ft bgs): 5	DEPTH TO WATER (ft bgs): NA
SAMPLING METHOD: 2" x 5' liner		BORING DIAMETER: 2"	DRILL DATE: 9/25/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	**ORGANIC SOIL** and grass.		PM-027-00.0-01.0@0831
1	SP	Moist, brown, medium dense fine **SAND** with trace small gravel (~5%). No sheen or odor.		PM-027-01.0-02.0@0833
2	SW	Moist, brown well-graded fine to coarse **SAND** with sub-rounded gravel (~10%) and trace silt (~5%). No sheen or odor.		PM-027-02.0-03.0@0835
3–4	SP	Moist, brown to dark brown, medium dense poorly graded fine to medium **SAND**. No sheen or odor.		
5		Bottom of boring = 5 feet.		

ABBREVIATIONS:
ft bgs = feet below ground surface
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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-028**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174666.954	**EASTING:** 1272149.444
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 306.101	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/25/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		PM-028-00.0-01.0@0818
1	SP	Moist, brown to light brown, poorly graded fine to medium **SAND** with gravel (~10%). No sheen or odor.		PM-028-01.0-02.0@0820
2				PM-028-02.0-03.0@0822
3		At 3 feet, becomes reddish brown with trace silt (~5%).		
4		Bottom of boring = 5 feet.		
5				

ABBREVIATIONS:
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USCS = Unified Soil Classification System
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PROJECT: POS-LLA		**LOCATION:**	**BORING ID:** PM-029
LOGGED BY: K. Anderson		**BORING LOCATION:** Area B1	
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174621.089159	**EASTING:** 1272146.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 306.56	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		PM-029-00.0-01.0@1400
	SW	Moist, brown well-graded **SAND** with silt and gravel.		
1				PM-029-01.0-02.0@1402
2				
3		At 3 feet, becomes dry with trace silt.		
4				
5		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-030**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B2		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174576.089159	**EASTING:** 1272146.44324	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 307.229	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 6	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	SW/OL/OH	Moist, brown well-graded **SAND** and **ORGANIC SOIL** with small rounded gravel.		
1	SW	Moist, brown well-graded **SAND** with small rounded gravel.		
2				
3		At 3 feet, becomes dry.		
4				PM-030-04.0-05.0@1325
5		Bottom of boring = 6 feet.		PM-030-05.0-06.0@1327
6				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-032**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B1	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174801.089159	**EASTING:** 1272191.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 309.101	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/25/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	**ORGANIC SOIL** and grass.		PM-032-00.0-01.0@0930
1	SP-SM	Moist, light brown to dark brown brown, poorly graded fine to medium **SAND** with silt (~10%) and gravel (~10%). No sheen or odor.		PM-032-01.0-02.0@0932
2				PM-032-02.0-03.0@0934
3				
	SW	At 3.5 feet, 6-inch lense of **GRAVEL** road base fill material then same as above.		
4	SP	Moist, brown poorly graded fine to medium **SAND**. No sheen or odor. Bottom of boring = 5 feet.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-033**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174756.089159	**EASTING:** 1272191.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 305.636	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/25/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	**ORGANIC SOIL** and grass.		
	SP	Moist, brown poorly graded fine to medium **SAND** with trace gravel (~5%). No sheen or odor.		
1				PM-033-01.0-02.0@0943
2				PM-033-02.0-03.0@0945
3				
4		Bottom of boring = 5 feet.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

FLOYD | SNIDER strategy ▪ science ▪ engineering	**PROJECT:** POS-LLA	**LOCATION:**	**BORING ID:** PM-034
	LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B1	

DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174711.089159	**EASTING:** 1272191.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 306.467	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/25/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	**ORGANIC SOIL** and grass.		
	SP	Moist, brown to light brown poorly graded fine to medium **SAND** with sub-rounded gravel (~10%). No sheen or odor.		
1				PM-034-01.0-02.0@0955
2				PM-034-02.0-03.0@0955
3				
4		Bottom of boring = 5 feet.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-036**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B2	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174617.643	**EASTING:** 1272192.268
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 307.424	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/25/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
0.5–5	SP	Moist, brown, medium dense poorly graded fine to medium **SAND** with gravel (~10%). No sheen or odor.		
2–3				PM-036-02.0-03.0@1010
5		Bottom of boring = 5 feet.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-036 rep 2**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B2		
DRILLED BY: Frank Scott, Cascade		**NORTHING:** 174617.643	**EASTING:** 1272192.268
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 307.424	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 6	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 11/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
0.33–6	SP	Moist, brown poorly graded fine to medium **SAND** with fine gravel (~10%). No odor.	Drive 0–6; Recovery 1.5–6	
4–5				PM-036-04.0-05.0@1400
5–6		Bottom of boring = 6 feet. Assume recovered intervals compressed for sample collection.		PM-036-05.0-06.0@1356

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Location re-sampled to fill data gaps.

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-036 rep 3**	
LOGGED BY: Kristin Anderson	COORDINATE SYSTEM: SPCS WA N NAD83 FT		
DRILLED BY: Frank Scott, Cascade	NORTHING: 174617.643	EASTING: 1272192.268	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	GROUND SURFACE ELEVATION: 299.8719		
DRILLING METHOD: Direct-Push	TOTAL DEPTH (ft bgs): 10	DEPTH TO WATER (ft bgs):	
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 2/1/2016	

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0	Asphalt	Asphalt ground surface.					
0.5–7	SP-SM	Moist, brown poorly graded fine **SAND** with silt and gravel.					
6–7							PM-006-06.0-07.0
7–10	SP	Moist, grayish brown fine **SAND** with trace fine gravel.					PM-006-07.0-08.0
8–9							PM-006-08.0-09.0
9–10							PM-006-09.0-10.0
10		Bottom of boring = 10 feet. Assume recovered intervals compressed for sample collection.					

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** PM-037
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B2		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174576.089159	**EASTING:** 1272191.44324	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 308.243	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 6.5	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	SW	Dry, brown well-graded **SAND** with little silt and organic matter. Small gravel present.		
1		At 1 foot, asphalt fragment present.		
2				
3	SW-SM	Moist, brown well-graded **SAND** with silt.		
4	SW	Dry, brown, loose well-graded **SAND** with little silt.		PM-037-04.0-05.0@1345
5				PM-037-05.0-06.0@1347
6		Bottom of boring = 6.5 feet.		

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-039**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174756.089159	**EASTING:** 1272236.44324	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 306.08	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/25/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	**ORGANIC SOIL** and grass.		
0.5–5	SP	Moist, brown to orange brown, medium dense, poorly graded fine to medium **SAND** with sub-rounded gravel (~10%). No sheen or odor.		
1–2				PM-039-01.0-02.0@1222
2–3				PM-039-02.0-03.0@1224
5		Bottom of boring = 5 feet.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-040**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174707.987	**EASTING:** 1272236.4
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 306.634	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/25/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	**ORGANIC SOIL** and grass.		
	SP	Moist, brown, medium dense, poorly graded fine to medium **SAND** with gravel (~10%). No sheen or odor.		
1				PM-040-01.0-02.0@1210
2				PM-040-02.0-03.0@1212
3				
4		Bottom of boring = 5 feet.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-040 rep 2**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B1		
DRILLED BY: Frank Scott, Cascade	**NORTHING:** 174707.987	**EASTING:** 1272236.4	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 306.634	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 11/23/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0–2	SW	Moist, light brown to gray, well-graded fine to coarse **SAND** with fine gravel (~20%). No odor.		PM-040-00.0-01.0@1410
2–3.5	SP	Moist, brown poorly graded fine to medium **SAND** with fine gravel (~15%). No odor.		
3.5–5	SW	At 3.5 feet, concrete present. At 4.5 feet, gravel content decreases (~5% gravel). Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Location re-sampled to fill data gaps.

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-041**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174666.089159	**EASTING:** 1272236.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 306.234	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/25/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
	SW	Moist, brown, medium dense well-graded fine to coarse **SAND** with gravel (15%). No sheen or odor.		PM-041-00.0-01.0@1202
1				PM-041-01.0-02.0@1204
2				PM-041-02.0-03.0@1206
3				
	SP	Moist, brown, medium dense poorly graded fine to medium **SAND**. No sheen or odor.		
4				
		Bottom of boring = 5 feet.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-042**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B2	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174620.215	**EASTING:** 1272236.89
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 308.187	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/25/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
0.5–5	SP	Moist, brown, medium dense poorly graded fine to medium **SAND** with trace gravel (~5%). No sheen or odor.		
2–3				PM-042-02.0-03.0@1104
5		Bottom of boring = 5 feet.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

FLOYD | SNIDER strategy ▪ science ▪ engineering	**PROJECT:** POS-LLA	**LOCATION:**	**BORING ID:** **PM-043**
	LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B2	

DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174531.003	**EASTING:** 1272236.47
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 309.576	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/25/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
0–5	SP	Moist, light brown, poorly graded fine to medium **SAND**. No sheen or odor.		
2–3				PM-043-02.0-03.0@1027
5		Bottom of boring = 5 feet.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

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PROJECT:	POS-LLA
LOCATION:	
BORING ID:	**PM-046**
LOGGED BY:	G. Cisneros
BORING LOCATION:	Area B1
DRILLED BY:	Kyle Ceruti, Cascade
NORTHING:	174711.089159
EASTING:	1272281.44324
DRILLING EQUIPMENT:	Geoprobe 7730 Limited Access Rig
SURFACE ELEVATION:	306.308
COORDINATE SYSTEM:	SPCS WA N NAD83 FT
DRILLING METHOD:	2" x 5" direct push rod
TOTAL DEPTH (ft bgs):	8
DEPTH TO WATER (ft bgs):	NA
SAMPLING METHOD:	2" x 5' liner
BORING DIAMETER:	2"
DRILL DATE:	9/22/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	**ORGANIC SOIL** and grass.		
0.5–4	SW	Moist, light brown, medium dense, well-graded fine to coarse gravelly **SAND** (15% gravel) and trace silt (~5%). No sheen or odor.		
1–2				PM-046-01.0-02.0@1455
2–3				PM-046-02.0-03.0@1457
4–8	SP	Moist, reddish brown to brown, medium dense, poorly graded fine to medium **SAND** with trace sub-rounded gravel (~5%). No sheen or odor.		
7–8		Bottom of boring = 8 feet.		PM-046-07.0-08.0@1459

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-046 rep 2**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B1		
DRILLED BY: Frank Scott, Cascade	**NORTHING:** 174711.089159	**EASTING:** 1272281.44324	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 306.308	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 11/23/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0				
1				
2				
3				
4				
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-048**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B2		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174618.981	**EASTING:** 1272282.275
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 309.432	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/25/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	**ORGANIC SOIL** and grass.		
1	SP	Moist, brown to light brown, medium dense, poorly graded fine to medium **SAND** with trace gravel (~5%). No sheen or odor.		
2				PM-048-02.0-03.0@1051
3				
4		Bottom of boring = 5 feet.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-048 rep 2**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B2		
DRILLED BY: Frank Scott, Cascade		**NORTHING:** 174618.981	**EASTING:** 1272282.275
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 309.432	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 11/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	**ORGANIC SOIL** and grass.		
	SP	Moist, brown poorly graded fine **SAND** with trace silt (~5%) and gravel (~5%). No odor.		PM-048-00.0-01.0@1345
1				PM-048-01.0-02.0@1347
2				
	ML	Moist, light brown, stiff low-plasticity **SILT**. No odor.		
3				
4				
		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Location re-sampled to fill data gaps.

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-050**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B2		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174531.089159	**EASTING:** 1272281.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 309.15	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/25/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
0.33–3.5	SP	Moist, brown, medium dense poorly graded fine to medium **SAND** with trace gravel (~5%). No sheen or odor.		2–3: PM-050-02.0-03.0@1037 PM-050-02.0-03.0-D@1039
3.5–5	SW	Moist, brown to light brown, well-graded fine to coarse gravelly **SAND**. Angular gravel. No sheen or odor. Bottom of boring = 5 feet.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-051**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A2	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174709.578	**EASTING:** 1272325.19
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 306.955	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
0.3–4	SW	Moist, brown, medium dense well-graded fine to coarse gravelly **SAND** (15% gravel) with trace gravel (~5%). No sheen or odor.		
1–2				PM-051-01.0-02.0@1020 PM-051-01.0-02.0-D@1020
4–10	SP	Moist, brown to dark brown, medium dense poorly graded fine to medium **SAND** with gravel (~10%). No sheen or odor.		
7–8				PM-051-07.0-08.0@1023

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-051**
LOGGED BY: G. Cisneros	BORING LOCATION: Area A2	
DRILLED BY: Kyle Ceruti, Cascade	NORTHING: 174709.578	EASTING: 1272325.19
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	SURFACE ELEVATION: 306.955	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	TOTAL DEPTH (ft bgs): 20	DEPTH TO WATER (ft bgs): NA
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 9/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10				
11				
12				PM-051-12.0-13.0@1026
13				
14	ML	Moist, olive brown, hard, low-plasticity **SILT**. No sheen or odor.		PM-051-14.0-15.0@1029
15	SW	Moist, brown to light brown, medium dense well-gradd fine to coarse gravelly **SAND** (15% sub-rounded gravel) with trace silt (~5%). No sheen or odor.		
16				
17				PM-051-17.0-18.0@1032
18	SP	Moist, brown to reddish brown, medium dense, poorly graded fine to medium **SAND**. No sheen or odor.		
19		Bottom of boring = 20 feet.		PM-051-19.0-20.0@1035

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

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PROJECT:	LOCATION:	BORING ID:
POS-LLA		PM-051
LOGGED BY: G. Cisneros	BORING LOCATION: Area A2	

DRILLED BY: Kyle Ceruti, Cascade	NORTHING: 174709.578	EASTING: 1272325.19
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	SURFACE ELEVATION: 306.955	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	TOTAL DEPTH (ft bgs): 20	DEPTH TO WATER (ft bgs): NA
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 9/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
20				

ABBREVIATIONS:
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USCS = Unified Soil Classification System
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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-052**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B1	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174666.089159	**EASTING:** 1272326.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 306.149	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/25/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
	SP	Moist, brown to light brown poorly graded fine **SAND**. No sheen or oodor.		PM-052-00.0-01.0@1144
1				PM-052-01.0-02.0@1146
2				
3				
4	SW	Brown, medium dense well-graded fine to coarse **SAND** with gravel (~10%). No sheen or odor. Bottom of boring = 5 feet.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-053**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174621.089159	**EASTING:** 1272326.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 307.622	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/25/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
	SP	Moist, light brown, medium dense poorly graded fine to medium **SAND** with trace gravel (<5%). No sheen or oodor.		PM-053-00.0-01.0@1124
1				PM-053-01.0-02.0@1126
2				
3				
4		Bottom of boring = 5 feet.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-054**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174811.647	**EASTING:** 1272362.579
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 314.426	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
0–5	SP	Moist, light brown, medium dense poorly graded fine to medium **SAND** with sub-rounded gravel (~10%). No sheen or oodor.		PM-054-00.0-01.0@1519
1				PM-054-01.0-02.0@1522
2				
3				
4		Bottom of boring = 5 feet.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-055**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174772.177	**EASTING:** 1272347.125
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 307.397	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/25/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	**ORGANIC SOIL**.		PM-055-00.0-01.0@1308
1	SP	Moist, brown, medium dense, poorly graded fine to medium **SAND**. No sheen or odor.		PM-055-01.0-02.0@1310
2				
3				
4		Bottom of boring = 5 feet.		
5				

ABBREVIATIONS:
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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:**	**PM-056**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A2		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174737.269715	**EASTING:** 1272348.28351	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 307.448	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 8	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/22/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
0.5–4.5	SW	Moist, brown, medium dense well-graded fine to coarse gravelly **SAND** (15% sub-rounded gravel). No sheen or odor.		PM-056-01.0-02.0@1441
4.5–6	SM	Moist, dark brown, medium dense silty fine **SAND** with sub-rounded gravel (~10%). No sheen or odor.		
6–8	ML	Moist, reddish brown to dark brown, hard, low-plasticity sandy **SILT**. No sheen or odor. Bottom of boring = 8 feet. Assume recovered intervals compressed for sample collection.		PM-056-07.0-08.0@1443

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-057**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A2	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174699.939	**EASTING:** 1272351.853
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 302.934	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 12	**DEPTH TO WATER (ft bgs):** 11
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/18/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	SW/OL/OH	Dry, brown well-graded **SAND** and **ORGANIC SOIL** with small rounded gravel.		
	SW	Dry, brown well-graded fine to coarse **SAND** with abundant gravel. No odor.		
1				
2		At 2 feet, becomes moist.		
3				
4				
5		At 4.75 feet, becomes dry.		
6				
7				
8		At 8 feet, becomes moist. No odor.		
9				PM-057-09.0-10.0@0940

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-057**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A2		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174699.939	**EASTING:** 1272351.853
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 302.934	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 12	**DEPTH TO WATER (ft bgs):** 11
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/18/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10				PM-057-10.0-11.0@0942
11 ▼		At 11 feet, becomes wet and gray with little silt. Slight hydrocarbon odor present. Bottom of boring = 12 feet. Assume recovered intervals compressed for sample collection.		PM-057-11.0-12.0@0944
12				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-057 rep 2	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A2		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174699.939	**EASTING:** 1272351.853
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 302.934	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** 11.5
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/18/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0		No samples collected 0-10 feet. Refer to PM-057 for lithology.		
1				
2				
3				
4				
5				
6				
7				
8				
9				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-057 rep 2**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A2		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174699.939	**EASTING:** 1272351.853	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 302.934	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** 11.5	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/18/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10	SW	Moist, brown well-graded **SAND** with gravel.		
11				
11.5 ▼		At 11.5 feet, becomes wet and gray. Hydrocarbon odor present.		
12				PM-057-12.0-13.0@1235
13	ML	Moist, brown firm **SILT**. No odor.		
14	SP	Moist to wet, brown poorly graded fine **SAND**. No odor.		PM-057-14.0-15.0@1240
15				
16				
17				PM-057-17.0-18.0@1242
18				
19				PM-057-19.0-20.0@1245
20		Bottom of boring = 20 feet. Assume recovered intervals		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-057 rep 2**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A2		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174699.939	**EASTING:** 1272351.853	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 302.934	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** 11.5	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/18/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
20		compressed for sample collection.		

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** PM-058
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A2		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174667.269715	**EASTING:** 1272348.28351
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 303.045	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 8	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/18/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	**ORGANIC SOIL.**		
	SP	Dry, gray brown poorly graded fine **SAND** with few large rounded gravel. No odor.		
1				PM-058-01.0-02.0@0913
2				
3				
4				
5				
6				
7		At 7.5 feet, abundant gravel present.		PM-058-07.0-08.0@0915
		Bottom of boring = 8 feet. Assume recovered intervals compressed for sample collection.		
8				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA		**LOCATION:**	**BORING ID:** PM-058 rep 2
LOGGED BY: G. Cisneros		**BORING LOCATION:** Area A2	
DRILLED BY: Chris, Gregory Drilling		**NORTHING:** 174667.269715	**EASTING:** 1272348.28351
DRILLING EQUIPMENT: Hollow Stem Auger Truck Rig		**SURFACE ELEVATION:** 303.045	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD/SAMPLER LENGTH: 18" D&M sampler, 140 lb. auto hammer		**BORING DIAMETER:** 8"	**DRILL DATE:** 2/24/2016

Depth (feet)	USCS Symbol	Soil Description and Observations (color, texture, moisture, **MAJOR CONSTITUENT**, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	PID (ppm)	Sample ID
0	OL/OH	**ORGANIC SOIL.**				
	SP	Dry, gray brown poorly graded fine **SAND** with few large rounded gravel. No odor.				
1						
2				--		PM-058-02.0-03.0 @ 1330
				--		
3				--		
				--		
4				--		PM-058-04.0-05.0 @ 1335
		Bottom of boring = 8 feet.		--		
5						
6						
7						
8						
9						
10						
11						
12						

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Blow counts not recorded.

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-059**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B1	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174634.615	**EASTING:** 1272357.812
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 302.751	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/25/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	**ORGANIC SOIL** and grass.		PM-059-00.0-01.0@1318
	SW	Light brown, medium dense, well-graded fine to coarse **SAND** with gravel (15%). No sheen or odor.		
1				PM-059-01.0-02.0@1320
2				
3				
	ML	Moist, olive brown, stiff low-plasticity **SILT**. No sheen or odor.		
4				
	SP	Moist, light brown, medium dense poorly graded fine to medium **SAND** with trace gravel (~5%). No sheen or odor. Bottom of boring = 5 feet.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-060**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A2		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174807.269715	**EASTING:** 1272383.28351	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 310.59	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 10	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/22/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
0–2.5	SM	Moist, brown dense silty fine to medium **SAND** with gravel (~10%). ~20% silt. No sheen or odor.		PM-060-01.0-02.0@1005
2.5–10	SW	Brown to light brown, medium dense, well-graded fine to coarse **SAND** with gravel (~10%) and trace silt (~5%).		PM-060-07.0-08.0@1007
10		Bottom of boring = 10 feet. Assume recovered intervals compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-060**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A2		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174807.269715	**EASTING:** 1272383.28351	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 310.59	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 10	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/22/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-061**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A2	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174771.628	**EASTING:** 1272384.125
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 309.539	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 8	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/21/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
	SW	Moist, brown well graded **SAND** with gravel and little silt. No odor.		
1				PM-061-01.0-02.0@1530
2				PM-061-02.0-03.0@1530
3				
4				
5				
6				
7		At 7.25 feet, becomes reddish brown.		PM-061-07.0-08.0@1532
		Bottom of boring = 8 feet. Assume recovered intervals compressed for sample collection.		
8				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:
Drove second 0–5 foot core for sample volume

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-062**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A2		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174739.711	**EASTING:** 1272382.888
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 309.104	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/22/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
0.5–9	SP	Moist, light brown, medium dense poorly graded fine to medium gravelly **SAND** (15% sub-rounded gravel). No sheen or odor.		
9	SM	Moist, dark brown, medium dense silty fine **SAND**. No sheen or odor.		PM-062-09.0-10.0@0917

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-062**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A2	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174739.711	**EASTING:** 1272382.888
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 309.104	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/22/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10				PM-062-10.0-11.0@0919
	SP	Moist, brown, medium dense poorly graded fine to medium **SAND** with sub-rounded gravel (~10%). No sheen or odor.		
11				PM-062-11.0-12.0@0921
12				PM-062-12.0-13.0@0923
13		At 13 feet, becomes reddish brown.		
14				PM-062-14.0-15.0@0925
15				
16		At 16.5 feet, gravel disappears.		
17				PM-062-17.0-18.0@0927
18				
19				PM-062-19.0-20.0@0929
		Bottom of boring = 20 feet. Assume recovered intervals		

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-062**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A2	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174739.711	**EASTING:** 1272382.888
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 309.104	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/22/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
20		compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:

FLOYD | SNIDER strategy ▪ science ▪ engineering	PROJECT: POS-LLA	LOCATION:	BORING ID: PM-063
	LOGGED BY: K. Anderson	BORING LOCATION: Area A2	
DRILLED BY: Kyle Ceruti, Cascade		NORTHING: 174702.12	EASTING: 1272383.587
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		SURFACE ELEVATION: 307.15	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		TOTAL DEPTH (ft bgs): 20	DEPTH TO WATER (ft bgs): 16.5
SAMPLING METHOD: 2" x 5' liner		BORING DIAMETER: 2"	DRILL DATE: 9/18/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
	SW	Dry, brown well-graded **SAND** with gravel and little silt. No odor.		
6.25		At 6.25 feet, becomes moist and dark brown.		
9				PM-063-09.0-10.0@1408 PM-063-09.0-10.0-D@1410

ABBREVIATIONS:
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NOTES:
Collected second core for sufficient sample volume. Assume recovered interval compressed for sample collection

FLOYD | SNIDER strategy ▪ science ▪ engineering	**PROJECT:** POS-LLA	**LOCATION:**	**BORING ID:** **PM-063**
	LOGGED BY: K. Anderson	**BORING LOCATION:** Area A2	

DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174702.12	**EASTING:** 1272383.587
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 307.15	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** 16.5
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/18/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10				PM-063-10.0-11.0@1443
11		At 11 feet, becomes light brown.		PM-063-11.0-12.0@1447
12				PM-063-12.0-13.0@1450
13				
14				PM-063-14.0-15.0@1445
15		(Encountered refusal due to a rock at 15 feet on first drive. Moved adjacent and re-drove 15-20 foot interval.)		
16		At 16 feet, large black oxidized wood fragment present.		
16.5	SP	Wet, gray poorly graded fine SAND.		
17				PM-063-17.0-18.0@1455
18	SW	Wet, gray well-graded **SAND** with abundant gravel and little silt. Slight musty odor.		
19				PM-063-19.0-20.0@1500
		Bottom of boring = 20 feet. Assume recovered intervals		

ABBREVIATIONS:
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NOTES:
Collected second core for sufficient sample volume. Assume recovered interval compressed for sample collection

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-063**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A2		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174702.12	**EASTING:** 1272383.587	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 307.15	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** 16.5	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/18/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
20		compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:
Collected second core for sufficient sample volume. Assume recovered interval compressed for sample collection

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-064**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A2		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174666.811	**EASTING:** 1272383.49	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 303.589	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 12	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/18/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	SW	Moist, brown well-graded gravelly **SAND**. Rounded and sub-angular gravel (swimming pool backfill).		
7.5	SP	At 7.5 feet, lense of concrete fragments (pool bottom) underlain by Moist, brown and reddish brown poorly graded fine **SAND** with few coarse sand lenses. No odor.		
9				PM-064-09.0-10.0@0856

ABBREVIATIONS:
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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-064**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A2		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174666.811	**EASTING:** 1272383.49	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 303.589	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 12	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/18/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10	ML	Moist, brown and gray mottled sandy **SILT** with few gravel. No odor.		PM-064-10.0-11.0@0858
11		Bottom of boring = 12 feet. Assume recovered intervals compressed for sample recovery.		PM-064-11.0-12.0@0900
12				

ABBREVIATIONS:
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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** PM-064A
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A2		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174666.811	**EASTING:** 1272383.49	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 303.589	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" dual-cased direct push rods	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** 16.5	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/21/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0		No samples 0-10 feet. Moved location outside of pool footprint due to recovery issues caused by gravelly backfill.		
1				
2				
3				
4				
5				
6				
7				
8				
9				

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:
Advanced to 20-foot adjacent to PM-064-moved outside pool due to gravel backfill slough. Drove 2 borings for sample volume.

FLOYD | SNIDER strategy ▪ science ▪ engineering	PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-064A**
	LOGGED BY: K. Anderson	BORING LOCATION: Area A2	
DRILLED BY: Kyle Ceruti, Cascade		NORTHING: 174666.811	EASTING: 1272383.49
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		SURFACE ELEVATION: 303.589	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" dual-cased direct push rods		TOTAL DEPTH (ft bgs): 20	DEPTH TO WATER (ft bgs): 16.5
SAMPLING METHOD: 2" x 5' liner		BORING DIAMETER: 2"	DRILL DATE: 9/21/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10	SP	Moist, brown poorly graded fine **SAND**. No odor.		
11				
12				PM-064-12.0-13.0@1426
13				
14				PM-064-14.0-15.0@1428
15				
16				
16.5 (▼)		At 16.5 feet, becomes wet.		
17				PM-064-17.0-18.0@1430
18				
19				PM-064-19.0-20.0@1432
20		Bottom of boring = 20 feet. Assume recovered intervals		

ABBREVIATIONS:
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NOTES:
Advanced to 20-foot adjacent to PM-064-moved outside pool due to gravel backfill slough. Drove 2 borings for sample volume.

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-064A**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A2		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174666.811	**EASTING:** 1272383.49	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 303.589	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" dual-cased direct push rods	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** 16.5	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/21/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
20		compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:
Advanced to 20-foot adjacent to PM-064-moved outside pool due to gravel backfill slough. Drove 2 borings for sample volume.

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-065**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A2	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174632.379	**EASTING:** 1272381.921
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 303.165	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 8	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/18/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
0.33–5	SW	Dry, brown well-graded **SAND** with gravel. No odor.		PM-065-01.0-02.0@0838
5–8	SP	Moist, brown poorly graded fine **SAND**. At 7.5 feet, becomes reddish brown. Bottom of boring = 8 feet. Assume recovered intervals compressed for sample collection.		PM-065-07.0-08.0@0840 PM-065-07.0-08.0-D@0842

ABBREVIATIONS:
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NOTES:
Encountered refusal on first attempt

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-066
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A3	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174424.55731	**EASTING:** 1272395.22686
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 300.763	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 10	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
	SW	Brown, medium dense, well-graded fine to coarse **SAND** with gravel (~10%) and trace silt (~5%). No sheen or odor.		
1				PM-066-01.0-02.0@1051
2	SP	Moist, brown, medium dense poorly graded fine to medium **SAND**. No sheen or odor.		
3				
4	ML	Moist, olive brown, stiff low-plasticity **SILT**. No sheen or odor.		
5	SP	Moist, brown, medium dense poorly graded fine to medium **SAND**. No sheen or odor.		
6				
7				
8				
9		Bottom of boring = 10 feet. Assume recovered intervals compressed for sample recovery.		PM-066-09.0-10.0@1054

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-066**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A3		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174424.55731	**EASTING:** 1272395.22686
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 300.763	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 10	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10				

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-067**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B5		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174361.819757	**EASTING:** 1272405.90391
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 300.847	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
	SW	Moist, brown to light brown, medium dense well-graded fine to coarse **SAND**. No sheen or odor.		
1				PM-067-01.0-02.0@1315
2				PM-067-02.0-03.0@1318
3				
4		Bottom of boring = 5 feet.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-068
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A2	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174846.089159	**EASTING:** 1272416.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 313.001	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 8	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/22/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
0.5–2.5	SM	Moist, brown, medium dense silty fine **SAND**. No sheen or odor.		PM-068-01.0-02.0@1125
2.5–5.5	SW	Moist, light brown, medium dense well-graded fine to coarse **SAND** with gravel (~10%) and trace silt (~5%). No sheen or odor.		
5.5–8	SP	Moist, gray brown, medium dense poorly graded fine to medium **SAND**. No sheen or odor.		PM-068-07.0-08.0@1127
8		Bottom of boring = 8 feet. Assume recovered intervals compressed for sample collection.		

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**
BORING ID: PM-069	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A2
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174807.269715
EASTING: 1272418.28351	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 310.88
COORDINATE SYSTEM: SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 8
DEPTH TO WATER (ft bgs): NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"
DRILL DATE: 9/22/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0–0.5	OL/OH	**ORGANIC SOIL** and mulch.		
0.5–3	SW	Moist, light brown, medium dense well-graded fine to coarse **SAND** with gravel (~10%) and trace silt (~5%).		PM-069-01.0-02.0@1048 (1–2 ft)
3–3.75	SM	Moist, dark brown, medium dense silty fine **SAND**. No sheen or odor.		
3.75–8	SP	Moist, light brown, medium dense poorly graded fine to medium **SAND** with gravel (~10%). No sheen or odor.		PM-069-07.0-08.0@1050 (7–8 ft)
8		Bottom of boring = 8 feet.		

ABBREVIATIONS:
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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-070**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A2		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174772.269715	**EASTING:** 1272418.28351
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 308.687	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 12	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/22/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface		
0.5–6.5	SW	Moist, dark brown, medium dense well-graded fine to coarse gravelly **SAND** with silt (~10%). ~15% gravel. No sheen or odor.		
6.5–10	SP	Moist, brown, medium dense poorly graded fine to medium gravelly **SAND**. ~15% sub-rounded gravel. No sheen or odor.		PM-070-09.0-10.0@1029

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-070**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A2		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174772.269715	**EASTING:** 1272418.28351	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 308.687	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 12	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/22/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10		At 10 feet, becomes medium to coarse-grained. No sheen or odor.		PM-070-10.0-11.0@1031
11		Bottom of boring = 12 feet.		PM-070-11.0-12.0@1033
12				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

FLOYD | SNIDER strategy ▪ science ▪ engineering	**PROJECT:** POS-LLA	**LOCATION:**	**BORING ID:** PM-070 rep 2
	LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A2	
DRILLED BY: Chris, Gregory Drilling		**NORTHING:** 174772.269715	**EASTING:** 1272418.28351
DRILLING EQUIPMENT: Hollow Stem Auger Truck Rig		**SURFACE ELEVATION:** 308.687	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA		**TOTAL DEPTH (ft bgs):** 8	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD/SAMPLER LENGTH: 18" D&M sampler, 140 lb. auto hammer		**BORING DIAMETER:** 8"	**DRILL DATE:** 2/24/2016

Depth (feet)	USCS Symbol	Soil Description and Observations (color, texture, moisture, **MAJOR CONSTITUENT**, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	PID (ppm)	Sample ID
0	Concrete	Concrete ground surface				
	SW	Moist, dark brown, medium dense well-graded fine to coarse gravelly **SAND** with silt (~10%). ~15% gravel. No sheen or odor.				
1				4		PM-070-01.0-02.0 @ 1010
				5		
2				3		PM-070-02.0-03.0 @ 1012
				4		
3				3		PM-070-03.0-04.0 @ 1015
				4		
4				4		PM-070-04.0-05.0 @ 1017
				4		
5				2		PM-070-05.0-06.0 @ 1020
				4		
6				3		PM-070-06.0-07.0 @ 1025
	SP	Moist, brown, medium dense poorly graded fine to medium gravelly **SAND**. ~15% sub-rounded gravel. No sheen or odor.		4		
7				--		PM-070-07.0-08.0 @ 1028
		Bottom of boring = 8 feet. Assume recovered intervals compressed for sample collection.		--		
8						
9						
10						
11						
12						

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
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NOTES:

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PROJECT:	LOCATION:	BORING ID:
POS-LLA		PM-071
LOGGED BY: K. Anderson	BORING LOCATION: Area A1	

DRILLED BY:	NORTHING:	EASTING:
Curtis Askew/Kyle Ceruti, Cascade	174732.488	1272417.054
DRILLING EQUIPMENT: CME 75 Auger Truck rig	SURFACE ELEVATION: 307.18	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA	TOTAL DEPTH (ft bgs): 26	DEPTH TO WATER (ft bgs): 22.1
SAMPLING METHOD: 2" x 18" split spoon, 140 lb. auto hammer	BORING DIAMETER: 8"	DRILL DATE: 9/15/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
0	Asphalt	Asphalt ground surface.			
	SW	Moist, brown well-graded fine to coarse **SAND** with small rounded gravel and trace silt. No odor.			
1					
2					
3					
4					
5				6	
				5	
6				5	
7					
8					
9					
10					

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Moved ~5.5 feet due to storm sewer lines-to re-survey

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-071**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade		**NORTHING:** 174732.488	**EASTING:** 1272417.054
DRILLING EQUIPMENT: CME 75 Auger Truck rig		**SURFACE ELEVATION:** 307.18	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA		**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 22.1
SAMPLING METHOD: 2" x 18" split spoon, 140 lb. auto hammer		**BORING DIAMETER:** 8"	**DRILL DATE:** 9/15/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
10					
11					
12					
13					
14					
15					
16					
17					
18					
		Moist, brown poorly graded fine SAND.			
19					

ABBREVIATIONS:
ft bgs = feet below ground surface
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▼ = denotes groundwater table

NOTES:
Moved ~5.5 feet due to storm sewer lines-to re-survey

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-071**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174732.488	**EASTING:** 1272417.054	
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:** 307.18	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 22.1	
SAMPLING METHOD: 2" x 18" split spoon, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/15/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
20	SP			10	
				13	
21				14	PM-071-21.0-22.0@0935
		At 21.5 feet, 0.4-foot lense of brown sandy silt, then same as above.		12	
22		At 22.1 feet, becomes wet. Thin bands of red oxidized sand present. No odor.		14	
				15	
23				9	PM-071-23.0-24.0@0945
				17	
24				20	
				7	
25				5	PM-071-25.0-26.0@1000
		Bottom of boring = 26 feet. Assume recovered intervals compressed for sample collection.		21	
26					

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:
Moved ~5.5 feet due to storm sewer lines-to re-survey

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-071 rep 2
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A1	
DRILLED BY: Chris, Gregory Drilling	**NORTHING:** 174732.488	**EASTING:** 1272417.054
DRILLING EQUIPMENT: Hollow Stem Auger Truck Rig	**SURFACE ELEVATION:** 307.18	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 10	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD/SAMPLER LENGTH: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 2/24/2016

Depth (feet)	USCS Symbol	Soil Description and Observations (color, texture, moisture, **MAJOR CONSTITUENT**, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	PID (ppm)	Sample ID
0	Asphalt	Asphalt ground surface.				
	SP	Moist, brown medium dense poorly graded fine to medium gravelly **SAND** .				
1				8		PM-071-01.0-02.0 @ 900
				8		
2				7		PM-071-02.0-03.0 @ 910
				9		
3				10		PM-071-03.0-04.0 @ 921
				10		
4				10		
				10		
5				5		PM-071-05.0-06.0 @ 925
				7		
6				8		
				5		
7				5		PM-071-07.0-08.0 @ 933
				4		
8				3		
				4		
9				5		PM-071-09.0-10.0 @ 935
		Bottom of boring = 10 feet.		5		
10						
11						
12						

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-072**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade		**NORTHING:** 174702.269715	**EASTING:** 1272418.28351
DRILLING EQUIPMENT: CME 75 Auger Truck rig		**SURFACE ELEVATION:** 307.09	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA		**TOTAL DEPTH (ft bgs):** 21.5	**DEPTH TO WATER (ft bgs):** 18.5
SAMPLING METHOD: 2" x 18" split spoon, 140 lb. auto hammer		**BORING DIAMETER:** 8"	**DRILL DATE:** 9/15/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
0	Concrete	Concrete ground surface.			
0.5		Moist, gray brown well-graded fine to coarse **SAND** with rounded gravel and trace silt.			
1					
2					
3					
4					
5			Drive 5–6.5	4	
			Recovery 5.75–6.5	5	
6		At 5.8 feet, becomes brown.		9	
		At 6.4 feet, nail (anthropogenic debris) present.			
7					
8					
9					
10					

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-072	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174702.269715	**EASTING:** 1272418.28351	
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:** 307.09	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 21.5	**DEPTH TO WATER (ft bgs):** 18.5	
SAMPLING METHOD: 2" x 18" split spoon, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/15/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
10	SW			3	
				2	
11					
12					
13					
14					
15				2	
16					
17					
18		At 18 feet, becomes loose and wet. Poor sample recovery 18.5 to 20 feet.			
				7	
19				5	
				5	

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-072**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade		**NORTHING:** 174702.269715	**EASTING:** 1272418.28351
DRILLING EQUIPMENT: CME 75 Auger Truck rig		**SURFACE ELEVATION:** 307.09	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA		**TOTAL DEPTH (ft bgs):** 21.5	**DEPTH TO WATER (ft bgs):** 18.5
SAMPLING METHOD: 2" x 18" split spoon, 140 lb. auto hammer		**BORING DIAMETER:** 8"	**DRILL DATE:** 9/15/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
20		At 20 feet, large rounded cobbles blocking sampler. Abandoned boring and re-drilled using larger diameter sampler.		7	
				9	
21				10	

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-072 rep 2**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174702.269715	**EASTING:** 1272418.28351	
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:** 307.09	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 18" D&M sampler, 300 lb. hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/15/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
0		No samples 0 to 18.5 feet. See PM-072 for lithology.			
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:
Location moved 2.5 feet south of original PM-072 location, needs re-survey

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-072 rep 2
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1	
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174702.269715	**EASTING:** 1272418.28351
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:** 307.09	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 18" D&M sampler, 300 lb. hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/15/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
10					
11					
12					
13					
14					
15					
16					
17					
18					
18.5		Wet, brown poorly graded silty fine **SAND** with abundant well rounded gravel. Driller reports cobbles in overlying material, likely causing poor recovery.		5	
19				5	PM-072-19.0-20.0@1215
				9	

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:
Location moved 2.5 feet south of original PM-072 location, needs re-survey

FLOYD | SNIDER strategy ▪ science ▪ engineering	PROJECT: POS-LLA	LOCATION:	BORING ID: PM-072 rep 2
	LOGGED BY: K. Anderson	BORING LOCATION: Area A1	
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade		NORTHING: 174702.269715	EASTING: 1272418.28351
DRILLING EQUIPMENT: CME 75 Auger Truck rig		SURFACE ELEVATION: 307.09	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA		TOTAL DEPTH (ft bgs): 26	DEPTH TO WATER (ft bgs): NA
SAMPLING METHOD: 18" D&M sampler, 300 lb. hammer		BORING DIAMETER: 8"	DRILL DATE: 9/15/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
20	SM	At 20 feet, slight hydrocarbon odor present.		3	PM-072-20.0-21.0@1225
				4	
21				7	PM-072-21.0-22.0@1232
		At 21.5 feet, becomes gray with increased silt.		7	
22	ML	Moist, brown firm sandy **SILT**. No odor.		15	
				20	
23	SP	Wet, gray poorly graded fine **SAND**. Slight hydrocarbon odor that dissipates quickly when sample is homogenized.		12	PM-072-23.0-24.0@1250 PM-072-23.0-24.0-D@1258
				20	
24				24	
		At 24.5 feet, grain size becomes smaller.		13	
25				17	PM-072-25.0-26.0@1305
		Bottom of boring = 26 feet. Assume recovered intervals compressed for sample collection.		22	
26					

ABBREVIATIONS:
ft bgs = feet below ground surface
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▼ = denotes groundwater table

NOTES:
Location moved 2.5 feet south of original PM-072 location, needs re-survey

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** PM-073
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade		**NORTHING:** 174667.047	**EASTING:** 1272417.292
DRILLING EQUIPMENT: CME 75 Auger Truck rig		**SURFACE ELEVATION:** 307.2	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA		**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 23
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer		**BORING DIAMETER:** 8"	**DRILL DATE:** 9/15/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
0	Concrete	Concrete ground surface.			
0.5	SW	Moist, brown well-graded fine to coarse **SAND** with rounded gravel and trace silt.			
5			Drive 5–6.5	12	
5.5			Recovery 5.75–6.5	16	
5.8		At 5.8 feet, geotextile fabric present.			
6				15	
10					

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:
1' west of target location due to vegetation

FLOYD | SNIDER strategy ▪ science ▪ engineering	**PROJECT:** POS-LLA	**LOCATION:**	**BORING ID:** PM-073
	LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1	

DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174667.047	**EASTING:** 1272417.292
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:** 307.2	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 23
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/15/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
10				16	
				25	
11		At 11 feet, abundant large gravel blocking sampler.		24	
12					
13					
14					
15					
16					
17					
18		Moist, brown poorly graded fine SAND.		15	
19		At 19.2 feet, becomes gray with hydrocarbon odor.		40	PM-073-19.0-20.0@1438 PM-073-19.0-20.0-D@1440
				42	

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
1' west of target location due to vegetation

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-073**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade		**NORTHING:** 174667.047	**EASTING:** 1272417.292
DRILLING EQUIPMENT: CME 75 Auger Truck rig		**SURFACE ELEVATION:** 307.2	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA		**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 23
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer		**BORING DIAMETER:** 8"	**DRILL DATE:** 9/15/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
20	SP			15	
				32	
21				30	PM-073-21.0-22.0@1445
				25	
22				40	
		At 22.5 feet, becomes reddish brown. Slight musty odor, no hydrocarbon odor.		35	
23 ▼		At 23 feet, becomes wet and gray with slight musty odor.		12	PM-073-23.0-24.0@1500
		At 23.5 feet, becomes reddish brown.		32	
24				30	
				12	
25				31	PM-073-25.0-26.0@1510
		Bottom of boring = 26 feet. Assume recovered intervals compressed for sample collection.		8	
26					

ABBREVIATIONS:
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▼ = denotes groundwater table

NOTES:
1' west of target location due to vegetation

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-074**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174633.749	**EASTING:** 1272416.611
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 303.265	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/17/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	Moist, brown **ORGANIC SOIL**.		
0–1.5	SW-SM	Dry, brown well-graded **SAND** with silt and rounded gravel. No odor.		
1–2				PM-074-01.0-02.0@1525
2.5–6	SW	From 1.5 to 2.5 feet, grades to light brown well-graded **SAND** with abundant gravel and trace silt.		
6–7.25	ML	Dry, brown and reddish brown mottled, firm sandy **SILT**. No odor.		
7.25–10	SP/SW	Interbedded lenses of poorly graded fine **SAND** and well-graded fine to coarse **SAND** with gravel.		

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:
Moved location to avoid tree branches overhead. Assume recovered interval compressed for sample collection. Drove second 20-foot core adjacent to target location for sample volume.

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PROJECT:	LOCATION:	BORING ID:
POS-LLA		PM-074

LOGGED BY:	BORING LOCATION:
K. Anderson	Area A1

DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174633.749	**EASTING:** 1272416.611
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 303.265	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/17/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10–12	SP	Moist, reddish brown and black brown poorly graded fine **SAND**. No odor.		PM-074-10.0-11.0@1530
12–18	SW	Dry, brown well-graded **SAND** with gravel. Some large gravel with diameter larger than core barrel. No odor.		
18–20	SP	Moist, brown poorly graded fine **SAND**. No odor.		PM-074-19.0-20.0@1535
		Bottom of boring = 20 feet. Assume recovered intervals		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Moved location to avoid tree branches overhead. Assume recovered interval compressed for sample collection. Drove second 20-foot core

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-074**
LOGGED BY: K. Anderson	BORING LOCATION: Area A1	
DRILLED BY: Kyle Ceruti, Cascade	NORTHING: 174633.749	EASTING: 1272416.611
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	SURFACE ELEVATION: 303.265	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	TOTAL DEPTH (ft bgs): 20	DEPTH TO WATER (ft bgs): NA
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 9/17/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
20		compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
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▼ = denotes groundwater table

NOTES:
Moved location to avoid tree branches overhead. Assume recovered interval compressed for sample collection. Drove second 20-foot core adjacent to target location for sample volume.

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-075**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A2		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174596.851	**EASTING:** 1272418.784
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 298.599	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 8	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/18/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
	GW	Large **GRAVEL** visible in borehole. No recovery.		
1				PM-075-01.0-02.0@0817
	SW	Moist, brown well-graded **SAND**. No odor.		
2				
3				
4				
5				
	ML	Moist, brown and gray mottled sandy **SILT**.		
6	SP	Moist, brown poorly graded fine **SAND**. Few large gravel with diameter larger than core barrel. No odor.		
7		Bottom of boring = 8 feet.		PM-075-07.0-08.0@0821
8				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Encountered refusal on first attempt

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-076**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A3		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174460.45	**EASTING:** 1272422.903	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 300.465	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 10	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/23/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
0–4	SW	Moist, brown, medium dense well-graded fine to coarse gravelly **SAND** with trace silt (~5%). ~15% sub-rounded gravel. No sheen or odor.		
1–2				PM-076-01.0-02.0@1112
4–10	SP	Moist, brown, medium dense poorly graded fine to medium **SAND**. No sheen or odor.		
9–10		Bottom of boring = 10 feet.		PM-076-09.0-10.0@1115

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-076**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A3		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174460.45	**EASTING:** 1272422.903
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 300.465	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 10	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-077**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B5		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174398.527058	**EASTING:** 1272431.93416
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 299.029	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
	SW	Moist, gray to brown, medium dense, well-grade fine to medium gravelly **SAND** with trace silt (<5%). ~15% gravel. No sheen or odor.		
1				PM-077-01.0-02.0@1330
2				PM-077-02.0-03.0@1333
3	SP	Moist, light brown, medium dense poorly graded fine to medium sand with sub-rounded gravel (~10%). No sheen or odor.		
4				
	SM	Moist, brown to gray, medium dense silty fine **SAND** with silt (15%). No sheen or odor. Bottom of boring = 5 feet.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-078**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B3	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174560.709467	**EASTING:** 1272436.61031
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 301.159	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
	SP	Moist, brown, medium dense poorly graded fine to medium **SAND** with sub-rounded gravel (~10%). No sheen or odor.		
1–2				PM-078-01.0-02.0@1355
2–3				PM-078-02.0-03.0@1358
3				
4				
5		Bottom of boring = 5 feet.		

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:

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PROJECT:	LOCATION:	BORING ID:
POS-LLA		PM-078 rep 2
LOGGED BY: G. Cisneros	BORING LOCATION: Area B3	
DRILLED BY: Frank Scott, Cascade	NORTHING: 174560.709467	EASTING: 1272436.61031
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	SURFACE ELEVATION: 301.159	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	TOTAL DEPTH (ft bgs): 17	DEPTH TO WATER (ft bgs): NA
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 11/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
0.5–10	SP	Moist, brown poorly graded fine to medium **SAND** with gravel 9~10%). No odor.		
2–3				PM-078-02.0-03.0@1136
7–8				PM-078-07.0-08.0@1138

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Location re-sampled to fill data gaps.

FLOYD | SNIDER strategy ▪ science ▪ engineering	PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-078 rep 2**
	LOGGED BY: G. Cisneros	BORING LOCATION: Area B3	
DRILLED BY: Frank Scott, Cascade		NORTHING: 174560.709467	EASTING: 1272436.61031
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		SURFACE ELEVATION: 301.159	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		TOTAL DEPTH (ft bgs): 17	DEPTH TO WATER (ft bgs): NA
SAMPLING METHOD: 2" x 5' liner		BORING DIAMETER: 2"	DRILL DATE: 11/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10				
11				PM-078-11.0-12.0@1140
12				PM-078-12.0-13.0@1142
13				PM-078-13.0-14.0@1144
14		At 14.5 feet, becomes reddish brown.		PM-078-14.0-15.0@1146
15				PM-078-15.0-16.0@1148
16		Bottom of boring = 17 feet. Assume recovered intervals compressed for sample collection.		PM-078-16.0-17.0@1150
17				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:
Location re-sampled to fill data gaps.

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-079
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B5	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174330.294	**EASTING:** 1272449.066
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 292.901	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	**ORGANIC SOIL.**		
	SP	Moist, light brown, medium dense poorly graded fine to medium **SAND** with sub-rounded gravel (~10%). No sheen or odor.		
1				PM-079-01.0-02.0@1425
2				PM-079-02.0-03.0@1428
3				
4		Bottom of boring = 5 feet.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
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▼ = denotes groundwater table

NOTES:

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	LOGGED BY: G. Cisneros	BORING LOCATION: Area A3	

DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174498.771	**EASTING:** 1272447.062
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 299.85	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 10	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
	SP	Moist, brown, medium dense, poorly graded fine to medium **SAND** with sub-rounded gravel (~10%). No sheen or odor.		
1–2				PM-080-01.0-02.0@1257 PM-080-01.0-02.0-D@1300
9–10		Bottom of boring = 10 feet.		PM-080-09.0-10.0@1303

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-080**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A3		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174498.771	**EASTING:** 1272447.062
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 299.85	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 10	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-081**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A2		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174807.269715	**EASTING:** 1272453.28351
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 308.727	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 8	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/22/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
0–2	SW	Moist, reddish brown, medium dense well graded fine to coarse **SAND** with trace silt (~5%) and gravel (~5%). No sheen or odor.		PM-081-01.0-02.0@1306 (1–2 ft)
2–4	SP	Moist, light brown, medium dense poorly graded fine to medium **SAND** with trace gravel (~5%). No sheen or odor.		
4–6.5	SW	Moist, light brown to gray, well-graded fine to coarse **SAND** with gravel (~10%) and trace silt (~5%). No sheen or odor.		
6–8	ML	Moist, olive brown, stiff, low-plasticity **SILT**. No sheen or odor.		PM-081-07.0-08.0@1308 (7–8 ft)
8		Bottom of boring = 8 feet. Assume recovered intervals compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-082**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A2		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174772.269715	**EASTING:** 1272453.28351	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 306.67	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 12	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/22/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
0.5	SM	Moist, dark brown, medium dense silty fine **SAND** (20% silt).		
2		At 2 feet, wood fragments present.		
3	SW	Moist, brown, medium dense well-graded fine to coarse **SAND** with gravel (~10%) and trace silt (~5%). No sheen or odor.		
7	ML	Moist, light brown to olive brown, hard, low-plasticity **SILT** interbedded with 0.5-inch thick fine sand lenses. No sheen or odor.		
9				PM-082-09.0-10.1@1108

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-082**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A2	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174772.269715	**EASTING:** 1272453.28351
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 306.67	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 12	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/22/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10				PM-082-10.0-11.0@1110
11		Bottom of boring = 12 feet.		PM-082-11.0-12.0@1112
12				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** PM-082 rep 2
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A2		
DRILLED BY: Chris, Gregory Drilling	**NORTHING:** 174772.269715	**EASTING:** 1272453.28351	
DRILLING EQUIPMENT: Hollow Stem Auger Truck Rig	**SURFACE ELEVATION:** 306.67	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 8	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD/SAMPLER LENGTH: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 2/24/2016	

Depth (feet)	USCS Symbol	Soil Description and Observations (color, texture, moisture, **MAJOR CONSTITUENT**, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	PID (ppm)	Sample ID
0	Asphalt	Asphalt ground surface.				
0.5	SP	Moist, dark brown, medium dense fine **SAND**.				
1				9		PM-082-01.0-02.0 @ 1044
1.5				10		
2		At 2 feet, wood fragments present.		9		PM-082-02.0-03.0 @ 1046
2.5				10		
3		Moist, brown, medium dense well-graded fine to coarse **SAND** with gravel (~10%) and trace silt (~5%). No sheen or odor. Large cobbles present from 3 to 5 feet.		8		
3.5				9		
4				10		
4.5				10		
5				7		PM-082-05.0-06.0 @ 1055
5.5				7		
6				8		PM-082-06.0-07.0 @ 1058
6.5				10		
7				5		PM-082-07.0-08.0 @ 1100
7.3	ML	Moist, light brown to olive brown, hard, low-plasticity **SILT** interbedded with 0.5-inch thick fine sand lenses. No sheen or odor. Bottom of boring = 8 feet.		5		
8						
9						
10						
11						
12						

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** PM-083
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174737.329	**EASTING:** 1272453.158
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 306.129	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/22/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
0.25–5.5	SM	Moist, gray to dark brown, medium dense silty fine to medium **SAND** with gravel (~10%). ~20% silt. No sheen or odor.		PM-083-01.0-02.0@1333
5.5–9.5	SP	Moist, light brown to gray, medium dense poorly graded fine to medium **SAND** with sub-rounded gravel (~10%). No sheen or odor.		
9.5–		Moist, light brown, medium dense well-graded fine to coarse gravelly **SAND** with trace silt (~5%). ~15% gravel. No sheen or odor.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-083**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A1		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174737.329	**EASTING:** 1272453.158	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 306.129	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/22/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10	SW			PM-083-10.0-11.0@1335
11				
12				
13				
14	ML	Moist, olive brown hard **SILT**. No sheen or odor.		
15				
15.5	SP	Moist, gray to brown, medium dense poorly graded fine to medium gravelly **SAND**. No sheen or odor.		
16				
17	ML	Moist, olive brown, hard low-plasticity **SILT**. No sheen or odor.		
18				
19				PM-083-19.0-20.0@1337
19.5	SP	Moist, gray poorly graded fine to medium **SAND**. No sheen or		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-083**
LOGGED BY: G. Cisneros	BORING LOCATION: Area A1	
DRILLED BY: Kyle Ceruti, Cascade	NORTHING: 174737.329	EASTING: 1272453.158
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	SURFACE ELEVATION: 306.129	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	TOTAL DEPTH (ft bgs): 20	DEPTH TO WATER (ft bgs): NA
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 9/22/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
20		odor. Bottom of boring = 20 feet.		

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-084
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1	
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174699.689	**EASTING:** 1272458.251
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:** 305.43	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 17
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/16/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
0	Asphalt	Asphalt ground surface.			
0.5–10	SW	Moist, brown well-graded fine to coarse **SAND** with well-graded sub-angular to angular gravel and trace silt. No odor.			
5–6.5			Drive 5–6.5; Recovery 5.75–6.5	14, 24, 43	

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Moved location approximately 5.5' east to avoid trees and thick concrete slab

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-084**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174699.689	**EASTING:** 1272458.251	
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:** 305.43	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 17	
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/16/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
10				6	
				6	
11				7	
12					
13					
14					
15					
16					
17 ▼					
18					
	SM	Wet, brown well-graded fine to coarse silty **SAND** with few fine gravel. No odor.		12	
19				35	PM-084-19.0-20.0@0850
				30	

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Moved location approximately 5.5' east to avoid trees and thick concrete slab

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PROJECT:	LOCATION:	BORING ID:
POS-LLA		PM-084
LOGGED BY: K. Anderson	BORING LOCATION: Area A1	

DRILLED BY:	NORTHING:	EASTING:
Curtis Askew/Kyle Ceruti, Cascade	174699.689	1272458.251
DRILLING EQUIPMENT: CME 75 Auger Truck rig	SURFACE ELEVATION: 305.43	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA	TOTAL DEPTH (ft bgs): 26	DEPTH TO WATER (ft bgs): 17
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	BORING DIAMETER: 8"	DRILL DATE: 9/16/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
20				30	
				34	
21	SP	Wet, gray poorly graded fine **SAND** with few rounded gravel. No odor.		41	PM-084-21.0-22.0@0905
				13	
22				22	
				38	
23				30	PM-084-23.0-24.0@0925
				35	
24				40	
				32	
25		At 25.2 feet, becomes slightly reddish-brown.		41	PM-084-25.0-26.0@0935
		Bottom of boring = 26 feet. Assume recovered intervals compressed for sample collection.		39	
26					

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Moved location approximately 5.5' east to avoid trees and thick concrete slab

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-084 rep 2**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A1		
DRILLED BY: Chris, Gregory Drilling		**NORTHING:** 174699.689	**EASTING:** 1272458.251
DRILLING EQUIPMENT: Hollow Stem Auger Truck Rig		**SURFACE ELEVATION:** 305.43	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA		**TOTAL DEPTH (ft bgs):** 10	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD/SAMPLER LENGTH: 18" D&M sampler, 140 lb. auto hammer		**BORING DIAMETER:** 8"	**DRILL DATE:** 2/24/2016

Depth (feet)	USCS Symbol	Soil Description and Observations (color, texture, moisture, **MAJOR CONSTITUENT**, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	PID (ppm)	Sample ID
0	Asphalt	Asphalt ground surface.				
	SP	Moist, brown poorly graded fine to coarse **SAND** with well-graded sub-angular to angular gravel and trace silt. No odor.				
1				1		PM-084-01.0-02.0 @ 1130
				15		
2				14		PM-084-02.0-03.0 @ 1132
				18		
3				14		PM-084-03.0-04.0 @ 1135
				13		
4				14		PM-084-04.0-05.0 @ 1137
				4		
5				19		PM-084-05.0-06.0 @ 1140
				26		
6				20		
				11		
7				16		PM-084-07.0-08.0 @ 1145
				21		
8				23		
				26		
9				3		PM-084-09.0-10.0 @ 1150
		Bottom of boring = 10 feet.		4		
10						
11						
12						

ABBREVIATIONS:
ft bgs = feet below ground surface USCS = Unified Soil Classification System
ppm = parts per million ▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-085
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A1	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174666.328	**EASTING:** 1272452.577
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 304.104	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 28	**DEPTH TO WATER (ft bgs):** 19.5
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
	SW	Moist, brown, medium dense well-graded fine to coarse gravelly **SAND** with trace silt (<5%). ~15% sub-rounded gravel. No sheen or odor.		
1–2				PM-085-01.0-02.0@0857
5		At 5 feet, occasional 1-inch silt lenses present.		
8		Moist, brown, medium dense poorly graded fine to medium **SAND** with sub-rounded gravel (~10%). No sheen or odor.		
9				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-085**
LOGGED BY: G. Cisneros	BORING LOCATION: Area A1	
DRILLED BY: Kyle Ceruti, Cascade	NORTHING: 174666.328	EASTING: 1272452.577
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	SURFACE ELEVATION: 304.104	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	TOTAL DEPTH (ft bgs): 28	DEPTH TO WATER (ft bgs): 19.5
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 9/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10	SP			PM-085-10.0-11.0@0832
11				
12				
13	SW	Moist, brown, medium dense well-graded fine to coarse gravelly **SAND** with trace silt (<5%). ~15% sub-rounded gravel. No sheen or odor.		
14	SP	Moist, gray, medium dense poorly graded medium to coarse **SAND** with gravel (~10%). Slight petroleum hydrocarbon odor present. No sheen.		
15				
16				
17				
18		At 18.5 feet, becomes wet and odor disappears.		
19				PM-085-19.0-20.0@0836

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-085**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174666.328	**EASTING:** 1272452.577
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 304.104	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 28	**DEPTH TO WATER (ft bgs):** 19.5
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
20–24	SW	Wet, gray, medium dense well-graded fine to coarse gravelly **SAND**. No sheen or odor.		
21–22				PM-085-21.0-22.0@0839
23–24				PM-085-23.0-24.0@0843
24–28	SP	Wet, gray, medium dense poorly graded fine to medium **SAND**. No sheen or odor.		
25–26				PM-085-25.0-26.0@0846
27–28				PM-085-27.0-28.0@0849
28		Bottom of boring = 28 feet. Assume recovered intervals compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

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PROJECT:	LOCATION:	BORING ID:
POS-LLA		PM-085 rep 2
LOGGED BY: G. Cisneros	BORING LOCATION: Area A1	

DRILLED BY: Frank Scott, Cascade	NORTHING: 174666.328	EASTING: 1272452.577
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	SURFACE ELEVATION: 304.104	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	TOTAL DEPTH (ft bgs): 25	DEPTH TO WATER (ft bgs): NA
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 11/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
	SM	Dark brown silty fine **SAND** with trace angular clasts (~5%).		
	SP	Brown poorly graded fine **SAND**.		
	SW	Moist, brown well-graded fine to coarse **SAND** with gravel (~10%) and trace silt (~5%). No odor.		
5				PM-085-00.0-10.0@1440
	SP	Moist, reddish brown poorly graded fine to medium **SAND** with trace gravel (~5%). No odor.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Location re-sampled to fill data gaps.

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-085 rep 2**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A1		
DRILLED BY: Frank Scott, Cascade	**NORTHING:** 174666.328	**EASTING:** 1272452.577	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 304.104	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 25	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 11/23/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10				
11		At 11 feet, becomes brown to light brown.		
12				
13				
14		At 14 feet, gravel disappears. Becomes wet and gray. No odor.		
15				
16	SP			
17		At 17 feet, slight hydrocarbon odor present. No sheen.		
18				
19				

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:
Location re-sampled to fill data gaps.

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** PM-085 rep 2
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A1		
DRILLED BY: Frank Scott, Cascade	**NORTHING:** 174666.328	**EASTING:** 1272452.577	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 304.104	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 25	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 11/23/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
20		At 20 feet, becomes medium to coarse. Slight hydrocarbon odor, no sheen.		
21				
22				PM-085-22.0-23.0@1500
23		At 23 feet, becomes fine. Slight hydrocarbon odor, no sheen.		
24		Bottom of boring = 25 feet. Assume recovered intervals compressed for sample collection.		PM-085-24.0-25.0@1502
25				

ABBREVIATIONS:
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NOTES:
Location re-sampled to fill data gaps.

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-086
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1	
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174632.383	**EASTING:** 1272454.995
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:** 302.27	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 18.75
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/16/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
0	Asphalt	Asphalt ground surface.			
0.5–10	SW	Slightly moist, dark black brown well-graded **SAND** with gravel and grace silt. Wood fragments present in shoe of sampler.			
5–6.5			Drive 5–6.5; Recovery 6.3–6.5	8, 8, 6	PM-086-05.0-06.0@1035

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
~1-foot east of target location due to vegetation

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-086**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1	
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174632.383	**EASTING:** 1272454.995
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:** 302.27	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 18.75
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/16/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
10	SP	Moist, brown poorly graded fine **SAND** with abundant wood fragments. Wood fragments have slight sweet odor.		8	PM-086-10.0-11.0@1040
		At 10.5 feet, wood fragments disappear.		10	
11		From 11 to 11.25 feet, color grades to gray.		12	
12					
13					
14					
15					
16					
17					
18				14	
19		At 18.75 feet, becomes wet. No odor.		22	PM-086-19.0-20.0@1055 PM-086-19.0-20.0-D@1040
				30	

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
~1-foot east of target location due to vegetation

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-086
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1	
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174632.383	**EASTING:** 1272454.995
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:** 302.27	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 18.75
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/16/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
20		At 20 feet, slight sweet odor.		11	
				22	
21		At 21.25 feet, 3-inch lense of wet, brown silty fine sand.		27	PM-086-21.0-22.0@1110
				27	
22		At 22.25 feet, 0.5-foot lense of reddish brown sand. Slight sweet odor.		39	
				44	
23				27	PM-086-23.0-24.0@1125
				31	
24				39	
				18	
25		At 25.4 feet, becomes gray with no odor. At 25.75 feet, becomes gray brown. Bottom of boring = 26 feet. Assume recovered intervals compressed for sample collection.		27	PM-086-25.0-26.0@1135
				30	
26					

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
~1-foot east of target location due to vegetation

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** PM-087
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A1		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174596.488	**EASTING:** 1272452.69	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 301.146	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** 19.5	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/22/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
0.5–4	SW	Moist, brown to dark brown, medium dense well-graded fine to coarse **SAND** with sub-rounded gravel (~10%) and silt (~10%). No sheen or odor.		
1–2				PM-087-01.0-02.0@0819
4–10	SP	Moist, brown, medium dense poorly graded medium to coarse gravelly **SAND**. ~15% sub-rounded gravel. No sheen or odor.		

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT:	LOCATION:	BORING ID:
POS-LLA		PM-087
LOGGED BY: G. Cisneros	BORING LOCATION: Area A1	

DRILLED BY: Kyle Ceruti, Cascade	NORTHING: 174596.488	EASTING: 1272452.69
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	SURFACE ELEVATION: 301.146	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	TOTAL DEPTH (ft bgs): 20	DEPTH TO WATER (ft bgs): 19.5
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 9/22/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10				PM-087-10.0-11.0@0821
11	ML	Moist, olive brown, stiff low-plasticity gravelly **SILT**. No sheen or odor.		
12				
13	SP	Moist, light brown, medium dense poorly graded fine to medium **SAND** with trace silt (~5%). No sheen or odor.		
14				
15				
16		At 16 feet, becomes reddish brown.		
17				
18				
19				PM-087-19.0-20.0@0823
		Bottom of boring = 20 feet. Assume recovered intervals		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-087**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A1		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174596.488	**EASTING:** 1272452.69	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 301.146	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** 19.5	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/22/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
20		compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-087 rep 2**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A1		
DRILLED BY: Frank Scott, Cascade	**NORTHING:** 174596.488	**EASTING:** 1272452.69	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 301.146	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 17	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 11/23/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
0.5	SP	Moist, brown poorly graded fine to medium **SAND** with gravel (~10%). No odor.		
6.5	SP	At 6.5 feet, becomes reddish brown with small gravel.		

ABBREVIATIONS:
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NOTES:
Location re-sampled to fill data gaps.

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-087 rep 2
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A1	
DRILLED BY: Frank Scott, Cascade	**NORTHING:** 174596.488	**EASTING:** 1272452.69
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 301.146	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 17	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 11/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10				
11		At 11 feet, becomes brown and medium to coarse.		PM-087-11.0-12.0@1120
12		At 12.5 feet, becomes coarse with increased large gravel (~15%).		PM-087-12.0-13.0@1122
13		At 13.5 feet, becomes fine to medium.		PM-087-13.0-14.0@1124
14				PM-087-14.0-15.0@1126
15		At 15 feet, becomes brown.		PM-087-15.0-16.0@1128
16		At 16 feet, becomes reddish brown. Bottom of boring = 17 feet. Assume recovered intervals compressed for sample collection.		PM-087-16.0-17.0@1130
17				

ABBREVIATIONS:
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NOTES:
Location re-sampled to fill data gaps.

FLOYD | SNIDER strategy ▪ science ▪ engineering	**PROJECT:** POS-LLA	**LOCATION:**	**BORING ID:** PM-088
	LOGGED BY: K. Anderson	**BORING LOCATION:** Area A3	

DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174434.968	**EASTING:** 1272459.195
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 299.003	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push double-cased rod	**TOTAL DEPTH (ft bgs):** 15	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/17/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
	SW	2-inch lense of red wood fragments underlain by moist, brown well-graded fine to coarse **SAND** with rounded gravel and trace silt. No odor.		
1				PM-088-01.0-02.0@0935
2				
3		At 3.5 feet, becomes loose and dry.		
4				
5				
6				
7		At 7.5 feet, becomes moist.		
8				
		Moist, dense gray-brown well-graded **SAND** with silt and gravel. Gravel becomes larger than above and lenses of poorly graded fine sand present. No odor.		
9				PM-088-09.0-10.0@0938

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:

FLOYD | SNIDER strategy ▪ science ▪ engineering	PROJECT: POS-LLA	LOCATION:	BORING ID: PM-088
	LOGGED BY: K. Anderson	BORING LOCATION: Area A3	
DRILLED BY: Kyle Ceruti, Cascade		NORTHING: 174434.968	EASTING: 1272459.195
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		SURFACE ELEVATION: 299.003	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push double-cased rod		TOTAL DEPTH (ft bgs): 15	DEPTH TO WATER (ft bgs): NA
SAMPLING METHOD: 2" x 5' liner		BORING DIAMETER: 2"	DRILL DATE: 9/17/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10	SW-SM			
11				PM-088-11.0-12.0@0940
12				
13				
14		Bottom of boring = 15 feet. Assume recovered intervals compressed for sample collection.		
15				

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-089**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B5	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174368.851	**EASTING:** 1272475.884
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 294.077	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	**ORGANIC SOIL** and grass.		
	SP	Moist, brown, medium dense poorly graded fine to medium **SAND** with sub-rounded gravel (~10%). No sheen or odor.		
1				PM-089-01.0-02.0@1433
2				PM-089-02.0-03.0@1436
3				
4		Bottom of boring = 5 feet.		
5				

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-090**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B3		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174534.679215	**EASTING:** 1272473.31761
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 299.818	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
	SW	Moist, brown to light brown, medium dense well-graded fine to coarse **SAND** with gravel (~10%) and trace silt (<5%). No sheen or odor.		
1				PM-090-01.0-02.0@1347
2				
3				
4				
		Bottom of boring = 5 feet.		
5				

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NOTES:

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-090 rep 2**
LOGGED BY: G. Cisneros	BORING LOCATION: Area B3	

DRILLED BY: Frank Scott, Cascade	NORTHING: 174534.679215	EASTING: 1272473.31761
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	SURFACE ELEVATION: 299.818	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	TOTAL DEPTH (ft bgs): 5	DEPTH TO WATER (ft bgs): NA
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 11/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
	SP	Moist, brown poorly graded fine to medium **SAND** with fine gravel (~10%). No odor.		
1				
2				PM-090-02.0-03.0@1308
	SW	Moist, brown well-graded fine to coarse **SAND** with fine gravel (~15%). No odor.		
3				PM-090-03.0-04.0@1310
	SP	Moist, brown poorly graded fine **SAND**. No odor.		
4				PM-090-04.0-05.0@1312
		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		
5				

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NOTES:
Location re-sampled to fill data gaps.

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-091**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A3		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174474.352	**EASTING:** 1272485.391
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 297.591	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push double-cased rod		**TOTAL DEPTH (ft bgs):** 15	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/17/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
0.5	SW	Moist, brown well-graded fine to coarse **SAND** with small gravel and trace silt.		
1				PM-091-01.0-02.0@1037
1.75		At 1.75 feet, becomes dry.		
4	SP	Slightly moist, brown poorly graded fine **SAND**. No odor.		
6	SW-SM	Moist, gray brown well-graded **SAND** with silt and gravel. Some gravel with diameter larger than core barrel. No odor.		
9	SP	Moist, brown poorly graded fine **SAND**. No odor.		PM-091-09.0-10.0@1040

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-091**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A3		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174474.352	**EASTING:** 1272485.391
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 297.591	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push double-cased rod		**TOTAL DEPTH (ft bgs):** 15	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/17/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10	SP			
11				PM-091-11.0-12.0@1043
12				
13				
14		Bottom of boring = 15 feet. Assume recovered intervals compressed for sample recovery.		
15				

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NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-092**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174775.85	**EASTING:** 1272486.017
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 307.732	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/22/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
0.25–7	SW	Moist, brown to light brown, medium dense well-graded fine to coarse gravelly **SAND** with trace silt (~5%). ~15% gravel. No sheen or odor.		
1–2				PM-092-01.0-02.0@1236
7–10	SP	Moist, light brown, medium dense poorly graded fine to medium gravelly **SAND**. ~15% gravel. No sheen or odor.		

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NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-092**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174775.85	**EASTING:** 1272486.017
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 307.732	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/22/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10–11.5				PM-092-10.0-11.0@1238
11.5–12.5	GW	Wet, gray to brown, well-graded fine to coarse sandy **GRAVEL** (likely perched water zone). ~30% sand. No sheen or odor.		
12.5–15.5	ML	Moist, olive brown, hard low-plasticty **SILT**. No sheen or odor.		
15.5–16.5	SP	Moist, light brown, medium dense poorly graded fine to medium gravelly **SAND**. ~15% sub-rounded gravel. No sheen or odor.		
16.5–19	SM	Wet, light brown to gray, medium dense silty fine **SAND**. No sheen or odor.		
19–20	SP	Moist, light brown, medium dense poorly graded fine to medium **SAND**. No sheen or odor. Bottom of boring = 20 feet.		PM-092-19.0-20.0@1240 PM-092-19.0-20.0-D@1240

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NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-092**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174775.85	**EASTING:** 1272486.017
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 307.732	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/22/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
20				

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-093**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174736.566	**EASTING:** 1272489.126	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 304.954	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
0.5–3.75	SW-SM	Moist, dark gray brown, well-graded **SAND** with silt and gravel. No odor. At 3.5 feet, asphalt fragments present.		PM-093-01.0-02.0@0807
3.75–7	SP	Moist, brown poorly graded fine **SAND**. At 5.5 feet, 6-inch lense of dark brown sand with silt then same as above.		
7–10	SW	Moist, well-graded **SAND** with abundant gravel. At 8.75 feet, becomes dry.		

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NOTES:
Advanced second boring for sample volume.

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-093**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174736.566	**EASTING:** 1272489.126	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 304.954	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10–11	SW-SM			PM-093-10.0-11.0@0809
11.5–14.25	SW-SM	Moist, well-graded **SAND** with silty lenses. No odor.		
14.25–17.5	ML	Moist, brown firm sandy **SILT**.		
17.5–20	SP	Large cobble cored by sampler at 17.5 feet, underlain by moist, brown poorly graded fine **SAND** with small rounded gravel.		
19–20	SP			PM-093-19.0-20.0@0811
20		Bottom of boring = 20 feet. Assume recovered intervals		

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NOTES:
Advanced second boring for sample volume.

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-093**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174736.566	**EASTING:** 1272489.126	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 304.954	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/24/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
20		compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:
Advanced second boring for sample volume.

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-094
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1	
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174667.316	**EASTING:** 1272487.994
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:** 303.54	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 18.5
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/16/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
0	Asphalt	Asphalt ground surface.			
0.5–10	SW	Moist, dark brown well-graded fine to coarse **SAND** with small gravel and trace silt. No odor.			
5.0–6.5			Drive 5.0–6.5; Recovery 5.5–6.5	8 / 12 / 11	PM-094-05.0-06.0@1310

ABBREVIATIONS:
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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-094	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade		**NORTHING:** 174667.316	**EASTING:** 1272487.994
DRILLING EQUIPMENT: CME 75 Auger Truck rig		**SURFACE ELEVATION:** 303.54	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA		**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 18.5
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer		**BORING DIAMETER:** 8"	**DRILL DATE:** 9/16/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
10				5	PM-094-10.0-11.0@1317
				8	
11	SP	Moist, brown poorly graded fine **SAND**. No odor.		11	
12					
13					
14					
15					
16					
17					
18					
18.5	SP-SM	Wet, brown well-graded fine to coarse **SAND** with silt and gravel.		12	
19		Wet, gray poorly graded fine **SAND**. Slight hydrocarbon odor.		14	PM-094-19.0-20.0@1335
				17	

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-094**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1	
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174667.316	**EASTING:** 1272487.994
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:** 303.54	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 18.5
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/16/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
20		At 20 feet, small to medium gravel and little silt present.		17	
				21	
21				23	PM-094-21.0-22.0@1345
				18	
22				24	
	SP	At 22.3 feet, 3-inch lense of red sand. Hydrocarbon odor present.		31	
23				16	PM-094-23.0-24.0@1400
				22	
24				23	
		At 24.5 feet, some pockets of brown silty sand and slight hydrocarbon odor present. At 24.75 feet, becomes gray brown.		14	
25				19	PM-094-25.0-26.0@1405
		Bottom of boring = 26 feet. Assume recovered intervals compressed for sample collection.		28	
26					

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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-095
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1	
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174634.239	**EASTING:** 1272488.894
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:** 301.52	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** 18.5
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/16/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
0	Asphalt	Asphalt ground surface.			
0.5	SW	Slightly moist, brown well-graded fine to coarse **SAND** with small rounded gravel and trace silt. Asphalt fragments present in shallow soil. No odor.			
1				12	PM-095-01.0-02.0@1505
1.5				13	
2				14	
9.5		At 9.5 feet, gravel becomes larger.		15	
10					

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-095**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1	
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174634.239	**EASTING:** 1272488.894
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:** 301.52	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** 18.5
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/16/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
10				17	PM-095-10.0-11.0@1515
				20	
11		From 11 to 20 feet, driller reports rig feedback indicating more dense material than that encountered in nearby borings.			
12					
13					
14					
15					
16					
17					
18					
18.5	SP	Wet, gray and brown poorly graded fine **SAND** with large gravel. No odor.		14	
19				21	PM-095-19.0-20.0@1525
		Bottom of boring = 20 feet. Assume recovered intervals compressed for sample collection.		29	

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-095	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade		**NORTHING:** 174634.239	**EASTING:** 1272488.894
DRILLING EQUIPMENT: CME 75 Auger Truck rig		**SURFACE ELEVATION:** 301.52	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA		**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** 18.5
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer		**BORING DIAMETER:** 8"	**DRILL DATE:** 9/16/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
20					

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-096**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A3	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174415.146	**EASTING:** 1272488.806
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 294.603	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 15	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/21/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	SW/OL/OH	Dry to slightly moist, brown well-graded **SAND** and **ORGANIC SOIL**.		
1	SW	Dry to slightly moist, brown well-graded **SAND**. Some rootlets present.		PM-096-01.0-02.0@1258
2				
3				
4				
5				
6		At 6 feet, becomes light brown.		
7				
8		At 8 feet, 1-inch silt lense.		
9				PM-096-09.0-10.0@1300

ABBREVIATIONS:
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NOTES:
Target location inaccesible, moved up slope elevation 5' higher, so drove to 15' to collect appropriate depth of samples

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-096**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A3		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174415.146	**EASTING:** 1272488.806	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 294.603	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 15	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/21/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10	SP	Moist, brown poorly graded fine **SAND**.		
	SW	Moist, brown well-graded **SAND**.		
11–12				PM-096-11.0-12.0@1302
13				
		At 13.5 feet, 1-inch silt lense.		
14		At 14 feet, reddish brown sand lense.		
		Bottom of boring = 15 feet. Assume recovered intervals compressed for sample collection.		PM-096-14.0-15.0@1302
15				

ABBREVIATIONS:
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NOTES:
Target location inaccesible, moved up slope elevation 5' higher, so drove to 15' to collect appropriate depth of samples

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** PM-096 rep 2
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A3		
DRILLED BY: Frank Scott, Cascade		**NORTHING:** 174415.146	**EASTING:** 1272488.806
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 294.603	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 11/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	**ORGANIC SOIL** and grass.		
0–5	SP	Moist, brown to dark brown poorly graded fine to medium **SAND** with trace silt (~5%) and fine gravel (~5%). No odor.		
2–3				PM-096-02.0-03.0@1320
3–4				PM-096-03.0-04.0@1322
4–5		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		PM-096-04.0-05.0@1324

ABBREVIATIONS:
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NOTES:
Location re-sampled to fill data gaps.

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-097**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A3	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174508.833	**EASTING:** 1272509.856
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 297.578	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 15	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/17/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
0.5–3.5	SW	Moist, brown well-graded fine to coarse **SAND** with small gravel and trace silt. No odor.		
3.5–10	SW-SM	Moist, brown well-graded fine to coarse **SAND** with silt. No odor. At 5 feet, becomes dry and light brown with larger gravel. At 7.5 feet, becomes dense.		

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-097**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A3		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174508.833	**EASTING:** 1272509.856
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 297.578	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 15	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/17/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10	SP	Moist, brown poorly graded fine **SAND**.		
11				
12				
13				
14				
15		Bottom of boring = 15 feet. Assume recovered intervals compressed for sample collection.		

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-098**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174670.247	**EASTING:** 1272514.541
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 301.651	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** 19
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/18/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
0.5–6	SW	Dry, brown well-graded **SAND** with gravel and little silt.		PM-098-01.0-02.0@1012 (1–2)
6–7.5	SW-SM	Dry, brown well-graded **SAND** with silt and gravel.		
7.5–10		Dry, brown well-graded **SAND** with gravel and little silt. From 8 to 10 feet, abundant large gravel present.		

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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-098**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174670.247	**EASTING:** 1272514.541
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 301.651	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** 19
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/18/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10	SW			PM-098-10.0-11.0@1015
11				
12				
13				
14				
15		(Large rock blocking sampler at 15 feet on first drive attempt. Moved adjacent and re-drove 15-20 foot interval.)		
16				
17				
18				
19	SP	Moist to wet, poorly graded fine **SAND**.		PM-098-19.0-20.0@1020
		Bottom of boring = 20 feet. Assume recovered intervals		

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NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-098**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174670.247	**EASTING:** 1272514.541
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 301.651	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** 19
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/18/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
		compressed for sample collection.		
20				

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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-098 rep 2**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A1	
DRILLED BY: Frank Scott, Cascade	**NORTHING:** 174670.247	**EASTING:** 1272514.541
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 301.651	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 11/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
1	SP	Moist, brown poorly graded fine to medium **SAND** with gravel (~10%). No odor.		
2				
3				
4				PM-098-04.0-05.0@0920
5		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		

ABBREVIATIONS:
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NOTES:
Location re-sampled to fill data gaps.

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-099**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A3	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174447.619	**EASTING:** 1272515.769
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 293.385	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 12	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/21/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	SW/OL/OH	Slightly moist, brown well-graded **SAND** and **ORGANIC SOIL**.		
1				PM-099-01.0-02.0@1145
1.5	SW	Slightly moist, brown well-graded **SAND**.		
6.25		At 6.25 feet, becomes moist.		
7.5	SW-SM	Moist, brown well-graded **SAND** with silt.		
9				PM-099-09.0-10.0@1147

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NOTES:
Drove twice to obtain adequate sample volume

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-099**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A3		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174447.619	**EASTING:** 1272515.769
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 293.385	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 12	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/21/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10		At 10.5 feet, 3-inch lense of firm silt.		
11		Bottom of boring = 12 feet. Assume recovered intervals compressed for sample collection.		PM-099-11.0-12.0@1149
12				

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NOTES:
Drove twice to obtain adequate sample volume

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-100
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B3	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174608.093819	**EASTING:** 1272525.37812
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 300.538	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	**ORGANIC SOIL** and mulch.		
	SW	Moist, brown to light brown, medium dense well-graded fine to coarse gravelly **SAND** with trace silt (<5%). ~15% gravel. No sheen or odor.		
1				PM-100-01.0-02.0@1539
2				PM-100-02.0-03.0@1542
3				
4		Bottom of boring = 5 feet.		
5				

ABBREVIATIONS:
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NOTES:

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PROJECT:	LOCATION:	BORING ID:
POS-LLA		PM-100 rep 2
LOGGED BY: G. Cisneros	BORING LOCATION: Area B3	
DRILLED BY: Frank Scott, Cascade	NORTHING: 174608.093819	EASTING: 1272525.37812
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	SURFACE ELEVATION: 300.538	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	TOTAL DEPTH (ft bgs): 15	DEPTH TO WATER (ft bgs): NA
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 11/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	**ORGANIC SOIL** and grass.		
0–4	SP	Moist, brown, medium dense poorly graded fine to medium **SAND** with trace gravel (~5%) and silt (~5%). No odor.		PM-100-03.0-04.0@1028
4–6	SM	Moist, brown fine to medium silty **SAND** with gravel (~10%). No odor.		PM-100-04.0-05.0@1030 PM-100-04.5-05.0-D@1032
6–10	SP	Moist, brown poorly graded fine to medium **SAND** with gravel (~10%). At 7.5 feet, 6-inch lense of well-graded coarse gravelly sand.		PM-100-09.0-10.0@1034

ABBREVIATIONS:
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NOTES:
Location re-sampled to fill data gaps.

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-100 rep 2**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B3	
DRILLED BY: Frank Scott, Cascade	**NORTHING:** 174608.093819	**EASTING:** 1272525.37812
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 300.538	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 15	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 11/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10				
11		At 11 feet, becomes borwn to dark brown with fine gravel.		PM-100-11.0-12.0@1036
12		At 12.25 feet, becomes wet.		PM-100-12.0-13.0@1038
13	ML	Moist, light brown stiff **SILT**. No odor.		PM-100-13.0-14.0@1040
14	SP	Moist, gray poorly graded fine **SAND**. No odor. Bottom of boring = 15 feet. Assume recovered intervals compressed for sample collection.		PM-100-14.0-15.0@1042
15				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Location re-sampled to fill data gaps.

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-101**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A3		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174546.103	**EASTING:** 1272536.987	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 297.366	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 15	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/17/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
0.5	SW	Moist, brown well-graded fine to coarse **SAND** with rounded gravel.		
1–2				PM-101-01.0-02.0@1150
5	SW-SM	Moist, gray and brown mottled well-graded **SAND** with silt.		
8		At 8 feet, becomes dark brown with abundant gravel.		
9–10				PM-101-09.0-10.0@1153 PM-101-09.0-10.0-D@1155

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-101
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A3	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174546.103	**EASTING:** 1272536.987
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 297.366	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 15	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/17/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10		At 9.75 feet, 2-inch lense of gray sand with silt, underlain by large wood fragment.		
11	ML	Moist, dark gray brown sandy **SILT** with peat.		PM-101-11.0-12.0@1158 PM-101-11.0-12.0-D@1200
12				
13	SP	Moist, gray poorly graded fine **SAND**. Some brown sand lenses and one angular gravel present.		
14		Bottom of boring = 15 feet. Assume recovered intervals compressed for sample collection.		
15				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-101 rep 2**	
LOGGED BY: Kristin Anderson	COORDINATE SYSTEM: SPCS WA N NAD83 FT		
DRILLED BY: Frank Scott, Cascade		NORTHING: 174546.103	EASTING: 1272536.987
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		GROUND SURFACE ELEVATION: 299.8719	
DRILLING METHOD: Direct-Push		TOTAL DEPTH (ft bgs): 5	DEPTH TO WATER (ft bgs):
SAMPLING METHOD: 2" x 5' liner		BORING DIAMETER: 2"	DRILL DATE: 2/1/2016

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0	Concrete	Concrete ground surface.					
0.5–5	SP-SM	Moist, brown poorly graded medium **SAND** with silt and gravel.					
2–3							PM-101-02.0-03.0
3–4							PM-101-03.0-04.0
4–5							PM-101-04.0-05.0
5		Bottom of boring = 5 feet. Assume recovered intervals compressed for sample collection.					

Depth scale: 0 1 2 3 4 5 6 7 8 9 10 11 12

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-102**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B4	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174707.538674	**EASTING:** 1272540.73132
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 302.886	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
	SP	Moist, light brown to brown, medium dense poorly graded fine to medium **SAND** with sub-rounded gravel (~10%). No sheen or odor.		
1				
2				
				PM-102-02.0-03.0@1512
3				
4		Bottom of boring = 5 feet.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-102 rep 2**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B4		
DRILLED BY: Frank Scott, Cascade	**NORTHING:** 174707.538674	**EASTING:** 1272540.73132	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 302.886	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 8	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 11/23/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
	SP	Moist, brown, medium dense poorly graded fine to medium **SAND** with trace gravel (~5%). No odor.		
1				
2				
3		At 3 feet, wood debris present.		
4				PM-102-04.0-05.0@1014
5				
6		At 6 feet, concrete present.		
7		Bottom of boring = 8 feet. Assume recovered intervals compressed for sample collection.		PM-102-07.0-08.0@1016
8				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Location re-sampled to fill data gaps.

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-102 rep 2**
LOGGED BY: Kristin Anderson	COORDINATE SYSTEM: SPCS WA N NAD83 FT	
DRILLED BY: Frank Scott, Cascade	NORTHING: 174707.538674	EASTING: 1272540.73132
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	GROUND SURFACE ELEVATION: 299.8719	
DRILLING METHOD: Direct-Push	TOTAL DEPTH (ft bgs): 10	DEPTH TO WATER (ft bgs):
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 2/1/2016

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0	Concrete	Concrete ground surface.					
0.5	SP-SM	Moist, brown poorly graded medium **SAND** with silt and gravel.					
4		At 4 feet, concrete fragments present.					
5.5		At 5.5 feet, becomes dark brown with peaty lenses.					
8							PM-102-08.0-09.0
9		Moist, brown well graded **SAND** with abundant large gravel.					PM-102-09.0-10.0
9.5	SW-SM	Bottom of boring = 10 feet. Assume recovered intervals compressed for sample collection.					
10							
11							
12							

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-103**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A3		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174480.937	**EASTING:** 1272548.678
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 290.409	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 12	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/21/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	SW/OL/OH	Moist, brown well-graded **SAND** and **ORGANIC SOIL**.		
		From 0.75 to 1 foot, large asphalt fragment.		
1	SW	Dry, brown well-graded **SAND** with gravel and trace silt.		PM-103-01.0-02.0@1042
2				
3				
4				
5				
6				
7				
8		At 8 feet, becomes slightly moist.		
9		From 9 to 10 feet, small wood fragments present.		PM-103-09.0-10.0@1044

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Two drives to obtain sample volume

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PROJECT:	LOCATION:	BORING ID:
POS-LLA		PM-103

LOGGED BY:	BORING LOCATION:
K. Anderson	Area A3

DRILLED BY:	NORTHING:	EASTING:
Kyle Ceruti, Cascade	174480.937	1272548.678

DRILLING EQUIPMENT:	SURFACE ELEVATION:	COORDINATE SYSTEM:
Geoprobe 7730 Limited Access Rig	290.409	SPCS WA N NAD83 FT

DRILLING METHOD:	TOTAL DEPTH (ft bgs):	DEPTH TO WATER (ft bgs):
2" x 5" direct push rod	12	NA

SAMPLING METHOD:	BORING DIAMETER:	DRILL DATE:
2" x 5' liner	2"	9/21/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10				
11		At 11.75 feet, thin silt lense. Bottom of boring = 12 feet. Assume recovered intervals compressed for sample collection.		PM-103-11.0-12.0@1046
12				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:
Two drives to obtain sample volume

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** PM-104
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B4		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174644.801121	**EASTING:** 1272551.40837	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 301.467	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/18/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
0.5–5	SP	Dry, brown poorly graded **SAND** with gravel. No odor.		
2–3				PM-104-02.0-03.0@1115
5		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-104 rep 2**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B4		
DRILLED BY: Frank Scott, Cascade		**NORTHING:** 174644.801121	**EASTING:** 1272551.40837
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 301.467	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 10	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 11/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Concrete	Concrete ground surface.		
0.5–6	SP	Moist, brown poorly graded fine to medium **SAND** with rounded gravel (~10%). No odor.		PM-104-04.0-05.0@0904 (4–5); PM-104-05.0-06.0@0906 (5–6)
6–9	SW	Moist, brown well-graded fine to coarse **SAND** with gravel and crushed rock. No odor.		PM-104-07.0-08.0@0908 (7–8)
9–10	SP	Moist, dark brown, medium dense poorly graded fine to medium **SAND** with trace gravel (~5%). No odor. Bottom of boring = 10 feet. Assume recovered intervals compressed for sample collection.		PM-104-09.0-10.0@0910

ABBREVIATIONS:
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USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Location re-sampled to fill data gaps.

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** PM-104 rep 2
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B4		
DRILLED BY: Frank Scott, Cascade	**NORTHING:** 174644.801121	**EASTING:** 1272551.40837	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 301.467	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 10	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 11/23/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Location re-sampled to fill data gaps.

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-105**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B4		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174756.089159	**EASTING:** 1272551.44324
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 302.643	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
1	SP	Moist, dark brown, medium dense poorly graded fine to medium **SAND**. No sheen or odor.		
2–3	SW	Moist, light brown to brown, medium dense well-graded fine to coarse gravelly **SAND**. No sheen or odor.		PM-105-02.0-03.0@1504
4–5	SP	Moist, brown, medium dense poorly graded fine to medium **SAND** with trace gravel (~5%). No sheen or odor. Bottom of boring = 5 feet.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-106**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B4		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174742.395	**EASTING:** 1272567.5	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 299.895	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/23/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
1	SP	Moist, dark brown, medium dense poorly graded fine to medium **SAND**. No sheen or odor.		
2				PM-106-02.0-03.0@1455
3	SW	Moist, light brown, medium dense well-graded fine to coarse gravelly **SAND**. ~30% gravel. No sheen or odor.		
4		Bottom of boring = 5 feet.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Moved 2' to the south due to sewer line

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-107**
LOGGED BY: K. Anderson	BORING LOCATION: Area A3	

DRILLED BY: Kyle Ceruti, Cascade	NORTHING: 174518.787	EASTING: 1272573.439
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	SURFACE ELEVATION: 289.273	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	TOTAL DEPTH (ft bgs): 12	DEPTH TO WATER (ft bgs): NA
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 9/21/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	SW/OL/OH	Dry, brown well-graded **SAND** and **ORGANIC SOIL** with gravel and trace silt.		
1	SW	Dry, brown well-graded **SAND** with gravel and trace silt.		PM-107-01.0-02.0@0920
2				
3		At 3.25 feet, becomes moist.		
4				
5				
6				
7				
8		At 8.5 feet, becomes black brown with gray silty pockets.		
9				PM-107-09.0-10.0@0922

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Drove second time for volume

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-107**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A3		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174518.787	**EASTING:** 1272573.439
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 289.273	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 12	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/21/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10		At 10.5 feet, becoms brown and silty pockets disappear.		
11	SP	Moist, gray brown poorly graded fine **SAND** with brown silty pockets. No odor. Bottom of boring = 12 feet. Assume recovered intervals compressed for sample collection.		PM-107-11.0-12.0@0924
12				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Drove second time for volume

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-108**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B4	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174681.508423	**EASTING:** 1272577.43862
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 298.3	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/17/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	SW	Slightly moist, well-graded fine to coarse **SAND** with gravel. No odor.		
1				
2				PM-108-02.0-03.0@1310
3				
4				PM-108-04.0-05.0@1313
5		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-109**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B4		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174618.770869	**EASTING:** 1272588.11567
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 296.932	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/17/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	SW	Moist, brown well-graded fine to coarse **SAND** with rounded gravel and trace silt. Some grass and organic debris present in top 0.5 foot.		
1				
2				PM-109-02.0-03.0@1215
3				
4		Bottom of boring = 5 feet.		PM-109-04.0-05.0@1217
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-109 rep 2**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B4		
DRILLED BY: Frank Scott, Cascade	**NORTHING:** 174618.770869	**EASTING:** 1272588.11567	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 296.932	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 15	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 11/23/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	**ORGANIC SOIL** and grass.		
0–6.5	SP	Moist, brown poorly graded fine to medium **SAND** with large gravel (~10%). No odor.		
6.5–9.5	SW	Moist, brown well-graded fine to coarse **SAND** with gravel (~15%) and trace silt (~5%). No odor.		PM-109-09.0-10.0@0845 PM-109-09.0-10.0-D@0847
9.5–10	SP	Moist, brown, medium dense poorly graded fine to medium **SAND** with fine gravel (~10%). No odor.		

ABBREVIATIONS:
ft bgs = feet below ground surface
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▼ = denotes groundwater table

NOTES:
Location re-sampled to fill data gaps.

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** PM-109 rep 2
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B4		
DRILLED BY: Frank Scott, Cascade	**NORTHING:** 174618.770869	**EASTING:** 1272588.11567	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 296.932	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 15	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 11/23/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10–11	SP			
11–12	SP			PM-109-11.0-12.0@0849
12–12.5	SM	Moist, gray to brown silty fine to medium **SAND** with fine gravel (~10%). No odor.		PM-109-12.0-13.0@0851
12.5–13	OL/OH	Dark brown to black **ORGANIC SILT**. No odor.		
13–14	SM	Gray, medium dense fine to medium silty **SAND** with fine gravel (~10%). No sheen or odor.		PM-109-13.0-14.0@0853
14–15	ML	Olive gray, stiff low-plasticity **SILT**. No odor or sheen. Bottom of boring = 15 feet. Assume recovered intervals compressed for sample collection.		PM-109-14.0-15.0@0855

ABBREVIATIONS:
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NOTES:
Location re-sampled to fill data gaps.

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-110**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B4		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174780.953278	**EASTING:** 1272592.79182	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 297.873	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/23/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
0.5–4	SP	Moist, brown, medium dense poorly graded fine to medium **SAND** with gravel (~10%). No sheen or odor.		PM-110-02.0-03.0@1448 (2–3 ft)
4–5	SW	Moist, brown to light brown, medium dense well-graded fine to coarse gravelly **SAND**. ~15% gravel. No sheen or odor. Bottom of boring = 5 feet.		

ABBREVIATIONS:
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USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-111**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A3	
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174555.289	**EASTING:** 1272599.353
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 288.12	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 15	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/21/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	SW/OL/OH	Dry, brown well-graded **SAND** and **ORGANIC SOIL** with gravel and trace silt.		
1	SW	Dry, brown well-graded **SAND** with gravel and trace silt.		PM-111-01.0-02.0@0845 PM-111-01.0-02.0-D@0851
5		At 5 feet, brick fragments present.		
8		Moist, brown well-graded **SAND** with silt. No odor.		
9		At 9.5 feet, becomes black brown.		PM-111-09.0-10.0@0847

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Drove twice for volume

FLOYD | SNIDER strategy ▪ science ▪ engineering	**PROJECT:** POS-LLA	**LOCATION:**	**BORING ID:** **PM-111**
	LOGGED BY: K. Anderson	**BORING LOCATION:** Area A3	

DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174555.289	**EASTING:** 1272599.353
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 288.12	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 15	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/21/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10	SW-SM	At 10 feet, few gray silty lenses.		
11				PM-111-11.0-12.0@0849
12				
13	SP	Moist, gray poorly graded **SAND** with few silty lenses.		
14		At 14 feet, becomes brown. At 14.75 feet, becomes reddish brown. Bottom of boring = 15 feet. Assume recovered intervals compressed for sample collection.		
15				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:
Drove twice for volume

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-112**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B4		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174718.215724	**EASTING:** 1272603.46887	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 296.216	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/17/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	SW	Moist, brown well-graded fine to coarse **SAND** with gravel.		
1				
2		At 2 feet, becomes dry.		PM-112-02.0-03.0@1315
3				
4		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		PM-112-04.0-05.0@1318
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
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▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-113**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B4		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174655.478171	**EASTING:** 1272614.14592
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 288.191	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/17/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0–4	GW	Pine needles and leaf debris at surface, then dry, gray well-graded rounded **GRAVEL** with well-graded sand. No odor.		
2–3				PM-113-02.0-03.0@1326
4	SW	At 4 feet, 3-inch lense of well-graded **SAND** with gravel.		
4–5	OL/OH	Moist, brown **ORGANIC SOIL**. Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		PM-113-04.0-05.0@1329

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** PM-114
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B4		
DRILLED BY: Kyle Ceruti, Cascade	**NORTHING:** 174592.740618	**EASTING:** 1272624.82297	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 287.23	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 9/17/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	SW	Slightly moist, brown well-graded **SAND** with gravel and little silt. No odor		
1		At 0.8 foot, wood in sampler (likely large tree root cored by sampler).		
2				PM-114-02.0-03.0@1421
3				
4				
5		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-114 rep 2**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B4	
DRILLED BY: Frank Scott, Cascade	**NORTHING:** 174592.740618	**EASTING:** 1272624.82297
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 287.23	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 15	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 11/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	**ORGANIC SOIL** and grass.		
0–8	SP	Moist, brown poorly graded fine to medium **SAND** with trace gravel (~5%). No odor.		
6.5		At 6.5 feet, becomes dark brown with increased gravel (~10%). No odor.		
8	OL/OH	Moist, dark brown to black **ORGANIC SILT** and peat. No odor.		
9–10				PM-114-09.0-10.0@0957

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:
Location re-sampled to fill data gaps.

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-114 rep 2**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B4	
DRILLED BY: Frank Scott, Cascade	**NORTHING:** 174592.740618	**EASTING:** 1272624.82297
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:** 287.23	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 15	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 11/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
10				
11	SM	Moist, gray fine to medium silty **SAND**. No odor.		PM-114-11.0-12.0@0959 PM-114-11.0-12.0-D@1007
12	SP	Moist, gray poorly graded fine to medium **SAND**. No odor.		PM-114-12.0-13.0@1001
13		At 13.5 feet, becomes wet.		PM-114-13.0-14.0@1003
14	SW	Wet, brown well-graded fine to coarse **SAND** with fine gravel. No odor. Bottom of boring = 15 feet. Assume recovered intervals compressed for sample collection.		PM-114-14.0-15.0@1005
15				

ABBREVIATIONS:
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NOTES:
Location re-sampled to fill data gaps.

FLOYD | SNIDER strategy ▪ science ▪ engineering	**PROJECT:** POS-LLA	**LOCATION:**	**BORING ID:** **PM-115**
	LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B4	
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174749.823	**EASTING:** 1272629.354
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 293.607	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/23/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
1	SP	Moist, brown to light brown, medium dense poorly graded fine to medium **SAND** with gravel (~10%). No sheen or odor.		
2				PM-115-02.0-03.0@1440
3				
4				
5		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		

ABBREVIATIONS:
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NOTES:
Moved 3' to SW due to sewer line

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-116**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B4		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174692.185473	**EASTING:** 1272640.17617
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 292.946	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/17/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	SW	Leaf litter at ground surface, then moist, brown well-graded **SAND** with gravel. No odor.		
1				
2		At 2.25 feet, becomes dry.		PM-116-02.0-03.0@1340
3				
4		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		PM-116-04.0-05.0@1343
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

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PROJECT:	LOCATION:	BORING ID:
POS-LLA		PM-117
LOGGED BY: K. Anderson	BORING LOCATION: Area B4	

DRILLED BY: Kyle Ceruti, Cascade	NORTHING: 174629.447919	EASTING: 1272650.85322
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	SURFACE ELEVATION: 287.79	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod	TOTAL DEPTH (ft bgs): 5	DEPTH TO WATER (ft bgs): NA
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 9/17/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	SW	Grass at ground surface, then moist, brown well-graded **SAND** with gravel and little silt. No odor.		
1				
2				PM-117-02.0-03.0@1415
3				
4				PM-117-04.0-05.0@1418
5		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-118**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B4		
DRILLED BY: Kyle Ceruti, Cascade		**NORTHING:** 174728.892775	**EASTING:** 1272666.20642
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		**SURFACE ELEVATION:** 290.278	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 2" x 5" direct push rod		**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: 2" x 5' liner		**BORING DIAMETER:** 2"	**DRILL DATE:** 9/17/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	Asphalt	Asphalt ground surface.		
	SW	Moist, dark black brown, well-graded **SAND** with rounded gravel.		
1				
2				PM-118-02.0-03.0@1353 PM-118-02.0-03.0-D@1355
3		At 3.5 feet, becomes brown. No odor.		
4		Bottom of boring = 5 feet. Assume recovered interval compressed for sample collection.		
5				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-119	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area B3		
DRILLED BY: Frank Scott, Cascade	**NORTHING:**	**EASTING:**	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	**SURFACE ELEVATION:**	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 2" x 5" direct push rod	**TOTAL DEPTH (ft bgs):** 8	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 2" x 5' liner	**BORING DIAMETER:** 2"	**DRILL DATE:** 11/23/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	Sample ID
0	OL/OH	**ORGANIC SOIL** and grass.		
	SP	Moist, brown poorly graded fine to medium **SAND**. No odor.		
1				PM-119-01.0-02.0@1256
2				PM-119-02.0-03.0@1258
3	SW	Moist, brown well-graded fine to coarse **SAND** with gravel (~10%). No odor.		PM-119-03.0-04.0@1300
4	SP	Moist, brown poorly graded fine **SAND**. No odor.		PM-119-04.0-05.0@1302
5				
6		At 6.5 feet, becomes fine to medium with trace gravel (~5%). No sheen or odor.		
7		Bottom of boring = 8 feet. Assume recovered intervals compressed for sample collection.		PM-119-07.0-08.0@1304
8				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
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NOTES:
New sample location to fill data gaps.

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PROJECT: POS-LLA		LOCATION:	BORING ID: **PM-120**
LOGGED BY: Kristin Anderson		COORDINATE SYSTEM: SPCS WA N NAD83 FT	
DRILLED BY: Frank Scott, Cascade		NORTHING: 174539.045	EASTING: 1272491.88
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		GROUND SURFACE ELEVATION: 299.8719	
DRILLING METHOD: Direct-Push		TOTAL DEPTH (ft bgs): 5	DEPTH TO WATER (ft bgs):
SAMPLING METHOD: 2" x 5' liner		BORING DIAMETER: 2"	DRILL DATE: 2/1/2016

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0	Asphalt	Asphalt ground surface.					
0–4	SP-SM	Moist, grayish brown poorly graded fine **SAND** with silt and gravel.					PM-120-00.0-01.0 @ 1640 PM-120-01.0-02.0 @ 1642
4–5	SW	Moist, well-graded gray **SAND** with trace silt Bottom of boring = 5 feet. Assume recovered intervals compressed for sample collection.					

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-121**	
LOGGED BY: Kristin Anderson	COORDINATE SYSTEM: SPCS WA N NAD83 FT		
DRILLED BY: Frank Scott, Cascade	NORTHING: 174547.04	EASTING: 1272517.892	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	GROUND SURFACE ELEVATION: 299.8719		
DRILLING METHOD: Direct-Push	TOTAL DEPTH (ft bgs): 5	DEPTH TO WATER (ft bgs):	
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 2/1/2016	

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0	Concrete	Concrete ground surface.					PM-121-00.0-01.0 @ 1328
0.5–4.75	SM	Moist, brown medium silty **SAND** with gravel.					PM-121-01.0-02.0 @ 1330 PM-121-01.0-02.0-D @ 1332 PM-121-04.0-05.0 @ 1240
4.75–5	SW	Bottom of boring = 5 feet. Assume recovered intervals compressed for sample collection.					

Depth scale: 0 1 2 3 4 5 6 7 8 9 10 11 12

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-121 rep 2**	
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A3		
DRILLED BY: Chris, Gregory Drilling	**NORTHING:** 174547.04	**EASTING:** 1272517.892	
DRILLING EQUIPMENT: Hollow Stem Auger Truck Rig	**SURFACE ELEVATION:** 297.6169	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 5	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD/SAMPLER LENGTH: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 2/24/2016	

Depth (feet)	USCS Symbol	Soil Description and Observations (color, texture, moisture, **MAJOR CONSTITUENT**, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	PID (ppm)	Sample ID
0	Concrete	Concrete ground surface.				
0.5–5	SP	Moist, brown medium **SAND** with gravel.				
2–2.5				10		PM-121-02.0-03.0 @ 1235
2.5–3				8		
3–3.5				8		
3.5–4				7		
4–4.5				13		PM-121-04.0-05.0 @ 1240
4.5–5		Bottom of boring = 5 feet.		13		

ABBREVIATIONS:
ft bgs = feet below ground surface USCS = Unified Soil Classification System
ppm = parts per million ▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-122**	
LOGGED BY: Kristin Anderson	COORDINATE SYSTEM: SPCS WA N NAD83 FT		
DRILLED BY: Frank Scott, Cascade		NORTHING: 174523.562	EASTING: 1272536.594
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		GROUND SURFACE ELEVATION: 299.8719	
DRILLING METHOD: Direct-Push		TOTAL DEPTH (ft bgs): 5	DEPTH TO WATER (ft bgs):
SAMPLING METHOD: 2" x 5' liner		BORING DIAMETER: 2"	DRILL DATE: 2/1/2016

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0	Concrete	Concrete ground surface.					
0.5	SM	Moist, brown poorly graded fine **SAND** with silt and gravel.					PM-122-00.0-01.0 @ 1555
1							PM-122-01.0-02.0 @ 1557
4.5	SW	Bottom of boring = 5 feet. Assume recovered intervals compressed for sample collection.					

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-123**	
LOGGED BY: Kristin Anderson	COORDINATE SYSTEM: SPCS WA N NAD83 FT		
DRILLED BY: Frank Scott, Cascade	NORTHING: 174506.617	EASTING: 1272539.061	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	GROUND SURFACE ELEVATION: 299.8719		
DRILLING METHOD: Direct-Push	TOTAL DEPTH (ft bgs): 5	DEPTH TO WATER (ft bgs):	
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 2/1/2016	

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0–5	SP	Moist, brown poorly graded medium **SAND** with little silt and gravel.	0–5	2–5			PM-123-00.0-01.0 @ 1600; PM-123-01.0-02.0 @ 1602
5		Bottom of boring = 5 feet. Assume recovered intervals compressed for sample collection.					

Depth scale: 0 1 2 3 4 5 6 7 8 9 10 11 12

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-123 rep 2**
LOGGED BY: G. Cisneros	**BORING LOCATION:** Area A3	
DRILLED BY: Chris, Gregory Drilling	**NORTHING:** 174506.617	**EASTING:** 1272539.061
DRILLING EQUIPMENT: Hollow Stem Auger Truck Rig	**SURFACE ELEVATION:** 297.1959	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 6	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD/SAMPLER LENGTH: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 2/24/2016

Depth (feet)	USCS Symbol	Soil Description and Observations (color, texture, moisture, **MAJOR CONSTITUENT**, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	PID (ppm)	Sample ID
0	SP	Moist, brown poorly graded medium **SAND** with little silt and gravel.				
2				8		PM-123-02.0-03.0 @ 1255
				10		
3				7		
				8		
4				11		PM-123-04.0-05.0 @ 1257
				10		
5		At 5 feet, becomes gravelly.		13		PM-123-05.0-06.0 @ 1259
	ML	Moist brown **SILT**. Bottom of boring = 6 feet. Assume recovered intervals compressed for sample collection.		11		
6						
7						
8						
9						
10						
11						
12						

ABBREVIATIONS:
ft bgs = feet below ground surface USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-124**	
LOGGED BY: Kristin Anderson	COORDINATE SYSTEM: SPCS WA N NAD83 FT		
DRILLED BY: Frank Scott, Cascade		NORTHING: 174528.183	EASTING: 1272525.084
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		GROUND SURFACE ELEVATION: 299.8719	
DRILLING METHOD: Direct-Push		TOTAL DEPTH (ft bgs): 5	DEPTH TO WATER (ft bgs):
SAMPLING METHOD: 2" x 5' liner		BORING DIAMETER: 2"	DRILL DATE: 2/1/2016

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0–1	SP-SM	Moist, brown very loose poorly graded fine **SAND** with silt and gravel. Poor recovery in loose material.					PM-124-00.0-01.0 @ 1550
1–2							PM-124-01.0-02.0 @ 1552
4.25–5		At bottom of core, sand becomes gray with larger gravel. Bottom of boring = 5 feet. Assume recovered intervals compressed for sample collection.					

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-125**
LOGGED BY: Kristin Anderson	COORDINATE SYSTEM: SPCS WA N NAD83 FT	
DRILLED BY: Frank Scott, Cascade	NORTHING: 174462.618	EASTING: 1272497.981
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	GROUND SURFACE ELEVATION: 299.8719	
DRILLING METHOD: Direct-Push	TOTAL DEPTH (ft bgs): 10	DEPTH TO WATER (ft bgs):
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 2/1/2016

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0	Concrete	Concrete ground surface.					
0.5–1	SP-SM	Moist, brown poorly graded fine **SAND** with silt and gravel.					PM-125-00.0-01.0 @ 1615
1–2							PM-125-01.0-02.0 @ 1617
5		At 5 feet, several larger cobbles (diameter greater than core barrel) present.					
9–10		Bottom of boring = 10 feet. Assume recovered intervals compressed for sample collection.					PM-125-09.0-10.0 @ 1619

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-126**	
LOGGED BY: Kristin Anderson	COORDINATE SYSTEM: SPCS WA N NAD83 FT		
DRILLED BY: Frank Scott, Cascade	NORTHING: 174422.219	EASTING: 1272470.839	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	GROUND SURFACE ELEVATION: 299.8719		
DRILLING METHOD: Direct-Push	TOTAL DEPTH (ft bgs): 5	DEPTH TO WATER (ft bgs):	
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 2/1/2016	

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0	Concrete	Concrete ground surface.					PM-126-00.0-01.0 @ 1625
1	SP-SM	Moist, reddish brown poorly graded fine **SAND** with silt and small rounded gravel.					PM-126-01.0-02.0 @ 1627
2							
3							
4							
5		Bottom of boring = 5 feet. Assume recovered intervals compressed for sample collection.					
6							
7							
8							
9							
10							
11							
12							

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-127**	
LOGGED BY: Kristin Anderson	COORDINATE SYSTEM: SPCS WA N NAD83 FT		
DRILLED BY: Frank Scott, Cascade	NORTHING: 174388.904	EASTING: 1272449.54	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	GROUND SURFACE ELEVATION: 299.8719		
DRILLING METHOD: Direct-Push	TOTAL DEPTH (ft bgs): 5	DEPTH TO WATER (ft bgs):	
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 2/1/2016	

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0	Concrete	Concrete ground surface.					
0–3.5	SP-SM	Moist, dark brown poorly graded fine **SAND** with silt and few gravel.					PM-127-00.0-01.0 @ 1630; PM-127-01.0-02.0 @ 1632
3.5–5	SW	Moist, dark brown well-graded **SAND** with trace silt.					
5		Bottom of boring = 5 feet. Assume recovered intervals compressed for sample collection.					

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-128**	
LOGGED BY: Kristin Anderson	COORDINATE SYSTEM: SPCS WA N NAD83 FT		
DRILLED BY: Frank Scott, Cascade	NORTHING: 174714.09	EASTING: 1272572.574	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	GROUND SURFACE ELEVATION: 299.8719		
DRILLING METHOD: Direct-Push	TOTAL DEPTH (ft bgs): 5	DEPTH TO WATER (ft bgs):	
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 2/1/2016	

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0	Asphalt	Asphalt ground surface.					
0–2	SP-SM	Moist, brown poorly graded fine **SAND** with silt and gravel.					PM-128-00.0-01.0 @ 1117
2		At 2 feet, becomes dark brown.					PM-128-02.0-03.0 @ 1119 PM-128-02.0-03.0-D @ 1121
3		At 3 feet, becomes reddish-brown.					
3.8		At 3.8 feet, becomes dry.					
5		Bottom of boring = 5 feet. Assume recovered intervals compressed for sample collection.					

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-129**	
LOGGED BY: Kristin Anderson	COORDINATE SYSTEM: SPCS WA N NAD83 FT		
DRILLED BY: Frank Scott, Cascade	NORTHING: 174726.885	EASTING: 1272543.859	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	GROUND SURFACE ELEVATION: 299.8719		
DRILLING METHOD: Direct-Push	TOTAL DEPTH (ft bgs): 5	DEPTH TO WATER (ft bgs):	
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 2/1/2016	

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0	Asphalt	Asphalt ground surface.					
0–2.5	SP-SM	Moist, brown poorly graded medium **SAND** with silt and gravel.					PM-129-00.0-01.0 @ 1130
2.5		At 2.5 feet, brick fragment present.					PM-129-02.0-03.0 @ 1105
5		Bottom of boring = 5 feet. Assume recovered intervals compressed for sample collection.					

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-130**	
LOGGED BY: Kristin Anderson	COORDINATE SYSTEM: SPCS WA N NAD83 FT		
DRILLED BY: Frank Scott, Cascade		NORTHING: 174573.27	EASTING: 1272613.754
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		GROUND SURFACE ELEVATION: 299.8719	
DRILLING METHOD: Direct-Push		TOTAL DEPTH (ft bgs): 10	DEPTH TO WATER (ft bgs):
SAMPLING METHOD: 2" x 5' liner		BORING DIAMETER: 2"	DRILL DATE: 2/1/2016

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0–1	OL-OH	**ORGANIC SOIL** and grass.					PM-130-00.0-01.0 @ 1219
1–5	SP-SM	Grades to moist, brown poorly graded **SAND** with silt and gravel from 0 to 2 feet.					
5–9	SP-SM	At 5 feet, poor recovery due to soft material.					
9–10	SP	Moist, grayish brown poorly graded fine **SAND** with little silt. Bottom of boring = 10 feet. Assume recovered intervals compressed for sample collection.					PM-130-09.0-10.0 @ 1224

ABBREVIATIONS:
ft bgs = feet below ground surface
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▼ = denotes groundwater table

NOTES:

FLOYD | SNIDER strategy ▪ science ▪ engineering	PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-131**
	LOGGED BY: Kristin Anderson	COORDINATE SYSTEM: SPCS WA N NAD83 FT	
DRILLED BY: Frank Scott, Cascade		NORTHING: 174602.873	EASTING: 1272572.416
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		GROUND SURFACE ELEVATION: 299.8719	
DRILLING METHOD: Direct-Push		TOTAL DEPTH (ft bgs): 6	DEPTH TO WATER (ft bgs):
SAMPLING METHOD: 2" x 5' liner		BORING DIAMETER: 2"	DRILL DATE: 2/1/2016

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0	Concrete	Concrete ground surface.					
	SP-SM	Moist, brown poorly graded fine **SAND** with silt and gravel.					PM-131-00.0-01.0 @ 1140
2.5		At 2.5 feet, large gravel present. Brick fragments at 3 feet.					
4							PM-131-04.0-06.0 @ 1142 PM-131-04.0-06.0-D @ 1144
6		Bottom of boring = 6 feet. Assume recovered intervals compressed for sample collection.					

Depth scale: 0 1 2 3 4 5 6 7 8 9 10 11 12

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-132**	
LOGGED BY: Kristin Anderson	COORDINATE SYSTEM: SPCS WA N NAD83 FT		
DRILLED BY: Frank Scott, Cascade		NORTHING: 174685.536	EASTING: 1272487.376
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig		GROUND SURFACE ELEVATION: 299.8719	
DRILLING METHOD: Direct-Push		TOTAL DEPTH (ft bgs): 5	DEPTH TO WATER (ft bgs):
SAMPLING METHOD: 2" x 5' liner		BORING DIAMETER: 2"	DRILL DATE: 2/1/2016

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0	Asphalt	Asphalt ground surface.					
0–5	SP-SM	Moist, grayish brown poorly graded fine **SAND** with silt and gravel.					PM-132-00.0-01.0 @ 1645
							PM-132-01.5-02.0 @ 1015
5		Bottom of boring = 5 feet. Assume recovered intervals compressed for sample collection.					

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

ABBREVIATIONS:
ft bgs = feet below ground surface USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-133**	
LOGGED BY: Kristin Anderson	COORDINATE SYSTEM: SPCS WA N NAD83 FT		
DRILLED BY: Frank Scott, Cascade	NORTHING: 174730.352	EASTING: 1272282.21	
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	GROUND SURFACE ELEVATION: 299.8719		
DRILLING METHOD: Direct-Push	TOTAL DEPTH (ft bgs): 5	DEPTH TO WATER (ft bgs):	
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 2/1/2016	

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0–5	GW	Moist to wet, grayish brown well-graded **GRAVEL** backfill with trace silt.	0–5	3–5			PM-133-00.0-01.0 @ 950
5		Bottom of boring = 5 feet. Assume recovered intervals compressed for sample collection.					

Depth scale: 0 1 2 3 4 5 6 7 8 9 10 11 12

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
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NOTES:

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PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-134**
LOGGED BY: Kristin Anderson	COORDINATE SYSTEM: SPCS WA N NAD83 FT	
DRILLED BY: Frank Scott, Cascade	NORTHING: 174640.564	EASTING: 1272279.512
DRILLING EQUIPMENT: Geoprobe 7730 Limited Access Rig	GROUND SURFACE ELEVATION: 299.8719	
DRILLING METHOD: Direct-Push	TOTAL DEPTH (ft bgs): 5	DEPTH TO WATER (ft bgs):
SAMPLING METHOD: 2" x 5' liner	BORING DIAMETER: 2"	DRILL DATE: 2/1/2016

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0	OL-OH	**ORGANIC SOIL** and grass.					
0–2.5	SP-SM	Moist, brown poorly graded fine **SAND** with silt and gravel.					PM-134-00.0-01.0 @ 930
2.5–5	SP	Moist, grayish-brown poorly graded fine **SAND** with trace fine gravel.					
		Bottom of boring = 5 feet. Assume recovered intervals compressed for sample collection.					

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

ABBREVIATIONS:
ft bgs = feet below ground surface USCS = Unified Soil Classification System
ppm = parts per million ▼ = denotes groundwater table

NOTES:

Port of Seattle
Lora Lake Apartments Site

Engineering Design Report

Appendix C
Lora Lake Apartments Parcel Soil Performance Monitoring Data Report

Attachment C.2
Laboratory Analytical Reports

(Lab reports are not included in this PDF but are available upon request)

Port of Seattle
Lora Lake Apartments Site

Engineering Design Report

Appendix C
Lora Lake Apartments Parcel Soil Performance Monitoring Data Report

Attachment C.3
Data Validation Reports

DATA VALIDATION REPORT

FLOYD SNIDER
LORA LAKE APARTMENTS RIFS

Prepared for:

Floyd/Snider
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Seattle, WA 98101

Prepared by:

EcoChem, Inc.
1011 Western Avenue, Suite 1006
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EcoChem Project: C15221-1

Revised April 20, 2016

Approved for Release:

Christine Ransom
Senior Project Chemist
EcoChem, Inc.

PROJECT NARRATIVE

Basis for the Data Validation

This report summarizes the results of data validation performed on soil and quality control (QC) sample data for the Lora Lake Apartments RIFS. The dioxin data received a full level validation (EPA Stage 4); all other parameters received a summary level validation (EPA Stage 2B). Field blanks received a compliance level review (EPA Stage 2A). A complete list of samples is provided in the Sample Index.

Samples were analyzed by Analytical Resources, Inc. (Tukwila, Washington). The analytical methods and EcoChem project chemists are listed in the following table:

<table>
<tr><th>ANALYSIS</th><th>METHOD</th><th>PRIMARY REVIEW</th><th>SECONDARY REVIEW</th></tr>
<tr><td>Dioxin/Furan Compounds</td><td>1613B</td><td>M. Swanson, E. Clayton</td><td>A. Bodkin, C. Ransom</td></tr>
<tr><td>Polycyclic Aromatic Hydrocarbons (PAH)</td><td>SW8270D SIM</td><td rowspan="2">A. Bodkin</td><td rowspan="2">C. Ransom</td></tr>
<tr><td>Pentachlorophenol</td><td>SW8041</td></tr>
<tr><td>Diesel Range Organics</td><td>NWTPH-Dx</td><td rowspan="3">E. Clayton</td><td rowspan="2">A. Bodkin</td></tr>
<tr><td>Gasoline Range Organics</td><td>NWTPH-Gx</td></tr>
<tr><td>Lead</td><td>SW6010</td><td>A. Bodkin, C. Ransom</td></tr>
</table>

The data were reviewed using guidance and quality control criteria documented in the analytical methods; *Port of Seattle Lora Lake Apartments, Remedial Investigation/Feasibility Study Work Plan* (Floyd Snider, July 30, 2010); *National Functional Guidelines for Chlorinated Dioxin/Furan Data Review* (USEPA 2011); *National Functional Guidelines for Organic Data Review* (USEPA 2008); and *National Functional Guidelines for Inorganic Data Review* (USEPA 2010).

EcoChem's goal in assigning data assessment qualifiers is to assist in proper data interpretation. If values are estimated (J or UJ), data may be used for site evaluation and risk assessment purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. If values are assigned an R, the data are to be rejected and should not be used for any site evaluation purposes. If values have no data qualifier assigned, then the data meet the data quality objectives as stated in the documents and methods referenced above.

Data qualifier definitions, reason codes, and validation criteria are included as APPENDIX A. A Qualified Data Summary Table is included in APPENDIX B. Data Validation Worksheets and project associated communications will be kept on file at EcoChem, Inc. A qualified laboratory electronic data deliverable (EDD) and ADEC worksheets are also submitted with this report.

Sample Index
Lora Lake Apartments RIFS

SDG	Sample ID	Laboratory ID	Dioxin	PAH	PCP	NWTPH-Dx	NWTPH-Gx	Lead
AMN9	PM-071-19.0-20.0	15-16415-AMN9A	✓	✓		✓	✓	
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	✓	✓		✓	✓	
AMN9	PM-072-19.0-20.0	15-16417-AMN9C	✓	✓	✓	✓	✓	
AMN9	PM-072-21.0-22.0	15-16418-AMN9D	✓	✓	✓	✓	✓	
AMN9	PM-073-19.0-20.0	15-16419-AMN9E	✓	✓	✓	✓	✓	
AMN9	PM-073-19.0-20.0-D	15-16420-AMN9F	✓	✓	✓	✓	✓	
AMN9	PM-073-21.0-22.0	15-16421-AMN9G	✓	✓	✓	✓	✓	
AMQ5	PM-084-19.0-20.0	15-16549-AMQ5A	✓	✓	✓	✓	✓	
AMQ5	PM-084-21.0-22.0	15-16550-AMQ5B	✓	✓	✓	✓	✓	
AMQ5	PM-086-19.0-20.0	15-16551-AMQ5C	✓	✓	✓	✓	✓	
AMQ5	PM-086-19.0-20.0-D	15-16552-AMQ5D	✓	✓	✓	✓	✓	
AMQ5	PM-086-21.0-22.0	15-16553-AMQ5E	✓	✓	✓	✓	✓	
AMQ5	PM-094-19.0-20.0	15-16556-AMQ5H	✓	✓		✓	✓	
AMQ5	PM-094-21.0-22.0	15-16557-AMQ5I	✓	✓		✓	✓	
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	✓	✓	✓	✓	✓	
AMQ5	PM-095-10.0-11.0	15-16559-AMQ5K	✓	✓	✓	✓	✓	
AMQ5	PM-095-19.0-20.0	15-16560-AMQ5L	✓	✓	✓	✓	✓	
AMQ5	RB-1	15-16561-AMQ5M		✓	✓	✓	✓	
AMQ5	TB-1	15-16562-AMQ5N					✓	
AMS0	PM091-01.0-02.0	15-16672-AMS0A		✓	✓			
AMS0	PM091-09.0-10.0	15-16673-AMS0B	✓	✓	✓			✓
AMS0	PM097-01.0-02.0	15-16674-AMS0C	✓	✓				
AMS0	PM097-09.0-10.0	15-16675-AMS0D	✓	✓				
AMS0	PM101-01.0-02.0	15-16676-AMS0E	✓	✓	✓			✓
AMS0	PM101-09.0-10.0	15-16677-AMS0F	✓	✓	✓			✓
AMS0	PM101-09.0-10.0-D	15-16678-AMS0G						✓
AMS0	PM109-02.0-03.0	15-16679-AMS0H	✓					
AMS0	PM108-02.0-03.0	15-16680-AMS0I	✓					
AMS0	PM112-02.0-03.0	15-16681-AMS0J	✓					
AMS0	PM113-02.0-03.0	15-16682-AMS0K	✓					

Sample Index
Lora Lake Apartments RIFS

SDG	Sample ID	Laboratory ID	Dioxin	PAH	PCP	NWTPH-Dx	NWTPH-Gx	Lead
AMS0	PM116-02.0-03.0	15-16683-AMS0L	✓					
AMS0	PM074-01.0-02.0	15-16684-AMS0M	✓	✓	✓	✓	✓	
AMS0	PM074-10.0-11.0	15-16685-AMS0N	✓	✓	✓	✓	✓	
AMS0	PM074-19.0-20.0	15-16686-AMS0O	✓	✓	✓	✓	✓	
AMS0	RB-2	15-16687-AMS0P						✓
AMS0	TB-2	15-16688-AMS0Q					✓	
AMU0	PM-065-01.0-02.0	15-16766-AMU0C	✓					
AMU0	PM-065-07.0-08.0	15-16767-AMU0D	✓					
AMU0	PM-065-07.0-08.0-D	15-16768-AMU0E	✓					
AMU0	PM-064-10.0-11.0	15-16770-AMU0G	✓					
AMU0	PM-057-11.0-12.0	15-16775-AMU0L				✓	✓	
AMU0	PM-057-10.0-11.0	15-16776-AMU0M	✓					
AMU0	PM-104-02.0-03.0	15-16780-AMU0Q	✓					
AMU0	PM-063-10.0-11.0	15-16787-AMU0X	✓					
AMU0	TB-3	15-16793-AMU0AD					✓	
AMW2	PM111-01.0-02.0	15-16895-AMW2A	✓	✓	✓			✓
AMW2	PM111-09.0-10.0	15-16896-AMW2B	✓	✓	✓			✓
AMW2	PM111-01.0-02.0-D	15-16897-AMW2C	✓					
AMW2	PM103-01.0-02.0	15-16898-AMW2D	✓	✓	✓			
AMW2	PM103-09.0-10.0	15-16899-AMW2E	✓	✓	✓			
AMW2	PM061-01.0-02.0	15-16900-AMW2F	✓		✓			
AMW2	PM061-07.0-08.0	15-16901-AMW2G	✓		✓			
AMW2	PM061-01.0-02.0-D	15-16902-AMW2H			✓			
AMX3	PM-087-01.0-02.0	15-16931-AMX3A	✓	✓		✓	✓	
AMX3	PM-087-10.0-11.0	15-16932-AMX3B	✓	✓		✓	✓	
AMX3	PM-087-19.0-20.0	15-16933-AMX3C	✓	✓		✓	✓	
AMX3	PM-062-10.0-11.0	15-16935-AMX3E	✓					
AMX3	PM-70-10.0-11.0	15-16944-AMX3N	✓		✓			
AMX3	PM-82-10.0-11.0	15-16949-AMX3S	✓					
AMX3	TB-5	15-16964-AMX3AH					✓	

Sample Index
Lora Lake Apartments RIFS

SDG	Sample ID	Laboratory ID	Dioxin	PAH	PCP	NWTPH-Dx	NWTPH-Gx	Lead
ANA6	PM-073-23.0-24.0	15-17009-ANA6A					✓	
ANA6	PM-073-25.0-26.0	15-17010-ANA6B					✓	
ANA6	PM-063-19.0-20.0	15-17011-ANA6C					✓	
ANA6	PM-064A-19.0-20.0	15-17012-ANA6D					✓	
ANB5	PM-085-01.0-02.0	15-17053-ANB5A	✓	✓	✓	✓	✓	
ANB5	PM-085-10.0-11.0	15-17054-ANB5B	✓	✓	✓	✓	✓	
ANB5	PM-085-19.0-20.0	15-17055-ANB5C	✓	✓	✓	✓	✓	
ANB5	PM-085-25.0-26.0	15-17056-ANB5D				✓	✓	
ANB5	PM-085-21.0-22.0	15-17058-ANB5F	✓	✓	✓	✓	✓	
ANB5	PM-051-01.0-02.0	15-17060-ANB5H	✓					
ANB5	PM-051-07.0-08.0	15-17061-ANB5I	✓					
ANB5	PM-051-01.0-02.0-D	15-17066-ANB5N	✓					
ANB5	PM-067-01.0-02.0	15-17071-ANB5S	✓					
ANB5	PM-077-01.0-02.0	15-17075-ANB5W	✓					
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	✓					
ANB5	PM-079-01.0-02.0	15-17083-ANB5AE	✓					
ANB5	PM-089-01.0-02.0	15-17085-ANB5AG	✓					
ANB5	Trip Blank	15-17097-ANB5AP					✓	
ANC0	PM-073-23.0-24.0	15-17104-ANC0A				✓		
ANC0	PM-073-25.0-26-0	15-17105-ANC0B				✓		
ANC0	PM-O63-19.0-20.0	15-17106-ANC0C				✓		
AND4	PM-013-00.0-01.0	15-17168-AND4B	✓					
AND4	PM-014-00.0-01.0	15-17171-AND4E	✓					
AND4	PM-014-00.0-01.0-D	15-17174-AND4H	✓					
AND4	PM-015-00.0-01.0	15-17176-AND4J	✓					
AND4	PM-030-04.0-05.0	15-17184-AND4R	✓	✓				
AND4	PM-037-04.0-05.0	15-17186-AND4T	✓	✓				
AND4	PM-029-00.0-01.0	15-17188-AND4V	✓					
AND4	PM-021-00.0-01.0	15-17190-AND4X	✓					
AND4	PM-020-01.0-02.0	15-17193-AND4AA	✓					

Sample Index
Lora Lake Apartments RIFS

SDG	Sample ID	Laboratory ID	Dioxin	PAH	PCP	NWTPH-Dx	NWTPH-Gx	Lead
AND4	PM-020-01.0-02.0-D	15-17196-AND4AD	✓					
AND4	PM-019-00.0-01.0	15-17197-AND4AE	✓					
ANI4	PM-028-00.0-01.0	15-17483-ANI4A	✓					
ANI4	PM-027-00.0-01.0	15-17484-ANI4B	✓					
ANI4	PM-026-00.0-01.0	15-17485-ANI4C	✓					
ANI4	PM-041-00.0-01.0	15-17486-ANI4D	✓					
ANI4	PM-036-02.0-03.0	15-17487-ANI4E	✓	✓				
ANI4	PM-036-02.0-03.0-D	15-17488-ANI4F	✓	✓				
ANI4	PM-042-02.0-03.0	15-17489-ANI4G	✓	✓				
ANI4	PM-091-01.0-02.0	15-17490-ANI4H	✓					✓
ANJ3	PM-098-19.0-20.0	15-17555-ANJ3A					✓	
ANJ3	PM-094-23.0-24.0	15-17556-ANJ3B					✓	
ANJ3	PM-094-25.0-26.0	15-17557-ANJ3C					✓	
ANJ4	PM-057-12.0-13.0	15-17564-ANJ4A					✓	
ANJ4	PM-057-14.0-15.0	15-17565-ANJ4B					✓	
ANJ4	PM-072-23.0-24.0	15-17566-ANJ4C					✓	
ANJ4	PM-072-25.0-26.0	15-17567-ANJ4D					✓	
ANJ4	PM-051-12.0-13.0	15-17568-ANJ4E					✓	
ANJ4	PM-051-14.0-15.0	15-17569-ANJ4F					✓	
ANM6	PM-035-00.0-01.0	15-17741-ANM6B	✓					
ANM6	PM-035-00.0-01.0-D	15-17744-ANM6E	✓					
ANS4	PM-085-27.0-28.0	15-17948-ANS4A					✓	
APY8	PM-012-00.0-01.0	15-20826-APY8A	✓					
APY8	PM-019-01.0-02.0	15-20827-APY8B	✓					
APY8	PM-018-00.0-01.0	15-20828-APY8C	✓					
APY8	PM-035-02.0-03.0	15-20829-APY8D	✓					
APY8	PM-047-00.0-01.0	15-20830-APY8E	✓					
APY8	PM-049-02.0-03.0	15-20831-APY8F	✓					
APY8	PM-062-11.0-12.0	15-20832-APY8G	✓					
APY8	PM-060-01.0-02.0	15-20833-APY8H	✓					

Sample Index
Lora Lake Apartments RIFS

SDG	Sample ID	Laboratory ID	Dioxin	PAH	PCP	NWTPH-Dx	NWTPH-Gx	Lead
APY8	PM-060-07.0-08.0	15-20834-APY8I	✓					
APY8	PM-056-01.0-02.0	15-20835-APY8J	✓					
APY8	PM-056-07.0-08.0	15-20836-APY8K	✓					
APY8	PM-043-02.0-03.0	15-20837-APY8L	✓					
APY8	PM-055-01.0-02.0	15-20838-APY8M	✓					
APY8	PM-025-00.0-01.0	15-20839-APY8N	✓					
APY8	PM-041-01.0-02.0	15-20840-APY8O	✓					
APY8	PM-072-23.0-24.0	15-20841-APY8P	✓					
APY8	PM-072-25.0-26.0	15-20842-APY8Q	✓					
APY8	PM-073-23.0-24.0	15-20843-APY8R	✓					
APY8	PM-073-25.0-26.0	15-20844-APY8S	✓					
APZ0	PM-075-01.0-02.0	15-20848-APZ0A	✓					
APZ0	PM-075-07.0-08.0	15-20849-APZ0B	✓					
APZ0	PM-064-11.0-12.0	15-20850-APZ0C	✓					
APZ0	PM-058-07.0-08.0	15-20851-APZ0D	✓					
APZ0	PM-098-19.0-20.0	15-20852-APZ0E	✓					
APZ0	PM-063-11.0-12.0	15-20853-APZ0F	✓					
APZ0	PM-111-11.0-12.0	15-20854-APZ0G	✓					
APZ0	PM-107-01.0-02.0	15-20855-APZ0H						✓
APZ0	PM-107-09.0-10.0	15-20856-APZ0I	✓					
APZ0	PM-107-11.0-12.0	15-20857-APZ0J	✓					
APZ0	PM-096-01.0-02.0	15-20858-APZ0K	✓					
APZ0	PM-085-27.0-28.0	15-20859-APZ0L	✓					
APZ0	PM-100-02.0-03.0	15-20860-APZ0M	✓					
APZ0	PM-078-01.0-02.0	15-20861-APZ0N	✓					
APZ0	PM-089-02.0-03.0	15-20862-APZ0O	✓					
APZ0	PM-102-02.0-03.0	15-20863-APZ0P	✓					
APZ0	PM-097-01.0-02.0	15-20864-APZ0Q						✓
APZ0	PM-108-04.0-05.0	15-20865-APZ0R	✓					
ARI3	PM-006-00.0.0-01.0	15-22737-ARI3A	✓					

Sample Index
Lora Lake Apartments RIFS

SDG	Sample ID	Laboratory ID	Dioxin	PAH	PCP	NWTPH-Dx	NWTPH-Gx	Lead
ARI3	PM-011-00.0.0-01.0	15-22738-ARI3B	✓					
ARI3	PM-012-01.0-02.0	15-22739-ARI3C	✓					
ARI3	PM-047-01.0-02.0	15-22740-ARI3D	✓					
ARI3	PM-052-00.0-01.0	15-22741-ARI3E	✓					
ARI3	PM-090-01.0-02.0	15-22742-ARI3F	✓					
ARI3	PM-105-02.0-03.0	15-22743-ARI3G	✓					
ARI3	PM-088-01.0-02.0	15-22744-ARI3H	✓					
ARI3	PM-088-09.0-10.0	15-22745-ARI3I	✓					
ARJ1	PM-109-09.0-10.0	15-22791-ARJ1A	✓					
ARJ1	PM-109-09.0-10.0-D	15-22792-ARJ1B	✓					
ARJ1	PM-104-04.0-05.0	15-22793-ARJ1C	✓					
ARJ1	PM-098-04.0-05.0	15-22794-ARJ1D	✓					
ARJ1	PM-114-09.0-10.0	15-22795-ARJ1E	✓					
ARJ1	PM-102-04.0-05.0	15-22796-ARJ1F	✓					
ARJ1	PM-100-03.0-04.0	15-22797-ARJ1G	✓					
ARJ1	PM-100-09.0-10.0	15-22798-ARJ1H	✓					
ARJ1	PM-087-11.0-12.0	15-22799-ARJ1I	✓					
ARJ1	PM-078-02.0-03.0	15-22800-ARJ1J	✓					
ARJ1	PM-078-07.0-08.0	15-22801-ARJ1K	✓					
ARJ1	PM-119-01.0-02.0	15-22802-ARJ1L	✓					
ARJ1	PM-096-02.0-03.0	15-22803-ARJ1M	✓					
ARJ1	PM-048-00.0-01.0	15-22804-ARJ1N	✓					
ARJ1	PM-036-04.0-05.0	15-22805-ARJ1O	✓					
ARJ1	PM-040-00.0-01.0	15-22806-ARJ1P	✓					
ARJ1	PM-046-00.0-01.0	15-22807-ARJ1Q	✓					
ARJ1	PM-085-22.0-23.0	15-22808-ARJ1R	✓					
ASQ3	PM-001-00.0-01.0	15-24352-ASQ3A	✓					
ASQ3	PM-007-00.0-01.0	15-24353-ASQ3B	✓					
ASQ3	PM-006-01.0-02.0	15-24354-ASQ3C	✓					
ASQ3	PM-005-00.0-01.0	15-24355-ASQ3D	✓					

Sample Index
Lora Lake Apartments RIFS

SDG	Sample ID	Laboratory ID	Dioxin	PAH	PCP	NWTPH-Dx	NWTPH-Gx	Lead
ASQ3	PM-046-01.0-02.0	15-24356-ASQ3E	✓					
ASQ3	PM-045-00.0-01.0	15-24357-ASQ3F	✓					
ASQ3	PM-104-05.0-06.0	15-24358-ASQ3G	✓					
ASQ3	PM-102-07.0-08.0	15-24359-ASQ3H	✓					
ASQ3	PM-036-05.0-06.0	15-24360-ASQ3I	✓					
ATT8	PM-046-02.0-03.0	16-192-ATT8A	✓					
ATT8	PM-104-07.0-08.0	16-193-ATT8B	✓					
AVG1	PM-133-0.0-1.0	16-1522-AVG1A	✓					
AVG1	PM-006-2.0-3.0	16-1523-AVG1B	✓					
AVG1	PM-036-6.0-7.0	16-1526-AVG1E	✓					
AVG1	PM-134-0.0-1.0	16-1530-AVG1I	✓					
AVG1	PM-132-1.5-2.0	16-1531-AVG1J	✓					
AVG1	PM-102-8.0-9.0	16-1532-AVG1K	✓					
AVG1	PM-102-9.0-10.0	16-1533-AVG1L	✓					
AVG1	PM-129-2.0-3.0	16-1539-AVG1R	✓					
AVG1	PM-128-2.0-3.0	16-1541-AVG1T	✓					
AVG1	PM-128-2.0-3.0-D	16-1542-AVG1U	✓					
AVG1	PM-131-4.0-6.0	16-1545-AVG1X	✓					
AVG1	PM-130-9.0-10.0	16-1548-AVG1AA	✓					
AVG1	PM-101-2.0-3.0	16-1549-AVG1AB						✓
AVG1	PM-121-1.0-2.0	16-1553-AVG1AF						✓
AVG1	PM-121-1.0-2.0-D	16-1554-AVG1AG						✓
AVG1	PM-124-1.0-2.0	16-1556-AVG1AI						✓
AVG1	PM-122-1.0-2.0	16-1558-AVG1AK						✓
AVG1	PM-123-1.0-2.0	16-1560-AVG1AM						✓
AVG1	PM-125-1.0-2.0	16-1562-AVG1AO	✓					
AVG1	PM-125-9.0-10.0	16-1563-AVG1AP	✓					
AVG1	PM-126-1.0-2.0	16-1565-AVG1AR	✓					
AVG1	PM-127-1.0-2.0	16-1567-AVG1AT	✓					
AVG1	PM-120-1.0-2.0	16-1569-AVG1AV						✓

Sample Index
Lora Lake Apartments RIFS

SDG	Sample ID	Laboratory ID	Dioxin	PAH	PCP	NWTPH-Dx	NWTPH-Gx	Lead
AWO1	PM-071-1.0-2.0	16-2984-AWO1A	✓					
AWO1	PM-070-1.0-2.0	16-2985-AWO1B	✓					
AWO1	PM-082-1.0-2.0	16-2986-AWO1C	✓					
AWO1	PM-084-1.0-2.0	16-2987-AWO1D	✓					
AWO1	PM-121-2.0-3.0	16-2988-AWO1E						✓
AWO1	PM-121-4.0-5.0	16-2989-AWO1F						✓
AWO1	PM-123-2.0-3.0	16-2990-AWO1G						✓
AWO1	PM-123-4.0-5.0	16-2991-AWO1H						✓
AWO5	PM-006-3.0-4.0	16-3615-AWO5A	✓					
AWO5	PM-006-4.0-5.0	16-3616-AWO5B	✓					
AWO5	PM-058-2.0-3.0	16-3617-AWO5C	✓					
AYG4	PM-083-01.0-02.0	16-5012-AYG4A	✓					
AYG4	PM-083-10.0-11.0	16-5013-AYG4B	✓					
AYG4	PM-071-3.0-4.0	16-5014-AYG4C	✓					
AYG4	PM-071-7.0-8.0	16-5015-AYG4D	✓					
AYG4	PM-071-9.0-10.0	16-5016-AYG4E	✓					
AYG4	PM-084-3.0-4.0	16-5017-AYG4F	✓					
AYG4	PM-084-7.0-8.0	16-5018-AYG4G	✓					
AYG4	PM-084-9.0-10.0	16-5019-AYG4H	✓					

DATA VALIDATION REPORT
Lora Lake Apartments RIFS
Dioxin/Furan Compounds by Method 1613

This report documents the review of analytical data from the analysis of soil samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Refer to the SAMPLE INDEX for a complete list of samples.

SDG	NUMBER OF SAMPLES	VALIDATION LEVEL
AMN9	7 Soil	EPA Stage 4
AMQ5	10 Soil	
AMS0	13 Soil	
AMU0	7 Soil	
AMW2	7 Soil	
AMX3	6 Soil	
ANB5	12 Soil	
AND4	11 Soil	
ANI4	8 Soil	
ANM6	2 Soil	
APY8	19 Soil	
APZ0	16 Soil	
ARI3	9 Soil	
ARJ1	18 Soil	
ASQ3	9 Soil	
ATT8	2 Soil	
AVG1	16 Soil	
AWO1	4 Soil	
AWO5	3 Soil	
AYG4	8 Soil	

DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

SDGs AMS0, AMW2: All client identifications (ID) were missing a dash (-) in the first ID segment. No action was taken other than to note the discrepancy.

EDD TO HARDCOPY VERIFICATION

Sample results and related quality control data were received as an electronic data deliverable (EDD) and laboratory report. The EDD was verified against the laboratory report (10%). No errors were noted.

TECHNICAL DATA VALIDATION

The quality control (QC) requirements reviewed are summarized in the following table:

1	Sample Receipt, Preservation, and Holding Times	2	Ongoing Precision and Recovery (OPR)
✓	System Performance and Resolution Checks	1	Field Duplicates
✓	Initial Calibration (ICAL)	✓	Target Analyte List
2	Calibration Verification	2	Reported Results
2	Blanks (Laboratory and Field)	2	Compound Identification
2	Labeled Compounds	1	Calculation Verification
1	Matrix Spike/Matrix Spike Duplicates (MS/MSD)		

✓ ***Stated method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.***
1 ***Quality control results are discussed below, but no data were qualified.***
2 ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Sample Receipt, Preservation, and Holding Times

As stated in validation guidance documents, sample coolers should arrive at the laboratory within the advisory temperature range of less than 6°C. Several coolers were received with temperatures greater than the upper control limit, ranging from 6.8°C to 16.8°C. Samples were delivered to the laboratory at the end of the day they were collected. The coolers had insufficient time to cool to 6°C. The temperature outliers did not impact data quality; therefore, no action was taken. Samples were stored in frozen archive prior to being released for analysis.

Continuing Calibration

Continuing calibration (CCAL) percent difference (%D) values were within the control limit range of 80-120% for native compounds and 70-130% for labeled compounds, with the exceptions noted below:

SDG AMN9: The %D value for OCDD in the CCAL from 9/25/15 @ 17:21 was greater than the upper control limit, indicating a potential high bias. The results for OCDD in Samples PM-072-19.0-20.0, PM-072-21.0-22.0, PM-073-19.0-20.0, PM-073-19.0-20.0-D, and PM-073-21.0-22.0 were estimated (J-5BH).

Blanks

In order to assess the impact of blank contamination on the reported sample results, action levels were established at five times the blank concentrations. If the concentrations in the associated field samples were less than the action levels, the results were qualified as not detected (U-7) at the reported concentrations.

The laboratory assigned an "EMPC" flag to an analyte result when a peak was detected but did not meet identification criteria. These values cannot be considered as positive identifications, but are "estimated maximum possible concentrations". When a result in the method blank had an "EMPC" flag, the result was treated as not-detected at an elevated detection limit; therefore no action level was established for these analytes. Blank qualifiers are not assigned to homolog groups.

Results for the following analytes were qualified as not-detected in one or more samples:

SDG	Analyte
AMN9	1,2,3,4,6,7,8-HpCDD, OCDD, OCDF
AMS0	1,2,3,7,8-PeCDF, 1,2,3,4,6,7,8-HpCDD, OCDD
AMX3	1,2,3,7,8,9-HxCDD, OCDD, OCDF
ANB5	1,2,3,7,8,9-HxCDD, 1,2,3,4,7,8,9-HpCDF, OCDD, OCDF
AND4	1,2,3,7,8,9-HxCDD, 1,2,3,7,8,9-HxCDF, 1,2,3,4,6,7,8-HpCDD, OCDD
APY8	1,2,3,6,7,8-HxCDD, 1,2,3,6,7,8-HxCDF, OCDD, OCDF
ARI3	1,2,3,4,6,7,8-HpCDD, OCDD, OCDF
ARJ1	123789-HxCDF
AVG1	2,3,7,8-TCDF, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,6,7,8-HpCDD, OCDF, OCDD

No field blanks were submitted.

Labeled Compounds

Labeled compounds were added to all samples. The labeled compound percent recovery (%R) values were evaluated using the control limits of 70-130% as specified in the Work Plan. For labeled compound recovery outliers that were greater than the upper control limit, positive results for the associated compounds were estimated (J-13H). For labeled compound outlier values that were less than the lower control limit, positive results and non-detected results for the associated compounds were estimated (J/UJ-13L).

SDG	Sample ID	Outlier	Bias	Qualifier
AMN9	PM-072-19.0-20.0	13C-1,2,3,4,7,8-HxCDD	Low	J-13L
		13C-1,2,3,6,7,8-HxCDD		
		13C-1,2,3,4,7,8-HxCDF		
		13C-1,2,3,6,7,8-HxCDF		
	PM-072-21.0-22.0	13C-OCDD	High	J-13H
	PM-073-19.0-20.0	13C-OCDD	Low	J-13L
	PM-073-19.0-20.0-D			
	PM-073-21.0-22.0	13C-1,2,3,6,7,8-HxCDF	Low	J-13L
AMQ5	PM-084-21.0-22.0	13C-OCDD	Low	J-13L
	PM-095-01.0-02.0	13C-2,3,7,8-TCDD	Low	UJ-13L
		13C-2,3,7,8-TCDF		

SDG	Sample ID	Outlier	Bias	Qualifier
AMQ5	PM-095-01.0-02.0	13C-1,2,3,7,8-PeCDD	Low	J-13L
		13C-1,2,3,7,8-PeCDF		
		13C-2,3,4,7,8-PeCDF		
AMQ5	PM-095-01.0-02.0	13C-1,2,3,4,7,8-HxCDD	Low	J-13L
		13C-1,2,3,6,7,8-HxCDD		
		13C-1,2,3,4,7,8-HxCDF		
		13C-1,2,3,7,8,9-HxCDF		
AMQ5	PM-095-01.0-02.0	13C-1,2,3,6,7,8-HxCDF	Low	UJ-13L
		13C-2,3,4,6,7,8-HxCDF	Low	J-13L
		13C-1,2,3,4,6,7,8-HpCDD		
		13C-1,2,3,4,6,7,8-HpCDF		
		13C-1,2,3,4,7,8,9-HpCDF		
		13C-OCDD		
	PM-095-10.0-11.0	13C-1,2,3,4,7,8,9-HpCDF	Low	J-13L
		13C-OCDD		
	PM-095-19.0-20.0	13C-1,2,3,4,7,8,9-HpCDF	Low	UJ-13L
		13C-OCDD	Low	J-13L
AMS0	PM074-01.0-02.0	13C-OCDD	High	J-13H
	PM074-10.0-11.0	13C-1,2,3,6,7,8-HxCDF	Low	J-13L
	PM097-01.0-02.0			
	PM109-02.0-03.0	13C-1,2,3,4,7,8-HxCDF	Low	J-13L
	PM116-02.0-03.0	13C-1,2,3,6,7,8-HxCDF		
	PM108-02.0-03.0	13C-2,3,7,8-TCDD	Low	UJ-13L
		13C-1,2,3,4,7,8-HxCDD	Low	J-13L
		13C-1,2,3,6,7,8-HxCDD		
		13C-1,2,3,4,7,8-HxCDF		
		13C-1,2,3,6,7,8-HxCDF		
		13C-1,2,3,7,8,9-HxCDF		
		13C-2,3,4,6,7,8-HxCDF		
AMU0	PM065-01.0-02.0	13C-1,2,3,4,7,8,9-HpCDF	Low	J-13L
		13C-OCDD		
AMW2	PM061-07.0-08.0	13C-OCDD	Low	J-13L
	PM103-01.0-02.0	13C-1,2,3,4,7,8,9-HpCDF	Low	UJ-13L
		13C-OCDD	Low	J-13L
	PM111-01.0-02.0	13C-1,2,3,4,7,8,9-HpCDF	Low	J-13L
	PM111-01.0-02.0-D	13C-1,2,3,7,8,9-HxCDF	Low	UJ-13L
		13C-1,2,3,4,6,7,8-HpCDF	Low	J-13L
		13C-1,2,3,4,7,8,9-HpCDF		

SDG	Sample ID	Outlier	Bias	Qualifier
AMW2	PM111-01.0-02.0-D	13C-OCDD	Low	J-13L
AMX3	PM-82-10.0-11.0	13C-OCDD	Low	UJ-13L
ANB5	PM-079-01.0-02.0	13C-OCDD	Low	J-13L
	PM-100-01.0-02.0	All Labelled Compounds	Low	J/UJ-13L
AND4	PM-013-00.0-01.0 PM-014-00.0-01.0 PM-015-00.0-01.0	13C-OCDD	Low	J-13L
AND4	PM-014-00.0-01.0-D	13C-1,2,3,4,6,7,8-HpCDD	Low	J-13L
		13C-1,2,3,4,6,7,8-HpCDF	Low	J-13L
		13C-1,2,3,4,7,8,9-HpCDF	Low	J-13L
		13C-OCDD	Low	J-13L
	PM-019-00.0-01.0	13C-1,2,3,4,6,7,8-HpCDD	Low	J-13L
		13C-1,2,3,4,6,7,8-HpCDF	Low	J-13L
		13C-1,2,3,4,7,8,9-HpCDF	Low	J-13L
		13C-OCDD	Low	J-13L
	PM-021-00.0-01.0	13C-1,2,3,4,6,7,8-HpCDD	Low	J-13L
		13C-1,2,3,4,6,7,8-HpCDF	Low	J-13L
		13C-1,2,3,4,7,8,9-HpCDF	Low	J-13L
		13C-OCDD	Low	J-13L
	PM-029-00.0-01.0	13C-1,2,3,4,7,8,9-HpCDF	Low	J-13L
		13C-OCDD	Low	J-13L
	PM-030-04.0-05.0	13C-OCDD	Low	J-13L
ANI4	PM-027-00.0-01.0	13C-OCDD	Low	J-13L
ANM6	PM-035-00.0-01.0	13C-OCDD	Low	J-13L
APY8	PM-018-00.0-01.0 PM-072-23.0-24.0	13C-1,2,3,4,7,8,9-HpCDF	Low	J-13L
		13C-OCDD	Low	J-13L
	PM-049-02.0-03.0 PM-056-01.0-02.0 PM-060-01.0-02.0	13C-OCDD	Low	J-13L
	PM-055-01.0-02.0 PM-073-25.0-26.0	13C-1,2,3,4,7,8,9-HpCDF	Low	J-13L
	PM-043-02.0-03.0	13C-2,3,4,7,8-PeCDF	Low	J-13L
		13C-1,2,3,4,7,8,9-HpCDF	Low	J-13L
APZ0	PM-075-07.0-08.0 PM-102-02.0-03.0	13C-OCDD	Low	J-13L
	PM-089-02.0-03.0 PM-108-04.0-05.0	13C-1,2,3,4,7,8,9-HpCDF	Low	J-13L
		13C-OCDD	Low	J-13L
	PM-096-01.0-02.0	13C-1,2,3,4,6,7,8-HpCDD	Low	J-13L
		13C-OCDD	Low	J-13L

SDG	Sample ID	Outlier	Bias	Qualifier
APZ0	PM-111-11.0-12.0	13C-2,3,4,7,8-PeCDF	Low	J-13L
ARI3	PM-011-00.0-01.0 PM-088-01.0-02.0	13C-1,2,3,4,7,8,9-HpCDF	Low	J/UJ-13L
		13C-OCDD	Low	J/UJ-13L
	PM-006-00.0-01.0	13C-1,2,3,4,6,7,8-HpCDF	Low	J-13L
		13C-1,2,3,4,7,8,9-HpCDF	Low	J-13L
		13C-OCDD	Low	J-13L
	PM-052-00.0-01.0	13C-1,2,3,4,7,8,9-HpCDF	Low	J-13L
	PM-052-00.0-01.0	13C-2,3,4,7,8-PeCDF	Low	J-13L
	PM-090-01.0-02.0	13C-2,3,4,7,8-PeCDF	Low	UJ-13L
		13C-1,2,3,4,7,8,9-HpCDF	Low	UJ-13L
		13C-OCDD	Low	J-13L
	PM-105-02.0-03.0	13C-1,2,3,7,8-PeCDF	Low	J-13L
		13C-2,3,4,7,8-PeCDF	Low	J-13L
		13C-1,2,3,4,6,7,8-HpCDD	Low	J-13L
		13C-1,2,3,4,6,7,8-HpCDF	Low	J-13L
		13C-1,2,3,4,7,8,9-HpCDF	Low	UJ-13L
		13C-OCDD	Low	J-13L
	PM-088-09.0-10.0	13C-1,2,3,7,8-PeCDD	Low	UJ-13L
		13C-1,2,3,7,8-PeCDF	Low	J-13L
		13C-2,3,4,7,8-PeCDF	Low	J-13L
		13C-1,2,3,7,8,9-HxCDF	Low	J-13L
		13C-1,2,3,4,6,7,8-HpCDD	Low	UJ-13L
		13C-1,2,3,4,6,7,8-HpCDF	Low	J-13L
		13C-1,2,3,4,7,8,9-HpCDF	Low	UJ-13L
		13C-OCDD	Low	UJ-13L
ARJ1	PM-040-00.0-01.0 PM-048-00.0-01.0 PM-078-07.0-08.0 PM-087-11.0-12.0 PM-119-01.0-02.0	13C-1,2,3,4,7,8,9-HpCDF	Low	J/UJ-13L
		13C-OCDD	Low	J-13L
	PM-100-09.0-10.0	13C-OCDD	Low	J-13L
	PM-104-040.-05.0	13C-1,2,3,4,7,8,9-HpCDF	Low	J-13L
		13C-1,2,3,7,8,9-HxCDF	Low	J-13L
		13C-1,2,3,7,8-PeCDD	Low	J-13L
		13C-1,2,3,7,8-PeCDF	Low	J-13L
	PM-036-04.0-05.0	13C-1,2,3,4,6,7,8-HpCDD	Low	J-13L
		13C-1,2,3,4,6,7,8-HpCDF	Low	J-13L
		13C-1,2,3,4,7,8,9-HpCDF	Low	J-13L
		13C-1,2,3,7,8,9-HxCDF	Low	J-13L

SDG	Sample ID	Outlier	Bias	Qualifier
ARJ1	PM-036-04.0-05.0	13C-2,3,4,7,8-PeCDF	Low	J-13L
		13C-OCDD	Low	J-13L
	PM-114-09.0-10.0	13C-1,2,3,4,6,7,8-HpCDD	Low	J-13L
		13C-1,2,3,4,6,7,8-HpCDF	Low	J-13L
		13C-1,2,3,4,7,8,9-HpCDF	Low	UJ-13L
		13C-1,2,3,7,8,9-HxCDF	Low	J-13L
		13C-1,2,3,7,8-PeCDD	Low	UJ-13L
	PM-114-09.0-10.0	13C-1,2,3,7,8-PeCDF	Low	UJ-13L
		13C-OCDD	Low	J-13L
	PM-085-22.0-23.0	13C-1,2,3,4,6,7,8-HpCDD	Low	J-13L
		13C-1,2,3,4,6,7,8-HpCDF	Low	J-13L
		13C-1,2,3,4,7,8,9-HpCDF	Low	J-13L
		13C-1,2,3,4,7,8-HxCDF	Low	J-13L
		13C-1,2,3,6,7,8-HxCDD	Low	J-13L
		13C-1,2,3,6,7,8-HxCDF	Low	J-13L
		13C-1,2,3,7,8,9-HxCDF	Low	UJ-13L
		13C-1,2,3,7,8-PeCDD	Low	J-13L
		13C-1,2,3,7,8-PeCDF	Low	J-13L
		13C-2,3,4,6,7,8-HxCDF	Low	J-13L
		13C-2,3,4,7,8-PeCDF	Low	J-13L
		13C-2,3,7,8-TCDD	Low	UJ-13L
		13C-2,3,7,8-TCDF	Low	UJ-13L
		13C-OCDD	Low	J-13L
ASQ3	PM-001-00.0-01.0	13C-1,2,3,4,6,7,8-HpCDF	Low	J-13L
		13C-1,2,3,4,7,8,9-HpCDF	Low	J-13L
		13C-1,2,3,7,8-PeCDD	Low	J-13L
		13C-2,3,4,7,8-PeCDF	Low	UJ-13L
		13C-OCDD	Low	J-13L
	PM-006-01.0-02.0	13C-1,2,3,4,6,7,8-HpCDF	Low	J-13L
		13C-1,2,3,4,7,8,9-HpCDF	Low	UJ-13L
		13C-1,2,3,7,8,9-HxCDF	Low	J-13L
		13C-1,2,3,7,8-PeCDD	Low	J-13L
		13C-1,2,3,7,8-PeCDF	Low	J-13L
		13C-2,3,4,7,8-PeCDF	Low	J-13L
		13C-OCDD	Low	J-13L
	PM-007-00.0-01.0	13C-1,2,3,4,6,7,8-HpCDD	Low	J-13L
		13C-1,2,3,4,6,7,8-HpCDF	Low	J-13L
		13C-1,2,3,4,7,8,9-HpCDF	Low	J-13L

SDG	Sample ID	Outlier	Bias	Qualifier
ASQ3	PM-007-00.0-01.0	13C-1,2,3,7,8,9-HxCDF	Low	UJ-13L
		13C-1,2,3,7,8-PeCDD	Low	J-13L
		13C-1,2,3,7,8-PeCDF	Low	UJ-13L
		13C-2,3,4,7,8-PeCDF	Low	J-13L
		13C-OCDD	Low	J-13L
	PM-045-00.0-01.0	13C-1,2,3,7,8-PeCDD	Low	J-13L
		13C-1,2,3,7,8-PeCDF	Low	UJ-13L
		13C-2,3,4,7,8-PeCDF	Low	J-13L
	PM-046-01.0-02.0	13C-1,2,3,4,7,8,9-HpCDF	Low	J-13L
		13C-OCDD	Low	J-13L
	PM-104-05.0-06.0	13C-1,2,3,4,7,8,9-HpCDF	Low	J-13L
AVG1	PM-134-0.0-1.0	13C-1,2,3,7,8-PeCDD	Low	J-13L
	PM-102-8.0-9.0 PM-132-1.5-2.0 PM-133-0.0-1.0	13C-1,2,3,7,8-PeCDD 13C-OCDD	Low	J/UJ-13L
	PM-125-9.0-10.0 PM-126-1.0-2.0	13C-1,2,3,4,6,7,8-HpCDF 13C-OCDD	Low	J/UJ-13L
	PM-006-2.0-3.0 PM-036-6.0-7.0 PM-102-9.0-10.0 PM-125-1.0-2.0 PM-127-1.0-2.0 PM-128-2.0-3.0 PM-128-2.0-3.0-D PM-129-2.0-3.0 PM-130-9.0-10.0 PM-131-4.0-6.0	13C-OCDD	Low	J-13L
AW01	PM-071-1.0-2.0	13C-OCDD	Low	J-13L
	PM-070-1.0-2.0			
	PM-082-1.0-2.0			
	PM-070-1.0-2.0	13C-1,2,3,4,6,7,8-HpCDF	Low	J-13L
AWO5	PM-006-3.0-4.0	13C-1,2,3,7,8-PeCDD	Low	J-13L
	PM-006-4.0-5.0 PM-058-2.0-3.0	13C-OCDD	Low	J-13L
		13C-1,2,3,4,6,7,8-HpCDF	Low	J-13L
		13C-1,2,3,4,7,8,9-HpCDF	Low	J-13L
AYG4	PM-071-3.0-4.0 PM-071-7.0-8.0 PM-071-9.0-10.0 PM-083-01.0-02.0 PM-083-10.0-11.0	13C-OCDD	Low	J-13L

SDG	Sample ID	Outlier	Bias	Qualifier
AYG4	PM-084-7.0-8.0 PM-084-9.0-10.0	13C-OCDD	Low	J-13L
	PM-083-01.0-02.0	13C-1,2,3,4,6,7,8-HpCDD	Low	J-13L
		13C-1,2,3,4,6,7,8-HpCDF	Low	J-13L
		13C-1,2,3,4,7,8,9-HpCDF	Low	UJ-13L
		13C-1,2,3,7,8,9-HxCDF	Low	UJ-13L
		13C-1,2,3,7,8-PeCDD	Low	UJ-13L

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicate analyses were not performed; they are not required by the method. Accuracy was evaluated using the labeled compound and ongoing precision and recovery (OPR) standard results. The acceptable OPR results indicates acceptable precision from analytical batch to batch; however, absence of a replicate analysis means that precision within the analytical batch could not be assessed.

Ongoing Precision and Recovery

SDG AMN9: The ongoing precision and recovery standard (OPR) %R value for OCDD was greater than the QAPP specified upper control limit of 130%, indicating a potential high bias. The associated OCDD results were estimated (J-10H).

SDG ASQ3: In both OPR, the %R values for OCDD were greater than the upper control limit. The OCDD results for all samples were estimated (J-10H).

SDG AVG1: The OPR %R values for OCDD and OCDF were greater than the upper control limit, indicating a potential high bias. The associated OCDD and OCDF results were estimated (J-10H).

Field Duplicates

The field duplicate relative percent difference (RPD) control limit is 50% for concentrations greater than 5x the reporting limit (RL). For concentrations less than 5x the RL, the difference between the sample result and the duplicate result must be less than 2x the RL. No qualifiers were applied based on field duplicate precision outliers. However, any outliers are noted below. Data users should take field precision into account when interpreting sample data.

Field duplicates are noted below.

SDG	Sample ID	Field duplicate ID
AMN9	PM-073-19.0-20.0	PM-073-19.0-20.0-D
AMQ5	PM-086-19.0-20.0	PM-086-19.0-20.0-D
AMU0	PM-065-07.0-08.0	PM-065-07.0-08.0-D

SDG	Sample ID	Field duplicate ID
AMW2	PM111-01.0-02.0	PM111-01.0-02.0-D
ANB5	PM-051-01.0-02.0	PM-051-01.0-02.0-D
AND4	PM-014-00.0-01.0	PM-014-00.0-01.0-D
	PM-020-01.0-02.0	PM-020-01.0-02.0-D
ANI4	PM-036-02.0-03.0	PM-036-02.0-03.0-D
ANM6	PM-035-00.0-01.0	PM-035-00.0-01.0-D
ARJ1	PM-109-09.0-10.0	PM-109-09.0-10.0-D
AVG1	PM-128-2.0-3.0	PM-128-2.0-3.0-D

SDG AMQ5: PM-086-19.0-20.0 and PM-086-19.0-20.0-D: the RPD values for OCDD, OCDF, and total HpCDF were greater than the control limit.

SDG ANB5: PM-051-01.0-02.0 and PM-051-01.0-02.0-D: the RPD values for 1234678-HpCDF, OCDF, total TCDD, and total HpCDF were greater than the control limit.

SDG AND4: PM-014-00.0-01.0 and PM-014-00.0-01.0-D: the RPD value for total TCDF was greater than the control limit.

PM-020-01.0-02.0 and PM-020-01.0-02.0-D: the RPD value for total HxCDD was greater than the control limit.

Reported Results

The laboratory assigned an "E" flag to several OCDD results to indicate the concentrations exceeded the calibration range of the instrument. These results were estimated (J-20).

Several samples were re-analyzed at dilution due to high concentrations of target analytes in the original analyses. The laboratory reported only the most appropriate result from the various analyses.

Compound Identification

The method requires the confirmation of 2,3,7,8-TCDF using an alternate GC column as the DB5 column that is typically used cannot fully separate 2,3,7,8-TCDF from closely eluting non-target TCDF isomers. The laboratory did not perform a second column confirmation; however the laboratory uses an RTX-Dioxin2 column. This column provides adequate resolution of the TCDF isomers as indicated by the acceptable peak to valley ratios. Since the 2,3,7,8-TCDF resolution was acceptable, no action was necessary.

The laboratory assigned an "EMPC" flag to one or more analytes to indicate that the ion ratio criterion for positive identification was not met. Since the ion abundance ratio is the primary identification criterion for high resolution mass spectroscopy, an outlier indicates that the reported result may be a false positive. These "EMPC" flagged results were qualified as not detected (U-25) at the reported concentration. The laboratory also assigned "EMPC" flags to total homolog groups. In these cases, the result for the group was estimated (J-25).

Diphenyl ether interferences were indicated for several samples. The laboratory assigned an "X" flag to these results. No action was taken if the flagged result was reported as an EMPC, as these results are qualified as not-detected based on identification criteria not being met. Where diphenyl ether interferences were present and the identification criteria were met, the results were estimated (J-23H) to indicate a potential high bias.

Calculation Verification

Several results were verified by recalculation from the raw data. No calculation or transcription errors were found.

OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. With the exceptions noted above, accuracy was acceptable as demonstrated by the labeled compound and OPR recoveries and precision was acceptable as demonstrated by the OPR and field duplicate RPD values.

Detection limits were elevated based on ion ratio outliers and method blank contamination. Results were estimated based on labeled compound outliers, exceeding the calibration range of the instrument, and diphenyl ether interference. Results for total homolog groups with EMPC flags were also estimated.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Lora Lake Apartments RIFS
Polycyclic Aromatic Hydrocarbons by SW846 Method 8270D- SIM

This report documents the review of analytical data from the analysis of soil samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Refer to the SAMPLE INDEX for a complete list of samples.

SDG	NUMBER OF SAMPLES	VALIDATION LEVEL
AMN9	7 Soil	EPA Stage 2B
AMQ5	10 Soil	EPA Stage 2B
	1 Rinsate Blank	EPA Stage 2A
AMS0	9 Soil	EPA Stage 2B
AMW2	4 Soil	EPA Stage 2B
AMX3	3 Soil	EPA Stage 2B
ANB5	4 Soil	EPA Stage 2B
AND4	2 Soil	EPA Stage 2B
ANI4	3 Soil	EPA Stage 2B

DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

SDGs AMS0, AMW2: All client identifications (ID) were missing a dash (-) in the first ID segment. No action was taken other than to note the discrepancy.

EDD TO HARDCOPY VERIFICATION

Sample results and related quality control data were received as an electronic data deliverable (EDD) and laboratory report. The EDD was verified against the laboratory report. No errors were noted.

TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed in the following table.

1	Sample Receipt, Preservation and Holding Times	✓	Laboratory Control Samples (LCS/LCSD)
✓	GC/MS Instrument Performance	1	Field Duplicates
✓	Initial Calibration (ICAL)	✓	Internal Standards
✓	Continuing Calibration Verification (CCV)	✓	Target Analyte List
1	Blanks (Laboratory and Field)	✓	Reporting Limits
2	Surrogate Compounds	✓	Compound Identification
✓	Matrix Spikes/Matrix Spike Duplicates (MS/MSD)	✓	Reported Results

✓ ***Stated method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.***
1 ***Quality control results are discussed below, but no data were qualified.***
2 ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Sample Receipt, Preservation, and Holding Times

As stated in validation guidance documents, sample coolers should arrive at the laboratory within the advisory temperature range of less than 6°C. Several coolers were received with temperatures greater than the upper control limit, ranging from 6.8°C to 16.8°C. Samples were delivered to the laboratory at the end of the day they were collected. The coolers had insufficient time to cool to 6°C. The temperature outliers did not impact data quality; therefore no action was taken.

SDGs AMS0, AMW2: All client identifications (ID) were missing a dash (-) in the first ID segment.

Field Blanks

SDG AMQ5: One equipment rinsate blank, RB-1, was submitted. No target analytes were detected in this blank.

Surrogate Compounds

SDG AMN9: The percent recovery (%R) value for 2-methylnaphthalene-d10 was less than the lower control limit of 40% in Sample PM-071-21.0-22.0. All results for this sample were estimated (J/UJ-13L) to indicate a potential low bias.

SDG AMS0: The %R value for 2-methylnaphthalene-d10 was less than the lower control limit of 40% in the following samples. All results for these samples were estimated (J/UJ-13L) to indicate a potential low bias.

PM-091-09.0-10.0	PM-074-01.0-02.0
PM-097-01.0-02.0	PM-074-10.0-11.0
PM-097-09.0-10.0	PM-074-19.0-20.0
PM-101-09.0-10.0	

Field Duplicates

The field duplicate relative percent difference (RPD) control limit is 50% for concentrations greater than 5x the reporting limit (RL). For concentrations less than 5x the RL, the difference between the sample result and the duplicate result must be less than 2x the RL.

SDG AMN9: One set of field duplicates were submitted: PM-073-19.0-20.0 and PM-073-19.0-20.0 -D. Field precision was acceptable.

SDG AMQ5: One set of field duplicates were submitted: PM-086-19.0-20.0 and PM-086-19.0-20.0 -D. Field precision was acceptable.

SDG ANI4: One set of field duplicates were submitted: PM-036-02.0-03.0 and PM-036-02.0-03.0 -D. Field precision was acceptable.

OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. With the exceptions noted above, accuracy was acceptable, as demonstrated by the surrogate, laboratory control sample/laboratory control sample duplicate (LCS/LCSD), and matrix spike/matrix spike duplicate (MS/MSD) %R values. Precision was acceptable as demonstrated by the MS/MSD, LCS/LCSD, and field duplicate RPD values.

Data were estimated due to surrogate recovery outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Lora Lake Apartments RIFS
Pentachlorophenol by SW846 Method 8041

This report documents the review of analytical data from the analysis of soil samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Refer to the SAMPLE INDEX for a complete list of samples.

SDG	NUMBER OF SAMPLES	VALIDATION LEVEL
AMN9	5 Soil	EPA Stage 2B
AMQ5	8 Soil	EPA Stage 2B
	1 Rinsate Blank	EPA Stage 2A
AMS0	7 Soil	EPA Stage 2B
AMW2	7 Soil	EPA Stage 2B
AMX3	1 Soil	EPA Stage 2B
ANB5	4 Soil	EPA Stage 2B

DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

SDGs AMS0, AMW2: All client identifications (ID) were missing a dash (-) in the first ID segment. No action was taken other than to note the discrepancy.

EDD TO HARDCOPY VERIFICATION

Sample results and related quality control data were received as an electronic data deliverable (EDD) and laboratory report. The EDD was verified against the laboratory report (10%). No errors were noted.

TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed in the following table.

1	Sample Receipt, Preservation and Holding Times	✓	Laboratory Control Samples (LCS/LCSD)
✓	Initial Calibration (ICAL)	1	Field Duplicates
2	Continuing Calibration Verification (CCV)	✓	Target Analyte List
1	Blanks (Laboratory and Field)	✓	Reporting Limits
2	Surrogate Compounds	✓	Compound Identification
✓	Matrix Spikes/Matrix Spike Duplicates (MS/MSD)	✓	Reported Results

✓ ***Stated method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.***
1 ***Quality control results are discussed below, but no data were qualified.***
2 ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Sample Receipt, Preservation, and Holding Times

As stated in validation guidance documents, sample coolers should arrive at the laboratory within the advisory temperature range of less than 6°C. Several coolers were received with temperatures greater than the upper control limit, ranging from 6.8°C to 16.8°C. Samples were delivered to the laboratory at the end of the day they were collected. The coolers had insufficient time to cool to 6°C. The temperature outliers did not impact data quality; therefore no action was taken.

Continuing Calibration Verification

The percent difference (%D) value on one of the two GC columns was greater than the control limit of 15% for one or more calibration standards. If a positive result was reported from the column with an outlier indicating a potential high bias, the result was estimated (J-5BH). If a positive result was reported from the column with an outlier indicating a potential low bias, the result was estimated (J-5BL). No action was taken if pentachlorophenol was not detected or if a positive result was reported from the column with %D values less than 15%. The following results were estimated:

SDG	SAMPLE	QUALIFIER
AMN9	PM-072-21.0-22.0	J-5BH
AMS0	PM-091-09.0-10.0	J-5BH
	PM-101-01.0-02.0	J-5BH
AMW2	PM-111-01.0-02.0	J-5BL
	PM-103-09.0-10.0	J-5BL

Field Blanks

SDG AMQ5: One equipment rinsate blank, RB-1, was submitted. No target analytes were detected in this blank.

Surrogate Compounds

The percent recovery (%R) value for 2,4,6-tribromophenol was less than the lower control limit of 40% in the following samples. All results for these samples were estimated (J-13L) to indicate a potential low bias.

SDG	SAMPLE	QUALIFIER
AMN9	PM-073-19.0-20.0	J-13L
AMQ5	PM-095-01.0-02.0	J-13L
AMS0	PM-091-09.0-10.0	J-13L
	PM-074-01.0-02.0	J-13L

Field Duplicates

The field duplicate relative percent difference (RPD) control limit is 50% for concentrations greater than 5x the reporting limit (RL). For concentrations less than 5x the RL, the difference between the sample result and the duplicate result must be less than 2x the RL.

SDG AMN9: One set of field duplicates were submitted: PM-073-19.0-20.0 and PM-073-19.0-20.0 -D. Field precision was acceptable.

SDG AMQ5: One set of field duplicates were submitted: PM-086-19.0-20.0 and PM-086-19.0-20.0 -D. Field precision was acceptable.

SDG AMW2: One set of field duplicates were submitted: PM-061-01.0-02.0 and PM-061-01.0-02.0 -D. Field precision was acceptable.

OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. With the exceptions noted above, accuracy was acceptable as demonstrated by the surrogate, laboratory control sample/laboratory control sample duplicate (LCS/LCSD), and matrix spike/matrix spike duplicate (MS/MSD) %R values. Precision was acceptable as demonstrated by the MS/MSD, LCS/LCSD, and field duplicate RPD values.

Data were estimated due to calibration verification outliers and surrogate recovery outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Lora Lake Apartments RIFS
Diesel and Residual Range Hydrocarbons by NWTPH-Dx

This report documents the review of analytical data from the analyses of soil samples and the associated laboratory and field quality control (QC) samples. Analytical Resources, Inc. of Tukwila, Washington, analyzed the samples. Refer to the SAMPLE INDEX for a complete list of samples.

SDG	NUMBER OF SAMPLES	VALIDATION LEVEL
AMN9	7 Soil	EPA Stage 2B
AMQ5	10 Soil	EPA Stage 2B
	1 Rinsate Blank	EPA Stage 2A
AMS0	3 Soil	EPA Stage 2B
AMU0	1 Soil	EPA Stage 2B
AMX3	3 Soil	EPA Stage 2B
ANB5	5 Soil	EPA Stage 2B
ANC0	3 Soil	EPA Stage 2B

DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

SDGs AMS0, AMW2: All client identifications (ID) were missing a dash (-) in the first ID segment. No action was taken other than to note the discrepancy.

SDG ANC0: The client ID for lab Sample ANC0C should be PM-063, not PM-O63. No action was taken other than to note the deiscrepancy.

The collection and receipt dates for this sample as noted on the COC are 9/18/15, the sample was logged in with dates of 9/21/15. The EDD was corrected.

EDD TO HARDCOPY VERIFICATION

Sample results and related quality control data were received as an electronic data deliverable (EDD) and laboratory report. The EDD was verified against the laboratory report (10%). No errors were noted.

TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1	Sample Receipt, Preservation and Holding Times	✓	Laboratory Control Samples (LCS/LCSD)
✓	GC/MS Instrument Performance	1	Field Duplicates
✓	Initial Calibration (ICAL)	✓	Target Analyte List
✓	Continuing Calibration Verification (CCV)	1	Reporting Limits
1	Blanks (Laboratory and Field)	✓	Compound Identification
✓	Surrogate Compounds	✓	Reported Results
✓	Matrix Spikes/Matrix Spike Duplicates (MS/MSD)		

✓ ***Stated method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.***
1 ***Quality control results are discussed below, but no data were qualified.***
2 ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Sample Receipt, Preservation, and Holding Times

As stated in validation guidance documents, sample coolers should arrive at the laboratory within the advisory temperature range of less than 6°C. Several coolers were received with temperatures greater than the upper control limit, ranging from 8.4°C to 16.8°C. Samples were delivered to the laboratory at the end of the day they were collected. The coolers had insufficient time to cool to 6°C. The temperature outliers did not impact data quality; therefore no action was taken.

Blanks

Field blanks collected for the sampling event were evaluated for impact of any contaminant on the reported sample results. Action levels were established at five times (5x) the concentration reported in the field blank. If a contaminant is reported in an associated field sample and the concentration is less than the action level, the result is qualified as not detected (U-6). No action is taken if the sample result is greater than the action level, or for non-detected results.

SDG AMQ5: Sample RB-1 was analyzed as a rinse blank. No positive results were detected.

Field Duplicates

The relative percent difference (RPD) control limit is 50% for results greater than 5x the reporting limit (RL). For results less than 5x the RL, the difference between the sample and replicate must be less than 2x the RL.

SDG AMN9: Samples PM-073-19.0-20.0 and PM-073-19.0-20.0-D were analyzed as field duplicates. The RPD values were within acceptance criteria.

SDG AMQ5: Samples PM-086-19.0-20.0 and PM-086-19.0-20.0-D were analyzed as field duplicates. The RPD values were within acceptance criteria.

Reporting Limits

All SDGs: Reporting limits (RLs) were elevated due to sample size, percent moisture adjustment, and/or dilution.

OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogate, LCS/LCSD and MS/MSD %R values, and precision was acceptable as demonstrated by the LCS/LCSD, MS/MSD and field duplicate RPD values.

All data, as reported, are acceptable for use.

DATA VALIDATION REPORT
Lora Lake Apartments RIFS
Gasoline Range Hydrocarbons by Method NWTPH-Gx

This report documents the review of analytical data from the analysis of soil samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Refer to the SAMPLE INDEX for a complete list of samples.

SDG	NUMBER OF SAMPLES	VALIDATION LEVEL
AMN9	7 Soil	EPA Stage 2B
AMQ5	10 Soil	EPA Stage 2B
	1 Rinsate Blank & 1 Trip Blank	EPA Stage 2A
AMS0	3 Soil	EPA Stage 2B
	1 Trip Blank	EPA Stage 2A
AMU0	1 Soil	EPA Stage 2B
	1 Trip Blank	EPA Stage 2A
AMX3	3 Soil	EPA Stage 2B
	1 Trip Blank	EPA Stage 2A
ANA6	4 Soil	EPA Stage 2B
ANB5	5 Soil	EPA Stage 2B
	1 Trip Blank	EPA Stage 2A
ANJ3	3 Soil	EPA Stage 2B
ANJ4	6 Soil	EPA Stage 2B
ANS4	1 Soil	EPA Stage 2B

DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

EDD TO HARDCOPY VERIFICATION

Sample results and related quality control data were received as an electronic data deliverable (EDD) and laboratory report. The EDD was verified against the laboratory report (10%). No errors were noted.

SDGs AMS0, AMW2: All client identifications (ID) were missing a dash (-) in the first ID segment. No action was taken other than to note the discrepancy.

SDG ANJ4: The units for the GRO result for the re-analysis of Sample PM-057-12.0-13.0 were incorrect in the EDD. The units were changed from "µg/kg" to "mg/kg".

TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1	Sample Receipt, Preservation and Holding Times	✓	Laboratory Control Samples (LCS/LCSD)
✓	GC/MS Instrument Performance	1	Field Duplicates
✓	Initial Calibration (ICAL)	✓	Target Analyte List
✓	Continuing Calibration Verification (CCV)	1	Reporting Limits
1	Blanks (Laboratory and Field)	✓	Compound Identification
✓	Surrogate Compounds	2	Reported Results
✓	Matrix Spikes/Matrix Spike Duplicates (MS/MSD)		

✓ ***Stated method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.***
1 ***Quality control results are discussed below, but no data were qualified.***
2 ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Sample Receipt, Preservation, and Holding Times

As stated in validation guidance documents, sample coolers should arrive at the laboratory within the advisory temperature range of less than 6°C. Several coolers were received with temperatures greater than the upper control limit, ranging from 7.9°C to 16.8°C. Samples were delivered to the laboratory at the end of the day they were collected. The coolers had insufficient time to cool to 6°C. The temperature outliers did not impact data quality; therefore no action was taken.

SDG AMS0: Sample TB-2 had a collection date of 9/15/15 noted on the COC, but was logged in with a collection date of 9/17/15. No action was taken as the field samples were collected on 9/17/15.

SDG AMX3: Sample TB-5 had a collection date of 9/16/15, noted on the COC, but was logged in with a collection date of 9/22/15.

SDG ANB5: Sample Trip Blank was not listed on the COC, but arrived in the sample cooler.

Blanks

Field blanks collected for the sampling event were evaluated for impact of any contaminant on the reported sample results. Action levels were established at five times (5x) the concentration reported in the field blank. If a contaminant is reported in an associated field sample and the concentration is less than the action level, the result is qualified as not detected (U-6). No action is taken if the sample result is greater than the action level, or for non-detected results.

SDG AMQ5: One rinsate blank, RB-1, and one trip blank, TB-1, were submitted. There were no positive results for these blanks.

SDG AMS0: One trip blank, TB-2, was submitted. Gasoline range organics were not detected in this blank.

SDG AMU0: One trip blank, TB-3, was submitted. Gasoline range organics were not detected in this blank.

SDG AMX3: One trip blank, TB-5, was submitted. Gasoline range organics were not detected in this blank.

Field Duplicates

The relative percent difference (RPD) control limit is 50% for results greater than 5x the reporting limit (RL). For results less than 5x the RL, the difference between the sample and replicate must be less than 2x the RL.

SDG AMN9: Samples PM-073-19.0-20.0 and PM-073-19.0-20.0-D were analyzed as field duplicates. The RPD values were within acceptance criteria.

SDG AMQ5: Samples PM-086-19.0-20.0 and PM-086-19.0-20.0-D were analyzed as field duplicates. The RPD values were within acceptance criteria.

Reporting Limits

Reporting limits (RLs) were elevated due to sample size, percent moisture adjustment, and/or dilution.

Reported Results

SDG ANJ4: Sample PM-057-12.0-13.0 was reanalyzed due to a result that exceeded the calibration range. The original result, which was E-flagged by the laboratory, was flagged as do not report (DNR-11). Results from the diluted analysis should be used.

OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogate, LCS/LCSD and MS/MSD %R values. Precision was also acceptable as demonstrated by the LCS/LCSD, MS/MSD, and field duplicate RPD values.

One result was flagged as do-not-report (DNR) do indicate which result should not be used form multiple reported analyses.

All other data, as reported, are acceptable for use.

DATA VALIDATION REPORT
Lora Lake Apartments RIFS
Lead by Method 6010C

This report documents the review of analytical data from the analysis of soil samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Refer to the SAMPLE INDEX for a complete list of samples.

SDG	NUMBER OF SAMPLES	VALIDATION LEVEL
AMS0	4 Soil	EPA Stage 2B
	1 Rinsate Blank	EPA Stage 2A
AMW2	2 Soil	EPA Stage 2B
ANI4	1 Soil	EPA Stage 2B
APZ0	2 Soil	EPA Stage 2B
AVG1	7 Soil	EPA Stage 2B
AWO1	4 Soil	EPA Stage 2B

DATA PACKAGE COMPLETENESS

The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

SDGs AMS0, AMW2: All client identifications (ID) were missing a dash (-) in the first ID segment. No action was taken other than to note the discrepancy.

EDD TO HARDCOPY VERIFICATION

Sample results and related quality control data were received as an electronic data deliverable (EDD) and laboratory report. The EDD was verified against the laboratory report (10%). No errors were noted.

TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1	Sample Receipt, Preservation, and Holding Times	2	Laboratory Duplicates
✓	Initial Calibration (ICAL)	1	Interference Check Standards
✓	Continuing Calibration (CCAL)	2	Field Duplicates
✓	Laboratory Blanks	✓	Target Analyte list
1	Field Blanks	✓	Reporting Limits
✓	Laboratory Control Samples (LCS/LCSD)	1	Reported Results
✓	Matrix Spikes (MS)		

✓ ***Stated method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.***
1 ***Quality control results are discussed below, but no data were qualified.***
2 ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Sample Receipt, Preservation, and Holding Times

As stated in validation guidance documents, sample coolers should arrive at the laboratory within the advisory temperature range of less than 6°C. Several coolers were received with temperatures greater than the upper control limit, ranging from 6.8°C to 16.8°C. Samples were delivered to the laboratory at the end of the day they were collected. The coolers had insufficient time to cool to 6°C. The temperature outliers did not impact data quality; therefore no action was taken.

SDG AMS0: Sample PM-091-01.0-02.0 was marked for analysis on the chain-of-custody (COC), but was cancelled by the client.

Field Blanks

SDG AMS0: One rinsate blank, RB-2, was submitted. No target analytes were detected in this blank.

Laboratory Duplicates

For laboratory duplicate samples, the relative percent difference (RPD) control limit is 20% for results greater than 5x the reporting limit (RL). For results less than 5x the RL, the difference between the sample and duplicate must be less than 2x the RL.

SDG AMW2: Sample PM111-09.0-10.0 was analyzed as the laboratory duplicate. The RPD value for lead was greater than the control limit. The associated sample results were estimated (J-9).

SDG AVG1: Sample PM-101-2.0-3.0 was analyzed as the laboratory duplicate. The RPD value for lead was greater than the control limit. The associated sample results were estimated (J-9).

Interference Check Standards

Interference check standard samples (ICSA/ICSAB) were analyzed as required by the method. The ICSAB %R values were within the criteria of 80% – 120% for all spiked elements.

The absolute value of the ICSA results for lead were often greater than the RL, however the concentrations of interfering elements in the field samples were less than the levels present in the ICSA or were greater than the action level. No qualifiers were added.

Field Duplicates

The RPD control limit is 50% for results greater than 5x the reporting limit (RL). For results less than 5x the RL, the difference between the sample and replicate must be less than 2x the RL

SDG AMS0: One set of field duplicates was submitted: PM101-09.0-10.0 and PM101-09.0-10.0-D. The RPD value was within acceptance criteria.

SDG AVG1: One set of field duplicates was submitted: PM-121-1.0-2.0 and PM-121-1.0-2.0-D. The RPD value for lead was greater than the control limit. The associated sample results were estimated (J-9).

Reported Results

The laboratory reported all results less than the practical quantitation limit (PQL) as not detected at the PQL.

OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical methods. Accuracy was acceptable as demonstrated by the laboratory control sample and matrix spike percent recovery values. With the exceptions noted above, precision was acceptable as demonstrated by the laboratory duplicate and field duplicate RPD values.

Data were estimated because of laboratory duplicate and field duplicate precision outliers.

All data, as qualified, are acceptable for use.

ECOCHEM
Data Quality

APPENDIX A

DATA QUALIFIER DEFINITIONS
REASON CODES
AND CRITERIA TABLES

DATA VALIDATION QUALIFIER CODES
Based on National Functional Guidelines

The following definitions provide brief explanations of the qualifiers assigned to results in the data review process.

U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents the approximate concentration.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

The following is an EcoChem qualifier that may also be assigned during the data review process:

DNR	Do not report; a more appropriate result is reported from another analysis or dilution.

DATA QUALIFIER REASON CODES

Group	Code	Reason for Qualification
Sample Handling	1	Improper Sample Handling or Sample Preservation (i.e., headspace, cooler temperature, pH, summa canister pressure); Exceeded Holding Times
Instrument Performance	24	Instrument Performance (i.e., tune, resolution, retention time window, endrin breakdown, lock-mass)
	5A	Initial Calibration (RF, %RSD, r^2)
	5B	Calibration Verification (CCV, CCAL; RF, %D, %R) Use bias flags (H,L)[1] where appropriate
	5C	Initial Calibration Verification (ICV %D, %R) Use bias flags (H,L)[1] where appropriate
Blank Contamination	6	Field Blank Contamination (Equipment Rinsate, Trip Blank, etc.)
	7	Lab Blank Contamination (i.e., method blank, instrument blank, etc.) Use low bias flag (L)[1] for negative instrument blanks
Precision and Accuracy	8	Matrix Spike (MS and/or MSD) Recoveries Use bias flags (H,L)[1] where appropriate
	9	Precision (all replicates: LCS/LCSD, MS/MSD, Lab Replicate, Field Replicate)
	10	Laboratory Control Sample Recoveries (a.k.a. Blank Spikes) Use bias flags (H,L)[1] where appropriate
	12	Reference Material Use bias flags (H,L)[1] where appropriate
	13	Surrogate Spike Recoveries (a.k.a. labeled compounds, recovery standards) Use bias flags (H,L)[1] where appropriate
Interferences	16	ICP/ICP-MS Serial Dilution Percent Difference
	17	ICP/ICP-MS Interference Check Standard Recovery Use bias flags (H,L)[1] where appropriate
	19	Internal Standard Performance (i.e., area, retention time, recovery)
	22	Elevated Detection Limit due to Interference (i.e., chemical and/or matrix)
	23	Bias from Matrix Interference (i.e. diphenyl ether, PCB/pesticides)
Identification and Quantitation	2	Chromatographic pattern in sample does not match pattern of calibration standard
	3	2nd column confirmation (RPD or %D)
	4	Tentatively Identified Compound (TIC) (associated with NJ only)
	20	Calibration Range or Linear Range Exceeded
	25	Compound Identification (i.e., ion ratio, retention time, relative abundance, etc.)
Miscellaneous	11	A more appropriate result is reported (multiple reported analyses i.e., dilutions, re-extractions, etc. Associated with "R" and "DNR" only)
	14	Other (See DV report for details)
	26	Method QC information not provided

[1] H = high bias indicated
L = low bias indicated

Dioxin/Furan Analysis by HRMS
(Based on Dioxin NFG 2011 and Methods EPA 1613B and SW-846 8290)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Sample Handling					
Cooler/Storage Temperature Preservation	Waters/Solids ≤ 6°C & in the dark Tissues <-10°C & in the dark **Preservation Aqueous:** If Cl_2 is present Thiosulfate must be added and if pH > 9 it must be adjusted to 7 - 9	NFG [1] Method[2]	J(pos)/R(ND) if thiosulfate not added if Cl_2 present; J(pos)/UJ(ND) if pH not adjusted J(pos)/UJ(ND) if temp > 20°C	1	**EcoChem PJ, see TM-05**
Holding Time	**If properly stored, 1 year or:** **Extraction (all matrices):** 30 days from collection **Analysis (all matrices)**: 45 days from extraction	NFG [1] Method[2]	If not properly stored or HT exceedance: J(pos)/UJ(ND)	1	**EcoChem PJ, see TM-05** Gross exceedance = > 1 year 2011 NFG **Note:** Under CWA, SDWA, and RCRA the HT for H2O is 7 days.
Instrument Performance					
Mass Resolution (Tuning)	PFK (Perfluorokerosene) ≥10,000 resolving power at m/z 304.9824. Exact mass of m/z 380.9760 w/in 5 ppm of theoretical value (380.97410 to 380.97790) . Analyzed prior to ICAL and at the start and end of each 12 hr. shift.	NFG [1] Method [2]	R(pos/ND) all analytes in all samples associated with the tune	24	Notify PM
Windows Defining Mix	Peaks for first and last eluters must be within established retention time windows for each selector group (chlorination level)	NFG [1] Method [2]	If peaks are not completely within windows (clipped): If natives are ok, J(pos)/UJ(ND) homologs (Totals) If natives are affected, R all results for that selector group	24	Notify PM
Column Performance Mix	Both mixes must be analyzed before ICAL and CCAL Valley < 25% (valley = (x/y)*100%) where x = ht. of TCDD (or TCDF) & y = baseline to bottom of valley For all isomers eluting near the 2378-TCDD (TCDF) peak (TCDD only for 8290)	NFG [1] Method [2]	J(pos) if valley > 25%	24	**EcoChem PJ, see TM-05, Rev. 2**; Note: TCDF is evaluated only if second column confirmation is performed
Initial Calibration **Sensitivity**	S/N ratio > 10 for all native and labeled compounds in CS1 std.	NFG [1] Method [2]	If <10, elevate Det. Limit or R(ND)	5A	
Initial Calibration **Selectivity**	Ion Abundance ratios within QC limits (Table 8 of method 8290) (Table 9 of method 1613B)	NFG [1] Method [2]	If 2 or more ion ratios are out for one compound in ICAL, J(pos)	5A	**EcoChem PJ, see TM-05, Rev. 2**

Dioxin/Furan Analysis by HRMS
(Based on Dioxin NFG 2011 and Methods EPA 1613B and SW-846 8290)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Instrument Performance (continued)					
Initial Calibration (Minimum 5 stds.) **Stability**	%RSD < 20% for native compounds %RSD <30% for labeled compounds (%RSD < 35% for labeled compounds under 1613b)	NFG (1) Method (2)	J(pos) natives if %RSD > 20%	5A	
	Absolute RT of $^{13}C_{12}$-1234-TCDD >25 min on DB5 & >15 min on DB-225	NFG (1) Method (2)	Narrate, no action		**EcoChem PJ, see TM-05, Rev. 2**
Continuing Calibration (Prior to each 12 hr. shift) **Sensitivity**	S/N ratio for CS3 standard > 10	NFG (1) Method (2)	If <10, elevate Det. Limit or R(ND)	5B	
Continuing Calibration (Prior to each 12 hr. shift) **Selectivity**	Ion Abundance ratios within QC limits (Table 8 of method 8290) (Table 9 of method 1613B)	NFG (1) Method (2)	For congener with ion ratio outlier, J(pos) natives in all samples associated with CCAL. No action for labeled congener ion ratio outliers.	25	**EcoChem PJ, see TM-05**
Continuing Calibration (Prior to each 12 hr. shift) **Stability**	%D+/-20% for native compounds %D +/-30% for labeled compounds **(Must meet limits in Table 6, Method 1613B)** If %D in the closing CCAL are within 25%/35%, the mean RF from the two CCAL may be used to calculate samples **(Section 8.3.2.4 of 8290)**.	NFG (1) Method (2)	**Labeled compounds:** Narrate, no action. **Native compounds:** 1613: J(pos)/UJ(ND)if %D is outside Table 6 limits J(pos)/R(ND) if %D is +/-75% of Table 6 limits 8290: J(pos)/UJ(ND) if %D = 20% - 75% J(pos)/R(ND) if %D > 75%	5B (H,L)[3]	
	Absolute RT of $^{13}C_{12}$-1234-TCDD and $^{13}C_{12}$-123789-HxCDD should be ± 15 seconds of ICAL RRT for all other compounds must meet criteria listed in Table 2 Method 1316.	NFG (1) Method (2)	Narrate, no action	5B	**EcoChem PJ, see TM-05**
Blank Contamination					
Method Blank (MB)	MB: One per matrix per batch of (of ≤ 20 samples) No detected compounds > RL	NFG (1) Method (2)	U(pos) if result is < 5X action level.	7	**Hierarchy of blank review:** **#1 - Review MB, qualify as needed** **#2 - Review FB , qualify as needed**
Field Blank (FB)	FB: frequency as per QAPP No detected compounds > RL		U(pos) if result is < 5X action level.	6	

Dioxin/Furan Analysis by HRMS
(Based on Dioxin NFG 2011 and Methods EPA 1613B and SW-846 8290)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Precision and Accuracy					
MS/MSD (recovery)	**MS/MSD not typically required for HRMS analyses.** If lab analyzes MS/MSD then one set per matrix per batch (of ≤ 20 samples) Use most current laboratory control limits	EcoChem standard policy	J(pos) if both %R > UCL - high bias J(pos)/UJ(ND) if both %R < LCL - low bias J(pos)/R(ND) if both %R < 10% - very low bias J(pos)/UJ(ND) if one > UCL & one < LCL, with no bias **PJ if only one %R outlier**	8 (H,L)[3]	No action if only one spike %R is outside criteria. No action if parent concentration is >4x the amount spiked. Qualify parent sample only unless other QC indicates systematic problems.
MS/MSD (RPD)	**MS/MSD not typically required for HRMS analyses.** If lab analyzes MS/MSD then one set per matrix per batch (of ≤ 20 samples) Use most current laboratory control limits	EcoChem standard policy	J(pos) in parent sample if RPD > CL	9	Qualify parent sample only.
LCS (or OPR)	One per lab batch (of ≤ 20 samples) Use most current laboratory control limits **or** Limits from Table 6 of 1613B	NFG (1) Method (2)	J(pos) if %R > UCL - high bias J(pos)/UJ(ND) if %R < LCL - low bias J(pos)/R(ND) if %R < 10% - very low bias	10 (H,L)[3]	No action if only one spike %R is outside criteria, when LCSD is analyzed. Qualify all associated samples.
LCS/LCSD (RPD)	**LCSD not typically required for HRMS analyses.** One set per matrix and batch of 20 samples RPD < 35%	Method (2) Ecochem standard policy	J(pos) assoc. compound in all samples if RPD > CL	9	Qualify all associated samples.
Lab Duplicate (RPD)	**Lab Dup not typically required for HRMS analyses.** One per lab batch (of ≤ 20 samples) Use most current laboratory control limits	EcoChem standard policy	J(pos)/UJ(ND) if RPD > CL	9	
Labeled Compounds (Internal Standards)	Added to all samples %R = 40% - 135% in all samples 8290 %R must meet limits in Table 7 Method 1613B	NFG (1) Method (2)	J(pos) if %R > UCL - high bias J(pos)/UJ(ND) if %R < LCL - low bias J(pos)/R(ND) if %R < 10% - very low bias	13 (H,L)[3]	
Field Duplicates	Solids: RPD <50% OR difference < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR difference < 1X RL (for results < 5X RL)	EcoChem standard policy	Narrate and qualify if required by project	9	**Use professional judgment**

Dioxin/Furan Analysis by HRMS
(Based on Dioxin NFG 2011 and Methods EPA 1613B and SW-846 8290)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Compound ID and Calculation					
Quantitation/ Identification	All ions for each isomer must maximize within ± 2 seconds. S/N ratio >2.5 Ion ratios must meet criteria listed in Table 8 Method 8290, or Table 9 of 1613B; RRTs w/in limits in Table 2 of 1613B	NFG (1) Method (2)	Narrate in report; qualify if necessary NJ(pos) for retention time outliers. U(pos) for ion ratio outliers.	25	**EcoChem PJ, see TM-05**
EMPC (estimated maximum possible concentration)	If quantitation identification criteria are not met, laboratory should report an EMPC value.	NFG (1) Method (2)	If laboratory correctly reported an EMPC value, qualify the native compound U(pos) to indicate that the value is a detection limit and qualify total homolog groups J (pos)	25	**Use professional judgment See TM-18**
Interferences	Interferences from chlorodiphenyl ether compounds	NFG (1) Method (2)	J(pos)/UJ(ND) if present	23	**See TM-16**
	Lock masses must not deviate ± 20% from values in Table 8 of 1613B	Method (2)	J(pos)/UJ(ND) if present	24	**See TM-17**
Second Column Confirmation	All 2,3,7,8-TCDF hits must be confirmed on a DB-225 (or equiv) column. All QC criteria must also be met for the confirmation analysis.	NFG (1) Method (2)	Report the DB-225 value. If not performed use PJ.	3	DNR-11 DB5 result if both results from both columns are reported. **EcoChem PJ, see TM-05**
Calculation Check	Check 10% of field & QC sample results	EcoChem standard policy	Contact laboratory for resolution and/or corrective action	na	Full data validation only.
Electronic Data Deliverable (EDD)					
Verification of EDD to hardcopy data	EcoChem verify @ 10% unless problems noted; then increase level up to 100% for next several packages.		Depending on scope of problem, correct at EcoChem (minor issues) to resubmittal by laboratory (major issues).	na	EcoChem Project Manager and/or Database Administrator will work with lab to provide long-term corrective action.
Dilutions, Re-extractions and/or Reanalyses	Report only one result per analyte	Standard reporting policy	Use "DNR" to flag results that will not be reported.	11	

(pos) - positive (detected) results; (ND) - not detected results

[1] National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) & Chlorinated Dibenzofurans (CDFs) Data Review, September 2011

[2] Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by High-Resolution Gas Chromatography/High-Resolution Mass Spectrometry (HRGC/HRMS), USEPA SW-846, Method 8290

[2] EPA Method 1613, Rev.B, Tetra-through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGS/HRMS, October 1994

[3] NFG 2013 suggests using "+ / -" to indicate bias; EcoChem has chosen "H" = high bias indicated; "L" = low bias indicated.

Semivolatile Organic Compounds by Gas Chromatography-Mass Spectroscopy (GC-MS)
(Based on NFG 1999 & 2008 and SW-846 Method 8270D)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Sample Handling					
Cooler/Storage Temperature Preservation	4°C±2°C sediment/tissues may require storage at -20°C	NFG (1) Method (3)	**If required by project:** J (pos)/UJ (ND) if greater than 6° C	1	Use **PJ** for temp outliers; see **TM20** Current SW846 criterion is ≤ 6° C (3)
Holding Time	**Extraction Aqueous:** 7 days from collection **Extraction Solid:** 14 days from collection **Analysis (all matrices)**: 40 days from extraction Holding time may be extended to 1 year for frozen sediments/tissues	NFG (1) Method (3)	J (pos)/UJ (ND) if HT exceeded J (pos)/R (ND) if gross exceedance (> 2x HT)	1	Gross exceedance = > 2x HT, as per 1999 NFG
Instrument Performance					
Tuning	DFTPP Beginning of each 12 hour period Use method or project acceptance criteria	NFG (1) Method (3)	R (pos/ND) all analytes in all samples associated with the tune	24	
Initial Calibration **Sensitivity**	RRF ≥ 0.05 except: RRF ≥ 0.01 poor responders *	NFG (1) Method (3)	Use **PJ** to qualify J (pos)/UJ (ND)	5A	**TM-06** EcoChem Policy for the Evaluation and Qualification of GCMS Instrument Performance **PJ** - no action if response is stable (ICAL RSD and CCAL %D acceptable)
Initial Calibration **Stability**	Minimum 5 standards %RSD ≤ 20.0% except: %RSD ≤ 40.0% poor responders * **or** co-efficient of determination (r^2) > 0.99	NFG (1) Method (3)	J (pos) if %RSD > limit **or** r^2 value <0.99	5A	
Initial Calibration Verification Check	Prepared from second source; analyze after each ICAL Percent recovery limits = 70-130%	Method (3)	J (pos) %R > UCL J (pos)/UJ (ND) %R < LCL	5A (H,L)[4]	QAPP may have overriding accuracy limits.

Semivolatile Organic Compounds by Gas Chromatography-Mass Spectroscopy (GC-MS)
(Based on NFG 1999 & 2008 and SW-846 Method 8270D)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Instrument Performance (continued)					
Continuing Calibration **Sensitivity**	RRF ≥ 0.05 except: RRF ≥ 0.01 poor responders *	NFG (1) Method (3)	Use **PJ** to qualify J (pos)/UJ (ND)	5B	see ICAL RRF guidance
Continuing Calibration **Stability**	Prior to sample analysis and every 12 hours %D ≤ 25% except: %D ≤ 40.0% poor responders *	NFG (1) Method (3)	J (pos) - %D > control limit (high bias) J (pos)/UJ (ND) - %D < -control limit (low bias)	5B (H,L)[4]	
Blank Contamination					
Method Blank (MB)	MB: One per matrix per batch of (of ≤ 20 samples) No detected compounds > MDL	NFG (2) Method (3)	U(pos) if result is < 5X or 10X action level	7	10X action level applies to phthalates only. 5X for all other target analytes **Hierarchy of blank review:** **#1 - Review MB, qualify as needed** **#2 - Review FB , qualify as needed** **Note: Actions as per 1999 NFG**
	No TICs present		R (pos) TICs using 10X rule	7	
Field Blank (FB)	No detected compounds > MDL	NFG (2) Method (3)	U (pos) if result is < 5X or 10X action level	6	
Precision and Accuracy					
LCS/LCSD (recovery)	One per matrix per batch (of ≤ 20 samples) LCSD not required by NFG or method Use method acceptance criteria/laboratory limits	Method (3)	J (pos) if %R > UCL J (pos)/UJ (ND) if %R < LCL J (pos)/R (ND)%R < 10%	10 (H,L)[4]	No action if only one spike %R is outside criteria when LCSD is analyzed, unless one recovery is <10%. QAPP may have overriding accuracy limits. Qualify all associated samples.
LCS/LCSD (RPD)	If LCSD analyzed RPD < lab limits	Method (3)	J (pos)	9	Qualify all associated samples. QAPP may have overriding precision limits.

Semivolatile Organic Compounds by Gas Chromatography-Mass Spectroscopy (GC-MS)
(Based on NFG 1999 & 2008 and SW-846 Method 8270D)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Precision and Accuracy (continued)					
Reference Material (RM, SRM, or CRM)	Result ±20% of the 95% confidence interval of the true value for analytes	EcoChem standard policy	J (pos)/UJ (ND) if < LCL J (pos) if > UCL	12 (H,L)[4]	QAPP may have overriding accuracy limits. Some manufacturers have different RM control limits
MS/MSD (recovery)	One per matrix per batch (of ≤ 20 samples) Use method acceptance criteria/laboratory limits	NFG (1) Method (3)	J (pos) %R > UCL J (pos)/UJ (ND) if both %R < LCL J (pos)/R (ND) if both %R < 10% J (pos)/UJ (ND) if one > UCL & one < LCL, with no bias	8 (H,L)[4]	No action if only one spike %R is outside criteria. No action if parent concentration is >4x the amount spiked. Qualify parent sample only.
MS/MSD (RPD)	One per matrix per batch (of ≤ 20 samples) Use method acceptance criteria/laboratory limits	NFG (1) Method (2)	J (pos) in parent sample if RPD > CL	9	Qualify parent sample only
Surrogates	Minimum of 3 acid & 3 base/neutral (B/N) compounds added to all samples Within method control limits	NFG (1) Method (3)	J (pos) if %R > UCL J (pos)/UJ (ND) if %R < LCL J (pos)/R (ND) if %R < 10%	13 (H,L)[4]	Qualify all compounds in associated fraction. Do not qualify if only 1 acid and/or 1 B/N surrogate is out, unless <10%. If 1 surrogate outlier < 10% then J (pos)/R (ND)
Internal Standards	Added to all samples Acceptable Range: IS area 50% to 200% of CCAL area RT within 30 seconds of CC RT	NFG (1) Method (3)	J (pos) if > 200% J (pos)/UJ (ND) if < 50% J (pos)/R (ND) if < 25% if RT >30 seconds use **PJ**	19	Qualify compounds quantified using particular internal standard
Field Duplicates	**Solids:** RPD < 50% OR difference < 2X RL (for results < 5X RL) **Aqueous:** RPD < 35% OR difference < 1X RL (for results < 5X RL)	EcoChem standard policy	J (pos)/UJ (ND) Qualify only parent and field duplicate samples	9	Use project limits if specified

Semivolatile Organic Compounds by Gas Chromatography-Mass Spectroscopy (GC-MS)
(Based on NFG 1999 & 2008 and SW-846 Method 8270D)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Compound Identification and Quantitation and Calculation					
Retention times and relative ion intensities	RRT within 0.06 of standard RRT Ion relative intensity within 20% of standard All ions in std. at > 10% intensity must be present in sample	NFG [(1)] Method [(3)]	U (pos) if identification criteria not met	25	
TICs	Major ions (>10%) in reference must be present in sample; intensities agree within 20%; check identification	NFG [(1)] Method [(3)]	NJ the TIC unless: R (pos) common laboratory contaminants	4	
Calibration Range	Results greater than highest calibration standard	EcoChem standard policy	Qualify J (pos)	20	If result from dilution analysis is not reported.
Dilutions, Re-extractions and/or Reanalyses	Report only one result per analyte	EcoChem standard policy	Use "DNR" to flag results that will not be reported.	11	**TM-04** EcoChem Policy for Rejection/Selection Process for Multiple Results

[1] National Functional Guidelines for Organic Data Review, June, 2008
[2] National Functional Guidelines for Organic Data Review, October, 1999
[3] Method SW846 8270D Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), Revision 4, February 2007.
[4] NFG 2013 suggests using "+ / -" to indicate bias; EcoChem has chosen "H" = high bias indicated; "L" = low bias indicated.

(pos): Positive Result(s)
(ND): Non-detects

* "Poor responder" compounds: acetophenone, atrazine, benzaldehyde, 1,1'-biphenyl, bis(2-ethylhexyl)phthalate, butylbenzylphthalate, caprolactam, carbazole, 4-chloroaniline, diethylphthalate, di-n-butylphthalate, 3-3'-dichlorobenzidine, dimethylphthalate, 2,4-dinitrophenol, 4,6-dinitro-2-methylphenol, di-n-octylphthalate, hexachlorobutadiene, hexachlorocyclopentadiene, 2-nitroaniline, 3-nitroaniline, 4-nitroaniline, 4-nitrophenol, N-nitrosodiphenylamine, 2,2'-oxybis-(1-chloropropane), 1,2,4,5-tetrachlorobenzene use a 0.010 RRF criterion.

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Diesel & Residual Range

(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Dx, June 1997, Wa DOE & Oregon DEQ)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature & Preservation	4°C±2°C Water: HCl to pH < 2	J(+)/UJ(-) if greater than 6 deg. C	1
Holding Time	Ext. Waters: 14 days preserved 7 days unpreserved Ext. Solids: 14 Days Analysis: 40 days from extraction	J(+)/UJ(-) if hold times exceeded J(+)/R(-) if exceeded > 3X (EcoChem PJ)	1
Initial Calibration	5 calibration points (All within 15% of true value) Linear Regression: $R^2 \geq 0.990$ If used, RSD of response factors ≤20%	Narrate if fewer than 5 calibration levels or if %R >15% J(+)/UJ(-) if R^2 <0.990 J(+)/UJ(-) if %RSD > 20%	5A
Mid-range Calibration Check Std.	Analyzed before and after each analysis shift & every 20 samples. Recovery range 85% to 115%	Narrate if frequency not met. J(+)/UJ(-) if %R < 85% J(+) if %R >115%	5B
Method Blank	At least one per batch (≤20 samples) No results >RL	U (at the RL) if sample result is < RL & < 5X blank result.	7
		U (at reported sample value) if sample result is ≥ RL and < 5X blank result	7
Field Blanks (if required by project)	No results > RL	Action is same as method blank for positive results remaining in the field blank after method blank qualifiers are assigned.	6
MS samples (accuracy) (if required by project)	%R within lab control limits	Qualify parent only, unless other QC indicates systematic problems. J(+) if both %R > upper control limit (UCL) J(+)/UJ(-) if both %R < lower control limit (LCL) No action if parent conc. >5X the amount spiked. Use PJ if only one %R outlier	8
Precision: MS/MSD or LCS/LCSD or sample/dup	At least one set per batch (≤10 samples) RPD ≤ lab control limit	J(+) if RPD > lab control limits	9
LCS (not required by method)	%R within lab control limits	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R <10% (EcoChem PJ)	10

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Diesel & Residual Range

(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Dx, June 1997, Wa DOE & Oregon DEQ)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Surrogates	2-fluorobiphenyl, p-terphenyl, o-terphenyl, and/or pentacosane added to all samples (inc. QC samples). %R = 50-150%	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R <10% No action if 2 or more surrogates are used, and only one is outside control limits. (EcoChem PJ)	13
Pattern Identification	Compare sample chromatogram to standard chromatogram to ensure range and pattern are reasonable match. Laboratory may flag results which have poor match.	J(+)	2
Field Duplicates	Use project control limits, if stated in QAPP EcoChem default: water: RPD < 35% solids: RPD < 50%	Narrate (Use Professional Judgement to qualify)	9
Two analyses for one sample (dilution)	Report only one result per analyte	"DNR" (or client requested qualifier) all results that should not be reported. (See TM-04)	11

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Gasoline Range

(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Gx, June 1997, Wa DOE & Oregon DEQ)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature & Preservation	4°C±2°C Water: HCl to pH < 2	J(+)/UJ(-) if greater than 6 deg. C	1
Holding Time	Waters: 14 days preserved 7 days unpreserved Solids: 14 Days	J(+)/UJ(-) if hold times exceeded J(+)/R(-) if exceeded > 3X (EcoChem PJ)	1
Initial Calibration	5 calibration points (All within 15% of true value) Linear Regression: $R^2 \geq 0.990$ If used, RSD of response factors ≤20%	Narrate if fewer than 5 calibration levels or if %R >15% J(+)/UJ(-) if R^2 <0.990 J(+)/UJ(-) if %RSD > 20%	5A
Mid-range Calibration Check Std.	Analyzed before and after each analysis shift & every 20 samples. Recovery range 80% to 120%	Narrate if frequency not met. J(+)/UJ(-) if %R < 80% J(+) if %R >120%	5B
Method Blank	At least one per batch (≤10 samples) No results >RL	U (at the RL) if sample result is < RL & < 5X blank result.	7
		U (at reported sample value) if sample result is ≥ RL and < 5X blank result	7
Trip Blank (if required by project)	No results >RL	Action is same as method blank for positive results remaining in trip blank after method blank qualifiers are assigned.	18
Field Blanks (if required by project)	No results > RL	Action is same as method blank for positive results remaining in field blank after method and trip blank qualifiers are assigned.	6
MS samples (accuracy) (if required by project)	%R within lab control limits	Qualify parent only, unless other QC indicates systematic problems. J(+) if both %R > upper control limit (UCL) J(+)/UJ(-) if both %R < lower control limit (LCL) No action if parent conc. >5X the amount spiked. Use PJ if only one %R outlier	8
Precision: MS/MSD or LCS/LCSD or sample/dup	At least one set per batch (≤10 samples) RPD ≤ lab control limit	J(+) if RPD > lab control limits	9

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Gasoline Range

(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Gx, June 1997, Wa DOE & Oregon DEQ)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
LCS (not required by method)	%R within lab control limits	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R <10% (EcoChem PJ)	10
Surrogates	Bromofluorobenzene and/or 1,4-difluorobenzene added to all samples (inc. QC samples). %R = 50-150%	J(+)/UJ(-) if %R < LCL J(+) if %R >UCL J(+)/R(-) if any %R <10% No action if 2 or more surrogates are used, and only one is outside control limits. (EcoChem PJ)	13
Pattern Identification	Compare sample chromatogram to standard chromatogram to ensure range and pattern are reasonable match. Laboratory may flag results which have poor match.	J(+)	2
Field Duplicates	Use project control limits, if stated in QAPP EcoChem default: water: RPD < 35% solids: RPD < 50%	Narrate outliers If required by project, qualify with J(+)/UJ(-)	9
Two analyses for one sample (e.g., dilution)	Report only one result per analyte	"DNR" (or client requested qualifier) all results that should not be reported. (See TM-04)	11

Metals by ICP-AES
(Based on Inorganic NFG 2010 and SW-846 6010C)

QC Element	EcoChem Acceptance Criteria	Source of Criteria	EcoChem Action for Non-Conformance	Reason Code	Discussion and Comments
Sample Handling					
Cooler / Storage Temperature Preservation	**Solid:** Cooler temperature 4°C±2°C **Aqueous:** Nitric Acid to pH < 2 **Dissolved Metals:** 0.45 µm filter, preserve to pH < 2 after filtration	NFG (1) Method (2)	Cooler Temps: **If required by project** J (pos)/UJ (ND) if greater than 6° C Aqueous: J (pos)/UJ (ND) if pH > 2	1	Use **PJ** to qualify for temperature outlier. Current SW846 criterion is ≤ 6° C (4) No quals for pH if samples preserved by lab upon receipt and within 1 day of collection.
Holding Time	All matrices: 180 days from date sampled Frozen soils, sediments, tissues (-20°C) - HT extended to 1 year	NFG (1) Method (2) EcoChem standard policy	J (pos)/UJ (ND) if holding time exceeded	1	
Instrument Performance					
Initial Calibration (ICAL)	Based on instrument requirements, blank + 1 standard minimum requirement for calibration If more than 1 standard used, r ≥ 0.995	NFG (1) Method (2)	J (pos)/UJ (ND) if r < 0.995	5A	
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ± 10% of true value	NFG (1) Method (2)	R (pos/ND) if %R < 75% J (pos)/UJ (ND) if %R 75% - 89% J (pos) if %R >111%	5A (H,L)[3]	Qualify all samples in run
Reporting Limit (RL) Standard Low Level ICV/CCV	concentration at RL %R = 70%-130%	Method (2)	J (pos) < 2x RL / R (ND) if %R <50% J (pos) < 2x RL / UJ (ND) if %R 50 - 69% J (pos) < 2x RL if %R > 130%	5A (H,L)[3]	Qualify all samples in run
Continuing Calibration Verification (CCV)	Immediately following ICV/ICB, then every two hours or ten samples, and at end of run. %R within ± 10% of true value	NFG (1) Method (2)	R (pos/ND) if %R < 75% J (pos)/UJ (ND) if %R 75% - 89% J (pos) if %R >111%	5B (H,L)[3]	Qualify samples bracketed by CCV outliers
Interference Check Samples (ICSA / ICSAB)	ICSAB %R 80% - 120% for all spiked elements | ICSA | < MDL for all unspiked elements	NFG (1) Method (2)	For samples with Al, Ca, Fe, Mg > ICS levels: **ICSAB**: J(pos)/R (ND) if %R < 50% J (pos)/UJ (ND) if %R = 50% - 79% J (pos) if %R > 120% **ICSA:** J (pos)< 2x ICSA/UJ (ND) for ICSA <Neg MDL J (pos) < 2x ICSA for ICSA > MDL	17 (H,L)[3]	Use **PJ** and inter-element correction factors to evaluate ICSA to determine if bias is present. Refer to **TM-09** for additional information.

Metals by ICP-AES
(Based on Inorganic NFG 2010 and SW-846 6010C)

QC Element	EcoChem Acceptance Criteria	Source of Criteria	EcoChem Action for Non-Conformance	Reason Code	Discussion and Comments
Blank Contamination					
Method Blank (MB)	One per matrix per batch of (of ≤ 20 samples) Blank conc < MDL	NFG (1) Method (2)	U (pos) if result is < 5X method blank concentration	7	Refer to **TM-02** for additional information. Blank Evaluation based on NFG 1994
Instrument Blanks (ICB/CCB)	After each ICV & CCV | blank concentration | < MDL	NFG (1) Method (2)	Action level is 5x absolute value of blank conc. For positive blanks: U (pos) results < action level For negative blanks: J (pos)/UJ (ND) results < action level	Pos Blanks: 7 Neg Blanks: 7L[3]	Use blanks bracketing samples for Qualification Refer to **TM-02** for additional information. **Hierarchy of blank review:** **#1 - Review MB, quaify as needed** **#2 - Review IB , qualify as needed** **#3 - Review FB , qualify as needed**
Field Blank (FB)	Blank conc < MDL	EcoChem standard policy	U (pos) if result is < 5x action level, as per analyte.	6	Qualify in associated field samples only. Refer to **TM-02** for additional information.
Precision and Accuracy					
LCS (recovery)	One per matrix per batch (of ≤ 20 samples); LCSD not required %R between 80-120%	Method (2)	J (pos)/R (ND) if %R <50% J (pos)/UJ (ND) if %R 50% - 79% J (pos) if %R > 120%	10 (H,L)[3]	Qualify all samples in batch QAPP may have overriding accuracy limits. NFG Limits 70% -130% (50% - 150% Ab, Ag)
LCS/LCSD (RPD)	LCSD not required, if analyzed: RPD ≤ 20%	Method (2)	J (pos)/UJ (ND) if RPD > 20%	9	Qualify all samples in batch QAPP may have overriding precision limits.
MS/MSD (recovery)	One per matrix per batch (of ≤ 20 samples); MSD not required %R between 75-125%	NFG (1) Method (2)	J (pos) if %R > 125% J (pos)/UJ (ND) if %R <75% J (pos)/R (ND) if %R < 30%, unless post digestion spike analyzed, J (pos)/UJ (ND) if post digestion spike %R OK	8 (H,L)[3]	No action if only one spike %R is outside criteria. NA if parent concentration >4x the amount spiked. Qualify all samples in batch. QAPP may have overriding accuracy limits.

Metals by ICP-AES
(Based on Inorganic NFG 2010 and SW-846 6010C)

QC Element	EcoChem Acceptance Criteria	Source of Criteria	EcoChem Action for Non-Conformance	Reason Code	Discussion and Comments
Precision and Accuracy con't					
Post Digestion Spikes	If MS is outside 75-125%, post-spike should be analyzed %R 80%-120% (method); 75%-125% (NFG)	NFG (1) Method (2)	Only used to support MS qualification decisions	NA	No qualifiers assigned based solely on this element.
MS/MSD (RPD)	MSD not required, if analyzed: RPD ≤ 20%	NFG (1) Method (2)	J (pos)/UJ (ND) if RPD > 20%	9	QAPP may have overriding precision limits.
Laboratory Duplicate	One per matrix per batch (of ≤ 20 samples) RPD ≤ 20% for results ≥ 5x RL Solids: difference < 2X RL for results < 5X RL Aqueous: difference < 1X RL for results < 5X RL	NFG (1) Method (2)	J (pos)/UJ (ND) if RPD > 20% or if difference > control limit	9	Qualify all samples in batch. QAPP may have overriding precision limits.
Reference Material (RM, SRM, or CRM)	Result ±20% of the 95% confidence interval of the true value for analytes	EcoChem standard policy	J (pos)/UJ (ND) if < LCL J (pos) if > UCL	12 (H,L)[3]	QAPP may have overriding accuracy limits. Some manufacturers may have different RM control limits
Serial Dilution	Analyze one sample per matrix at a 5x dilution %D <10% for original sample conc. > 50x MDL	NFG (1) Method (2)	J (pos)/UJ (ND) if %D > 10% and native sample concentration > 50x MDL	16	Qualify all samples in batch.
Field Duplicate	Solids: RPD <50% (for results ≥ 5x RL) OR difference < 2X RL (for results < 5X RL) Aqueous: RPD <35% (for results ≥ 5x RL) OR difference < 1X RL (for results < 5X RL)	EcoChem standard policy	Qualify only parent and field duplicate samples J (pos)/UJ (ND)	9	QAPP may have overriding precision limits. Client/QAPP may not require qualification based on field precision.

Metals by ICP-AES
(Based on Inorganic NFG 2010 and SW-846 6010C)

QC Element	EcoChem Acceptance Criteria	Source of Criteria	EcoChem Action for Non-Conformance	Reason Code	Discussion and Comments
Compound Quantitation					
Total and Dissolved Comparison	Total > Dissolved	EcoChem standard policy	J (pos)/UJ (ND) if Dissolved > Total and results fall outside of standard duplicate precision criteria	14	
Calibration Range	Results < instrument linear range	NFG (1) Method (2)	J (pos) if result exceeds linear range and sample was not diluted	20	
Dilutions, Re-extractions and/or Reanalyses	Report only one result per analyte	EcoChem standard policy	Use "DNR" to flag results that will not be reported.	11	**TM-04** EcoChem Policy for Rejection/Selection Process for Multiple Results

[1] National Functional Guidelines for Inorganic Superfund Data Review, January 2010.
[2] Method SW846 6010C Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES), Revision 3, February 2007.
[3] "H" = high bias indicated; "L" = low bias indicated
[4] SW846, Chapter 3, Inorganic Analytes

(pos): Positive Result
(ND): Not Detected

ECOCHEM
Data Quality

APPENDIX B

QUALIFIED DATA SUMMARY TABLE

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AMN9	PM-071-19.0-20.0	15-16415-AMN9A	EPA 1613B	1,2,3,4,6,7,8-HpCDD	12.2	pg/g	B	U	7
AMN9	PM-071-19.0-20.0	15-16415-AMN9A	EPA 1613B	1,2,3,6,7,8-HxCDF	0.0918	pg/g	JEMPC	U	25
AMN9	PM-071-19.0-20.0	15-16415-AMN9A	EPA 1613B	1,2,3,7,8,9-HxCDF	0.168	pg/g	JEMPC	U	25
AMN9	PM-071-19.0-20.0	15-16415-AMN9A	EPA 1613B	2,3,4,7,8-PeCDF	0.0559	pg/g	JEMPC	U	25
AMN9	PM-071-19.0-20.0	15-16415-AMN9A	EPA 1613B	2,3,7,8-TCDD	0.166	pg/g	JEMPC	U	25
AMN9	PM-071-19.0-20.0	15-16415-AMN9A	EPA 1613B	OCDD	68.5	pg/g	B	U	7
AMN9	PM-071-19.0-20.0	15-16415-AMN9A	EPA 1613B	OCDF	4.41	pg/g	B	U	7
AMN9	PM-071-19.0-20.0	15-16415-AMN9A	EPA 1613B	Total HpCDF	4.36	pg/g	EMPC	J	25
AMN9	PM-071-19.0-20.0	15-16415-AMN9A	EPA 1613B	Total HxCDD	7.64	pg/g	EMPC	J	25
AMN9	PM-071-19.0-20.0	15-16415-AMN9A	EPA 1613B	Total HxCDF	1.39	pg/g	EMPC	J	25
AMN9	PM-071-19.0-20.0	15-16415-AMN9A	EPA 1613B	Total PeCDD	0.459	pg/g	EMPC	J	25
AMN9	PM-071-19.0-20.0	15-16415-AMN9A	EPA 1613B	Total PeCDF	0.399	pg/g	EMPC	J	25
AMN9	PM-071-19.0-20.0	15-16415-AMN9A	EPA 1613B	Total TCDD	7.92	pg/g	EMPC	J	25
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	EPA 1613B	1,2,3,4,7,8-HxCDF	0.383	pg/g	JEMPC	U	25
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	EPA 1613B	1,2,3,6,7,8-HxCDF	0.233	pg/g	JEMPC	U	25
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	EPA 1613B	1,2,3,7,8-PeCDD	0.209	pg/g	JEMPC	U	25
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	EPA 1613B	1,2,3,7,8-PeCDF	0.106	pg/g	JEMPC	U	25
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	EPA 1613B	2,3,4,6,7,8-HxCDF	0.219	pg/g	JEMPC	U	25
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	EPA 1613B	2,3,4,7,8-PeCDF	0.104	pg/g	JEMPC	U	25
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	EPA 1613B	2,3,7,8-TCDD	0.16	pg/g	JEMPC	U	25
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	EPA 1613B	2,3,7,8-TCDF	0.0319	pg/g	JEMPC	U	25
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	EPA 1613B	OCDD	678	pg/g	B	U	7
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	EPA 1613B	Total HpCDF	56.7	pg/g	EMPC	J	25
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	EPA 1613B	Total HxCDD	13.5	pg/g	EMPC	J	25
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	EPA 1613B	Total HxCDF	12.4	pg/g	EMPC	J	25
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	EPA 1613B	Total PeCDD	1.53	pg/g	EMPC	J	25
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	EPA 1613B	Total PeCDF	1.99	pg/g	EMPC	J	25
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	EPA 1613B	Total TCDD	39.3	pg/g	EMPC	J	25
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	EPA 1613B	Total TCDF	1.41	pg/g	EMPC	J	25
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	SW8270D SIM	Benzo(a)anthracene	4.9	ug/kg	U	UJ	13L
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	SW8270D SIM	Benzo(a)pyrene	4.9	ug/kg	U	UJ	13L

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	SW8270D SIM	Chrysene	4.9	ug/kg	U	UJ	13L
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	SW8270D SIM	Dibenz(a,h)anthracene	4.9	ug/kg	U	UJ	13L
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	SW8270D SIM	Indeno(1,2,3-cd)pyrene	4.9	ug/kg	U	UJ	13L
AMN9	PM-071-21.0-22.0	15-16416-AMN9B	SW8270D SIM	Total Benzofluoranthenes	4.9	ug/kg	U	UJ	13L
AMN9	PM-072-19.0-20.0	15-16417-AMN9C	EPA 1613B	1,2,3,4,7,8-HxCDD	85	pg/g		J	13L
AMN9	PM-072-19.0-20.0	15-16417-AMN9C	EPA 1613B	1,2,3,4,7,8-HxCDF	80.3	pg/g		J	13L
AMN9	PM-072-19.0-20.0	15-16417-AMN9C	EPA 1613B	1,2,3,6,7,8-HxCDD	990	pg/g		J	13L
AMN9	PM-072-19.0-20.0	15-16417-AMN9C	EPA 1613B	1,2,3,6,7,8-HxCDF	47.6	pg/g		J	13L
AMN9	PM-072-19.0-20.0	15-16417-AMN9C	EPA 1613B	Total HxCDD	17200	pg/g	EMPC	J	25
AMN9	PM-072-19.0-20.0	15-16417-AMN9C	EPA 1613B	Total HxCDF	4800	pg/g	EMPC	J	25
AMN9	PM-072-19.0-20.0	15-16417-AMN9C	EPA 1613B	Total PeCDD	3580	pg/g	EMPC	J	25
AMN9	PM-072-19.0-20.0	15-16417-AMN9C	EPA 1613B	Total PeCDF	1050	pg/g	EMPC	J	25
AMN9	PM-072-19.0-20.0	15-16417-AMN9C	EPA 1613B	Total TCDD	883	pg/g	EMPC	J	25
AMN9	PM-072-19.0-20.0	15-16417-AMN9C	EPA 1613B	Total TCDF	215	pg/g	EMPC	J	25
AMN9	PM-072-19.0-20.0	15-16417-AMN9CDL	EPA 1613B	OCDD	235000	pg/g	E	J	5BH,10H,20
AMN9	PM-072-21.0-22.0	15-16418-AMN9D	EPA 1613B	1,2,3,7,8-PeCDF	1.31	pg/g	EMPC	U	25
AMN9	PM-072-21.0-22.0	15-16418-AMN9D	EPA 1613B	OCDF	3570	pg/g		J	13H
AMN9	PM-072-21.0-22.0	15-16418-AMN9D	EPA 1613B	Total HpCDF	4120	pg/g	EMPC	J	25
AMN9	PM-072-21.0-22.0	15-16418-AMN9D	EPA 1613B	Total HxCDD	1900	pg/g	EMPC	J	25
AMN9	PM-072-21.0-22.0	15-16418-AMN9D	EPA 1613B	Total HxCDF	1170	pg/g	EMPC	J	25
AMN9	PM-072-21.0-22.0	15-16418-AMN9D	EPA 1613B	Total PeCDF	246	pg/g	EMPC	J	25
AMN9	PM-072-21.0-22.0	15-16418-AMN9D	EPA 1613B	Total TCDD	137	pg/g	EMPC	J	25
AMN9	PM-072-21.0-22.0	15-16418-AMN9D	EPA 1613B	Total TCDF	57	pg/g	EMPC	J	25
AMN9	PM-072-21.0-22.0	15-16418-AMN9D	SW8041	Pentachlorophenol	400	ug/kg		J	5BH
AMN9	PM-072-21.0-22.0	15-16418-AMN9DDL	EPA 1613B	OCDD	52800	pg/g		J	5BH,10H,13H
AMN9	PM-073-19.0-20.0	15-16419-AMN9E	EPA 1613B	2,3,7,8-TCDF	1.38	pg/g	EMPC	U	25
AMN9	PM-073-19.0-20.0	15-16419-AMN9E	EPA 1613B	Total HxCDD	5020	pg/g	EMPC	J	25
AMN9	PM-073-19.0-20.0	15-16419-AMN9E	EPA 1613B	Total HxCDF	6460	pg/g	EMPC	J	25
AMN9	PM-073-19.0-20.0	15-16419-AMN9E	EPA 1613B	Total TCDD	99.4	pg/g	EMPC	J	25
AMN9	PM-073-19.0-20.0	15-16419-AMN9E	EPA 1613B	Total TCDF	59.2	pg/g	EMPC	J	25
AMN9	PM-073-19.0-20.0	15-16419-AMN9E	SW8041	Pentachlorophenol	170	ug/kg		J	13L

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AMN9	PM-073-19.0-20.0	15-16419-AMN9EDL	EPA 1613B	OCDD	296000	pg/g	E	J	5BH,10H,13L,20
AMN9	PM-073-19.0-20.0	15-16419-AMN9EDL	EPA 1613B	OCDF	101000	pg/g		J	13L
AMN9	PM-073-19.0-20.0-D	15-16420-AMN9F	EPA 1613B	Total HxCDD	5160	pg/g	EMPC	J	25
AMN9	PM-073-19.0-20.0-D	15-16420-AMN9F	EPA 1613B	Total HxCDF	6500	pg/g	EMPC	J	25
AMN9	PM-073-19.0-20.0-D	15-16420-AMN9F	EPA 1613B	Total PeCDD	454	pg/g	EMPC	J	25
AMN9	PM-073-19.0-20.0-D	15-16420-AMN9F	EPA 1613B	Total PeCDF	719	pg/g	EMPC	J	25
AMN9	PM-073-19.0-20.0-D	15-16420-AMN9F	EPA 1613B	Total TCDD	102	pg/g	EMPC	J	25
AMN9	PM-073-19.0-20.0-D	15-16420-AMN9F	EPA 1613B	Total TCDF	61.5	pg/g	EMPC	J	25
AMN9	PM-073-19.0-20.0-D	15-16420-AMN9FDL	EPA 1613B	OCDD	276000	pg/g	E	J	5BH,10H,13L,20
AMN9	PM-073-19.0-20.0-D	15-16420-AMN9FDL	EPA 1613B	OCDF	79000	pg/g		J	13L
AMN9	PM-073-21.0-22.0	15-16421-AMN9G	EPA 1613B	1,2,3,6,7,8-HxCDF	60.2	pg/g		J	13L
AMN9	PM-073-21.0-22.0	15-16421-AMN9G	EPA 1613B	2,3,7,8-TCDF	1.08	pg/g	EMPC	U	25
AMN9	PM-073-21.0-22.0	15-16421-AMN9G	EPA 1613B	Total PeCDD	861	pg/g	EMPC	J	25
AMN9	PM-073-21.0-22.0	15-16421-AMN9G	EPA 1613B	Total PeCDF	661	pg/g	EMPC	J	25
AMN9	PM-073-21.0-22.0	15-16421-AMN9G	EPA 1613B	Total TCDD	112	pg/g	EMPC	J	25
AMN9	PM-073-21.0-22.0	15-16421-AMN9G	EPA 1613B	Total TCDF	58.2	pg/g	EMPC	J	25
AMN9	PM-073-21.0-22.0	15-16421-AMN9GDL	EPA 1613B	OCDD	209000	pg/g	E	J	5BH,10H,20
AMQ5	PM-084-19.0-20.0	15-16549-AMQ5A	EPA 1613B	1,2,3,6,7,8-HxCDF	1.6	pg/g	JEMPC	U	25
AMQ5	PM-084-19.0-20.0	15-16549-AMQ5A	EPA 1613B	1,2,3,7,8-PeCDF	0.468	pg/g	JEMPC	U	25
AMQ5	PM-084-19.0-20.0	15-16549-AMQ5A	EPA 1613B	2,3,7,8-TCDD	1.12	pg/g	JEMPC	U	25
AMQ5	PM-084-19.0-20.0	15-16549-AMQ5A	EPA 1613B	Total HpCDF	519	pg/g	EMPC	J	25
AMQ5	PM-084-19.0-20.0	15-16549-AMQ5A	EPA 1613B	Total HxCDF	100	pg/g	EMPC	J	25
AMQ5	PM-084-19.0-20.0	15-16549-AMQ5A	EPA 1613B	Total PeCDD	11.4	pg/g	EMPC	J	25
AMQ5	PM-084-19.0-20.0	15-16549-AMQ5A	EPA 1613B	Total PeCDF	13.4	pg/g	EMPC	J	25
AMQ5	PM-084-19.0-20.0	15-16549-AMQ5A	EPA 1613B	Total TCDD	30.4	pg/g	EMPC	J	25
AMQ5	PM-084-21.0-22.0	15-16550-AMQ5B	EPA 1613B	1,2,3,4,7,8-HxCDF	1.1	pg/g	JEMPC	U	25
AMQ5	PM-084-21.0-22.0	15-16550-AMQ5B	EPA 1613B	1,2,3,6,7,8-HxCDF	0.831	pg/g	JEMPC	U	25
AMQ5	PM-084-21.0-22.0	15-16550-AMQ5B	EPA 1613B	1,2,3,7,8-PeCDD	0.687	pg/g	BJEMPC	U	25
AMQ5	PM-084-21.0-22.0	15-16550-AMQ5B	EPA 1613B	1,2,3,7,8-PeCDF	0.421	pg/g	JEMPC	U	25
AMQ5	PM-084-21.0-22.0	15-16550-AMQ5B	EPA 1613B	2,3,4,7,8-PeCDF	0.287	pg/g	JEMPC	U	25
AMQ5	PM-084-21.0-22.0	15-16550-AMQ5B	EPA 1613B	2,3,7,8-TCDD	0.913	pg/g	JEMPC	U	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AMQ5	PM-084-21.0-22.0	15-16550-AMQ5B	EPA 1613B	OCDD	2520	pg/g		J	13L
AMQ5	PM-084-21.0-22.0	15-16550-AMQ5B	EPA 1613B	OCDF	137	pg/g		J	13L
AMQ5	PM-084-21.0-22.0	15-16550-AMQ5B	EPA 1613B	Total HpCDF	159	pg/g	EMPC	J	25
AMQ5	PM-084-21.0-22.0	15-16550-AMQ5B	EPA 1613B	Total HxCDD	95	pg/g	EMPC	J	25
AMQ5	PM-084-21.0-22.0	15-16550-AMQ5B	EPA 1613B	Total HxCDF	49.6	pg/g	EMPC	J	25
AMQ5	PM-084-21.0-22.0	15-16550-AMQ5B	EPA 1613B	Total PeCDD	18	pg/g	EMPC	J	25
AMQ5	PM-084-21.0-22.0	15-16550-AMQ5B	EPA 1613B	Total PeCDF	8.12	pg/g	EMPC	J	25
AMQ5	PM-084-21.0-22.0	15-16550-AMQ5B	EPA 1613B	Total TCDD	7.73	pg/g	EMPC	J	25
AMQ5	PM-084-21.0-22.0	15-16550-AMQ5B	EPA 1613B	Total TCDF	3.35	pg/g	EMPC	J	25
AMQ5	PM-086-19.0-20.0	15-16551-AMQ5C	EPA 1613B	1,2,3,4,7,8,9-HpCDF	0.218	pg/g	JEMPC	U	25
AMQ5	PM-086-19.0-20.0	15-16551-AMQ5C	EPA 1613B	1,2,3,4,7,8-HxCDD	0.13	pg/g	JEMPC	U	25
AMQ5	PM-086-19.0-20.0	15-16551-AMQ5C	EPA 1613B	1,2,3,4,7,8-HxCDF	0.26	pg/g	JEMPC	U	25
AMQ5	PM-086-19.0-20.0	15-16551-AMQ5C	EPA 1613B	1,2,3,6,7,8-HxCDF	0.076	pg/g	JEMPC	U	25
AMQ5	PM-086-19.0-20.0	15-16551-AMQ5C	EPA 1613B	1,2,3,7,8,9-HxCDF	0.068	pg/g	BJEMPC	U	25
AMQ5	PM-086-19.0-20.0	15-16551-AMQ5C	EPA 1613B	1,2,3,7,8-PeCDD	0.104	pg/g	BJEMPC	U	25
AMQ5	PM-086-19.0-20.0	15-16551-AMQ5C	EPA 1613B	2,3,4,6,7,8-HxCDF	0.094	pg/g	JEMPC	U	25
AMQ5	PM-086-19.0-20.0	15-16551-AMQ5C	EPA 1613B	Total HpCDF	13.6	pg/g	EMPC	J	25
AMQ5	PM-086-19.0-20.0	15-16551-AMQ5C	EPA 1613B	Total HxCDD	10.1	pg/g	EMPC	J	25
AMQ5	PM-086-19.0-20.0	15-16551-AMQ5C	EPA 1613B	Total HxCDF	3.52	pg/g	EMPC	J	25
AMQ5	PM-086-19.0-20.0	15-16551-AMQ5C	EPA 1613B	Total PeCDD	1.88	pg/g	EMPC	J	25
AMQ5	PM-086-19.0-20.0	15-16551-AMQ5C	EPA 1613B	Total PeCDF	0.724	pg/g	EMPC	J	25
AMQ5	PM-086-19.0-20.0	15-16551-AMQ5C	EPA 1613B	Total TCDD	3.24	pg/g	EMPC	J	25
AMQ5	PM-086-19.0-20.0	15-16551-AMQ5C	EPA 1613B	Total TCDF	0.249	pg/g	EMPC	J	25
AMQ5	PM-086-19.0-20.0-D	15-16552-AMQ5D	EPA 1613B	1,2,3,4,7,8-HxCDD	0.135	pg/g	JEMPC	U	25
AMQ5	PM-086-19.0-20.0-D	15-16552-AMQ5D	EPA 1613B	1,2,3,6,7,8-HxCDF	0.0797	pg/g	JEMPC	U	25
AMQ5	PM-086-19.0-20.0-D	15-16552-AMQ5D	EPA 1613B	2,3,4,6,7,8-HxCDF	0.0737	pg/g	JEMPC	U	25
AMQ5	PM-086-19.0-20.0-D	15-16552-AMQ5D	EPA 1613B	2,3,4,7,8-PeCDF	0.0857	pg/g	JEMPC	U	25
AMQ5	PM-086-19.0-20.0-D	15-16552-AMQ5D	EPA 1613B	Total HpCDF	19.4	pg/g	EMPC	J	25
AMQ5	PM-086-19.0-20.0-D	15-16552-AMQ5D	EPA 1613B	Total HxCDD	10.7	pg/g	EMPC	J	25
AMQ5	PM-086-19.0-20.0-D	15-16552-AMQ5D	EPA 1613B	Total HxCDF	5.17	pg/g	EMPC	J	25
AMQ5	PM-086-19.0-20.0-D	15-16552-AMQ5D	EPA 1613B	Total PeCDD	1.56	pg/g	EMPC	J	25

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AMQ5	PM-086-19.0-20.0-D	15-16552-AMQ5D	EPA 1613B	Total PeCDF	1.19	pg/g	EMPC	J	25
AMQ5	PM-086-19.0-20.0-D	15-16552-AMQ5D	EPA 1613B	Total TCDD	3.03	pg/g	EMPC	J	25
AMQ5	PM-086-19.0-20.0-D	15-16552-AMQ5D	EPA 1613B	Total TCDF	0.31	pg/g	EMPC	J	25
AMQ5	PM-086-21.0-22.0	15-16553-AMQ5E	EPA 1613B	1,2,3,6,7,8-HxCDD	0.762	pg/g	JEMPC	U	25
AMQ5	PM-086-21.0-22.0	15-16553-AMQ5E	EPA 1613B	1,2,3,6,7,8-HxCDF	0.102	pg/g	JEMPC	U	25
AMQ5	PM-086-21.0-22.0	15-16553-AMQ5E	EPA 1613B	1,2,3,7,8-PeCDD	0.144	pg/g	BJEMPC	U	25
AMQ5	PM-086-21.0-22.0	15-16553-AMQ5E	EPA 1613B	2,3,4,6,7,8-HxCDF	0.11	pg/g	JEMPC	U	25
AMQ5	PM-086-21.0-22.0	15-16553-AMQ5E	EPA 1613B	2,3,4,7,8-PeCDF	0.0659	pg/g	JEMPC	U	25
AMQ5	PM-086-21.0-22.0	15-16553-AMQ5E	EPA 1613B	2,3,7,8-TCDD	0.166	pg/g	JEMPC	U	25
AMQ5	PM-086-21.0-22.0	15-16553-AMQ5E	EPA 1613B	Total HxCDD	9.05	pg/g	EMPC	J	25
AMQ5	PM-086-21.0-22.0	15-16553-AMQ5E	EPA 1613B	Total HxCDF	5.06	pg/g	EMPC	J	25
AMQ5	PM-086-21.0-22.0	15-16553-AMQ5E	EPA 1613B	Total PeCDD	1.43	pg/g	EMPC	J	25
AMQ5	PM-086-21.0-22.0	15-16553-AMQ5E	EPA 1613B	Total PeCDF	1.08	pg/g	EMPC	J	25
AMQ5	PM-086-21.0-22.0	15-16553-AMQ5E	EPA 1613B	Total TCDD	2.59	pg/g	EMPC	J	25
AMQ5	PM-094-19.0-20.0	15-16556-AMQ5H	EPA 1613B	1,2,3,6,7,8-HxCDF	23	pg/g	EMPC	U	25
AMQ5	PM-094-19.0-20.0	15-16556-AMQ5H	EPA 1613B	1,2,3,7,8-PeCDF	2.71	pg/g	BJEMPC	U	25
AMQ5	PM-094-19.0-20.0	15-16556-AMQ5H	EPA 1613B	2,3,7,8-TCDD	12.1	pg/g	JEMPC	U	25
AMQ5	PM-094-19.0-20.0	15-16556-AMQ5H	EPA 1613B	2,3,7,8-TCDF	2.11	pg/g	JEMPC	U	25
AMQ5	PM-094-19.0-20.0	15-16556-AMQ5H	EPA 1613B	OCDD	145000	pg/g	E	J	20
AMQ5	PM-094-19.0-20.0	15-16556-AMQ5H	EPA 1613B	Total HpCDF	16100	pg/g	EMPC	J	25
AMQ5	PM-094-19.0-20.0	15-16556-AMQ5H	EPA 1613B	Total HxCDD	2880	pg/g	EMPC	J	25
AMQ5	PM-094-19.0-20.0	15-16556-AMQ5H	EPA 1613B	Total HxCDF	3190	pg/g	EMPC	J	25
AMQ5	PM-094-19.0-20.0	15-16556-AMQ5H	EPA 1613B	Total PeCDF	393	pg/g	EMPC	J	25
AMQ5	PM-094-19.0-20.0	15-16556-AMQ5H	EPA 1613B	Total TCDD	141	pg/g	EMPC	J	25
AMQ5	PM-094-19.0-20.0	15-16556-AMQ5H	EPA 1613B	Total TCDF	67.7	pg/g	EMPC	J	25
AMQ5	PM-094-21.0-22.0	15-16557-AMQ5I	EPA 1613B	1,2,3,4,7,8-HxCDF	5.88	pg/g	JEMPC	U	25
AMQ5	PM-094-21.0-22.0	15-16557-AMQ5I	EPA 1613B	2,3,4,6,7,8-HxCDF	13.8	pg/g	EMPC	U	25
AMQ5	PM-094-21.0-22.0	15-16557-AMQ5I	EPA 1613B	2,3,4,7,8-PeCDF	0.951	pg/g	JEMPC	U	25
AMQ5	PM-094-21.0-22.0	15-16557-AMQ5I	EPA 1613B	2,3,7,8-TCDD	2.71	pg/g	JEMPC	U	25
AMQ5	PM-094-21.0-22.0	15-16557-AMQ5I	EPA 1613B	Total HxCDF	439	pg/g	EMPC	J	25
AMQ5	PM-094-21.0-22.0	15-16557-AMQ5I	EPA 1613B	Total PeCDD	88.5	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AMQ5	PM-094-21.0-22.0	15-16557-AMQ5I	EPA 1613B	Total PeCDF	64.6	pg/g	EMPC	J	25
AMQ5	PM-094-21.0-22.0	15-16557-AMQ5I	EPA 1613B	Total TCDD	28.8	pg/g	EMPC	J	25
AMQ5	PM-094-21.0-22.0	15-16557-AMQ5I	EPA 1613B	Total TCDF	9.53	pg/g	EMPC	J	25
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	EPA 1613B	1,2,3,4,6,7,8-HpCDD	888	pg/g		J	13L
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	EPA 1613B	1,2,3,4,6,7,8-HpCDF	235	pg/g		J	13L
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	EPA 1613B	1,2,3,4,7,8,9-HpCDF	7.97	pg/g		J	13L
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	EPA 1613B	1,2,3,4,7,8-HxCDD	5.9	pg/g		J	13L
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	EPA 1613B	1,2,3,4,7,8-HxCDF	6.05	pg/g		J	13L
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	EPA 1613B	1,2,3,6,7,8-HxCDD	27.1	pg/g		J	13L
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	EPA 1613B	1,2,3,6,7,8-HxCDF	4.96	pg/g	EMPC	UJ	13L,25
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	EPA 1613B	1,2,3,7,8,9-HxCDF	0.886	pg/g	J	J	13L
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	EPA 1613B	1,2,3,7,8-PeCDD	4.27	pg/g		J	13L
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	EPA 1613B	1,2,3,7,8-PeCDF	0.792	pg/g	J	J	13L
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	EPA 1613B	2,3,4,6,7,8-HxCDF	7.84	pg/g		J	13L
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	EPA 1613B	2,3,4,7,8-PeCDF	2.11	pg/g		J	13L
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	EPA 1613B	2,3,7,8-TCDD	0.802	pg/g	JEMPC	UJ	13L,25
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	EPA 1613B	2,3,7,8-TCDF	1.36	pg/g	EMPC	UJ	13L,25
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	EPA 1613B	OCDD	8850	pg/g	E	J	13L,20
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	EPA 1613B	OCDF	918	pg/g		J	13L
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	EPA 1613B	Total HpCDF	777	pg/g	EMPC	J	25
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	EPA 1613B	Total HxCDF	226	pg/g	EMPC	J	25
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	EPA 1613B	Total PeCDF	112	pg/g	EMPC	J	25
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	EPA 1613B	Total TCDD	14.9	pg/g	EMPC	J	25
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	EPA 1613B	Total TCDF	50.4	pg/g	EMPC	J	25
AMQ5	PM-095-01.0-02.0	15-16558-AMQ5J	SW8041	Pentachlorophenol	8.4	ug/kg		J	13L
AMQ5	PM-095-10.0-11.0	15-16559-AMQ5K	EPA 1613B	1,2,3,4,7,8,9-HpCDF	17.7	pg/g		J	13L
AMQ5	PM-095-10.0-11.0	15-16559-AMQ5K	EPA 1613B	2,3,7,8-TCDD	1.16	pg/g	EMPC	U	25
AMQ5	PM-095-10.0-11.0	15-16559-AMQ5K	EPA 1613B	OCDD	21800	pg/g	E	J	13L,20
AMQ5	PM-095-10.0-11.0	15-16559-AMQ5K	EPA 1613B	OCDF	2030	pg/g		J	13L
AMQ5	PM-095-10.0-11.0	15-16559-AMQ5K	EPA 1613B	Total HxCDF	410	pg/g	EMPC	J	25
AMQ5	PM-095-10.0-11.0	15-16559-AMQ5K	EPA 1613B	Total PeCDF	76	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AMQ5	PM-095-10.0-11.0	15-16559-AMQ5K	EPA 1613B	Total TCDD	14.2	pg/g	EMPC	J	25
AMQ5	PM-095-10.0-11.0	15-16559-AMQ5K	EPA 1613B	Total TCDF	17.9	pg/g	EMPC	J	25
AMQ5	PM-095-19.0-20.0	15-16560-AMQ5L	EPA 1613B	1,2,3,4,7,8,9-HpCDF	1.05	pg/g	EMPC	UJ	13L,25
AMQ5	PM-095-19.0-20.0	15-16560-AMQ5L	EPA 1613B	1,2,3,6,7,8-HxCDF	0.232	pg/g	JEMPC	U	25
AMQ5	PM-095-19.0-20.0	15-16560-AMQ5L	EPA 1613B	1,2,3,7,8-PeCDD	0.33	pg/g	BJEMPC	U	25
AMQ5	PM-095-19.0-20.0	15-16560-AMQ5L	EPA 1613B	1,2,3,7,8-PeCDF	0.0639	pg/g	JEMPC	U	25
AMQ5	PM-095-19.0-20.0	15-16560-AMQ5L	EPA 1613B	2,3,7,8-TCDD	0.228	pg/g	JEMPC	U	25
AMQ5	PM-095-19.0-20.0	15-16560-AMQ5L	EPA 1613B	OCDD	1440	pg/g		J	13L
AMQ5	PM-095-19.0-20.0	15-16560-AMQ5L	EPA 1613B	OCDF	116	pg/g		J	13L
AMQ5	PM-095-19.0-20.0	15-16560-AMQ5L	EPA 1613B	Total HpCDF	104	pg/g	EMPC	J	25
AMQ5	PM-095-19.0-20.0	15-16560-AMQ5L	EPA 1613B	Total HxCDF	23.6	pg/g	EMPC	J	25
AMQ5	PM-095-19.0-20.0	15-16560-AMQ5L	EPA 1613B	Total PeCDD	7.27	pg/g	EMPC	J	25
AMQ5	PM-095-19.0-20.0	15-16560-AMQ5L	EPA 1613B	Total PeCDF	3.65	pg/g	EMPC	J	25
AMQ5	PM-095-19.0-20.0	15-16560-AMQ5L	EPA 1613B	Total TCDD	3.9	pg/g	EMPC	J	25
AMQ5	PM-095-19.0-20.0	15-16560-AMQ5L	EPA 1613B	Total TCDF	0.802	pg/g	EMPC	J	25
AMS0	PM091-09.0-10.0	15-16673-AMS0B	EPA 1613B	1,2,3,4,6,7,8-HpCDD	1.66	pg/g	BEMPC	U	25
AMS0	PM091-09.0-10.0	15-16673-AMS0B	EPA 1613B	1,2,3,4,6,7,8-HpCDF	0.413	pg/g	JEMPC	U	25
AMS0	PM091-09.0-10.0	15-16673-AMS0B	EPA 1613B	1,2,3,4,7,8,9-HpCDF	0.239	pg/g	JEMPC	U	25
AMS0	PM091-09.0-10.0	15-16673-AMS0B	EPA 1613B	1,2,3,4,7,8-HxCDD	0.251	pg/g	BJEMPC	U	25
AMS0	PM091-09.0-10.0	15-16673-AMS0B	EPA 1613B	1,2,3,6,7,8-HxCDD	0.317	pg/g	JEMPC	U	25
AMS0	PM091-09.0-10.0	15-16673-AMS0B	EPA 1613B	1,2,3,6,7,8-HxCDF	0.156	pg/g	JEMPC	U	25
AMS0	PM091-09.0-10.0	15-16673-AMS0B	EPA 1613B	1,2,3,7,8-PeCDF	0.283	pg/g	BJEMPC	U	25
AMS0	PM091-09.0-10.0	15-16673-AMS0B	EPA 1613B	2,3,4,6,7,8-HxCDF	0.154	pg/g	JEMPC	U	25
AMS0	PM091-09.0-10.0	15-16673-AMS0B	EPA 1613B	2,3,4,7,8-PeCDF	0.179	pg/g	JEMPC	U	25
AMS0	PM091-09.0-10.0	15-16673-AMS0B	EPA 1613B	OCDD	17.2	pg/g	B	U	7
AMS0	PM091-09.0-10.0	15-16673-AMS0B	EPA 1613B	OCDF	1.27	pg/g	BEMPC	U	25
AMS0	PM091-09.0-10.0	15-16673-AMS0B	EPA 1613B	Total HpCDD	4.16	pg/g	EMPC	J	25
AMS0	PM091-09.0-10.0	15-16673-AMS0B	EPA 1613B	Total HpCDF	0.992	pg/g	EMPC	J	25
AMS0	PM091-09.0-10.0	15-16673-AMS0B	EPA 1613B	Total HxCDD	2.21	pg/g	EMPC	J	25
AMS0	PM091-09.0-10.0	15-16673-AMS0B	EPA 1613B	Total HxCDF	1.01	pg/g	EMPC	J	25
AMS0	PM091-09.0-10.0	15-16673-AMS0B	EPA 1613B	Total PeCDF	0.462	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AMS0	PM091-09.0-10.0	15-16673-AMS0B	SW8041	Pentachlorophenol	7.5	ug/kg		J	5BH, 13L
AMS0	PM091-09.0-10.0	15-16673-AMS0B	SW8270D SIM	Benzo(a)anthracene	4.8	ug/kg	U	UJ	13L
AMS0	PM091-09.0-10.0	15-16673-AMS0B	SW8270D SIM	Benzo(a)pyrene	4.8	ug/kg	U	UJ	13L
AMS0	PM091-09.0-10.0	15-16673-AMS0B	SW8270D SIM	Chrysene	4.8	ug/kg	U	UJ	13L
AMS0	PM091-09.0-10.0	15-16673-AMS0B	SW8270D SIM	Dibenz(a,h)anthracene	4.8	ug/kg	U	UJ	13L
AMS0	PM091-09.0-10.0	15-16673-AMS0B	SW8270D SIM	Indeno(1,2,3-cd)pyrene	4.8	ug/kg	U	UJ	13L
AMS0	PM091-09.0-10.0	15-16673-AMS0B	SW8270D SIM	Total Benzofluoranthenes	4.8	ug/kg	U	UJ	13L
AMS0	PM097-01.0-02.0	15-16674-AMS0C	EPA 1613B	1,2,3,4,7,8,9-HpCDF	5.32	pg/g	EMPC	U	25
AMS0	PM097-01.0-02.0	15-16674-AMS0C	EPA 1613B	1,2,3,6,7,8-HxCDF	3.6	pg/g		J	13L
AMS0	PM097-01.0-02.0	15-16674-AMS0C	EPA 1613B	1,2,3,7,8-PeCDF	0.858	pg/g	XEMPC	U	25
AMS0	PM097-01.0-02.0	15-16674-AMS0C	EPA 1613B	2,3,7,8-TCDD	0.626	pg/g	JEMPC	U	25
AMS0	PM097-01.0-02.0	15-16674-AMS0C	EPA 1613B	OCDD	5100	pg/g	E	J	20
AMS0	PM097-01.0-02.0	15-16674-AMS0C	EPA 1613B	Total HpCDF	488	pg/g	EMPC	J	25
AMS0	PM097-01.0-02.0	15-16674-AMS0C	EPA 1613B	Total HxCDD	144	pg/g	EMPC	J	25
AMS0	PM097-01.0-02.0	15-16674-AMS0C	EPA 1613B	Total HxCDF	155	pg/g	EMPC	J	25
AMS0	PM097-01.0-02.0	15-16674-AMS0C	EPA 1613B	Total PeCDD	19.4	pg/g	EMPC	J	25
AMS0	PM097-01.0-02.0	15-16674-AMS0C	EPA 1613B	Total PeCDF	87.5	pg/g	EMPC	J	25
AMS0	PM097-01.0-02.0	15-16674-AMS0C	EPA 1613B	Total TCDD	6.04	pg/g	EMPC	J	25
AMS0	PM097-01.0-02.0	15-16674-AMS0C	EPA 1613B	Total TCDF	22.7	pg/g	EMPC	J	25
AMS0	PM097-01.0-02.0	15-16674-AMS0C	SW8270D SIM	Benzo(a)anthracene	2.6	ug/kg	J	J	13L
AMS0	PM097-01.0-02.0	15-16674-AMS0C	SW8270D SIM	Benzo(a)pyrene	2.5	ug/kg	J	J	13L
AMS0	PM097-01.0-02.0	15-16674-AMS0C	SW8270D SIM	Chrysene	5	ug/kg	U	UJ	13L
AMS0	PM097-01.0-02.0	15-16674-AMS0C	SW8270D SIM	Dibenz(a,h)anthracene	5	ug/kg	U	UJ	13L
AMS0	PM097-01.0-02.0	15-16674-AMS0C	SW8270D SIM	Indeno(1,2,3-cd)pyrene	5	ug/kg	U	UJ	13L
AMS0	PM097-01.0-02.0	15-16674-AMS0C	SW8270D SIM	Total Benzofluoranthenes	5.6	ug/kg		J	13L
AMS0	PM097-09.0-10.0	15-16675-AMS0D	EPA 1613B	1,2,3,4,6,7,8-HpCDD	9.84	pg/g	B	U	7
AMS0	PM097-09.0-10.0	15-16675-AMS0D	EPA 1613B	1,2,3,7,8,9-HxCDD	0.304	pg/g	BJEMPC	U	25
AMS0	PM097-09.0-10.0	15-16675-AMS0D	EPA 1613B	1,2,3,7,8,9-HxCDF	0.209	pg/g	BJEMPC	U	25
AMS0	PM097-09.0-10.0	15-16675-AMS0D	EPA 1613B	Total HxCDD	2.2	pg/g	EMPC	J	25
AMS0	PM097-09.0-10.0	15-16675-AMS0D	EPA 1613B	Total HxCDF	1.08	pg/g	EMPC	J	25
AMS0	PM097-09.0-10.0	15-16675-AMS0D	EPA 1613B	Total TCDD	0.783	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AMS0	PM097-09.0-10.0	15-16675-AMS0D	EPA 1613B	Total TCDF	0.19	pg/g	EMPC	J	25
AMS0	PM097-09.0-10.0	15-16675-AMS0D	SW8270D SIM	Benzo(a)anthracene	5	ug/kg	U	UJ	13L
AMS0	PM097-09.0-10.0	15-16675-AMS0D	SW8270D SIM	Benzo(a)pyrene	5	ug/kg	U	UJ	13L
AMS0	PM097-09.0-10.0	15-16675-AMS0D	SW8270D SIM	Chrysene	5	ug/kg	U	UJ	13L
AMS0	PM097-09.0-10.0	15-16675-AMS0D	SW8270D SIM	Dibenz(a,h)anthracene	5	ug/kg	U	UJ	13L
AMS0	PM097-09.0-10.0	15-16675-AMS0D	SW8270D SIM	Indeno(1,2,3-cd)pyrene	5	ug/kg	U	UJ	13L
AMS0	PM097-09.0-10.0	15-16675-AMS0D	SW8270D SIM	Total Benzofluoranthenes	5	ug/kg	U	UJ	13L
AMS0	PM101-01.0-02.0	15-16676-AMS0E	EPA 1613B	1,2,3,7,8-PeCDF	1	pg/g	X	J	23
AMS0	PM101-01.0-02.0	15-16676-AMS0E	EPA 1613B	OCDD	13000	pg/g	E	J	20
AMS0	PM101-01.0-02.0	15-16676-AMS0E	EPA 1613B	Total HxCDD	294	pg/g	EMPC	J	25
AMS0	PM101-01.0-02.0	15-16676-AMS0E	EPA 1613B	Total PeCDF	108	pg/g	EMPC	J	25
AMS0	PM101-01.0-02.0	15-16676-AMS0E	EPA 1613B	Total TCDD	13.9	pg/g	EMPC	J	25
AMS0	PM101-01.0-02.0	15-16676-AMS0E	EPA 1613B	Total TCDF	36.3	pg/g	EMPC	J	25
AMS0	PM101-01.0-02.0	15-16676-AMS0E	SW8041	Pentachlorophenol	12	ug/kg		J	5BH
AMS0	PM101-09.0-10.0	15-16677-AMS0F	EPA 1613B	1,2,3,7,8-PeCDF	0.812	pg/g	BJEMPC	U	25
AMS0	PM101-09.0-10.0	15-16677-AMS0F	EPA 1613B	2,3,7,8-TCDF	0.396	pg/g	JEMPC	U	25
AMS0	PM101-09.0-10.0	15-16677-AMS0F	EPA 1613B	Total HpCDF	733	pg/g	EMPC	J	25
AMS0	PM101-09.0-10.0	15-16677-AMS0F	EPA 1613B	Total HxCDD	175	pg/g	EMPC	J	25
AMS0	PM101-09.0-10.0	15-16677-AMS0F	EPA 1613B	Total PeCDD	19.5	pg/g	EMPC	J	25
AMS0	PM101-09.0-10.0	15-16677-AMS0F	EPA 1613B	Total PeCDF	62.9	pg/g	EMPC	J	25
AMS0	PM101-09.0-10.0	15-16677-AMS0F	EPA 1613B	Total TCDD	5.15	pg/g	EMPC	J	25
AMS0	PM101-09.0-10.0	15-16677-AMS0F	EPA 1613B	Total TCDF	14.6	pg/g	EMPC	J	25
AMS0	PM101-09.0-10.0	15-16677-AMS0F	SW8270D SIM	Benzo(a)anthracene	4.6	ug/kg	U	UJ	13L
AMS0	PM101-09.0-10.0	15-16677-AMS0F	SW8270D SIM	Benzo(a)pyrene	4.6	ug/kg	U	UJ	13L
AMS0	PM101-09.0-10.0	15-16677-AMS0F	SW8270D SIM	Chrysene	4.6	ug/kg	U	UJ	13L
AMS0	PM101-09.0-10.0	15-16677-AMS0F	SW8270D SIM	Dibenz(a,h)anthracene	4.6	ug/kg	U	UJ	13L
AMS0	PM101-09.0-10.0	15-16677-AMS0F	SW8270D SIM	Indeno(1,2,3-cd)pyrene	4.6	ug/kg	U	UJ	13L
AMS0	PM101-09.0-10.0	15-16677-AMS0F	SW8270D SIM	Total Benzofluoranthenes	4.6	ug/kg	U	UJ	13L
AMS0	PM109-02.0-03.0	15-16679-AMS0H	EPA 1613B	1,2,3,4,7,8-HxCDF	17.8	pg/g		J	13L
AMS0	PM109-02.0-03.0	15-16679-AMS0H	EPA 1613B	1,2,3,6,7,8-HxCDF	8.76	pg/g		J	13L
AMS0	PM109-02.0-03.0	15-16679-AMS0H	EPA 1613B	1,2,3,7,8-PeCDF	1.5	pg/g	BJEMPC	U	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AMS0	PM109-02.0-03.0	15-16679-AMS0H	EPA 1613B	2,3,7,8-TCDD	2.77	pg/g	JEMPC	U	25
AMS0	PM109-02.0-03.0	15-16679-AMS0H	EPA 1613B	2,3,7,8-TCDF	0.78	pg/g	JEMPC	U	25
AMS0	PM109-02.0-03.0	15-16679-AMS0H	EPA 1613B	OCDD	27200	pg/g	E	J	20
AMS0	PM109-02.0-03.0	15-16679-AMS0H	EPA 1613B	Total HxCDF	557	pg/g	EMPC	J	25
AMS0	PM109-02.0-03.0	15-16679-AMS0H	EPA 1613B	Total PeCDD	95.3	pg/g	EMPC	J	25
AMS0	PM109-02.0-03.0	15-16679-AMS0H	EPA 1613B	Total PeCDF	100	pg/g	EMPC	J	25
AMS0	PM109-02.0-03.0	15-16679-AMS0H	EPA 1613B	Total TCDD	38.6	pg/g	EMPC	J	25
AMS0	PM109-02.0-03.0	15-16679-AMS0H	EPA 1613B	Total TCDF	21.4	pg/g	EMPC	J	25
AMS0	PM108-02.0-03.0	15-16680-AMS0I	EPA 1613B	1,2,3,4,7,8-HxCDD	28.8	pg/g		J	13L
AMS0	PM108-02.0-03.0	15-16680-AMS0I	EPA 1613B	1,2,3,4,7,8-HxCDF	58.8	pg/g		J	13L
AMS0	PM108-02.0-03.0	15-16680-AMS0I	EPA 1613B	1,2,3,6,7,8-HxCDD	159	pg/g		J	13L
AMS0	PM108-02.0-03.0	15-16680-AMS0I	EPA 1613B	1,2,3,6,7,8-HxCDF	22.1	pg/g		J	13L
AMS0	PM108-02.0-03.0	15-16680-AMS0I	EPA 1613B	1,2,3,7,8,9-HxCDF	6.9	pg/g		J	13L
AMS0	PM108-02.0-03.0	15-16680-AMS0I	EPA 1613B	1,2,3,7,8-PeCDF	3.25	pg/g	BJEMPC	U	25
AMS0	PM108-02.0-03.0	15-16680-AMS0I	EPA 1613B	2,3,4,6,7,8-HxCDF	33.1	pg/g		J	13L
AMS0	PM108-02.0-03.0	15-16680-AMS0I	EPA 1613B	2,3,4,7,8-PeCDF	12.6	pg/g	EMPC	U	25
AMS0	PM108-02.0-03.0	15-16680-AMS0I	EPA 1613B	2,3,7,8-TCDD	6.72	pg/g	EMPC	UJ	13L,25
AMS0	PM108-02.0-03.0	15-16680-AMS0I	EPA 1613B	2,3,7,8-TCDF	1.58	pg/g	JEMPC	U	25
AMS0	PM108-02.0-03.0	15-16680-AMS0I	EPA 1613B	OCDD	50200	pg/g	E	J	20
AMS0	PM108-02.0-03.0	15-16680-AMS0I	EPA 1613B	Total HpCDF	5590	pg/g	EMPC	J	25
AMS0	PM108-02.0-03.0	15-16680-AMS0I	EPA 1613B	Total PeCDF	311	pg/g	EMPC	J	25
AMS0	PM108-02.0-03.0	15-16680-AMS0I	EPA 1613B	Total TCDD	231	pg/g	EMPC	J	25
AMS0	PM108-02.0-03.0	15-16680-AMS0I	EPA 1613B	Total TCDF	93.6	pg/g	EMPC	J	25
AMS0	PM112-02.0-03.0	15-16681-AMS0J	EPA 1613B	1,2,3,4,6,7,8-HpCDD	10.1	pg/g	B	U	7
AMS0	PM112-02.0-03.0	15-16681-AMS0J	EPA 1613B	1,2,3,6,7,8-HxCDD	0.361	pg/g	JEMPC	U	25
AMS0	PM112-02.0-03.0	15-16681-AMS0J	EPA 1613B	1,2,3,6,7,8-HxCDF	0.166	pg/g	JEMPC	U	25
AMS0	PM112-02.0-03.0	15-16681-AMS0J	EPA 1613B	1,2,3,7,8,9-HxCDD	0.361	pg/g	BJEMPC	U	25
AMS0	PM112-02.0-03.0	15-16681-AMS0J	EPA 1613B	1,2,3,7,8-PeCDF	0.171	pg/g	BJ	U	7
AMS0	PM112-02.0-03.0	15-16681-AMS0J	EPA 1613B	2,3,4,6,7,8-HxCDF	0.293	pg/g	JEMPC	U	25
AMS0	PM112-02.0-03.0	15-16681-AMS0J	EPA 1613B	2,3,4,7,8-PeCDF	0.201	pg/g	JEMPC	U	25
AMS0	PM112-02.0-03.0	15-16681-AMS0J	EPA 1613B	2,3,7,8-TCDF	0.179	pg/g	JEMPC	U	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AMS0	PM112-02.0-03.0	15-16681-AMS0J	EPA 1613B	Total HxCDD	4.21	pg/g	EMPC	J	25
AMS0	PM112-02.0-03.0	15-16681-AMS0J	EPA 1613B	Total HxCDF	3.59	pg/g	EMPC	J	25
AMS0	PM112-02.0-03.0	15-16681-AMS0J	EPA 1613B	Total PeCDD	1.7	pg/g	EMPC	J	25
AMS0	PM112-02.0-03.0	15-16681-AMS0J	EPA 1613B	Total PeCDF	4.18	pg/g	EMPC	J	25
AMS0	PM112-02.0-03.0	15-16681-AMS0J	EPA 1613B	Total TCDD	2.15	pg/g	EMPC	J	25
AMS0	PM112-02.0-03.0	15-16681-AMS0J	EPA 1613B	Total TCDF	4.74	pg/g	EMPC	J	25
AMS0	PM113-02.0-03.0	15-16682-AMS0K	EPA 1613B	1,2,3,4,6,7,8-HpCDD	2.84	pg/g	B	U	7
AMS0	PM113-02.0-03.0	15-16682-AMS0K	EPA 1613B	1,2,3,4,6,7,8-HpCDF	0.403	pg/g	JEMPC	U	25
AMS0	PM113-02.0-03.0	15-16682-AMS0K	EPA 1613B	OCDD	23.8	pg/g	B	U	7
AMS0	PM113-02.0-03.0	15-16682-AMS0K	EPA 1613B	OCDF	1.62	pg/g	BEMPC	U	25
AMS0	PM113-02.0-03.0	15-16682-AMS0K	EPA 1613B	Total HpCDF	1.14	pg/g	EMPC	J	25
AMS0	PM113-02.0-03.0	15-16682-AMS0K	EPA 1613B	Total HxCDD	1.5	pg/g	EMPC	J	25
AMS0	PM113-02.0-03.0	15-16682-AMS0K	EPA 1613B	Total HxCDF	0.289	pg/g	EMPC	J	25
AMS0	PM116-02.0-03.0	15-16683-AMS0L	EPA 1613B	1,2,3,4,7,8,9-HpCDF	10.6	pg/g	EMPC	U	25
AMS0	PM116-02.0-03.0	15-16683-AMS0L	EPA 1613B	1,2,3,4,7,8-HxCDF	8.88	pg/g		J	13L
AMS0	PM116-02.0-03.0	15-16683-AMS0L	EPA 1613B	1,2,3,6,7,8-HxCDF	3.86	pg/g		J	13L
AMS0	PM116-02.0-03.0	15-16683-AMS0L	EPA 1613B	2,3,7,8-TCDD	0.484	pg/g	JEMPC	U	25
AMS0	PM116-02.0-03.0	15-16683-AMS0L	EPA 1613B	2,3,7,8-TCDF	0.547	pg/g	JEMPC	U	25
AMS0	PM116-02.0-03.0	15-16683-AMS0L	EPA 1613B	OCDD	9850	pg/g	E	J	20
AMS0	PM116-02.0-03.0	15-16683-AMS0L	EPA 1613B	Total HpCDF	1240	pg/g	EMPC	J	25
AMS0	PM116-02.0-03.0	15-16683-AMS0L	EPA 1613B	Total HxCDF	229	pg/g	EMPC	J	25
AMS0	PM116-02.0-03.0	15-16683-AMS0L	EPA 1613B	Total PeCDD	35.5	pg/g	EMPC	J	25
AMS0	PM116-02.0-03.0	15-16683-AMS0L	EPA 1613B	Total PeCDF	60.6	pg/g	EMPC	J	25
AMS0	PM116-02.0-03.0	15-16683-AMS0L	EPA 1613B	Total TCDD	17.8	pg/g	EMPC	J	25
AMS0	PM116-02.0-03.0	15-16683-AMS0L	EPA 1613B	Total TCDF	22.1	pg/g	EMPC	J	25
AMS0	PM074-01.0-02.0	15-16684-AMS0M	EPA 1613B	1,2,3,4,7,8-HxCDF	472	pg/g	EMPC	U	25
AMS0	PM074-01.0-02.0	15-16684-AMS0M	EPA 1613B	1,2,3,6,7,8-HxCDF	276	pg/g	EMPC	U	25
AMS0	PM074-01.0-02.0	15-16684-AMS0M	EPA 1613B	2,3,4,7,8-PeCDF	111	pg/g	JEMPC	U	25
AMS0	PM074-01.0-02.0	15-16684-AMS0M	EPA 1613B	2,3,7,8-TCDF	24.7	pg/g	JEMPC	U	25
AMS0	PM074-01.0-02.0	15-16684-AMS0M	EPA 1613B	OCDD	994000	pg/g	E	J	13H,20
AMS0	PM074-01.0-02.0	15-16684-AMS0M	EPA 1613B	OCDF	115000	pg/g		J	13H

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AMS0	PM074-01.0-02.0	15-16684-AMS0M	EPA 1613B	Total HpCDF	93900	pg/g	EMPC	J	25
AMS0	PM074-01.0-02.0	15-16684-AMS0M	EPA 1613B	Total HxCDD	23400	pg/g	EMPC	J	25
AMS0	PM074-01.0-02.0	15-16684-AMS0M	EPA 1613B	Total HxCDF	16600	pg/g	EMPC	J	25
AMS0	PM074-01.0-02.0	15-16684-AMS0M	EPA 1613B	Total PeCDD	4460	pg/g	EMPC	J	25
AMS0	PM074-01.0-02.0	15-16684-AMS0M	EPA 1613B	Total PeCDF	1950	pg/g	EMPC	J	25
AMS0	PM074-01.0-02.0	15-16684-AMS0M	EPA 1613B	Total TCDD	1870	pg/g	EMPC	J	25
AMS0	PM074-01.0-02.0	15-16684-AMS0M	EPA 1613B	Total TCDF	377	pg/g	EMPC	J	25
AMS0	PM074-01.0-02.0	15-16684-AMS0M	SW8041	Pentachlorophenol	250	ug/kg		J	13L
AMS0	PM074-01.0-02.0	15-16684-AMS0M	SW8270D SIM	Benzo(a)anthracene	21	ug/kg		J	13L
AMS0	PM074-01.0-02.0	15-16684-AMS0M	SW8270D SIM	Benzo(a)pyrene	27	ug/kg		J	13L
AMS0	PM074-01.0-02.0	15-16684-AMS0M	SW8270D SIM	Chrysene	40	ug/kg		J	13L
AMS0	PM074-01.0-02.0	15-16684-AMS0M	SW8270D SIM	Dibenz(a,h)anthracene	6.8	ug/kg		J	13L
AMS0	PM074-01.0-02.0	15-16684-AMS0M	SW8270D SIM	Indeno(1,2,3-cd)pyrene	22	ug/kg		J	13L
AMS0	PM074-01.0-02.0	15-16684-AMS0M	SW8270D SIM	Total Benzofluoranthenes	70	ug/kg		J	13L
AMS0	PM074-10.0-11.0	15-16685-AMS0N	EPA 1613B	1,2,3,4,7,8,9-HpCDF	7.93	pg/g	EMPC	U	25
AMS0	PM074-10.0-11.0	15-16685-AMS0N	EPA 1613B	1,2,3,4,7,8-HxCDD	2.99	pg/g	BJEMPC	U	25
AMS0	PM074-10.0-11.0	15-16685-AMS0N	EPA 1613B	1,2,3,6,7,8-HxCDF	2.48	pg/g	J	J	13L
AMS0	PM074-10.0-11.0	15-16685-AMS0N	EPA 1613B	1,2,3,7,8-PeCDD	1.93	pg/g	BJEMPC	U	25
AMS0	PM074-10.0-11.0	15-16685-AMS0N	EPA 1613B	2,3,4,6,7,8-HxCDF	6.02	pg/g	EMPC	U	25
AMS0	PM074-10.0-11.0	15-16685-AMS0N	EPA 1613B	2,3,4,7,8-PeCDF	1.09	pg/g	JEMPC	U	25
AMS0	PM074-10.0-11.0	15-16685-AMS0N	EPA 1613B	Total HpCDF	435	pg/g	EMPC	J	25
AMS0	PM074-10.0-11.0	15-16685-AMS0N	EPA 1613B	Total HxCDD	136	pg/g	EMPC	J	25
AMS0	PM074-10.0-11.0	15-16685-AMS0N	EPA 1613B	Total HxCDF	115	pg/g	EMPC	J	25
AMS0	PM074-10.0-11.0	15-16685-AMS0N	EPA 1613B	Total PeCDD	44.8	pg/g	EMPC	J	25
AMS0	PM074-10.0-11.0	15-16685-AMS0N	EPA 1613B	Total PeCDF	28	pg/g	EMPC	J	25
AMS0	PM074-10.0-11.0	15-16685-AMS0N	EPA 1613B	Total TCDD	43.7	pg/g	EMPC	J	25
AMS0	PM074-10.0-11.0	15-16685-AMS0N	EPA 1613B	Total TCDF	13.7	pg/g	EMPC	J	25
AMS0	PM074-10.0-11.0	15-16685-AMS0N	SW8270D SIM	Benzo(a)anthracene	4.6	ug/kg	U	UJ	13L
AMS0	PM074-10.0-11.0	15-16685-AMS0N	SW8270D SIM	Benzo(a)pyrene	4.6	ug/kg	U	UJ	13L
AMS0	PM074-10.0-11.0	15-16685-AMS0N	SW8270D SIM	Chrysene	4.6	ug/kg	U	UJ	13L
AMS0	PM074-10.0-11.0	15-16685-AMS0N	SW8270D SIM	Dibenz(a,h)anthracene	4.6	ug/kg	U	UJ	13L

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AMS0	PM074-10.0-11.0	15-16685-AMS0N	SW8270D SIM	Indeno(1,2,3-cd)pyrene	4.6	ug/kg	U	UJ	13L
AMS0	PM074-10.0-11.0	15-16685-AMS0N	SW8270D SIM	Total Benzofluoranthenes	4.6	ug/kg	U	UJ	13L
AMS0	PM074-19.0-20.0	15-16686-AMS0O	EPA 1613B	1,2,3,4,7,8,9-HpCDF	5.84	pg/g	EMPC	U	25
AMS0	PM074-19.0-20.0	15-16686-AMS0O	EPA 1613B	2,3,7,8-TCDD	0.461	pg/g	JEMPC	U	25
AMS0	PM074-19.0-20.0	15-16686-AMS0O	EPA 1613B	OCDD	5780	pg/g	E	J	20
AMS0	PM074-19.0-20.0	15-16686-AMS0O	EPA 1613B	Total HpCDF	612	pg/g	EMPC	J	25
AMS0	PM074-19.0-20.0	15-16686-AMS0O	EPA 1613B	Total HxCDD	128	pg/g	EMPC	J	25
AMS0	PM074-19.0-20.0	15-16686-AMS0O	EPA 1613B	Total HxCDF	142	pg/g	EMPC	J	25
AMS0	PM074-19.0-20.0	15-16686-AMS0O	EPA 1613B	Total PeCDD	23.7	pg/g	EMPC	J	25
AMS0	PM074-19.0-20.0	15-16686-AMS0O	EPA 1613B	Total PeCDF	26.7	pg/g	EMPC	J	25
AMS0	PM074-19.0-20.0	15-16686-AMS0O	EPA 1613B	Total TCDD	42.8	pg/g	EMPC	J	25
AMS0	PM074-19.0-20.0	15-16686-AMS0O	EPA 1613B	Total TCDF	4.75	pg/g	EMPC	J	25
AMS0	PM074-19.0-20.0	15-16686-AMS0O	SW8270D SIM	Benzo(a)anthracene	4.7	ug/kg	U	UJ	13L
AMS0	PM074-19.0-20.0	15-16686-AMS0O	SW8270D SIM	Benzo(a)pyrene	4.7	ug/kg	U	UJ	13L
AMS0	PM074-19.0-20.0	15-16686-AMS0O	SW8270D SIM	Chrysene	4.7	ug/kg	U	UJ	13L
AMS0	PM074-19.0-20.0	15-16686-AMS0O	SW8270D SIM	Dibenz(a,h)anthracene	4.7	ug/kg	U	UJ	13L
AMS0	PM074-19.0-20.0	15-16686-AMS0O	SW8270D SIM	Indeno(1,2,3-cd)pyrene	4.7	ug/kg	U	UJ	13L
AMS0	PM074-19.0-20.0	15-16686-AMS0O	SW8270D SIM	Total Benzofluoranthenes	4.7	ug/kg	U	UJ	13L
AMU0	PM-065-01.0-02.0	15-16766-AMU0C	EPA 1613B	1,2,3,4,7,8,9-HpCDF	3.14	pg/g		J	13L
AMU0	PM-065-01.0-02.0	15-16766-AMU0C	EPA 1613B	1,2,3,6,7,8-HxCDF	1.12	pg/g	EMPC	U	25
AMU0	PM-065-01.0-02.0	15-16766-AMU0C	EPA 1613B	1,2,3,7,8,9-HxCDF	0.188	pg/g	BJEMPC	U	25
AMU0	PM-065-01.0-02.0	15-16766-AMU0C	EPA 1613B	1,2,3,7,8-PeCDF	0.228	pg/g	JEMPC	U	25
AMU0	PM-065-01.0-02.0	15-16766-AMU0C	EPA 1613B	2,3,7,8-TCDD	0.464	pg/g	JEMPC	U	25
AMU0	PM-065-01.0-02.0	15-16766-AMU0C	EPA 1613B	2,3,7,8-TCDF	0.134	pg/g	JEMPC	U	25
AMU0	PM-065-01.0-02.0	15-16766-AMU0C	EPA 1613B	OCDD	3590	pg/g		J	13L
AMU0	PM-065-01.0-02.0	15-16766-AMU0C	EPA 1613B	OCDF	395	pg/g		J	13L
AMU0	PM-065-01.0-02.0	15-16766-AMU0C	EPA 1613B	Total HpCDF	332	pg/g	EMPC	J	25
AMU0	PM-065-01.0-02.0	15-16766-AMU0C	EPA 1613B	Total HxCDD	69.6	pg/g	EMPC	J	25
AMU0	PM-065-01.0-02.0	15-16766-AMU0C	EPA 1613B	Total HxCDF	65.4	pg/g	EMPC	J	25
AMU0	PM-065-01.0-02.0	15-16766-AMU0C	EPA 1613B	Total PeCDD	7.02	pg/g	EMPC	J	25
AMU0	PM-065-01.0-02.0	15-16766-AMU0C	EPA 1613B	Total PeCDF	11.8	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AMU0	PM-065-01.0-02.0	15-16766-AMU0C	EPA 1613B	Total TCDD	3.86	pg/g	EMPC	J	25
AMU0	PM-065-01.0-02.0	15-16766-AMU0C	EPA 1613B	Total TCDF	2.71	pg/g	EMPC	J	25
AMU0	PM-065-07.0-08.0	15-16767-AMU0D	EPA 1613B	1,2,3,4,7,8-HxCDD	0.102	pg/g	JEMPC	U	25
AMU0	PM-065-07.0-08.0	15-16767-AMU0D	EPA 1613B	1,2,3,6,7,8-HxCDD	0.152	pg/g	BJEMPC	U	25
AMU0	PM-065-07.0-08.0	15-16767-AMU0D	EPA 1613B	1,2,3,6,7,8-HxCDF	0.0825	pg/g	JEMPC	U	25
AMU0	PM-065-07.0-08.0	15-16767-AMU0D	EPA 1613B	1,2,3,7,8,9-HxCDD	0.178	pg/g	BJEMPC	U	25
AMU0	PM-065-07.0-08.0	15-16767-AMU0D	EPA 1613B	1,2,3,7,8,9-HxCDF	0.135	pg/g	BJEMPC	U	25
AMU0	PM-065-07.0-08.0	15-16767-AMU0D	EPA 1613B	1,2,3,7,8-PeCDF	0.126	pg/g	JEMPC	U	25
AMU0	PM-065-07.0-08.0	15-16767-AMU0D	EPA 1613B	2,3,4,6,7,8-HxCDF	0.0847	pg/g	BJEMPC	U	25
AMU0	PM-065-07.0-08.0	15-16767-AMU0D	EPA 1613B	2,3,4,7,8-PeCDF	0.0369	pg/g	JEMPC	U	25
AMU0	PM-065-07.0-08.0	15-16767-AMU0D	EPA 1613B	Total HxCDD	1.74	pg/g	EMPC	J	25
AMU0	PM-065-07.0-08.0	15-16767-AMU0D	EPA 1613B	Total HxCDF	0.303	pg/g	EMPC	J	25
AMU0	PM-065-07.0-08.0	15-16767-AMU0D	EPA 1613B	Total PeCDD	0.754	pg/g	EMPC	J	25
AMU0	PM-065-07.0-08.0	15-16767-AMU0D	EPA 1613B	Total PeCDF	0.165	pg/g	EMPC	J	25
AMU0	PM-065-07.0-08.0	15-16767-AMU0D	EPA 1613B	Total TCDD	3.58	pg/g	EMPC	J	25
AMU0	PM-065-07.0-08.0-D	15-16768-AMU0E	EPA 1613B	1,2,3,6,7,8-HxCDD	0.110	pg/g	BJEMPC	U	25
AMU0	PM-065-07.0-08.0-D	15-16768-AMU0E	EPA 1613B	1,2,3,7,8,9-HxCDD	0.105	pg/g	BJEMPC	U	25
AMU0	PM-065-07.0-08.0-D	15-16768-AMU0E	EPA 1613B	1,2,3,7,8-PeCDD	0.0856	pg/g	JEMPC	U	25
AMU0	PM-065-07.0-08.0-D	15-16768-AMU0E	EPA 1613B	1,2,3,7,8-PeCDF	0.103	pg/g	JEMPC	U	25
AMU0	PM-065-07.0-08.0-D	15-16768-AMU0E	EPA 1613B	2,3,4,7,8-PeCDF	0.0483	pg/g	JX	J	23
AMU0	PM-065-07.0-08.0-D	15-16768-AMU0E	EPA 1613B	2,3,7,8-TCDD	0.187	pg/g	JEMPC	U	25
AMU0	PM-065-07.0-08.0-D	15-16768-AMU0E	EPA 1613B	OCDD	4530	pg/g	E	J	20
AMU0	PM-065-07.0-08.0-D	15-16768-AMU0E	EPA 1613B	Total HpCDF	0.598	pg/g	EMPC	J	25
AMU0	PM-065-07.0-08.0-D	15-16768-AMU0E	EPA 1613B	Total HxCDD	1.12	pg/g	EMPC	J	25
AMU0	PM-065-07.0-08.0-D	15-16768-AMU0E	EPA 1613B	Total PeCDD	0.268	pg/g	EMPC	J	25
AMU0	PM-065-07.0-08.0-D	15-16768-AMU0E	EPA 1613B	Total PeCDF	0.170	pg/g	EMPC	J	25
AMU0	PM-065-07.0-08.0-D	15-16768-AMU0E	EPA 1613B	Total TCDD	2.52	pg/g	EMPC	J	25
AMU0	PM-065-07.0-08.0-D	15-16768-AMU0E	EPA 1613B	Total TCDF	0.259	pg/g	EMPC	J	25
AMU0	PM-064-10.0-11.0	15-16770-AMU0G	EPA 1613B	1,2,3,7,8,9-HxCDF	10.5	pg/g	JEMPC	U	25
AMU0	PM-064-10.0-11.0	15-16770-AMU0G	EPA 1613B	2,3,7,8-TCDD	12.0	pg/g	JEMPC	U	25
AMU0	PM-064-10.0-11.0	15-16770-AMU0G	EPA 1613B	OCDD	100000	pg/g	E	J	20

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AMU0	PM-064-10.0-11.0	15-16770-AMU0G	EPA 1613B	Total HpCDF	6570	pg/g	EMPC	J	25
AMU0	PM-064-10.0-11.0	15-16770-AMU0G	EPA 1613B	Total HxCDD	3300	pg/g	EMPC	J	25
AMU0	PM-064-10.0-11.0	15-16770-AMU0G	EPA 1613B	Total HxCDF	2130	pg/g	EMPC	J	25
AMU0	PM-064-10.0-11.0	15-16770-AMU0G	EPA 1613B	Total PeCDD	1230	pg/g	EMPC	J	25
AMU0	PM-064-10.0-11.0	15-16770-AMU0G	EPA 1613B	Total PeCDF	810	pg/g	EMPC	J	25
AMU0	PM-064-10.0-11.0	15-16770-AMU0G	EPA 1613B	Total TCDD	535	pg/g	EMPC	J	25
AMU0	PM-064-10.0-11.0	15-16770-AMU0G	EPA 1613B	Total TCDF	164	pg/g	EMPC	J	25
AMU0	PM-057-10.0-11.0	15-16776-AMU0M	EPA 1613B	2,3,4,7,8-PeCDF	17.8	pg/g	EMPC	U	25
AMU0	PM-057-10.0-11.0	15-16776-AMU0M	EPA 1613B	2,3,7,8-TCDD	5.39	pg/g	JEMPC	U	25
AMU0	PM-057-10.0-11.0	15-16776-AMU0M	EPA 1613B	Total HxCDD	425	pg/g	EMPC	J	25
AMU0	PM-057-10.0-11.0	15-16776-AMU0M	EPA 1613B	Total HxCDF	362	pg/g	EMPC	J	25
AMU0	PM-057-10.0-11.0	15-16776-AMU0M	EPA 1613B	Total PeCDD	159	pg/g	EMPC	J	25
AMU0	PM-057-10.0-11.0	15-16776-AMU0M	EPA 1613B	Total PeCDF	139	pg/g	EMPC	J	25
AMU0	PM-057-10.0-11.0	15-16776-AMU0M	EPA 1613B	Total TCDD	399	pg/g	EMPC	J	25
AMU0	PM-057-10.0-11.0	15-16776-AMU0M	EPA 1613B	Total TCDF	37.9	pg/g	EMPC	J	25
AMU0	PM-104-02.0-03.0	15-16780-AMU0Q	EPA 1613B	1,2,3,6,7,8-HxCDF	13.0	pg/g	EMPC	U	25
AMU0	PM-104-02.0-03.0	15-16780-AMU0Q	EPA 1613B	1,2,3,7,8,9-HxCDF	3.62	pg/g	BJEMPC	U	25
AMU0	PM-104-02.0-03.0	15-16780-AMU0Q	EPA 1613B	1,2,3,7,8-PeCDF	1.44	pg/g	JEMPC	U	25
AMU0	PM-104-02.0-03.0	15-16780-AMU0Q	EPA 1613B	2,3,4,7,8-PeCDF	7.34	pg/g	JEMPC	U	25
AMU0	PM-104-02.0-03.0	15-16780-AMU0Q	EPA 1613B	2,3,7,8-TCDD	2.35	pg/g	JEMPC	U	25
AMU0	PM-104-02.0-03.0	15-16780-AMU0Q	EPA 1613B	2,3,7,8-TCDF	0.739	pg/g	JEMPC	U	25
AMU0	PM-104-02.0-03.0	15-16780-AMU0Q	EPA 1613B	OCDD	69800	pg/g	E	J	20
AMU0	PM-104-02.0-03.0	15-16780-AMU0Q	EPA 1613B	Total HpCDF	5840	pg/g	EMPC	J	25
AMU0	PM-104-02.0-03.0	15-16780-AMU0Q	EPA 1613B	Total HxCDD	842	pg/g	EMPC	J	25
AMU0	PM-104-02.0-03.0	15-16780-AMU0Q	EPA 1613B	Total HxCDF	1040	pg/g	EMPC	J	25
AMU0	PM-104-02.0-03.0	15-16780-AMU0Q	EPA 1613B	Total PeCDD	71.3	pg/g	EMPC	J	25
AMU0	PM-104-02.0-03.0	15-16780-AMU0Q	EPA 1613B	Total PeCDF	127	pg/g	EMPC	J	25
AMU0	PM-104-02.0-03.0	15-16780-AMU0Q	EPA 1613B	Total TCDD	24.4	pg/g	EMPC	J	25
AMU0	PM-104-02.0-03.0	15-16780-AMU0Q	EPA 1613B	Total TCDF	23.2	pg/g	EMPC	J	25
AMU0	PM-063-10.0-11.0	15-16787-AMU0X	EPA 1613B	1,2,3,6,7,8-HxCDF	11.6	pg/g	EMPC	U	25
AMU0	PM-063-10.0-11.0	15-16787-AMU0X	EPA 1613B	2,3,7,8-TCDD	2.69	pg/g	JEMPC	U	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AMU0	PM-063-10.0-11.0	15-16787-AMU0X	EPA 1613B	2,3,7,8-TCDF	0.719	pg/g	JEMPC	U	25
AMU0	PM-063-10.0-11.0	15-16787-AMU0X	EPA 1613B	OCDD	43600	pg/g	E	J	20
AMU0	PM-063-10.0-11.0	15-16787-AMU0X	EPA 1613B	Total HxCDD	993	pg/g	EMPC	J	25
AMU0	PM-063-10.0-11.0	15-16787-AMU0X	EPA 1613B	Total HxCDF	908	pg/g	EMPC	J	25
AMU0	PM-063-10.0-11.0	15-16787-AMU0X	EPA 1613B	Total PeCDD	81.6	pg/g	EMPC	J	25
AMU0	PM-063-10.0-11.0	15-16787-AMU0X	EPA 1613B	Total PeCDF	122	pg/g	EMPC	J	25
AMU0	PM-063-10.0-11.0	15-16787-AMU0X	EPA 1613B	Total TCDD	32.8	pg/g	EMPC	J	25
AMU0	PM-063-10.0-11.0	15-16787-AMU0X	EPA 1613B	Total TCDF	25.2	pg/g	EMPC	J	25
AMW2	PM111-01.0-02.0	15-16895-AMW2A	EPA 1613B	1,2,3,4,7,8,9-HpCDF	17.2	pg/g		J	13L
AMW2	PM111-01.0-02.0	15-16895-AMW2A	EPA 1613B	1,2,3,7,8,9-HxCDF	1.76	pg/g	EMPC	U	25
AMW2	PM111-01.0-02.0	15-16895-AMW2A	EPA 1613B	OCDD	20300	pg/g	E	J	20
AMW2	PM111-01.0-02.0	15-16895-AMW2A	EPA 1613B	Total HxCDD	543	pg/g	EMPC	J	25
AMW2	PM111-01.0-02.0	15-16895-AMW2A	EPA 1613B	Total HxCDF	397	pg/g	EMPC	J	25
AMW2	PM111-01.0-02.0	15-16895-AMW2A	EPA 1613B	Total PeCDD	97.7	pg/g	EMPC	J	25
AMW2	PM111-01.0-02.0	15-16895-AMW2A	EPA 1613B	Total PeCDF	104	pg/g	EMPC	J	25
AMW2	PM111-01.0-02.0	15-16895-AMW2A	EPA 1613B	Total TCDF	48.9	pg/g	EMPC	J	25
AMW2	PM111-01.0-02.0	15-16895-AMW2A	SW6010C	Lead	31	mg/kg		J	9
AMW2	PM111-01.0-02.0	15-16895-AMW2A	SW8041	Pentachlorophenol	28	ug/kg		J	5BL
AMW2	PM111-09.0-10.0	15-16896-AMW2B	EPA 1613B	1,2,3,6,7,8-HxCDF	15.2	pg/g	EMPC	U	25
AMW2	PM111-09.0-10.0	15-16896-AMW2B	EPA 1613B	1,2,3,7,8-PeCDF	1.33	pg/g	JXEMPC	U	25
AMW2	PM111-09.0-10.0	15-16896-AMW2B	EPA 1613B	2,3,7,8-TCDD	2.48	pg/g	JEMPC	U	25
AMW2	PM111-09.0-10.0	15-16896-AMW2B	EPA 1613B	2,3,7,8-TCDF	1.34	pg/g	JEMPC	U	25
AMW2	PM111-09.0-10.0	15-16896-AMW2B	EPA 1613B	OCDD	41200	pg/g	E	J	20
AMW2	PM111-09.0-10.0	15-16896-AMW2B	EPA 1613B	Total HpCDF	3730	pg/g	EMPC	J	25
AMW2	PM111-09.0-10.0	15-16896-AMW2B	EPA 1613B	Total HxCDF	928	pg/g	EMPC	J	25
AMW2	PM111-09.0-10.0	15-16896-AMW2B	EPA 1613B	Total PeCDD	170	pg/g	EMPC	J	25
AMW2	PM111-09.0-10.0	15-16896-AMW2B	EPA 1613B	Total PeCDF	274	pg/g	EMPC	J	25
AMW2	PM111-09.0-10.0	15-16896-AMW2B	EPA 1613B	Total TCDD	87	pg/g	EMPC	J	25
AMW2	PM111-09.0-10.0	15-16896-AMW2B	EPA 1613B	Total TCDF	70	pg/g	EMPC	J	25
AMW2	PM111-09.0-10.0	15-16896-AMW2B	SW6010C	Lead	39	mg/kg		J	9
AMW2	PM111-01.0-02.0-D	15-16897-AMW2C	EPA 1613B	1,2,3,4,6,7,8-HpCDF	582	pg/g		J	13L

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AMW2	PM111-01.0-02.0-D	15-16897-AMW2C	EPA 1613B	1,2,3,4,7,8,9-HpCDF	19.1	pg/g		J	13L
AMW2	PM111-01.0-02.0-D	15-16897-AMW2C	EPA 1613B	1,2,3,4,7,8-HxCDF	11	pg/g	EMPC	U	25
AMW2	PM111-01.0-02.0-D	15-16897-AMW2C	EPA 1613B	1,2,3,6,7,8-HxCDF	7.26	pg/g	EMPC	U	25
AMW2	PM111-01.0-02.0-D	15-16897-AMW2C	EPA 1613B	1,2,3,7,8,9-HxCDF	2.03	pg/g	BJEMPC	UJ	13L,25
AMW2	PM111-01.0-02.0-D	15-16897-AMW2C	EPA 1613B	2,3,4,7,8-PeCDF	2.87	pg/g	JEMPC	U	25
AMW2	PM111-01.0-02.0-D	15-16897-AMW2C	EPA 1613B	2,3,7,8-TCDD	2.41	pg/g	JEMPC	U	25
AMW2	PM111-01.0-02.0-D	15-16897-AMW2C	EPA 1613B	2,3,7,8-TCDF	1.34	pg/g	JEMPC	U	25
AMW2	PM111-01.0-02.0-D	15-16897-AMW2C	EPA 1613B	OCDD	23500	pg/g	E	J	13L,20
AMW2	PM111-01.0-02.0-D	15-16897-AMW2C	EPA 1613B	OCDF	2020	pg/g		J	13L
AMW2	PM111-01.0-02.0-D	15-16897-AMW2C	EPA 1613B	Total HpCDF	1940	pg/g	EMPC	J	25
AMW2	PM111-01.0-02.0-D	15-16897-AMW2C	EPA 1613B	Total HxCDF	414	pg/g	EMPC	J	25
AMW2	PM111-01.0-02.0-D	15-16897-AMW2C	EPA 1613B	Total PeCDF	95.9	pg/g	EMPC	J	25
AMW2	PM111-01.0-02.0-D	15-16897-AMW2C	EPA 1613B	Total TCDD	51	pg/g	EMPC	J	25
AMW2	PM111-01.0-02.0-D	15-16897-AMW2C	EPA 1613B	Total TCDF	40.6	pg/g	EMPC	J	25
AMW2	PM103-01.0-02.0	15-16898-AMW2D	EPA 1613B	1,2,3,4,7,8,9-HpCDF	6.47	pg/g	EMPC	UJ	13L,25
AMW2	PM103-01.0-02.0	15-16898-AMW2D	EPA 1613B	1,2,3,6,7,8-HxCDF	4.23	pg/g	EMPC	U	25
AMW2	PM103-01.0-02.0	15-16898-AMW2D	EPA 1613B	1,2,3,7,8-PeCDF	0.525	pg/g	JX	J	23
AMW2	PM103-01.0-02.0	15-16898-AMW2D	EPA 1613B	2,3,7,8-TCDD	0.502	pg/g	JEMPC	U	25
AMW2	PM103-01.0-02.0	15-16898-AMW2D	EPA 1613B	OCDD	7440	pg/g	E	J	13L,20
AMW2	PM103-01.0-02.0	15-16898-AMW2D	EPA 1613B	OCDF	661	pg/g		J	13L
AMW2	PM103-01.0-02.0	15-16898-AMW2D	EPA 1613B	Total HpCDF	627	pg/g	EMPC	J	25
AMW2	PM103-01.0-02.0	15-16898-AMW2D	EPA 1613B	Total HxCDD	185	pg/g	EMPC	J	25
AMW2	PM103-01.0-02.0	15-16898-AMW2D	EPA 1613B	Total HxCDF	179	pg/g	EMPC	J	25
AMW2	PM103-01.0-02.0	15-16898-AMW2D	EPA 1613B	Total PeCDD	25.2	pg/g	EMPC	J	25
AMW2	PM103-01.0-02.0	15-16898-AMW2D	EPA 1613B	Total PeCDF	55.9	pg/g	EMPC	J	25
AMW2	PM103-01.0-02.0	15-16898-AMW2D	EPA 1613B	Total TCDD	8	pg/g	EMPC	J	25
AMW2	PM103-01.0-02.0	15-16898-AMW2D	EPA 1613B	Total TCDF	15.2	pg/g	EMPC	J	25
AMW2	PM103-09.0-10.0	15-16899-AMW2E	EPA 1613B	1,2,3,7,8,9-HxCDF	0.473	pg/g	BJEMPC	U	25
AMW2	PM103-09.0-10.0	15-16899-AMW2E	EPA 1613B	2,3,7,8-TCDD	0.341	pg/g	JEMPC	U	25
AMW2	PM103-09.0-10.0	15-16899-AMW2E	EPA 1613B	2,3,7,8-TCDF	0.353	pg/g	JEMPC	U	25
AMW2	PM103-09.0-10.0	15-16899-AMW2E	EPA 1613B	Total HxCDF	98.9	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AMW2	PM103-09.0-10.0	15-16899-AMW2E	EPA 1613B	Total PeCDD	14.2	pg/g	EMPC	J	25
AMW2	PM103-09.0-10.0	15-16899-AMW2E	EPA 1613B	Total PeCDF	43.5	pg/g	EMPC	J	25
AMW2	PM103-09.0-10.0	15-16899-AMW2E	EPA 1613B	Total TCDD	4.71	pg/g	EMPC	J	25
AMW2	PM103-09.0-10.0	15-16899-AMW2E	EPA 1613B	Total TCDF	15.4	pg/g	EMPC	J	25
AMW2	PM103-09.0-10.0	15-16899-AMW2E	SW8041	Pentachlorophenol	4.2	ug/kg	J	J	5BL
AMW2	PM061-01.0-02.0	15-16900-AMW2F	EPA 1613B	1,2,3,7,8,9-HxCDF	15.5	pg/g	EMPC	U	25
AMW2	PM061-01.0-02.0	15-16900-AMW2F	EPA 1613B	1,2,3,7,8-PeCDF	5.3	pg/g	BJEMPC	U	25
AMW2	PM061-01.0-02.0	15-16900-AMW2F	EPA 1613B	2,3,7,8-TCDD	6.31	pg/g	JEMPC	U	25
AMW2	PM061-01.0-02.0	15-16900-AMW2F	EPA 1613B	2,3,7,8-TCDF	1.71	pg/g	JEMPC	U	25
AMW2	PM061-01.0-02.0	15-16900-AMW2F	EPA 1613B	OCDD	257000	pg/g	E	J	20
AMW2	PM061-01.0-02.0	15-16900-AMW2F	EPA 1613B	Total HpCDD	49600	pg/g	EMPC	J	25
AMW2	PM061-01.0-02.0	15-16900-AMW2F	EPA 1613B	Total HpCDF	26700	pg/g	EMPC	J	25
AMW2	PM061-01.0-02.0	15-16900-AMW2F	EPA 1613B	Total HxCDD	3790	pg/g	EMPC	J	25
AMW2	PM061-01.0-02.0	15-16900-AMW2F	EPA 1613B	Total HxCDF	4410	pg/g	EMPC	J	25
AMW2	PM061-01.0-02.0	15-16900-AMW2F	EPA 1613B	Total PeCDF	487	pg/g	EMPC	J	25
AMW2	PM061-01.0-02.0	15-16900-AMW2F	EPA 1613B	Total TCDD	37.8	pg/g	EMPC	J	25
AMW2	PM061-01.0-02.0	15-16900-AMW2F	EPA 1613B	Total TCDF	74.6	pg/g	EMPC	J	25
AMW2	PM061-07.0-08.0	15-16901-AMW2G	EPA 1613B	1,2,3,7,8-PeCDF	1.13	pg/g	XEMPC	U	25
AMW2	PM061-07.0-08.0	15-16901-AMW2G	EPA 1613B	2,3,4,7,8-PeCDF	1.18	pg/g	EMPC	U	25
AMW2	PM061-07.0-08.0	15-16901-AMW2G	EPA 1613B	2,3,7,8-TCDD	0.329	pg/g	JEMPC	U	25
AMW2	PM061-07.0-08.0	15-16901-AMW2G	EPA 1613B	OCDD	366	pg/g		J	13L
AMW2	PM061-07.0-08.0	15-16901-AMW2G	EPA 1613B	OCDF	58.7	pg/g		J	13L
AMW2	PM061-07.0-08.0	15-16901-AMW2G	EPA 1613B	Total HxCDF	27.2	pg/g	EMPC	J	25
AMW2	PM061-07.0-08.0	15-16901-AMW2G	EPA 1613B	Total PeCDF	22.2	pg/g	EMPC	J	25
AMW2	PM061-07.0-08.0	15-16901-AMW2G	EPA 1613B	Total TCDD	16.6	pg/g	EMPC	J	25
AMW2	PM061-07.0-08.0	15-16901-AMW2G	EPA 1613B	Total TCDF	26.1	pg/g	EMPC	J	25
AMX3	PM-087-01.0-02.0	15-16931-AMX3A	EPA 1613B	2,3,7,8-TCDD	1.84	pg/g	JEMPC	U	25
AMX3	PM-087-01.0-02.0	15-16931-AMX3A	EPA 1613B	2,3,7,8-TCDF	0.89	pg/g	JEMPC	U	25
AMX3	PM-087-01.0-02.0	15-16931-AMX3A	EPA 1613B	OCDD	45300	pg/g	E	J	20
AMX3	PM-087-01.0-02.0	15-16931-AMX3A	EPA 1613B	Total HxCDD	707	pg/g	EMPC	J	25
AMX3	PM-087-01.0-02.0	15-16931-AMX3A	EPA 1613B	Total HxCDF	813	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AMX3	PM-087-01.0-02.0	15-16931-AMX3A	EPA 1613B	Total PeCDF	158	pg/g	EMPC	J	25
AMX3	PM-087-01.0-02.0	15-16931-AMX3A	EPA 1613B	Total TCDD	16.1	pg/g	EMPC	J	25
AMX3	PM-087-01.0-02.0	15-16931-AMX3A	EPA 1613B	Total TCDF	74.5	pg/g	EMPC	J	25
AMX3	PM-087-10.0-11.0	15-16932-AMX3B	EPA 1613B	1,2,3,7,8,9-HxCDF	10	pg/g	EMPC	U	25
AMX3	PM-087-10.0-11.0	15-16932-AMX3B	EPA 1613B	1,2,3,7,8-PeCDF	2.11	pg/g	JEMPC	U	25
AMX3	PM-087-10.0-11.0	15-16932-AMX3B	EPA 1613B	2,3,7,8-TCDF	1.25	pg/g	JEMPC	U	25
AMX3	PM-087-10.0-11.0	15-16932-AMX3B	EPA 1613B	OCDD	54300	pg/g	E	J	20
AMX3	PM-087-10.0-11.0	15-16932-AMX3B	EPA 1613B	Total HpCDF	7020	pg/g	EMPC	J	25
AMX3	PM-087-10.0-11.0	15-16932-AMX3B	EPA 1613B	Total HxCDF	2020	pg/g	EMPC	J	25
AMX3	PM-087-10.0-11.0	15-16932-AMX3B	EPA 1613B	Total PeCDD	614	pg/g	EMPC	J	25
AMX3	PM-087-10.0-11.0	15-16932-AMX3B	EPA 1613B	Total PeCDF	682	pg/g	EMPC	J	25
AMX3	PM-087-10.0-11.0	15-16932-AMX3B	EPA 1613B	Total TCDD	258	pg/g	EMPC	J	25
AMX3	PM-087-10.0-11.0	15-16932-AMX3B	EPA 1613B	Total TCDF	87.9	pg/g	EMPC	J	25
AMX3	PM-087-19.0-20.0	15-16933-AMX3C	EPA 1613B	1,2,3,4,7,8-HxCDD	0.0876	pg/g	BJEMPC	U	25
AMX3	PM-087-19.0-20.0	15-16933-AMX3C	EPA 1613B	1,2,3,6,7,8-HxCDD	0.249	pg/g	BJEMPC	U	25
AMX3	PM-087-19.0-20.0	15-16933-AMX3C	EPA 1613B	1,2,3,7,8,9-HxCDD	0.197	pg/g	BJEMPC	U	25
AMX3	PM-087-19.0-20.0	15-16933-AMX3C	EPA 1613B	1,2,3,7,8-PeCDF	0.0318	pg/g	JEMPC	U	25
AMX3	PM-087-19.0-20.0	15-16933-AMX3C	EPA 1613B	OCDD	31	pg/g	B	U	7
AMX3	PM-087-19.0-20.0	15-16933-AMX3C	EPA 1613B	OCDF	0.88	pg/g	J	U	7
AMX3	PM-087-19.0-20.0	15-16933-AMX3C	EPA 1613B	Total HpCDF	0.755	pg/g	EMPC	J	25
AMX3	PM-087-19.0-20.0	15-16933-AMX3C	EPA 1613B	Total HxCDD	2.81	pg/g	EMPC	J	25
AMX3	PM-087-19.0-20.0	15-16933-AMX3C	EPA 1613B	Total HxCDF	0.0991	pg/g	EMPC	J	25
AMX3	PM-087-19.0-20.0	15-16933-AMX3C	EPA 1613B	Total PeCDD	0.737	pg/g	EMPC	J	25
AMX3	PM-087-19.0-20.0	15-16933-AMX3C	EPA 1613B	Total PeCDF	0.0905	pg/g	EMPC	J	25
AMX3	PM-087-19.0-20.0	15-16933-AMX3C	EPA 1613B	Total TCDF	0.241	pg/g	EMPC	J	25
AMX3	PM-062-10.0-11.0	15-16935-AMX3E	EPA 1613B	1,2,3,6,7,8-HxCDF	20.9	pg/g	EMPC	U	25
AMX3	PM-062-10.0-11.0	15-16935-AMX3E	EPA 1613B	1,2,3,7,8,9-HxCDF	7.08	pg/g	JEMPC	U	25
AMX3	PM-062-10.0-11.0	15-16935-AMX3E	EPA 1613B	1,2,3,7,8-PeCDF	2.63	pg/g	BJEMPC	U	25
AMX3	PM-062-10.0-11.0	15-16935-AMX3E	EPA 1613B	2,3,4,6,7,8-HxCDF	16.6	pg/g	EMPC	U	25
AMX3	PM-062-10.0-11.0	15-16935-AMX3E	EPA 1613B	2,3,4,7,8-PeCDF	10.2	pg/g	JEMPC	U	25
AMX3	PM-062-10.0-11.0	15-16935-AMX3E	EPA 1613B	2,3,7,8-TCDD	4.22	pg/g	JEMPC	U	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AMX3	PM-062-10.0-11.0	15-16935-AMX3E	EPA 1613B	OCDD	82100	pg/g	E	J	20
AMX3	PM-062-10.0-11.0	15-16935-AMX3E	EPA 1613B	Total HpCDF	8770	pg/g	EMPC	J	25
AMX3	PM-062-10.0-11.0	15-16935-AMX3E	EPA 1613B	Total HxCDD	1210	pg/g	EMPC	J	25
AMX3	PM-062-10.0-11.0	15-16935-AMX3E	EPA 1613B	Total HxCDF	1510	pg/g	EMPC	J	25
AMX3	PM-062-10.0-11.0	15-16935-AMX3E	EPA 1613B	Total PeCDD	82.6	pg/g	EMPC	J	25
AMX3	PM-062-10.0-11.0	15-16935-AMX3E	EPA 1613B	Total PeCDF	168	pg/g	EMPC	J	25
AMX3	PM-062-10.0-11.0	15-16935-AMX3E	EPA 1613B	Total TCDD	14.1	pg/g	EMPC	J	25
AMX3	PM-062-10.0-11.0	15-16935-AMX3E	EPA 1613B	Total TCDF	28.4	pg/g	EMPC	J	25
AMX3	PM-70-10.0-11.0	15-16944-AMX3N	EPA 1613B	1,2,3,4,7,8,9-HpCDF	0.0798	pg/g	BJEMPC	U	25
AMX3	PM-70-10.0-11.0	15-16944-AMX3N	EPA 1613B	1,2,3,4,7,8-HxCDD	0.0738	pg/g	BJEMPC	U	25
AMX3	PM-70-10.0-11.0	15-16944-AMX3N	EPA 1613B	1,2,3,6,7,8-HxCDF	0.0778	pg/g	JEMPC	U	25
AMX3	PM-70-10.0-11.0	15-16944-AMX3N	EPA 1613B	1,2,3,7,8,9-HxCDD	0.211	pg/g	BJ	U	7
AMX3	PM-70-10.0-11.0	15-16944-AMX3N	EPA 1613B	OCDD	22.8	pg/g	B	U	7
AMX3	PM-70-10.0-11.0	15-16944-AMX3N	EPA 1613B	Total HpCDF	1.39	pg/g	EMPC	J	25
AMX3	PM-70-10.0-11.0	15-16944-AMX3N	EPA 1613B	Total HxCDD	1.11	pg/g	EMPC	J	25
AMX3	PM-70-10.0-11.0	15-16944-AMX3N	EPA 1613B	Total HxCDF	0.514	pg/g	EMPC	J	25
AMX3	PM-70-10.0-11.0	15-16944-AMX3N	EPA 1613B	Total PeCDF	0.121	pg/g	EMPC	J	25
AMX3	PM-70-10.0-11.0	15-16944-AMX3N	EPA 1613B	Total TCDF	0.0903	pg/g	EMPC	J	25
AMX3	PM-82-10.0-11.0	15-16949-AMX3S	EPA 1613B	1,2,3,7,8,9-HxCDD	0.213	pg/g	BJEMPC	U	25
AMX3	PM-82-10.0-11.0	15-16949-AMX3S	EPA 1613B	1,2,3,7,8-PeCDD	0.117	pg/g	BJEMPC	U	25
AMX3	PM-82-10.0-11.0	15-16949-AMX3S	EPA 1613B	2,3,4,6,7,8-HxCDF	0.0358	pg/g	JEMPC	U	25
AMX3	PM-82-10.0-11.0	15-16949-AMX3S	EPA 1613B	2,3,7,8-TCDD	0.169	pg/g	JEMPC	U	25
AMX3	PM-82-10.0-11.0	15-16949-AMX3S	EPA 1613B	OCDD	22.8	pg/g	B	UJ	7,13L
AMX3	PM-82-10.0-11.0	15-16949-AMX3S	EPA 1613B	OCDF	0.796	pg/g	BJ	UJ	7,13L
AMX3	PM-82-10.0-11.0	15-16949-AMX3S	EPA 1613B	Total HpCDF	0.317	pg/g	EMPC	J	25
AMX3	PM-82-10.0-11.0	15-16949-AMX3S	EPA 1613B	Total HxCDD	2.12	pg/g	EMPC	J	25
AMX3	PM-82-10.0-11.0	15-16949-AMX3S	EPA 1613B	Total HxCDF	0.104	pg/g	EMPC	J	25
AMX3	PM-82-10.0-11.0	15-16949-AMX3S	EPA 1613B	Total PeCDD	0.663	pg/g	EMPC	J	25
AMX3	PM-82-10.0-11.0	15-16949-AMX3S	EPA 1613B	Total TCDD	1.08	pg/g	EMPC	J	25
ANB5	PM-085-01.0-02.0	15-17053-ANB5A	EPA 1613B	Total HxCDD	16600	pg/g	EMPC	J	25
ANB5	PM-085-01.0-02.0	15-17053-ANB5A	EPA 1613B	Total HxCDF	20500	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
ANB5	PM-085-01.0-02.0	15-17053-ANB5A	EPA 1613B	Total PeCDF	2320	pg/g	EMPC	J	25
ANB5	PM-085-01.0-02.0	15-17053-ANB5A	EPA 1613B	Total TCDD	169	pg/g	EMPC	J	25
ANB5	PM-085-01.0-02.0	15-17053-ANB5A	EPA 1613B	Total TCDF	508	pg/g	EMPC	J	25
ANB5	PM-085-01.0-02.0	15-17053-ANB5ADL	EPA 1613B	OCDD	1080000	pg/g	E	J	20
ANB5	PM-085-10.0-11.0	15-17054-ANB5B	EPA 1613B	1,2,3,7,8,9-HxCDF	8.06	pg/g	BJEMPC	U	25
ANB5	PM-085-10.0-11.0	15-17054-ANB5B	EPA 1613B	2,3,4,6,7,8-HxCDF	29.9	pg/g	EMPC	U	25
ANB5	PM-085-10.0-11.0	15-17054-ANB5B	EPA 1613B	2,3,7,8-TCDD	7.7	pg/g	JEMPC	U	25
ANB5	PM-085-10.0-11.0	15-17054-ANB5B	EPA 1613B	OCDD	94600	pg/g	E	J	20
ANB5	PM-085-10.0-11.0	15-17054-ANB5B	EPA 1613B	Total HpCDF	8540	pg/g	EMPC	J	25
ANB5	PM-085-10.0-11.0	15-17054-ANB5B	EPA 1613B	Total HxCDF	1700	pg/g	EMPC	J	25
ANB5	PM-085-10.0-11.0	15-17054-ANB5B	EPA 1613B	Total PeCDF	219	pg/g	EMPC	J	25
ANB5	PM-085-10.0-11.0	15-17054-ANB5B	EPA 1613B	Total TCDD	111	pg/g	EMPC	J	25
ANB5	PM-085-10.0-11.0	15-17054-ANB5B	EPA 1613B	Total TCDF	29.9	pg/g	EMPC	J	25
ANB5	PM-085-19.0-20.0	15-17055-ANB5C	EPA 1613B	1,2,3,7,8-PeCDF	3.69	pg/g	BJEMPC	U	25
ANB5	PM-085-19.0-20.0	15-17055-ANB5C	EPA 1613B	2,3,7,8-TCDF	1.89	pg/g	JEMPC	U	25
ANB5	PM-085-19.0-20.0	15-17055-ANB5C	EPA 1613B	OCDD	179000	pg/g	E	J	20
ANB5	PM-085-19.0-20.0	15-17055-ANB5C	EPA 1613B	Total HxCDD	2630	pg/g	EMPC	J	25
ANB5	PM-085-19.0-20.0	15-17055-ANB5C	EPA 1613B	Total PeCDD	346	pg/g	EMPC	J	25
ANB5	PM-085-19.0-20.0	15-17055-ANB5C	EPA 1613B	Total PeCDF	434	pg/g	EMPC	J	25
ANB5	PM-085-19.0-20.0	15-17055-ANB5C	EPA 1613B	Total TCDD	105	pg/g	EMPC	J	25
ANB5	PM-085-19.0-20.0	15-17055-ANB5C	EPA 1613B	Total TCDF	66.8	pg/g	EMPC	J	25
ANB5	PM-085-21.0-22.0	15-17058-ANB5F	EPA 1613B	1,2,3,4,7,8,9-HpCDF	104	pg/g	EMPC	U	25
ANB5	PM-085-21.0-22.0	15-17058-ANB5F	EPA 1613B	1,2,3,7,8-PeCDF	3.07	pg/g	BJEMPC	U	25
ANB5	PM-085-21.0-22.0	15-17058-ANB5F	EPA 1613B	2,3,7,8-TCDD	10.8	pg/g	JEMPC	U	25
ANB5	PM-085-21.0-22.0	15-17058-ANB5F	EPA 1613B	2,3,7,8-TCDF	1.49	pg/g	JEMPC	U	25
ANB5	PM-085-21.0-22.0	15-17058-ANB5F	EPA 1613B	OCDD	106000	pg/g	E	J	20
ANB5	PM-085-21.0-22.0	15-17058-ANB5F	EPA 1613B	Total HpCDF	11000	pg/g	EMPC	J	25
ANB5	PM-085-21.0-22.0	15-17058-ANB5F	EPA 1613B	Total PeCDD	199	pg/g	EMPC	J	25
ANB5	PM-085-21.0-22.0	15-17058-ANB5F	EPA 1613B	Total PeCDF	285	pg/g	EMPC	J	25
ANB5	PM-085-21.0-22.0	15-17058-ANB5F	EPA 1613B	Total TCDD	56.7	pg/g	EMPC	J	25
ANB5	PM-085-21.0-22.0	15-17058-ANB5F	EPA 1613B	Total TCDF	38.5	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
ANB5	PM-051-01.0-02.0	15-17060-ANB5H	EPA 1613B	1,2,3,7,8,9-HxCDF	4.2	pg/g	BJEMPC	U	25
ANB5	PM-051-01.0-02.0	15-17060-ANB5H	EPA 1613B	2,3,4,6,7,8-HxCDF	16.9	pg/g	EMPC	U	25
ANB5	PM-051-01.0-02.0	15-17060-ANB5H	EPA 1613B	2,3,7,8-TCDD	1.58	pg/g	JEMPC	U	25
ANB5	PM-051-01.0-02.0	15-17060-ANB5H	EPA 1613B	2,3,7,8-TCDF	0.337	pg/g	JEMPC	U	25
ANB5	PM-051-01.0-02.0	15-17060-ANB5H	EPA 1613B	OCDD	27300	pg/g	E	J	20
ANB5	PM-051-01.0-02.0	15-17060-ANB5H	EPA 1613B	Total HpCDF	3180	pg/g	EMPC	J	25
ANB5	PM-051-01.0-02.0	15-17060-ANB5H	EPA 1613B	Total HxCDF	630	pg/g	EMPC	J	25
ANB5	PM-051-01.0-02.0	15-17060-ANB5H	EPA 1613B	Total PeCDF	117	pg/g	EMPC	J	25
ANB5	PM-051-01.0-02.0	15-17060-ANB5H	EPA 1613B	Total TCDD	40.5	pg/g	EMPC	J	25
ANB5	PM-051-01.0-02.0	15-17060-ANB5H	EPA 1613B	Total TCDF	35.1	pg/g	EMPC	J	25
ANB5	PM-051-07.0-08.0	15-17061-ANB5I	EPA 1613B	1,2,3,4,7,8-HxCDF	5.24	pg/g	EMPC	U	25
ANB5	PM-051-07.0-08.0	15-17061-ANB5I	EPA 1613B	1,2,3,6,7,8-HxCDF	2.9	pg/g	EMPC	U	25
ANB5	PM-051-07.0-08.0	15-17061-ANB5I	EPA 1613B	1,2,3,7,8-PeCDF	0.534	pg/g	JEMPC	U	25
ANB5	PM-051-07.0-08.0	15-17061-ANB5I	EPA 1613B	2,3,4,7,8-PeCDF	2.12	pg/g	EMPC	U	25
ANB5	PM-051-07.0-08.0	15-17061-ANB5I	EPA 1613B	2,3,7,8-TCDD	0.615	pg/g	JEMPC	U	25
ANB5	PM-051-07.0-08.0	15-17061-ANB5I	EPA 1613B	2,3,7,8-TCDF	0.341	pg/g	JEMPC	U	25
ANB5	PM-051-07.0-08.0	15-17061-ANB5I	EPA 1613B	OCDD	8580	pg/g	E	J	20
ANB5	PM-051-07.0-08.0	15-17061-ANB5I	EPA 1613B	Total HpCDD	1850	pg/g	EMPC	J	25
ANB5	PM-051-07.0-08.0	15-17061-ANB5I	EPA 1613B	Total HxCDD	194	pg/g	EMPC	J	25
ANB5	PM-051-07.0-08.0	15-17061-ANB5I	EPA 1613B	Total HxCDF	226	pg/g	EMPC	J	25
ANB5	PM-051-07.0-08.0	15-17061-ANB5I	EPA 1613B	Total PeCDD	25.2	pg/g	EMPC	J	25
ANB5	PM-051-07.0-08.0	15-17061-ANB5I	EPA 1613B	Total PeCDF	42.1	pg/g	EMPC	J	25
ANB5	PM-051-07.0-08.0	15-17061-ANB5I	EPA 1613B	Total TCDD	13.6	pg/g	EMPC	J	25
ANB5	PM-051-07.0-08.0	15-17061-ANB5I	EPA 1613B	Total TCDF	13.9	pg/g	EMPC	J	25
ANB5	PM-051-01.0-02.0-D	15-17066-ANB5N	EPA 1613B	1,2,3,7,8-PeCDF	1.42	pg/g	JEMPC	U	25
ANB5	PM-051-01.0-02.0-D	15-17066-ANB5N	EPA 1613B	2,3,7,8-TCDD	1.64	pg/g	JEMPC	U	25
ANB5	PM-051-01.0-02.0-D	15-17066-ANB5N	EPA 1613B	OCDD	34200	pg/g	E	J	20
ANB5	PM-051-01.0-02.0-D	15-17066-ANB5N	EPA 1613B	Total HxCDF	808	pg/g	EMPC	J	25
ANB5	PM-051-01.0-02.0-D	15-17066-ANB5N	EPA 1613B	Total PeCDD	52.7	pg/g	EMPC	J	25
ANB5	PM-051-01.0-02.0-D	15-17066-ANB5N	EPA 1613B	Total PeCDF	129	pg/g	EMPC	J	25
ANB5	PM-051-01.0-02.0-D	15-17066-ANB5N	EPA 1613B	Total TCDD	24.8	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
ANB5	PM-051-01.0-02.0-D	15-17066-ANB5N	EPA 1613B	Total TCDF	32.6	pg/g	EMPC	J	25
ANB5	PM-067-01.0-02.0	15-17071-ANB5S	EPA 1613B	2,3,7,8-TCDD	0.917	pg/g	JEMPC	U	25
ANB5	PM-067-01.0-02.0	15-17071-ANB5S	EPA 1613B	OCDD	5520	pg/g	E	J	20
ANB5	PM-067-01.0-02.0	15-17071-ANB5S	EPA 1613B	Total HpCDF	343	pg/g	EMPC	J	25
ANB5	PM-067-01.0-02.0	15-17071-ANB5S	EPA 1613B	Total HxCDD	220	pg/g	EMPC	J	25
ANB5	PM-067-01.0-02.0	15-17071-ANB5S	EPA 1613B	Total HxCDF	309	pg/g	EMPC	J	25
ANB5	PM-067-01.0-02.0	15-17071-ANB5S	EPA 1613B	Total PeCDF	665	pg/g	EMPC	J	25
ANB5	PM-067-01.0-02.0	15-17071-ANB5S	EPA 1613B	Total TCDD	16.8	pg/g	EMPC	J	25
ANB5	PM-067-01.0-02.0	15-17071-ANB5S	EPA 1613B	Total TCDF	300	pg/g	EMPC	J	25
ANB5	PM-077-01.0-02.0	15-17075-ANB5W	EPA 1613B	1,2,3,4,6,7,8-HpCDF	0.213	pg/g	BJEMPC	U	25
ANB5	PM-077-01.0-02.0	15-17075-ANB5W	EPA 1613B	1,2,3,7,8,9-HxCDD	0.151	pg/g	BJ	U	7
ANB5	PM-077-01.0-02.0	15-17075-ANB5W	EPA 1613B	1,2,3,7,8,9-HxCDF	0.0816	pg/g	BJEMPC	U	25
ANB5	PM-077-01.0-02.0	15-17075-ANB5W	EPA 1613B	1,2,3,7,8-PeCDF	0.0358	pg/g	JEMPC	U	25
ANB5	PM-077-01.0-02.0	15-17075-ANB5W	EPA 1613B	OCDD	12.6	pg/g	B	U	7
ANB5	PM-077-01.0-02.0	15-17075-ANB5W	EPA 1613B	OCDF	0.814	pg/g	BJ	U	7
ANB5	PM-077-01.0-02.0	15-17075-ANB5W	EPA 1613B	Total HpCDF	0.484	pg/g	EMPC	J	25
ANB5	PM-077-01.0-02.0	15-17075-ANB5W	EPA 1613B	Total HxCDF	0.238	pg/g	EMPC	J	25
ANB5	PM-077-01.0-02.0	15-17075-ANB5W	EPA 1613B	Total PeCDD	0.0941	pg/g	EMPC	J	25
ANB5	PM-077-01.0-02.0	15-17075-ANB5W	EPA 1613B	Total PeCDF	0.0357	pg/g	EMPC	J	25
ANB5	PM-077-01.0-02.0	15-17075-ANB5W	EPA 1613B	Total TCDD	0.346	pg/g	EMPC	J	25
ANB5	PM-077-01.0-02.0	15-17075-ANB5W	EPA 1613B	Total TCDF	0.0691	pg/g	EMPC	J	25
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	EPA 1613B	1,2,3,4,6,7,8-HpCDF	5440	pg/g		J	13L
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	EPA 1613B	1,2,3,4,7,8,9-HpCDF	198	pg/g		J	13L
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	EPA 1613B	1,2,3,4,7,8-HxCDD	85.2	pg/g		J	13L
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	EPA 1613B	1,2,3,4,7,8-HxCDF	76.7	pg/g		J	13L
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	EPA 1613B	1,2,3,6,7,8-HxCDD	608	pg/g		J	13L
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	EPA 1613B	1,2,3,6,7,8-HxCDF	41.2	pg/g		J	13L
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	EPA 1613B	1,2,3,7,8,9-HxCDD	244	pg/g		J	13L
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	EPA 1613B	1,2,3,7,8,9-HxCDF	11.8	pg/g	BJEMPC	UJ	13L,25
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	EPA 1613B	1,2,3,7,8-PeCDD	41.6	pg/g		J	13L
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	EPA 1613B	1,2,3,7,8-PeCDF	3.66	pg/g	BJEMPC	UJ	13L,25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	EPA 1613B	2,3,4,6,7,8-HxCDF	75.3	pg/g		J	13L
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	EPA 1613B	2,3,4,7,8-PeCDF	9.16	pg/g	J	J	13L
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	EPA 1613B	2,3,7,8-TCDD	7.58	pg/g	JEMPC	UJ	13L,25
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	EPA 1613B	2,3,7,8-TCDF	0.82	pg/g	U	UJ	13L
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	EPA 1613B	OCDF	23300	pg/g		J	13L
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	EPA 1613B	Total HpCDF	21500	pg/g	EMPC	J	25
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	EPA 1613B	Total HxCDD	3480	pg/g	EMPC	J	25
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	EPA 1613B	Total HxCDF	3790	pg/g	EMPC	J	25
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	EPA 1613B	Total PeCDD	308	pg/g	EMPC	J	25
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	EPA 1613B	Total PeCDF	361	pg/g	EMPC	J	25
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	EPA 1613B	Total TCDD	158	pg/g	EMPC	J	25
ANB5	PM-100-01.0-02.0	15-17078-ANB5Z	EPA 1613B	Total TCDF	52.5	pg/g	EMPC	J	25
ANB5	PM-100-01.0-02.0	15-17078-ANB5ZDL	EPA 1613B	1,2,3,4,6,7,8-HpCDD	22500	pg/g		J	13L
ANB5	PM-100-01.0-02.0	15-17078-ANB5ZDL	EPA 1613B	OCDD	225000	pg/g		J	13L
ANB5	PM-079-01.0-02.0	15-17083-ANB5AE	EPA 1613B	1,2,3,4,7,8,9-HpCDF	0.191	pg/g	BJ	U	7
ANB5	PM-079-01.0-02.0	15-17083-ANB5AE	EPA 1613B	1,2,3,4,7,8-HxCDD	0.265	pg/g	BJEMPC	U	25
ANB5	PM-079-01.0-02.0	15-17083-ANB5AE	EPA 1613B	1,2,3,4,7,8-HxCDF	0.209	pg/g	JEMPC	U	25
ANB5	PM-079-01.0-02.0	15-17083-ANB5AE	EPA 1613B	1,2,3,7,8-PeCDD	0.251	pg/g	BJEMPC	U	25
ANB5	PM-079-01.0-02.0	15-17083-ANB5AE	EPA 1613B	2,3,7,8-TCDD	0.145	pg/g	JEMPC	U	25
ANB5	PM-079-01.0-02.0	15-17083-ANB5AE	EPA 1613B	2,3,7,8-TCDF	0.0716	pg/g	JEMPC	U	25
ANB5	PM-079-01.0-02.0	15-17083-ANB5AE	EPA 1613B	OCDD	150	pg/g		J	13L
ANB5	PM-079-01.0-02.0	15-17083-ANB5AE	EPA 1613B	OCDF	11.5	pg/g		J	13L
ANB5	PM-079-01.0-02.0	15-17083-ANB5AE	EPA 1613B	Total HpCDF	12.4	pg/g	EMPC	J	25
ANB5	PM-079-01.0-02.0	15-17083-ANB5AE	EPA 1613B	Total HxCDD	7.29	pg/g	EMPC	J	25
ANB5	PM-079-01.0-02.0	15-17083-ANB5AE	EPA 1613B	Total HxCDF	5.76	pg/g	EMPC	J	25
ANB5	PM-079-01.0-02.0	15-17083-ANB5AE	EPA 1613B	Total PeCDD	1.73	pg/g	EMPC	J	25
ANB5	PM-079-01.0-02.0	15-17083-ANB5AE	EPA 1613B	Total PeCDF	4.59	pg/g	EMPC	J	25
ANB5	PM-079-01.0-02.0	15-17083-ANB5AE	EPA 1613B	Total TCDD	1.6	pg/g	EMPC	J	25
ANB5	PM-079-01.0-02.0	15-17083-ANB5AE	EPA 1613B	Total TCDF	1.34	pg/g	EMPC	J	25
ANB5	PM-089-01.0-02.0	15-17085-ANB5AG	EPA 1613B	1,2,3,4,7,8,9-HpCDF	35.2	pg/g	EMPC	U	25
ANB5	PM-089-01.0-02.0	15-17085-ANB5AG	EPA 1613B	1,2,3,6,7,8-HxCDF	13.1	pg/g	EMPC	U	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
ANB5	PM-089-01.0-02.0	15-17085-ANB5AG	EPA 1613B	1,2,3,7,8,9-HxCDF	3.98	pg/g	BJEMPC	U	25
ANB5	PM-089-01.0-02.0	15-17085-ANB5AG	EPA 1613B	1,2,3,7,8-PeCDF	2.4	pg/g	JXEMPC	U	25
ANB5	PM-089-01.0-02.0	15-17085-ANB5AG	EPA 1613B	2,3,4,6,7,8-HxCDF	22.6	pg/g	EMPC	U	25
ANB5	PM-089-01.0-02.0	15-17085-ANB5AG	EPA 1613B	2,3,7,8-TCDD	4.03	pg/g	JEMPC	U	25
ANB5	PM-089-01.0-02.0	15-17085-ANB5AG	EPA 1613B	OCDD	38600	pg/g	E	J	20
ANB5	PM-089-01.0-02.0	15-17085-ANB5AG	EPA 1613B	Total HpCDF	3520	pg/g	EMPC	J	25
ANB5	PM-089-01.0-02.0	15-17085-ANB5AG	EPA 1613B	Total HxCDF	731	pg/g	EMPC	J	25
ANB5	PM-089-01.0-02.0	15-17085-ANB5AG	EPA 1613B	Total PeCDF	162	pg/g	EMPC	J	25
ANB5	PM-089-01.0-02.0	15-17085-ANB5AG	EPA 1613B	Total TCDD	73.8	pg/g	EMPC	J	25
ANB5	PM-089-01.0-02.0	15-17085-ANB5AG	EPA 1613B	Total TCDF	54.7	pg/g	EMPC	J	25
AND4	PM-013-00.0-01.0	15-17168-AND4B	EPA 1613B	1,2,3,4,7,8-HxCDF	0.353	pg/g	JEMPC	U	25
AND4	PM-013-00.0-01.0	15-17168-AND4B	EPA 1613B	1,2,3,7,8,9-HxCDD	0.894	pg/g	BJ	U	7
AND4	PM-013-00.0-01.0	15-17168-AND4B	EPA 1613B	1,2,3,7,8,9-HxCDF	0.3	pg/g	BJ	U	7
AND4	PM-013-00.0-01.0	15-17168-AND4B	EPA 1613B	2,3,4,6,7,8-HxCDF	0.392	pg/g	JEMPC	U	25
AND4	PM-013-00.0-01.0	15-17168-AND4B	EPA 1613B	2,3,7,8-TCDD	0.182	pg/g	JEMPC	U	25
AND4	PM-013-00.0-01.0	15-17168-AND4B	EPA 1613B	2,3,7,8-TCDF	0.163	pg/g	JEMPC	U	25
AND4	PM-013-00.0-01.0	15-17168-AND4B	EPA 1613B	OCDD	215	pg/g		J	13L
AND4	PM-013-00.0-01.0	15-17168-AND4B	EPA 1613B	OCDF	21.3	pg/g		J	13L
AND4	PM-013-00.0-01.0	15-17168-AND4B	EPA 1613B	Total HxCDD	8.31	pg/g	EMPC	J	25
AND4	PM-013-00.0-01.0	15-17168-AND4B	EPA 1613B	Total HxCDF	5.68	pg/g	EMPC	J	25
AND4	PM-013-00.0-01.0	15-17168-AND4B	EPA 1613B	Total PeCDD	2.67	pg/g	EMPC	J	25
AND4	PM-013-00.0-01.0	15-17168-AND4B	EPA 1613B	Total PeCDF	3.74	pg/g	EMPC	J	25
AND4	PM-013-00.0-01.0	15-17168-AND4B	EPA 1613B	Total TCDD	1.66	pg/g	EMPC	J	25
AND4	PM-013-00.0-01.0	15-17168-AND4B	EPA 1613B	Total TCDF	3.34	pg/g	EMPC	J	25
AND4	PM-014-00.0-01.0	15-17171-AND4E	EPA 1613B	1,2,3,7,8,9-HxCDF	0.863	pg/g	BJEMPC	U	25
AND4	PM-014-00.0-01.0	15-17171-AND4E	EPA 1613B	2,3,7,8-TCDD	0.556	pg/g	JEMPC	U	25
AND4	PM-014-00.0-01.0	15-17171-AND4E	EPA 1613B	2,3,7,8-TCDF	0.377	pg/g	JEMPC	U	25
AND4	PM-014-00.0-01.0	15-17171-AND4E	EPA 1613B	OCDD	8570	pg/g	E	J	13L,20
AND4	PM-014-00.0-01.0	15-17171-AND4E	EPA 1613B	OCDF	918	pg/g		J	13L
AND4	PM-014-00.0-01.0	15-17171-AND4E	EPA 1613B	Total HxCDD	164	pg/g	EMPC	J	25
AND4	PM-014-00.0-01.0	15-17171-AND4E	EPA 1613B	Total HxCDF	186	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AND4	PM-014-00.0-01.0	15-17171-AND4E	EPA 1613B	Total PeCDF	34.8	pg/g	EMPC	J	25
AND4	PM-014-00.0-01.0	15-17171-AND4E	EPA 1613B	Total TCDD	4.7	pg/g	EMPC	J	25
AND4	PM-014-00.0-01.0	15-17171-AND4E	EPA 1613B	Total TCDF	10.8	pg/g	EMPC	J	25
AND4	PM-014-00.0-01.0-D	15-17174-AND4H	EPA 1613B	1,2,3,4,6,7,8-HpCDD	977	pg/g		J	13L
AND4	PM-014-00.0-01.0-D	15-17174-AND4H	EPA 1613B	1,2,3,4,6,7,8-HpCDF	292	pg/g		J	13L
AND4	PM-014-00.0-01.0-D	15-17174-AND4H	EPA 1613B	1,2,3,4,7,8,9-HpCDF	9.06	pg/g		J	13L
AND4	PM-014-00.0-01.0-D	15-17174-AND4H	EPA 1613B	1,2,3,7,8,9-HxCDF	0.745	pg/g	BJEMPC	U	25
AND4	PM-014-00.0-01.0-D	15-17174-AND4H	EPA 1613B	1,2,3,7,8-PeCDF	0.362	pg/g	BJEMPC	U	25
AND4	PM-014-00.0-01.0-D	15-17174-AND4H	EPA 1613B	2,3,7,8-TCDD	0.517	pg/g	JEMPC	U	25
AND4	PM-014-00.0-01.0-D	15-17174-AND4H	EPA 1613B	OCDD	9860	pg/g	E	J	13L,20
AND4	PM-014-00.0-01.0-D	15-17174-AND4H	EPA 1613B	OCDF	1190	pg/g		J	13L
AND4	PM-014-00.0-01.0-D	15-17174-AND4H	EPA 1613B	Total HpCDF	986	pg/g	EMPC	J	25
AND4	PM-014-00.0-01.0-D	15-17174-AND4H	EPA 1613B	Total HxCDD	175	pg/g	EMPC	J	25
AND4	PM-014-00.0-01.0-D	15-17174-AND4H	EPA 1613B	Total HxCDF	207	pg/g	EMPC	J	25
AND4	PM-014-00.0-01.0-D	15-17174-AND4H	EPA 1613B	Total PeCDD	15.8	pg/g	EMPC	J	25
AND4	PM-014-00.0-01.0-D	15-17174-AND4H	EPA 1613B	Total PeCDF	31.1	pg/g	EMPC	J	25
AND4	PM-014-00.0-01.0-D	15-17174-AND4H	EPA 1613B	Total TCDD	4.46	pg/g	EMPC	J	25
AND4	PM-014-00.0-01.0-D	15-17174-AND4H	EPA 1613B	Total TCDF	7.51	pg/g	EMPC	J	25
AND4	PM-015-00.0-01.0	15-17176-AND4J	EPA 1613B	1,2,3,4,7,8,9-HpCDF	0.342	pg/g	BJEMPC	U	25
AND4	PM-015-00.0-01.0	15-17176-AND4J	EPA 1613B	1,2,3,6,7,8-HxCDF	0.457	pg/g	BJEMPC	U	25
AND4	PM-015-00.0-01.0	15-17176-AND4J	EPA 1613B	1,2,3,7,8,9-HxCDF	0.168	pg/g	BJEMPC	U	25
AND4	PM-015-00.0-01.0	15-17176-AND4J	EPA 1613B	1,2,3,7,8-PeCDF	0.326	pg/g	BJEMPC	U	25
AND4	PM-015-00.0-01.0	15-17176-AND4J	EPA 1613B	OCDD	197	pg/g		J	13L
AND4	PM-015-00.0-01.0	15-17176-AND4J	EPA 1613B	OCDF	17.7	pg/g		J	13L
AND4	PM-015-00.0-01.0	15-17176-AND4J	EPA 1613B	Total HpCDF	17	pg/g	EMPC	J	25
AND4	PM-015-00.0-01.0	15-17176-AND4J	EPA 1613B	Total HxCDF	11.8	pg/g	EMPC	J	25
AND4	PM-015-00.0-01.0	15-17176-AND4J	EPA 1613B	Total PeCDD	47.7	pg/g	EMPC	J	25
AND4	PM-015-00.0-01.0	15-17176-AND4J	EPA 1613B	Total PeCDF	17.1	pg/g	EMPC	J	25
AND4	PM-015-00.0-01.0	15-17176-AND4J	EPA 1613B	Total TCDD	44	pg/g	EMPC	J	25
AND4	PM-015-00.0-01.0	15-17176-AND4J	EPA 1613B	Total TCDF	12.4	pg/g	EMPC	J	25
AND4	PM-030-04.0-05.0	15-17184-AND4R	EPA 1613B	1,2,3,4,6,7,8-HpCDD	7.91	pg/g	B	U	7

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AND4	PM-030-04.0-05.0	15-17184-AND4R	EPA 1613B	1,2,3,4,6,7,8-HpCDF	1.8	pg/g	BJEMPC	U	25
AND4	PM-030-04.0-05.0	15-17184-AND4R	EPA 1613B	1,2,3,4,7,8,9-HpCDF	0.183	pg/g	BJEMPC	U	25
AND4	PM-030-04.0-05.0	15-17184-AND4R	EPA 1613B	1,2,3,4,7,8-HxCDD	0.303	pg/g	JEMPC	U	25
AND4	PM-030-04.0-05.0	15-17184-AND4R	EPA 1613B	1,2,3,6,7,8-HxCDD	0.495	pg/g	BJEMPC	U	25
AND4	PM-030-04.0-05.0	15-17184-AND4R	EPA 1613B	1,2,3,7,8,9-HxCDD	0.477	pg/g	BJEMPC	U	25
AND4	PM-030-04.0-05.0	15-17184-AND4R	EPA 1613B	1,2,3,7,8,9-HxCDF	0.56	pg/g	BJEMPC	U	25
AND4	PM-030-04.0-05.0	15-17184-AND4R	EPA 1613B	OCDD	78.7	pg/g	B	UJ	7,13L
AND4	PM-030-04.0-05.0	15-17184-AND4R	EPA 1613B	OCDF	6.39	pg/g	BJ	J	13L
AND4	PM-030-04.0-05.0	15-17184-AND4R	EPA 1613B	Total HpCDF	4.28	pg/g	EMPC	J	25
AND4	PM-030-04.0-05.0	15-17184-AND4R	EPA 1613B	Total HxCDD	5.01	pg/g	EMPC	J	25
AND4	PM-030-04.0-05.0	15-17184-AND4R	EPA 1613B	Total HxCDF	0.961	pg/g	EMPC	J	25
AND4	PM-037-04.0-05.0	15-17186-AND4T	EPA 1613B	1,2,3,4,7,8-HxCDD	0.347	pg/g	JEMPC	U	25
AND4	PM-037-04.0-05.0	15-17186-AND4T	EPA 1613B	1,2,3,4,7,8-HxCDF	0.223	pg/g	JEMPC	U	25
AND4	PM-037-04.0-05.0	15-17186-AND4T	EPA 1613B	1,2,3,6,7,8-HxCDF	0.166	pg/g	BJEMPC	U	25
AND4	PM-037-04.0-05.0	15-17186-AND4T	EPA 1613B	1,2,3,7,8,9-HxCDD	0.731	pg/g	BJ	U	7
AND4	PM-037-04.0-05.0	15-17186-AND4T	EPA 1613B	1,2,3,7,8,9-HxCDF	0.144	pg/g	BJEMPC	U	25
AND4	PM-037-04.0-05.0	15-17186-AND4T	EPA 1613B	1,2,3,7,8-PeCDD	0.335	pg/g	BJEMPC	U	25
AND4	PM-037-04.0-05.0	15-17186-AND4T	EPA 1613B	2,3,4,7,8-PeCDF	0.069	pg/g	BJEMPC	U	25
AND4	PM-037-04.0-05.0	15-17186-AND4T	EPA 1613B	2,3,7,8-TCDD	0.171	pg/g	JEMPC	U	25
AND4	PM-037-04.0-05.0	15-17186-AND4T	EPA 1613B	Total HxCDD	9.72	pg/g	EMPC	J	25
AND4	PM-037-04.0-05.0	15-17186-AND4T	EPA 1613B	Total HxCDF	6.07	pg/g	EMPC	J	25
AND4	PM-037-04.0-05.0	15-17186-AND4T	EPA 1613B	Total PeCDD	2.78	pg/g	EMPC	J	25
AND4	PM-037-04.0-05.0	15-17186-AND4T	EPA 1613B	Total PeCDF	1.33	pg/g	EMPC	J	25
AND4	PM-037-04.0-05.0	15-17186-AND4T	EPA 1613B	Total TCDD	1.69	pg/g	EMPC	J	25
AND4	PM-029-00.0-01.0	15-17188-AND4V	EPA 1613B	1,2,3,4,7,8,9-HpCDF	12.7	pg/g		J	13L
AND4	PM-029-00.0-01.0	15-17188-AND4V	EPA 1613B	1,2,3,7,8,9-HxCDF	1.39	pg/g	EMPC	U	25
AND4	PM-029-00.0-01.0	15-17188-AND4V	EPA 1613B	1,2,3,7,8-PeCDF	0.939	pg/g	JX	J	23
AND4	PM-029-00.0-01.0	15-17188-AND4V	EPA 1613B	OCDD	17100	pg/g	E	J	13L,20
AND4	PM-029-00.0-01.0	15-17188-AND4V	EPA 1613B	OCDF	1680	pg/g		J	13L
AND4	PM-029-00.0-01.0	15-17188-AND4V	EPA 1613B	Total HpCDF	1370	pg/g	EMPC	J	25
AND4	PM-029-00.0-01.0	15-17188-AND4V	EPA 1613B	Total HxCDF	285	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AND4	PM-029-00.0-01.0	15-17188-AND4V	EPA 1613B	Total PeCDD	67.9	pg/g	EMPC	J	25
AND4	PM-029-00.0-01.0	15-17188-AND4V	EPA 1613B	Total PeCDF	66.6	pg/g	EMPC	J	25
AND4	PM-029-00.0-01.0	15-17188-AND4V	EPA 1613B	Total TCDD	24.5	pg/g	EMPC	J	25
AND4	PM-029-00.0-01.0	15-17188-AND4V	EPA 1613B	Total TCDF	25.3	pg/g	EMPC	J	25
AND4	PM-021-00.0-01.0	15-17190-AND4X	EPA 1613B	1,2,3,4,6,7,8-HpCDD	534	pg/g		J	13L
AND4	PM-021-00.0-01.0	15-17190-AND4X	EPA 1613B	1,2,3,4,6,7,8-HpCDF	145	pg/g		J	13L
AND4	PM-021-00.0-01.0	15-17190-AND4X	EPA 1613B	1,2,3,4,7,8,9-HpCDF	4.58	pg/g		J	13L
AND4	PM-021-00.0-01.0	15-17190-AND4X	EPA 1613B	1,2,3,7,8-PeCDF	0.429	pg/g	BJX	J	23
AND4	PM-021-00.0-01.0	15-17190-AND4X	EPA 1613B	OCDD	5220	pg/g	E	J	13L,20
AND4	PM-021-00.0-01.0	15-17190-AND4X	EPA 1613B	OCDF	566	pg/g		J	13L
AND4	PM-021-00.0-01.0	15-17190-AND4X	EPA 1613B	Total HxCDF	105	pg/g	EMPC	J	25
AND4	PM-021-00.0-01.0	15-17190-AND4X	EPA 1613B	Total PeCDF	25.2	pg/g	EMPC	J	25
AND4	PM-021-00.0-01.0	15-17190-AND4X	EPA 1613B	Total TCDD	11.7	pg/g	EMPC	J	25
AND4	PM-021-00.0-01.0	15-17190-AND4X	EPA 1613B	Total TCDF	12.8	pg/g	EMPC	J	25
AND4	PM-020-01.0-02.0	15-17193-AND4AA	EPA 1613B	1,2,3,7,8,9-HxCDF	0.654	pg/g	BJEMPC	U	25
AND4	PM-020-01.0-02.0	15-17193-AND4AA	EPA 1613B	2,3,7,8-TCDD	0.787	pg/g	JEMPC	U	25
AND4	PM-020-01.0-02.0	15-17193-AND4AA	EPA 1613B	OCDD	4900	pg/g	E	J	20
AND4	PM-020-01.0-02.0	15-17193-AND4AA	EPA 1613B	Total HpCDF	465	pg/g	EMPC	J	25
AND4	PM-020-01.0-02.0	15-17193-AND4AA	EPA 1613B	Total HxCDD	128	pg/g	EMPC	J	25
AND4	PM-020-01.0-02.0	15-17193-AND4AA	EPA 1613B	Total HxCDF	109	pg/g	EMPC	J	25
AND4	PM-020-01.0-02.0	15-17193-AND4AA	EPA 1613B	Total PeCDD	26.1	pg/g	EMPC	J	25
AND4	PM-020-01.0-02.0	15-17193-AND4AA	EPA 1613B	Total PeCDF	31.4	pg/g	EMPC	J	25
AND4	PM-020-01.0-02.0	15-17193-AND4AA	EPA 1613B	Total TCDD	11.7	pg/g	EMPC	J	25
AND4	PM-020-01.0-02.0	15-17193-AND4AA	EPA 1613B	Total TCDF	13.8	pg/g	EMPC	J	25
AND4	PM-020-01.0-02.0-D	15-17196-AND4AD	EPA 1613B	1,2,3,4,7,8,9-HpCDF	5.8	pg/g	EMPC	U	25
AND4	PM-020-01.0-02.0-D	15-17196-AND4AD	EPA 1613B	1,2,3,7,8-PeCDF	0.453	pg/g	BJX	J	23
AND4	PM-020-01.0-02.0-D	15-17196-AND4AD	EPA 1613B	2,3,7,8-TCDD	0.687	pg/g	JEMPC	U	25
AND4	PM-020-01.0-02.0-D	15-17196-AND4AD	EPA 1613B	OCDD	5460	pg/g	E	J	20
AND4	PM-020-01.0-02.0-D	15-17196-AND4AD	EPA 1613B	Total HpCDF	516	pg/g	EMPC	J	25
AND4	PM-020-01.0-02.0-D	15-17196-AND4AD	EPA 1613B	Total HxCDF	120	pg/g	EMPC	J	25
AND4	PM-020-01.0-02.0-D	15-17196-AND4AD	EPA 1613B	Total PeCDF	34.9	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AND4	PM-020-01.0-02.0-D	15-17196-AND4AD	EPA 1613B	Total TCDD	12.7	pg/g	EMPC	J	25
AND4	PM-020-01.0-02.0-D	15-17196-AND4AD	EPA 1613B	Total TCDF	15	pg/g	EMPC	J	25
AND4	PM-019-00.0-01.0	15-17197-AND4AE	EPA 1613B	1,2,3,4,6,7,8-HpCDF	971	pg/g		J	13L
AND4	PM-019-00.0-01.0	15-17197-AND4AE	EPA 1613B	1,2,3,4,7,8,9-HpCDF	31.5	pg/g		J	13L
AND4	PM-019-00.0-01.0	15-17197-AND4AE	EPA 1613B	Total HpCDF	3460	pg/g	EMPC	J	25
AND4	PM-019-00.0-01.0	15-17197-AND4AE	EPA 1613B	Total HxCDF	698	pg/g	EMPC	J	25
AND4	PM-019-00.0-01.0	15-17197-AND4AE	EPA 1613B	Total PeCDD	231	pg/g	EMPC	J	25
AND4	PM-019-00.0-01.0	15-17197-AND4AE	EPA 1613B	Total PeCDF	144	pg/g	EMPC	J	25
AND4	PM-019-00.0-01.0	15-17197-AND4AE	EPA 1613B	Total TCDD	112	pg/g	EMPC	J	25
AND4	PM-019-00.0-01.0	15-17197-AND4AE	EPA 1613B	Total TCDF	67.7	pg/g	EMPC	J	25
AND4	PM-019-00.0-01.0	15-17197-AND4AEDL	EPA 1613B	1,2,3,4,6,7,8-HpCDD	4090	pg/g		J	13L
AND4	PM-019-00.0-01.0	15-17197-AND4AEDL	EPA 1613B	OCDD	42200	pg/g	E	J	13L,20
AND4	PM-019-00.0-01.0	15-17197-AND4AEDL	EPA 1613B	OCDF	4290	pg/g		J	13L
ANI4	PM-028-00.0-01.0	15-17483-ANI4A	EPA 1613B	1,2,3,6,7,8-HxCDF	4.2	pg/g	EMPC	U	25
ANI4	PM-028-00.0-01.0	15-17483-ANI4A	EPA 1613B	1,2,3,7,8-PeCDF	1	pg/g	XEMPC	U	25
ANI4	PM-028-00.0-01.0	15-17483-ANI4A	EPA 1613B	2,3,4,7,8-PeCDF	2.66	pg/g	EMPC	U	25
ANI4	PM-028-00.0-01.0	15-17483-ANI4A	EPA 1613B	OCDD	9180	pg/g	E	J	20
ANI4	PM-028-00.0-01.0	15-17483-ANI4A	EPA 1613B	Total HxCDD	241	pg/g	EMPC	J	25
ANI4	PM-028-00.0-01.0	15-17483-ANI4A	EPA 1613B	Total HxCDF	226	pg/g	EMPC	J	25
ANI4	PM-028-00.0-01.0	15-17483-ANI4A	EPA 1613B	Total PeCDF	88.7	pg/g	EMPC	J	25
ANI4	PM-028-00.0-01.0	15-17483-ANI4A	EPA 1613B	Total TCDD	16	pg/g	EMPC	J	25
ANI4	PM-028-00.0-01.0	15-17483-ANI4A	EPA 1613B	Total TCDF	53.3	pg/g	EMPC	J	25
ANI4	PM-027-00.0-01.0	15-17484-ANI4B	EPA 1613B	1,2,3,4,7,8-HxCDF	0.31	pg/g	JEMPC	U	25
ANI4	PM-027-00.0-01.0	15-17484-ANI4B	EPA 1613B	1,2,3,7,8,9-HxCDD	0.983	pg/g	BJEMPC	U	25
ANI4	PM-027-00.0-01.0	15-17484-ANI4B	EPA 1613B	2,3,7,8-TCDD	0.184	pg/g	JEMPC	U	25
ANI4	PM-027-00.0-01.0	15-17484-ANI4B	EPA 1613B	OCDD	320	pg/g		J	13L
ANI4	PM-027-00.0-01.0	15-17484-ANI4B	EPA 1613B	OCDF	29.5	pg/g		J	13L
ANI4	PM-027-00.0-01.0	15-17484-ANI4B	EPA 1613B	Total HxCDD	15.4	pg/g	EMPC	J	25
ANI4	PM-027-00.0-01.0	15-17484-ANI4B	EPA 1613B	Total HxCDF	8.03	pg/g	EMPC	J	25
ANI4	PM-027-00.0-01.0	15-17484-ANI4B	EPA 1613B	Total PeCDD	9.9	pg/g	EMPC	J	25
ANI4	PM-027-00.0-01.0	15-17484-ANI4B	EPA 1613B	Total PeCDF	4.14	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
ANI4	PM-027-00.0-01.0	15-17484-ANI4B	EPA 1613B	Total TCDD	8.26	pg/g	EMPC	J	25
ANI4	PM-027-00.0-01.0	15-17484-ANI4B	EPA 1613B	Total TCDF	2.81	pg/g	EMPC	J	25
ANI4	PM-026-00.0-01.0	15-17485-ANI4C	EPA 1613B	1,2,3,4,7,8,9-HpCDF	11.1	pg/g	EMPC	U	25
ANI4	PM-026-00.0-01.0	15-17485-ANI4C	EPA 1613B	1,2,3,6,7,8-HxCDF	4.62	pg/g	BJEMPC	U	25
ANI4	PM-026-00.0-01.0	15-17485-ANI4C	EPA 1613B	1,2,3,7,8-PeCDF	1.31	pg/g	BJEMPC	U	25
ANI4	PM-026-00.0-01.0	15-17485-ANI4C	EPA 1613B	2,3,7,8-TCDD	1.88	pg/g	JEMPC	U	25
ANI4	PM-026-00.0-01.0	15-17485-ANI4C	EPA 1613B	2,3,7,8-TCDF	0.479	pg/g	JEMPC	U	25
ANI4	PM-026-00.0-01.0	15-17485-ANI4C	EPA 1613B	Total HpCDF	1240	pg/g	EMPC	J	25
ANI4	PM-026-00.0-01.0	15-17485-ANI4C	EPA 1613B	Total HxCDD	161	pg/g	EMPC	J	25
ANI4	PM-026-00.0-01.0	15-17485-ANI4C	EPA 1613B	Total HxCDF	218	pg/g	EMPC	J	25
ANI4	PM-026-00.0-01.0	15-17485-ANI4C	EPA 1613B	Total PeCDD	14.3	pg/g	EMPC	J	25
ANI4	PM-026-00.0-01.0	15-17485-ANI4C	EPA 1613B	Total PeCDF	29.7	pg/g	EMPC	J	25
ANI4	PM-026-00.0-01.0	15-17485-ANI4C	EPA 1613B	Total TCDD	1.88	pg/g	EMPC	J	25
ANI4	PM-026-00.0-01.0	15-17485-ANI4C	EPA 1613B	Total TCDF	3.23	pg/g	EMPC	J	25
ANI4	PM-041-00.0-01.0	15-17486-ANI4D	EPA 1613B	1,2,3,4,7,8-HxCDF	24.7	pg/g	EMPC	U	25
ANI4	PM-041-00.0-01.0	15-17486-ANI4D	EPA 1613B	1,2,3,6,7,8-HxCDF	11.4	pg/g	EMPC	U	25
ANI4	PM-041-00.0-01.0	15-17486-ANI4D	EPA 1613B	2,3,7,8-TCDD	2.86	pg/g	JEMPC	U	25
ANI4	PM-041-00.0-01.0	15-17486-ANI4D	EPA 1613B	OCDD	42000	pg/g	E	J	20
ANI4	PM-041-00.0-01.0	15-17486-ANI4D	EPA 1613B	Total HxCDD	611	pg/g	EMPC	J	25
ANI4	PM-041-00.0-01.0	15-17486-ANI4D	EPA 1613B	Total HxCDF	955	pg/g	EMPC	J	25
ANI4	PM-041-00.0-01.0	15-17486-ANI4D	EPA 1613B	Total PeCDD	53.1	pg/g	EMPC	J	25
ANI4	PM-041-00.0-01.0	15-17486-ANI4D	EPA 1613B	Total PeCDF	113	pg/g	EMPC	J	25
ANI4	PM-041-00.0-01.0	15-17486-ANI4D	EPA 1613B	Total TCDD	14.8	pg/g	EMPC	J	25
ANI4	PM-041-00.0-01.0	15-17486-ANI4D	EPA 1613B	Total TCDF	15.1	pg/g	EMPC	J	25
ANI4	PM-036-02.0-03.0	15-17487-ANI4E	EPA 1613B	1,2,3,4,7,8,9-HpCDF	102	pg/g	EMPC	U	25
ANI4	PM-036-02.0-03.0	15-17487-ANI4E	EPA 1613B	1,2,3,7,8-PeCDF	3.56	pg/g	BJEMPC	U	25
ANI4	PM-036-02.0-03.0	15-17487-ANI4E	EPA 1613B	2,3,7,8-TCDD	9.44	pg/g	JEMPC	U	25
ANI4	PM-036-02.0-03.0	15-17487-ANI4E	EPA 1613B	OCDD	139000	pg/g	E	J	20
ANI4	PM-036-02.0-03.0	15-17487-ANI4E	EPA 1613B	Total HpCDF	12400	pg/g	EMPC	J	25
ANI4	PM-036-02.0-03.0	15-17487-ANI4E	EPA 1613B	Total PeCDF	275	pg/g	EMPC	J	25
ANI4	PM-036-02.0-03.0	15-17487-ANI4E	EPA 1613B	Total TCDD	157	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
ANI4	PM-036-02.0-03.0	15-17487-ANI4E	EPA 1613B	Total TCDF	53.3	pg/g	EMPC	J	25
ANI4	PM-036-02.0-03.0-D	15-17488-ANI4F	EPA 1613B	OCDD	167000	pg/g	E	J	20
ANI4	PM-036-02.0-03.0-D	15-17488-ANI4F	EPA 1613B	Total HpCDF	14400	pg/g	EMPC	J	25
ANI4	PM-036-02.0-03.0-D	15-17488-ANI4F	EPA 1613B	Total HxCDD	3210	pg/g	EMPC	J	25
ANI4	PM-036-02.0-03.0-D	15-17488-ANI4F	EPA 1613B	Total HxCDF	2600	pg/g	EMPC	J	25
ANI4	PM-036-02.0-03.0-D	15-17488-ANI4F	EPA 1613B	Total PeCDF	347	pg/g	EMPC	J	25
ANI4	PM-036-02.0-03.0-D	15-17488-ANI4F	EPA 1613B	Total TCDD	197	pg/g	EMPC	J	25
ANI4	PM-036-02.0-03.0-D	15-17488-ANI4F	EPA 1613B	Total TCDF	71.5	pg/g	EMPC	J	25
ANI4	PM-042-02.0-03.0	15-17489-ANI4G	EPA 1613B	2,3,4,6,7,8-HxCDF	3.01	pg/g	EMPC	U	25
ANI4	PM-042-02.0-03.0	15-17489-ANI4G	EPA 1613B	2,3,7,8-TCDD	0.232	pg/g	JEMPC	U	25
ANI4	PM-042-02.0-03.0	15-17489-ANI4G	EPA 1613B	Total HpCDF	1550	pg/g	EMPC	J	25
ANI4	PM-042-02.0-03.0	15-17489-ANI4G	EPA 1613B	Total HxCDD	94.3	pg/g	EMPC	J	25
ANI4	PM-042-02.0-03.0	15-17489-ANI4G	EPA 1613B	Total HxCDF	218	pg/g	EMPC	J	25
ANI4	PM-042-02.0-03.0	15-17489-ANI4G	EPA 1613B	Total PeCDD	2.33	pg/g	EMPC	J	25
ANI4	PM-042-02.0-03.0	15-17489-ANI4G	EPA 1613B	Total PeCDF	9.11	pg/g	EMPC	J	25
ANI4	PM-042-02.0-03.0	15-17489-ANI4G	EPA 1613B	Total TCDD	1.13	pg/g	EMPC	J	25
ANI4	PM-042-02.0-03.0	15-17489-ANI4G	EPA 1613B	Total TCDF	0.574	pg/g	EMPC	J	25
ANI4	PM-091-01.0-02.0	15-17490-ANI4H	EPA 1613B	1,2,3,4,7,8,9-HpCDF	1.45	pg/g	EMPC	U	25
ANI4	PM-091-01.0-02.0	15-17490-ANI4H	EPA 1613B	1,2,3,7,8-PeCDF	0.325	pg/g	JEMPC	U	25
ANI4	PM-091-01.0-02.0	15-17490-ANI4H	EPA 1613B	2,3,7,8-TCDD	0.243	pg/g	JEMPC	U	25
ANI4	PM-091-01.0-02.0	15-17490-ANI4H	EPA 1613B	Total HpCDF	120	pg/g	EMPC	J	25
ANI4	PM-091-01.0-02.0	15-17490-ANI4H	EPA 1613B	Total HxCDD	38.8	pg/g	EMPC	J	25
ANI4	PM-091-01.0-02.0	15-17490-ANI4H	EPA 1613B	Total HxCDF	77.4	pg/g	EMPC	J	25
ANI4	PM-091-01.0-02.0	15-17490-ANI4H	EPA 1613B	Total PeCDF	127	pg/g	EMPC	J	25
ANI4	PM-091-01.0-02.0	15-17490-ANI4H	EPA 1613B	Total TCDD	3.06	pg/g	EMPC	J	25
ANI4	PM-091-01.0-02.0	15-17490-ANI4H	EPA 1613B	Total TCDF	45.7	pg/g	EMPC	J	25
ANJ4	PM-057-12.0-13.0	15-17564-ANJ4A	NWTPHG	Gasoline Range Hydrocarbon	530	mg/kg	E	DNR	11
ANM6	PM-035-00.0-01.0	15-17741-ANM6B	EPA 1613B	1,2,3,6,7,8-HxCDF	3.04	pg/g	EMPC	U	25
ANM6	PM-035-00.0-01.0	15-17741-ANM6B	EPA 1613B	1,2,3,7,8,9-HxCDF	1.13	pg/g	EMPC	U	25
ANM6	PM-035-00.0-01.0	15-17741-ANM6B	EPA 1613B	2,3,4,7,8-PeCDF	0.762	pg/g	JEMPC	U	25
ANM6	PM-035-00.0-01.0	15-17741-ANM6B	EPA 1613B	2,3,7,8-TCDD	0.586	pg/g	JEMPC	U	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
ANM6	PM-035-00.0-01.0	15-17741-ANM6B	EPA 1613B	2,3,7,8-TCDF	0.217	pg/g	JEMPC	U	25
ANM6	PM-035-00.0-01.0	15-17741-ANM6B	EPA 1613B	OCDD	13100	pg/g	E	J	13L,20
ANM6	PM-035-00.0-01.0	15-17741-ANM6B	EPA 1613B	OCDF	1390	pg/g		J	13L
ANM6	PM-035-00.0-01.0	15-17741-ANM6B	EPA 1613B	Total HpCDF	1280	pg/g	EMPC	J	25
ANM6	PM-035-00.0-01.0	15-17741-ANM6B	EPA 1613B	Total HxCDF	256	pg/g	EMPC	J	25
ANM6	PM-035-00.0-01.0	15-17741-ANM6B	EPA 1613B	Total PeCDD	26.5	pg/g	EMPC	J	25
ANM6	PM-035-00.0-01.0	15-17741-ANM6B	EPA 1613B	Total PeCDF	31.9	pg/g	EMPC	J	25
ANM6	PM-035-00.0-01.0	15-17741-ANM6B	EPA 1613B	Total TCDD	9.07	pg/g	EMPC	J	25
ANM6	PM-035-00.0-01.0	15-17741-ANM6B	EPA 1613B	Total TCDF	8.25	pg/g	EMPC	J	25
ANM6	PM-035-00.0-01.0-D	15-17744-ANM6E	EPA 1613B	1,2,3,6,7,8-HxCDF	3.29	pg/g	EMPC	U	25
ANM6	PM-035-00.0-01.0-D	15-17744-ANM6E	EPA 1613B	1,2,3,7,8,9-HxCDF	1.2	pg/g	EMPC	U	25
ANM6	PM-035-00.0-01.0-D	15-17744-ANM6E	EPA 1613B	2,3,7,8-TCDD	0.614	pg/g	JEMPC	U	25
ANM6	PM-035-00.0-01.0-D	15-17744-ANM6E	EPA 1613B	OCDD	14300	pg/g	E	J	20
ANM6	PM-035-00.0-01.0-D	15-17744-ANM6E	EPA 1613B	Total HxCDD	261	pg/g	EMPC	J	25
ANM6	PM-035-00.0-01.0-D	15-17744-ANM6E	EPA 1613B	Total HxCDF	283	pg/g	EMPC	J	25
ANM6	PM-035-00.0-01.0-D	15-17744-ANM6E	EPA 1613B	Total PeCDD	32.9	pg/g	EMPC	J	25
ANM6	PM-035-00.0-01.0-D	15-17744-ANM6E	EPA 1613B	Total PeCDF	38.1	pg/g	EMPC	J	25
ANM6	PM-035-00.0-01.0-D	15-17744-ANM6E	EPA 1613B	Total TCDD	12.2	pg/g	EMPC	J	25
ANM6	PM-035-00.0-01.0-D	15-17744-ANM6E	EPA 1613B	Total TCDF	9.85	pg/g	EMPC	J	25
APY8	PM-012-00.0-01.0	15-20826-APY8A	EPA 1613B	1,2,3,7,8,9-HxCDF	13.8	pg/g	EMPC	U	25
APY8	PM-012-00.0-01.0	15-20826-APY8A	EPA 1613B	2,3,4,7,8-PeCDF	6.44	pg/g	JEMPC	U	25
APY8	PM-012-00.0-01.0	15-20826-APY8A	EPA 1613B	2,3,7,8-TCDD	8.91	pg/g	JEMPC	U	25
APY8	PM-012-00.0-01.0	15-20826-APY8A	EPA 1613B	OCDD	201000	pg/g	E	J	20
APY8	PM-012-00.0-01.0	15-20826-APY8A	EPA 1613B	Total HpCDD	37900	pg/g	EMPC	J	25
APY8	PM-012-00.0-01.0	15-20826-APY8A	EPA 1613B	Total HpCDF	22800	pg/g	EMPC	J	25
APY8	PM-012-00.0-01.0	15-20826-APY8A	EPA 1613B	Total HxCDF	3420	pg/g	EMPC	J	25
APY8	PM-012-00.0-01.0	15-20826-APY8A	EPA 1613B	Total PeCDD	141	pg/g	EMPC	J	25
APY8	PM-012-00.0-01.0	15-20826-APY8A	EPA 1613B	Total PeCDF	159	pg/g	EMPC	J	25
APY8	PM-012-00.0-01.0	15-20826-APY8A	EPA 1613B	Total TCDD	52.7	pg/g	EMPC	J	25
APY8	PM-012-00.0-01.0	15-20826-APY8A	EPA 1613B	Total TCDF	21.5	pg/g	EMPC	J	25
APY8	PM-019-01.0-02.0	15-20827-APY8B	EPA 1613B	1,2,3,7,8-PeCDF	0.878	pg/g	BJXEMPC	U	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
APY8	PM-019-01.0-02.0	15-20827-APY8B	EPA 1613B	2,3,7,8-TCDF	0.816	pg/g	JEMPC	U	25
APY8	PM-019-01.0-02.0	15-20827-APY8B	EPA 1613B	OCDD	18900	pg/g	E	J	20
APY8	PM-019-01.0-02.0	15-20827-APY8B	EPA 1613B	Total HpCDF	2870	pg/g	EMPC	J	25
APY8	PM-019-01.0-02.0	15-20827-APY8B	EPA 1613B	Total HxCDD	291	pg/g	EMPC	J	25
APY8	PM-019-01.0-02.0	15-20827-APY8B	EPA 1613B	Total HxCDF	454	pg/g	EMPC	J	25
APY8	PM-019-01.0-02.0	15-20827-APY8B	EPA 1613B	Total PeCDF	85.6	pg/g	EMPC	J	25
APY8	PM-019-01.0-02.0	15-20827-APY8B	EPA 1613B	Total TCDD	11.0	pg/g	EMPC	J	25
APY8	PM-019-01.0-02.0	15-20827-APY8B	EPA 1613B	Total TCDF	45.7	pg/g	EMPC	J	25
APY8	PM-018-00.0-01.0	15-20828-APY8C	EPA 1613B	1,2,3,4,7,8,9-HpCDF	3.97	pg/g		J	13L
APY8	PM-018-00.0-01.0	15-20828-APY8C	EPA 1613B	1,2,3,7,8,9-HxCDF	0.680	pg/g	BJEMPC	U	25
APY8	PM-018-00.0-01.0	15-20828-APY8C	EPA 1613B	1,2,3,7,8-PeCDF	0.386	pg/g	BJEMPC	U	25
APY8	PM-018-00.0-01.0	15-20828-APY8C	EPA 1613B	2,3,4,7,8-PeCDF	1.33	pg/g	EMPC	U	25
APY8	PM-018-00.0-01.0	15-20828-APY8C	EPA 1613B	2,3,7,8-TCDF	0.276	pg/g	BJEMPC	U	25
APY8	PM-018-00.0-01.0	15-20828-APY8C	EPA 1613B	OCDD	4310	pg/g	E	J	13L,20
APY8	PM-018-00.0-01.0	15-20828-APY8C	EPA 1613B	OCDF	476	pg/g		J	13L
APY8	PM-018-00.0-01.0	15-20828-APY8C	EPA 1613B	Total HpCDF	411	pg/g	EMPC	J	25
APY8	PM-018-00.0-01.0	15-20828-APY8C	EPA 1613B	Total HxCDD	99.8	pg/g	EMPC	J	25
APY8	PM-018-00.0-01.0	15-20828-APY8C	EPA 1613B	Total HxCDF	88.3	pg/g	EMPC	J	25
APY8	PM-018-00.0-01.0	15-20828-APY8C	EPA 1613B	Total PeCDF	22.1	pg/g	EMPC	J	25
APY8	PM-018-00.0-01.0	15-20828-APY8C	EPA 1613B	Total TCDD	9.03	pg/g	EMPC	J	25
APY8	PM-018-00.0-01.0	15-20828-APY8C	EPA 1613B	Total TCDF	8.90	pg/g	EMPC	J	25
APY8	PM-035-02.0-03.0	15-20829-APY8D	EPA 1613B	1,2,3,4,7,8,9-HpCDF	0.619	pg/g	BJEMPC	U	25
APY8	PM-035-02.0-03.0	15-20829-APY8D	EPA 1613B	1,2,3,4,7,8-HxCDF	0.374	pg/g	BJEMPC	U	25
APY8	PM-035-02.0-03.0	15-20829-APY8D	EPA 1613B	2,3,4,6,7,8-HxCDF	0.534	pg/g	JEMPC	U	25
APY8	PM-035-02.0-03.0	15-20829-APY8D	EPA 1613B	2,3,7,8-TCDD	0.183	pg/g	JEMPC	U	25
APY8	PM-035-02.0-03.0	15-20829-APY8D	EPA 1613B	2,3,7,8-TCDF	0.106	pg/g	BJEMPC	U	25
APY8	PM-035-02.0-03.0	15-20829-APY8D	EPA 1613B	Total HpCDF	62.4	pg/g	EMPC	J	25
APY8	PM-035-02.0-03.0	15-20829-APY8D	EPA 1613B	Total HxCDD	17.8	pg/g	EMPC	J	25
APY8	PM-035-02.0-03.0	15-20829-APY8D	EPA 1613B	Total HxCDF	15.3	pg/g	EMPC	J	25
APY8	PM-035-02.0-03.0	15-20829-APY8D	EPA 1613B	Total PeCDD	4.13	pg/g	EMPC	J	25
APY8	PM-035-02.0-03.0	15-20829-APY8D	EPA 1613B	Total PeCDF	7.47	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
APY8	PM-035-02.0-03.0	15-20829-APY8D	EPA 1613B	Total TCDD	2.62	pg/g	EMPC	J	25
APY8	PM-035-02.0-03.0	15-20829-APY8D	EPA 1613B	Total TCDF	3.00	pg/g	EMPC	J	25
APY8	PM-047-00.0-01.0	15-20830-APY8E	EPA 1613B	2,3,7,8-TCDD	4.97	pg/g	JEMPC	U	25
APY8	PM-047-00.0-01.0	15-20830-APY8E	EPA 1613B	OCDD	147000	pg/g	E	J	20
APY8	PM-047-00.0-01.0	15-20830-APY8E	EPA 1613B	Total HpCDF	14900	pg/g	EMPC	J	25
APY8	PM-047-00.0-01.0	15-20830-APY8E	EPA 1613B	Total HxCDF	2800	pg/g	EMPC	J	25
APY8	PM-047-00.0-01.0	15-20830-APY8E	EPA 1613B	Total PeCDF	367	pg/g	EMPC	J	25
APY8	PM-047-00.0-01.0	15-20830-APY8E	EPA 1613B	Total TCDD	25.5	pg/g	EMPC	J	25
APY8	PM-047-00.0-01.0	15-20830-APY8E	EPA 1613B	Total TCDF	105	pg/g	EMPC	J	25
APY8	PM-049-02.0-03.0	15-20831-APY8F	EPA 1613B	1,2,3,4,7,8,9-HpCDF	0.603	pg/g	BJEMPC	U	25
APY8	PM-049-02.0-03.0	15-20831-APY8F	EPA 1613B	1,2,3,4,7,8-HxCDD	0.324	pg/g	BJEMPC	U	25
APY8	PM-049-02.0-03.0	15-20831-APY8F	EPA 1613B	1,2,3,7,8-PeCDD	0.320	pg/g	BJEMPC	U	25
APY8	PM-049-02.0-03.0	15-20831-APY8F	EPA 1613B	2,3,4,6,7,8-HxCDF	0.148	pg/g	BJEMPC	U	25
APY8	PM-049-02.0-03.0	15-20831-APY8F	EPA 1613B	2,3,7,8-TCDD	0.322	pg/g	JEMPC	U	25
APY8	PM-049-02.0-03.0	15-20831-APY8F	EPA 1613B	OCDD	409	pg/g		J	13L
APY8	PM-049-02.0-03.0	15-20831-APY8F	EPA 1613B	OCDF	41.5	pg/g		J	13L
APY8	PM-049-02.0-03.0	15-20831-APY8F	EPA 1613B	Total HpCDD	83.0	pg/g	EMPC	J	25
APY8	PM-049-02.0-03.0	15-20831-APY8F	EPA 1613B	Total HpCDF	37.3	pg/g	EMPC	J	25
APY8	PM-049-02.0-03.0	15-20831-APY8F	EPA 1613B	Total HxCDD	10.3	pg/g	EMPC	J	25
APY8	PM-049-02.0-03.0	15-20831-APY8F	EPA 1613B	Total HxCDF	9.25	pg/g	EMPC	J	25
APY8	PM-049-02.0-03.0	15-20831-APY8F	EPA 1613B	Total PeCDD	2.54	pg/g	EMPC	J	25
APY8	PM-049-02.0-03.0	15-20831-APY8F	EPA 1613B	Total PeCDF	2.69	pg/g	EMPC	J	25
APY8	PM-049-02.0-03.0	15-20831-APY8F	EPA 1613B	Total TCDD	1.68	pg/g	EMPC	J	25
APY8	PM-049-02.0-03.0	15-20831-APY8F	EPA 1613B	Total TCDF	1.40	pg/g	EMPC	J	25
APY8	PM-062-11.0-12.0	15-20832-APY8G	EPA 1613B	1,2,3,7,8,9-HxCDF	4.41	pg/g	BJEMPC	U	25
APY8	PM-062-11.0-12.0	15-20832-APY8G	EPA 1613B	2,3,4,7,8-PeCDF	6.04	pg/g	EMPC	U	25
APY8	PM-062-11.0-12.0	15-20832-APY8G	EPA 1613B	2,3,7,8-TCDD	2.13	pg/g	JEMPC	U	25
APY8	PM-062-11.0-12.0	15-20832-APY8G	EPA 1613B	OCDD	43400	pg/g	E	J	20
APY8	PM-062-11.0-12.0	15-20832-APY8G	EPA 1613B	Total HpCDF	4400	pg/g	EMPC	J	25
APY8	PM-062-11.0-12.0	15-20832-APY8G	EPA 1613B	Total HxCDD	643	pg/g	EMPC	J	25
APY8	PM-062-11.0-12.0	15-20832-APY8G	EPA 1613B	Total HxCDF	812	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
APY8	PM-062-11.0-12.0	15-20832-APY8G	EPA 1613B	Total PeCDD	52.6	pg/g	EMPC	J	25
APY8	PM-062-11.0-12.0	15-20832-APY8G	EPA 1613B	Total PeCDF	106	pg/g	EMPC	J	25
APY8	PM-062-11.0-12.0	15-20832-APY8G	EPA 1613B	Total TCDD	13.6	pg/g	EMPC	J	25
APY8	PM-062-11.0-12.0	15-20832-APY8G	EPA 1613B	Total TCDF	29.7	pg/g	EMPC	J	25
APY8	PM-060-01.0-02.0	15-20833-APY8H	EPA 1613B	1,2,3,6,7,8-HxCDF	1.79	pg/g	EMPC	U	25
APY8	PM-060-01.0-02.0	15-20833-APY8H	EPA 1613B	1,2,3,7,8-PeCDD	0.812	pg/g	JEMPC	U	25
APY8	PM-060-01.0-02.0	15-20833-APY8H	EPA 1613B	2,3,4,7,8-PeCDF	1.10	pg/g	EMPC	U	25
APY8	PM-060-01.0-02.0	15-20833-APY8H	EPA 1613B	2,3,7,8-TCDD	0.287	pg/g	JEMPC	U	25
APY8	PM-060-01.0-02.0	15-20833-APY8H	EPA 1613B	2,3,7,8-TCDF	0.603	pg/g	BJEMPC	U	25
APY8	PM-060-01.0-02.0	15-20833-APY8H	EPA 1613B	OCDD	969	pg/g		J	13L
APY8	PM-060-01.0-02.0	15-20833-APY8H	EPA 1613B	OCDF	121	pg/g		J	13L
APY8	PM-060-01.0-02.0	15-20833-APY8H	EPA 1613B	Total HpCDF	200	pg/g	EMPC	J	25
APY8	PM-060-01.0-02.0	15-20833-APY8H	EPA 1613B	Total HxCDD	30.5	pg/g	EMPC	J	25
APY8	PM-060-01.0-02.0	15-20833-APY8H	EPA 1613B	Total HxCDF	60.9	pg/g	EMPC	J	25
APY8	PM-060-01.0-02.0	15-20833-APY8H	EPA 1613B	Total PeCDD	8.73	pg/g	EMPC	J	25
APY8	PM-060-01.0-02.0	15-20833-APY8H	EPA 1613B	Total PeCDF	26.7	pg/g	EMPC	J	25
APY8	PM-060-01.0-02.0	15-20833-APY8H	EPA 1613B	Total TCDD	5.95	pg/g	EMPC	J	25
APY8	PM-060-01.0-02.0	15-20833-APY8H	EPA 1613B	Total TCDF	17.1	pg/g	EMPC	J	25
APY8	PM-060-07.0-08.0	15-20834-APY8I	EPA 1613B	1,2,3,4,7,8,9-HpCDF	0.203	pg/g	BJEMPC	U	25
APY8	PM-060-07.0-08.0	15-20834-APY8I	EPA 1613B	1,2,3,4,7,8-HxCDD	0.165	pg/g	BJEMPC	U	25
APY8	PM-060-07.0-08.0	15-20834-APY8I	EPA 1613B	1,2,3,6,7,8-HxCDD	0.143	pg/g	BJEMPC	U	25
APY8	PM-060-07.0-08.0	15-20834-APY8I	EPA 1613B	1,2,3,7,8-PeCDD	0.145	pg/g	BJEMPC	U	25
APY8	PM-060-07.0-08.0	15-20834-APY8I	EPA 1613B	2,3,4,6,7,8-HxCDF	0.105	pg/g	BJEMPC	U	25
APY8	PM-060-07.0-08.0	15-20834-APY8I	EPA 1613B	OCDD	15.1	pg/g	B	U	7
APY8	PM-060-07.0-08.0	15-20834-APY8I	EPA 1613B	OCDF	1.33	pg/g	BJ	U	7
APY8	PM-060-07.0-08.0	15-20834-APY8I	EPA 1613B	Total HpCDD	3.38	pg/g	EMPC	J	25
APY8	PM-060-07.0-08.0	15-20834-APY8I	EPA 1613B	Total HpCDF	1.11	pg/g	EMPC	J	25
APY8	PM-060-07.0-08.0	15-20834-APY8I	EPA 1613B	Total HxCDD	1.09	pg/g	EMPC	J	25
APY8	PM-060-07.0-08.0	15-20834-APY8I	EPA 1613B	Total HxCDF	0.439	pg/g	EMPC	J	25
APY8	PM-060-07.0-08.0	15-20834-APY8I	EPA 1613B	Total PeCDD	0.263	pg/g	EMPC	J	25
APY8	PM-060-07.0-08.0	15-20834-APY8I	EPA 1613B	Total PeCDF	0.137	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
APY8	PM-060-07.0-08.0	15-20834-APY8I	EPA 1613B	Total TCDD	0.159	pg/g	EMPC	J	25
APY8	PM-060-07.0-08.0	15-20834-APY8I	EPA 1613B	Total TCDF	0.0567	pg/g	EMPC	J	25
APY8	PM-056-01.0-02.0	15-20835-APY8J	EPA 1613B	1,2,3,4,7,8,9-HpCDF	0.347	pg/g	BJEMPC	U	25
APY8	PM-056-01.0-02.0	15-20835-APY8J	EPA 1613B	1,2,3,6,7,8-HxCDD	0.517	pg/g	BJ	U	7
APY8	PM-056-01.0-02.0	15-20835-APY8J	EPA 1613B	1,2,3,6,7,8-HxCDF	0.194	pg/g	BJ	U	7
APY8	PM-056-01.0-02.0	15-20835-APY8J	EPA 1613B	1,2,3,7,8,9-HxCDD	0.497	pg/g	BJEMPC	U	25
APY8	PM-056-01.0-02.0	15-20835-APY8J	EPA 1613B	2,3,4,6,7,8-HxCDF	0.383	pg/g	BJEMPC	U	25
APY8	PM-056-01.0-02.0	15-20835-APY8J	EPA 1613B	2,3,7,8-TCDD	0.180	pg/g	JEMPC	U	25
APY8	PM-056-01.0-02.0	15-20835-APY8J	EPA 1613B	2,3,7,8-TCDF	0.0479	pg/g	BJEMPC	U	25
APY8	PM-056-01.0-02.0	15-20835-APY8J	EPA 1613B	OCDD	194	pg/g		J	13L
APY8	PM-056-01.0-02.0	15-20835-APY8J	EPA 1613B	OCDF	33.0	pg/g		J	13L
APY8	PM-056-01.0-02.0	15-20835-APY8J	EPA 1613B	Total HpCDD	40.7	pg/g	EMPC	J	25
APY8	PM-056-01.0-02.0	15-20835-APY8J	EPA 1613B	Total HpCDF	22.3	pg/g	EMPC	J	25
APY8	PM-056-01.0-02.0	15-20835-APY8J	EPA 1613B	Total HxCDD	5.22	pg/g	EMPC	J	25
APY8	PM-056-01.0-02.0	15-20835-APY8J	EPA 1613B	Total HxCDF	4.68	pg/g	EMPC	J	25
APY8	PM-056-01.0-02.0	15-20835-APY8J	EPA 1613B	Total PeCDD	0.844	pg/g	EMPC	J	25
APY8	PM-056-01.0-02.0	15-20835-APY8J	EPA 1613B	Total PeCDF	1.47	pg/g	EMPC	J	25
APY8	PM-056-01.0-02.0	15-20835-APY8J	EPA 1613B	Total TCDD	0.460	pg/g	EMPC	J	25
APY8	PM-056-01.0-02.0	15-20835-APY8J	EPA 1613B	Total TCDF	0.555	pg/g	EMPC	J	25
APY8	PM-056-07.0-08.0	15-20836-APY8K	EPA 1613B	1,2,3,6,7,8-HxCDD	0.179	pg/g	BJEMPC	U	25
APY8	PM-056-07.0-08.0	15-20836-APY8K	EPA 1613B	1,2,3,6,7,8-HxCDF	0.120	pg/g	BJ	U	7
APY8	PM-056-07.0-08.0	15-20836-APY8K	EPA 1613B	1,2,3,7,8,9-HxCDD	0.179	pg/g	BJEMPC	U	25
APY8	PM-056-07.0-08.0	15-20836-APY8K	EPA 1613B	1,2,3,7,8,9-HxCDF	0.0996	pg/g	BJEMPC	U	25
APY8	PM-056-07.0-08.0	15-20836-APY8K	EPA 1613B	2,3,4,6,7,8-HxCDF	0.0936	pg/g	BJEMPC	U	25
APY8	PM-056-07.0-08.0	15-20836-APY8K	EPA 1613B	OCDD	37.2	pg/g	B	U	7
APY8	PM-056-07.0-08.0	15-20836-APY8K	EPA 1613B	Total HpCDD	14.0	pg/g	EMPC	J	25
APY8	PM-056-07.0-08.0	15-20836-APY8K	EPA 1613B	Total HpCDF	6.03	pg/g	EMPC	J	25
APY8	PM-056-07.0-08.0	15-20836-APY8K	EPA 1613B	Total HxCDD	2.16	pg/g	EMPC	J	25
APY8	PM-056-07.0-08.0	15-20836-APY8K	EPA 1613B	Total HxCDF	1.84	pg/g	EMPC	J	25
APY8	PM-056-07.0-08.0	15-20836-APY8K	EPA 1613B	Total PeCDD	0.348	pg/g	EMPC	J	25
APY8	PM-056-07.0-08.0	15-20836-APY8K	EPA 1613B	Total PeCDF	0.377	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
APY8	PM-056-07.0-08.0	15-20836-APY8K	EPA 1613B	Total TCDD	0.0847	pg/g	EMPC	J	25
APY8	PM-056-07.0-08.0	15-20836-APY8K	EPA 1613B	Total TCDF	0.148	pg/g	EMPC	J	25
APY8	PM-043-02.0-03.0	15-20837-APY8L	EPA 1613B	1,2,3,4,7,8,9-HpCDF	15.1	pg/g		J	13L
APY8	PM-043-02.0-03.0	15-20837-APY8L	EPA 1613B	2,3,4,7,8-PeCDF	1.40	pg/g		J	13L
APY8	PM-043-02.0-03.0	15-20837-APY8L	EPA 1613B	2,3,7,8-TCDD	0.359	pg/g	JEMPC	U	25
APY8	PM-043-02.0-03.0	15-20837-APY8L	EPA 1613B	OCDD	22500	pg/g	E	J	20
APY8	PM-043-02.0-03.0	15-20837-APY8L	EPA 1613B	Total HpCDF	1990	pg/g	EMPC	J	25
APY8	PM-043-02.0-03.0	15-20837-APY8L	EPA 1613B	Total HxCDD	305	pg/g	EMPC	J	25
APY8	PM-043-02.0-03.0	15-20837-APY8L	EPA 1613B	Total PeCDD	22.7	pg/g	EMPC	J	25
APY8	PM-043-02.0-03.0	15-20837-APY8L	EPA 1613B	Total PeCDF	43.4	pg/g	EMPC	J	25
APY8	PM-043-02.0-03.0	15-20837-APY8L	EPA 1613B	Total TCDD	4.12	pg/g	EMPC	J	25
APY8	PM-043-02.0-03.0	15-20837-APY8L	EPA 1613B	Total TCDF	6.58	pg/g	EMPC	J	25
APY8	PM-055-01.0-02.0	15-20838-APY8M	EPA 1613B	1,2,3,4,7,8,9-HpCDF	13.3	pg/g		J	13L
APY8	PM-055-01.0-02.0	15-20838-APY8M	EPA 1613B	1,2,3,7,8,9-HxCDF	1.50	pg/g	EMPC	U	25
APY8	PM-055-01.0-02.0	15-20838-APY8M	EPA 1613B	OCDD	12700	pg/g	E	J	20
APY8	PM-055-01.0-02.0	15-20838-APY8M	EPA 1613B	Total HpCDF	1350	pg/g	EMPC	J	25
APY8	PM-055-01.0-02.0	15-20838-APY8M	EPA 1613B	Total HxCDD	364	pg/g	EMPC	J	25
APY8	PM-055-01.0-02.0	15-20838-APY8M	EPA 1613B	Total HxCDF	305	pg/g	EMPC	J	25
APY8	PM-055-01.0-02.0	15-20838-APY8M	EPA 1613B	Total PeCDF	106	pg/g	EMPC	J	25
APY8	PM-055-01.0-02.0	15-20838-APY8M	EPA 1613B	Total TCDD	26.6	pg/g	EMPC	J	25
APY8	PM-055-01.0-02.0	15-20838-APY8M	EPA 1613B	Total TCDF	42.5	pg/g	EMPC	J	25
APY8	PM-025-00.0-01.0	15-20839-APY8N	EPA 1613B	1,2,3,7,8,9-HxCDF	0.349	pg/g	BJEMPC	U	25
APY8	PM-025-00.0-01.0	15-20839-APY8N	EPA 1613B	1,2,3,7,8-PeCDF	0.404	pg/g	BJX	J	23H
APY8	PM-025-00.0-01.0	15-20839-APY8N	EPA 1613B	2,3,4,6,7,8-HxCDF	1.99	pg/g	EMPC	U	25
APY8	PM-025-00.0-01.0	15-20839-APY8N	EPA 1613B	2,3,7,8-TCDD	0.817	pg/g	JEMPC	U	25
APY8	PM-025-00.0-01.0	15-20839-APY8N	EPA 1613B	2,3,7,8-TCDF	0.398	pg/g	BJEMPC	U	25
APY8	PM-025-00.0-01.0	15-20839-APY8N	EPA 1613B	Total HxCDF	53.2	pg/g	EMPC	J	25
APY8	PM-025-00.0-01.0	15-20839-APY8N	EPA 1613B	Total PeCDD	15.7	pg/g	EMPC	J	25
APY8	PM-025-00.0-01.0	15-20839-APY8N	EPA 1613B	Total PeCDF	20.6	pg/g	EMPC	J	25
APY8	PM-025-00.0-01.0	15-20839-APY8N	EPA 1613B	Total TCDD	11.1	pg/g	EMPC	J	25
APY8	PM-025-00.0-01.0	15-20839-APY8N	EPA 1613B	Total TCDF	10.6	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
APY8	PM-041-01.0-02.0	15-20840-APY8O	EPA 1613B	1,2,3,7,8,9-HxCDF	1.19	pg/g	BEMPC	U	25
APY8	PM-041-01.0-02.0	15-20840-APY8O	EPA 1613B	2,3,7,8-TCDD	0.695	pg/g	JEMPC	U	25
APY8	PM-041-01.0-02.0	15-20840-APY8O	EPA 1613B	OCDD	11800	pg/g	E	J	20
APY8	PM-041-01.0-02.0	15-20840-APY8O	EPA 1613B	Total HpCDF	1090	pg/g	EMPC	J	25
APY8	PM-041-01.0-02.0	15-20840-APY8O	EPA 1613B	Total HxCDD	195	pg/g	EMPC	J	25
APY8	PM-041-01.0-02.0	15-20840-APY8O	EPA 1613B	Total HxCDF	225	pg/g	EMPC	J	25
APY8	PM-041-01.0-02.0	15-20840-APY8O	EPA 1613B	Total PeCDF	45.2	pg/g	EMPC	J	25
APY8	PM-041-01.0-02.0	15-20840-APY8O	EPA 1613B	Total TCDD	10.4	pg/g	EMPC	J	25
APY8	PM-041-01.0-02.0	15-20840-APY8O	EPA 1613B	Total TCDF	9.74	pg/g	EMPC	J	25
APY8	PM-072-23.0-24.0	15-20841-APY8P	EPA 1613B	1,2,3,4,7,8,9-HpCDF	1.05	pg/g		J	13L
APY8	PM-072-23.0-24.0	15-20841-APY8P	EPA 1613B	1,2,3,7,8-PeCDF	0.0653	pg/g	BJEMPC	U	25
APY8	PM-072-23.0-24.0	15-20841-APY8P	EPA 1613B	2,3,7,8-TCDD	0.277	pg/g	JEMPC	U	25
APY8	PM-072-23.0-24.0	15-20841-APY8P	EPA 1613B	OCDD	770	pg/g		J	13L
APY8	PM-072-23.0-24.0	15-20841-APY8P	EPA 1613B	OCDF	54.3	pg/g		J	13L
APY8	PM-072-23.0-24.0	15-20841-APY8P	EPA 1613B	Total HpCDF	62.0	pg/g	EMPC	J	25
APY8	PM-072-23.0-24.0	15-20841-APY8P	EPA 1613B	Total HxCDD	22.4	pg/g	EMPC	J	25
APY8	PM-072-23.0-24.0	15-20841-APY8P	EPA 1613B	Total PeCDD	4.19	pg/g	EMPC	J	25
APY8	PM-072-23.0-24.0	15-20841-APY8P	EPA 1613B	Total PeCDF	2.97	pg/g	EMPC	J	25
APY8	PM-072-23.0-24.0	15-20841-APY8P	EPA 1613B	Total TCDD	3.15	pg/g	EMPC	J	25
APY8	PM-072-23.0-24.0	15-20841-APY8P	EPA 1613B	Total TCDF	1.63	pg/g	EMPC	J	25
APY8	PM-072-25.0-26.0	15-20842-APY8Q	EPA 1613B	1,2,3,4,7,8,9-HpCDF	3.08	pg/g	EMPC	U	25
APY8	PM-072-25.0-26.0	15-20842-APY8Q	EPA 1613B	Total HpCDF	212	pg/g	EMPC	J	25
APY8	PM-072-25.0-26.0	15-20842-APY8Q	EPA 1613B	Total HxCDD	95.5	pg/g	EMPC	J	25
APY8	PM-072-25.0-26.0	15-20842-APY8Q	EPA 1613B	Total PeCDF	12.1	pg/g	EMPC	J	25
APY8	PM-072-25.0-26.0	15-20842-APY8Q	EPA 1613B	Total TCDD	14.5	pg/g	EMPC	J	25
APY8	PM-072-25.0-26.0	15-20842-APY8Q	EPA 1613B	Total TCDF	5.07	pg/g	EMPC	J	25
APY8	PM-073-23.0-24.0	15-20843-APY8R	EPA 1613B	1,2,3,7,8-PeCDF	0.354	pg/g	BJEMPC	U	25
APY8	PM-073-23.0-24.0	15-20843-APY8R	EPA 1613B	2,3,4,7,8-PeCDF	2.63	pg/g	EMPC	U	25
APY8	PM-073-23.0-24.0	15-20843-APY8R	EPA 1613B	2,3,7,8-TCDD	1.79	pg/g	EMPC	U	25
APY8	PM-073-23.0-24.0	15-20843-APY8R	EPA 1613B	2,3,7,8-TCDF	0.198	pg/g	BJEMPC	U	25
APY8	PM-073-23.0-24.0	15-20843-APY8R	EPA 1613B	OCDD	25900	pg/g	E	J	20

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
APY8	PM-073-23.0-24.0	15-20843-APY8R	EPA 1613B	Total HxCDF	620	pg/g	EMPC	J	25
APY8	PM-073-23.0-24.0	15-20843-APY8R	EPA 1613B	Total PeCDF	74.4	pg/g	EMPC	J	25
APY8	PM-073-23.0-24.0	15-20843-APY8R	EPA 1613B	Total TCDD	27.7	pg/g	EMPC	J	25
APY8	PM-073-23.0-24.0	15-20843-APY8R	EPA 1613B	Total TCDF	8.74	pg/g	EMPC	J	25
APY8	PM-073-25.0-26.0	15-20844-APY8S	EPA 1613B	1,2,3,4,7,8,9-HpCDF	15.3	pg/g		J	13L
APY8	PM-073-25.0-26.0	15-20844-APY8S	EPA 1613B	2,3,7,8-TCDD	0.916	pg/g	JEMPC	U	25
APY8	PM-073-25.0-26.0	15-20844-APY8S	EPA 1613B	2,3,7,8-TCDF	0.162	pg/g	BJEMPC	U	25
APY8	PM-073-25.0-26.0	15-20844-APY8S	EPA 1613B	OCDD	11400	pg/g	E	J	20
APY8	PM-073-25.0-26.0	15-20844-APY8S	EPA 1613B	Total HpCDF	1400	pg/g	EMPC	J	25
APY8	PM-073-25.0-26.0	15-20844-APY8S	EPA 1613B	Total HxCDF	269	pg/g	EMPC	J	25
APY8	PM-073-25.0-26.0	15-20844-APY8S	EPA 1613B	Total PeCDD	33.4	pg/g	EMPC	J	25
APY8	PM-073-25.0-26.0	15-20844-APY8S	EPA 1613B	Total PeCDF	35.3	pg/g	EMPC	J	25
APY8	PM-073-25.0-26.0	15-20844-APY8S	EPA 1613B	Total TCDD	14.8	pg/g	EMPC	J	25
APY8	PM-073-25.0-26.0	15-20844-APY8S	EPA 1613B	Total TCDF	4.00	pg/g	EMPC	J	25
APZ0	PM-075-01.0-02.0	15-20848-APZ0A	EPA 1613B	2,3,7,8-TCDF	0.421	pg/g	JEMPC	U	25
APZ0	PM-075-01.0-02.0	15-20848-APZ0A	EPA 1613B	Total HpCDF	6580	pg/g	EMPC	J	25
APZ0	PM-075-01.0-02.0	15-20848-APZ0A	EPA 1613B	Total HxCDD	1400	pg/g	EMPC	J	25
APZ0	PM-075-01.0-02.0	15-20848-APZ0A	EPA 1613B	Total HxCDF	1280	pg/g	EMPC	J	25
APZ0	PM-075-01.0-02.0	15-20848-APZ0A	EPA 1613B	Total PeCDF	205	pg/g	EMPC	J	25
APZ0	PM-075-01.0-02.0	15-20848-APZ0A	EPA 1613B	Total TCDD	49.4	pg/g	EMPC	J	25
APZ0	PM-075-01.0-02.0	15-20848-APZ0A	EPA 1613B	Total TCDF	33.4	pg/g	EMPC	J	25
APZ0	PM-075-01.0-02.0	15-20848-APZ0ADL	EPA 1613B	OCDD	67000	pg/g	E	J	20
APZ0	PM-075-07.0-08.0	15-20849-APZ0B	EPA 1613B	1,2,3,4,7,8-HxCDD	0.252	pg/g	BJEMPC	U	25
APZ0	PM-075-07.0-08.0	15-20849-APZ0B	EPA 1613B	1,2,3,4,7,8-HxCDF	0.236	pg/g	JEMPC	U	25
APZ0	PM-075-07.0-08.0	15-20849-APZ0B	EPA 1613B	1,2,3,6,7,8-HxCDF	0.113	pg/g	JEMPC	U	25
APZ0	PM-075-07.0-08.0	15-20849-APZ0B	EPA 1613B	1,2,3,7,8,9-HxCDD	0.512	pg/g	BJEMPC	U	25
APZ0	PM-075-07.0-08.0	15-20849-APZ0B	EPA 1613B	2,3,4,7,8-PeCDF	0.0879	pg/g	JEMPC	U	25
APZ0	PM-075-07.0-08.0	15-20849-APZ0B	EPA 1613B	OCDD	490	pg/g		J	13L
APZ0	PM-075-07.0-08.0	15-20849-APZ0B	EPA 1613B	OCDF	12.8	pg/g		J	13L
APZ0	PM-075-07.0-08.0	15-20849-APZ0B	EPA 1613B	Total HpCDF	9.77	pg/g	EMPC	J	25
APZ0	PM-075-07.0-08.0	15-20849-APZ0B	EPA 1613B	Total HxCDD	5.43	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
APZ0	PM-075-07.0-08.0	15-20849-APZ0B	EPA 1613B	Total HxCDF	1.97	pg/g	EMPC	J	25
APZ0	PM-075-07.0-08.0	15-20849-APZ0B	EPA 1613B	Total PeCDD	0.676	pg/g	EMPC	J	25
APZ0	PM-075-07.0-08.0	15-20849-APZ0B	EPA 1613B	Total PeCDF	0.402	pg/g	EMPC	J	25
APZ0	PM-075-07.0-08.0	15-20849-APZ0B	EPA 1613B	Total TCDD	346	pg/g	EMPC	J	25
APZ0	PM-075-07.0-08.0	15-20849-APZ0B	EPA 1613B	Total TCDF	2.32	pg/g	EMPC	J	25
APZ0	PM-064-11.0-12.0	15-20850-APZ0C	EPA 1613B	1,2,3,4,7,8-HxCDD	4.75	pg/g	BJEMPC	U	25
APZ0	PM-064-11.0-12.0	15-20850-APZ0C	EPA 1613B	1,2,3,4,7,8-HxCDF	8.12	pg/g	JEMPC	U	25
APZ0	PM-064-11.0-12.0	15-20850-APZ0C	EPA 1613B	1,2,3,6,7,8-HxCDF	9.55	pg/g	JEMPC	U	25
APZ0	PM-064-11.0-12.0	15-20850-APZ0C	EPA 1613B	1,2,3,7,8,9-HxCDF	6.98	pg/g	BJEMPC	U	25
APZ0	PM-064-11.0-12.0	15-20850-APZ0C	EPA 1613B	2,3,7,8-TCDD	3.94	pg/g	JEMPC	U	25
APZ0	PM-064-11.0-12.0	15-20850-APZ0C	EPA 1613B	2,3,7,8-TCDF	0.804	pg/g	JEMPC	U	25
APZ0	PM-064-11.0-12.0	15-20850-APZ0C	EPA 1613B	Total HxCDD	960	pg/g	EMPC	J	25
APZ0	PM-064-11.0-12.0	15-20850-APZ0C	EPA 1613B	Total HxCDF	476	pg/g	EMPC	J	25
APZ0	PM-064-11.0-12.0	15-20850-APZ0C	EPA 1613B	Total PeCDD	350	pg/g	EMPC	J	25
APZ0	PM-064-11.0-12.0	15-20850-APZ0C	EPA 1613B	Total PeCDF	201	pg/g	EMPC	J	25
APZ0	PM-064-11.0-12.0	15-20850-APZ0C	EPA 1613B	Total TCDD	179	pg/g	EMPC	J	25
APZ0	PM-064-11.0-12.0	15-20850-APZ0C	EPA 1613B	Total TCDF	62.5	pg/g	EMPC	J	25
APZ0	PM-058-07.0-08.0	15-20851-APZ0D	EPA 1613B	2,3,4,7,8-PeCDF	1.63	pg/g	EMPC	U	25
APZ0	PM-058-07.0-08.0	15-20851-APZ0D	EPA 1613B	OCDD	12500	pg/g	E	J	20
APZ0	PM-058-07.0-08.0	15-20851-APZ0D	EPA 1613B	Total HpCDF	1210	pg/g	EMPC	J	25
APZ0	PM-058-07.0-08.0	15-20851-APZ0D	EPA 1613B	Total HxCDD	330	pg/g	EMPC	J	25
APZ0	PM-058-07.0-08.0	15-20851-APZ0D	EPA 1613B	Total PeCDD	33.2	pg/g	EMPC	J	25
APZ0	PM-058-07.0-08.0	15-20851-APZ0D	EPA 1613B	Total PeCDF	33.3	pg/g	EMPC	J	25
APZ0	PM-058-07.0-08.0	15-20851-APZ0D	EPA 1613B	Total TCDD	22.9	pg/g	EMPC	J	25
APZ0	PM-058-07.0-08.0	15-20851-APZ0D	EPA 1613B	Total TCDF	4.39	pg/g	EMPC	J	25
APZ0	PM-098-19.0-20.0	15-20852-APZ0E	EPA 1613B	OCDD	8140	pg/g	E	J	20
APZ0	PM-098-19.0-20.0	15-20852-APZ0E	EPA 1613B	Total HpCDF	926	pg/g	EMPC	J	25
APZ0	PM-098-19.0-20.0	15-20852-APZ0E	EPA 1613B	Total HxCDF	206	pg/g	EMPC	J	25
APZ0	PM-098-19.0-20.0	15-20852-APZ0E	EPA 1613B	Total PeCDF	38.2	pg/g	EMPC	J	25
APZ0	PM-098-19.0-20.0	15-20852-APZ0E	EPA 1613B	Total TCDD	24.3	pg/g	EMPC	J	25
APZ0	PM-098-19.0-20.0	15-20852-APZ0E	EPA 1613B	Total TCDF	6.34	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
APZ0	PM-063-11.0-12.0	15-20853-APZ0F	EPA 1613B	2,3,7,8-TCDD	1.77	pg/g	EMPC	U	25
APZ0	PM-063-11.0-12.0	15-20853-APZ0F	EPA 1613B	OCDD	17100	pg/g	E	J	20
APZ0	PM-063-11.0-12.0	15-20853-APZ0F	EPA 1613B	Total HpCDF	1940	pg/g	EMPC	J	25
APZ0	PM-063-11.0-12.0	15-20853-APZ0F	EPA 1613B	Total HxCDD	669	pg/g	EMPC	J	25
APZ0	PM-063-11.0-12.0	15-20853-APZ0F	EPA 1613B	Total HxCDF	473	pg/g	EMPC	J	25
APZ0	PM-063-11.0-12.0	15-20853-APZ0F	EPA 1613B	Total PeCDD	95.5	pg/g	EMPC	J	25
APZ0	PM-063-11.0-12.0	15-20853-APZ0F	EPA 1613B	Total PeCDF	91.5	pg/g	EMPC	J	25
APZ0	PM-063-11.0-12.0	15-20853-APZ0F	EPA 1613B	Total TCDD	68.9	pg/g	EMPC	J	25
APZ0	PM-063-11.0-12.0	15-20853-APZ0F	EPA 1613B	Total TCDF	19.3	pg/g	EMPC	J	25
APZ0	PM-111-11.0-12.0	15-20854-APZ0G	EPA 1613B	1,2,3,7,8-PeCDF	1.18	pg/g	EMPC	U	25
APZ0	PM-111-11.0-12.0	15-20854-APZ0G	EPA 1613B	2,3,4,7,8-PeCDF	4.96	pg/g		J	13L
APZ0	PM-111-11.0-12.0	15-20854-APZ0G	EPA 1613B	Total HpCDF	3070	pg/g	EMPC	J	25
APZ0	PM-111-11.0-12.0	15-20854-APZ0G	EPA 1613B	Total HxCDF	832	pg/g	EMPC	J	25
APZ0	PM-111-11.0-12.0	15-20854-APZ0G	EPA 1613B	Total PeCDD	133	pg/g	EMPC	J	25
APZ0	PM-111-11.0-12.0	15-20854-APZ0G	EPA 1613B	Total PeCDF	236	pg/g	EMPC	J	25
APZ0	PM-111-11.0-12.0	15-20854-APZ0G	EPA 1613B	Total TCDD	43	pg/g	EMPC	J	25
APZ0	PM-111-11.0-12.0	15-20854-APZ0G	EPA 1613B	Total TCDF	56.7	pg/g	EMPC	J	25
APZ0	PM-107-09.0-10.0	15-20856-APZ0I	EPA 1613B	2,3,7,8-TCDD	0.835	pg/g	JEMPC	U	25
APZ0	PM-107-09.0-10.0	15-20856-APZ0I	EPA 1613B	2,3,7,8-TCDF	0.616	pg/g	JEMPC	U	25
APZ0	PM-107-09.0-10.0	15-20856-APZ0I	EPA 1613B	OCDD	14700	pg/g	E	J	20
APZ0	PM-107-09.0-10.0	15-20856-APZ0I	EPA 1613B	Total HpCDF	1450	pg/g	EMPC	J	25
APZ0	PM-107-09.0-10.0	15-20856-APZ0I	EPA 1613B	Total HxCDF	386	pg/g	EMPC	J	25
APZ0	PM-107-09.0-10.0	15-20856-APZ0I	EPA 1613B	Total PeCDD	63.7	pg/g	EMPC	J	25
APZ0	PM-107-09.0-10.0	15-20856-APZ0I	EPA 1613B	Total PeCDF	132	pg/g	EMPC	J	25
APZ0	PM-107-09.0-10.0	15-20856-APZ0I	EPA 1613B	Total TCDD	19.7	pg/g	EMPC	J	25
APZ0	PM-107-09.0-10.0	15-20856-APZ0I	EPA 1613B	Total TCDF	35.4	pg/g	EMPC	J	25
APZ0	PM-107-11.0-12.0	15-20857-APZ0J	EPA 1613B	1,2,3,4,7,8-HxCDD	1.36	pg/g	EMPC	U	25
APZ0	PM-107-11.0-12.0	15-20857-APZ0J	EPA 1613B	1,2,3,7,8,9-HxCDF	0.277	pg/g	BJEMPC	U	25
APZ0	PM-107-11.0-12.0	15-20857-APZ0J	EPA 1613B	1,2,3,7,8-PeCDF	0.263	pg/g	JEMPC	U	25
APZ0	PM-107-11.0-12.0	15-20857-APZ0J	EPA 1613B	2,3,7,8-TCDD	0.267	pg/g	JEMPC	U	25
APZ0	PM-107-11.0-12.0	15-20857-APZ0J	EPA 1613B	2,3,7,8-TCDF	0.244	pg/g	JEMPC	U	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
APZ0	PM-107-11.0-12.0	15-20857-APZ0J	EPA 1613B	Total HpCDF	171	pg/g	EMPC	J	25
APZ0	PM-107-11.0-12.0	15-20857-APZ0J	EPA 1613B	Total HxCDD	47.2	pg/g	EMPC	J	25
APZ0	PM-107-11.0-12.0	15-20857-APZ0J	EPA 1613B	Total HxCDF	54	pg/g	EMPC	J	25
APZ0	PM-107-11.0-12.0	15-20857-APZ0J	EPA 1613B	Total PeCDD	8.28	pg/g	EMPC	J	25
APZ0	PM-107-11.0-12.0	15-20857-APZ0J	EPA 1613B	Total PeCDF	22.2	pg/g	EMPC	J	25
APZ0	PM-107-11.0-12.0	15-20857-APZ0J	EPA 1613B	Total TCDD	3.43	pg/g	EMPC	J	25
APZ0	PM-107-11.0-12.0	15-20857-APZ0J	EPA 1613B	Total TCDF	8.19	pg/g	EMPC	J	25
APZ0	PM-096-01.0-02.0	15-20858-APZ0K	EPA 1613B	1,2,3,4,7,8-HxCDF	176	pg/g	EMPC	U	25
APZ0	PM-096-01.0-02.0	15-20858-APZ0K	EPA 1613B	2,3,7,8-TCDF	7.77	pg/g	JEMPC	U	25
APZ0	PM-096-01.0-02.0	15-20858-APZ0K	EPA 1613B	Total HpCDF	36900	pg/g	EMPC	J	25
APZ0	PM-096-01.0-02.0	15-20858-APZ0K	EPA 1613B	Total HxCDF	7520	pg/g	EMPC	J	25
APZ0	PM-096-01.0-02.0	15-20858-APZ0K	EPA 1613B	Total PeCDF	1320	pg/g	EMPC	J	25
APZ0	PM-096-01.0-02.0	15-20858-APZ0K	EPA 1613B	Total TCDF	456	pg/g	EMPC	J	25
APZ0	PM-096-01.0-02.0	15-20858-APZ0KDL	EPA 1613B	1,2,3,4,6,7,8-HpCDD	44800	pg/g		J	13L
APZ0	PM-096-01.0-02.0	15-20858-APZ0KDL	EPA 1613B	OCDD	427000	pg/g	E	J	13L,20
APZ0	PM-085-27.0-28.0	15-20859-APZ0L	EPA 1613B	1,2,3,4,7,8-HxCDD	6.35	pg/g	BJEMPC	U	25
APZ0	PM-085-27.0-28.0	15-20859-APZ0L	EPA 1613B	1,2,3,7,8-PeCDD	5.33	pg/g	BJEMPC	U	25
APZ0	PM-085-27.0-28.0	15-20859-APZ0L	EPA 1613B	2,3,7,8-TCDD	2.39	pg/g	JEMPC	U	25
APZ0	PM-085-27.0-28.0	15-20859-APZ0L	EPA 1613B	OCDD	74000	pg/g	E	J	20
APZ0	PM-085-27.0-28.0	15-20859-APZ0L	EPA 1613B	Total HpCDF	2760	pg/g	EMPC	J	25
APZ0	PM-085-27.0-28.0	15-20859-APZ0L	EPA 1613B	Total HxCDD	546	pg/g	EMPC	J	25
APZ0	PM-085-27.0-28.0	15-20859-APZ0L	EPA 1613B	Total HxCDF	542	pg/g	EMPC	J	25
APZ0	PM-085-27.0-28.0	15-20859-APZ0L	EPA 1613B	Total PeCDD	34.5	pg/g	EMPC	J	25
APZ0	PM-085-27.0-28.0	15-20859-APZ0L	EPA 1613B	Total TCDD	11.9	pg/g	EMPC	J	25
APZ0	PM-100-02.0-03.0	15-20860-APZ0M	EPA 1613B	1,2,3,7,8-PeCDF	6.57	pg/g	JEMPC	U	25
APZ0	PM-100-02.0-03.0	15-20860-APZ0M	EPA 1613B	Total HpCDF	49100	pg/g	EMPC	J	25
APZ0	PM-100-02.0-03.0	15-20860-APZ0M	EPA 1613B	Total HxCDD	8160	pg/g	EMPC	J	25
APZ0	PM-100-02.0-03.0	15-20860-APZ0M	EPA 1613B	Total HxCDF	10400	pg/g	EMPC	J	25
APZ0	PM-100-02.0-03.0	15-20860-APZ0M	EPA 1613B	Total PeCDD	672	pg/g	EMPC	J	25
APZ0	PM-100-02.0-03.0	15-20860-APZ0M	EPA 1613B	Total PeCDF	1290	pg/g	EMPC	J	25
APZ0	PM-100-02.0-03.0	15-20860-APZ0M	EPA 1613B	Total TCDD	251	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
APZ0	PM-100-02.0-03.0	15-20860-APZ0M	EPA 1613B	Total TCDF	160	pg/g	EMPC	J	25
APZ0	PM-100-02.0-03.0	15-20860-APZ0MDL	EPA 1613B	OCDD	451000	pg/g	E	J	20
APZ0	PM-078-01.0-02.0	15-20861-APZ0N	EPA 1613B	1,2,3,7,8-PeCDF	1.68	pg/g	X	J	23H
APZ0	PM-078-01.0-02.0	15-20861-APZ0N	EPA 1613B	Total HxCDD	1290	pg/g	EMPC	J	25
APZ0	PM-078-01.0-02.0	15-20861-APZ0N	EPA 1613B	Total PeCDD	156	pg/g	EMPC	J	25
APZ0	PM-078-01.0-02.0	15-20861-APZ0N	EPA 1613B	Total PeCDF	222	pg/g	EMPC	J	25
APZ0	PM-078-01.0-02.0	15-20861-APZ0N	EPA 1613B	Total TCDD	92.7	pg/g	EMPC	J	25
APZ0	PM-078-01.0-02.0	15-20861-APZ0N	EPA 1613B	Total TCDF	58	pg/g	EMPC	J	25
APZ0	PM-078-01.0-02.0	15-20861-APZ0NDL	EPA 1613B	OCDD	61400	pg/g	E	J	20
APZ0	PM-089-02.0-03.0	15-20862-APZ0O	EPA 1613B	1,2,3,4,7,8,9-HpCDF	1.09	pg/g		J	13L
APZ0	PM-089-02.0-03.0	15-20862-APZ0O	EPA 1613B	1,2,3,7,8-PeCDF	0.36	pg/g	JEMPC	U	25
APZ0	PM-089-02.0-03.0	15-20862-APZ0O	EPA 1613B	2,3,4,7,8-PeCDF	0.707	pg/g	JEMPC	U	25
APZ0	PM-089-02.0-03.0	15-20862-APZ0O	EPA 1613B	2,3,7,8-TCDF	0.152	pg/g	JEMPC	U	25
APZ0	PM-089-02.0-03.0	15-20862-APZ0O	EPA 1613B	OCDD	914	pg/g		J	13L
APZ0	PM-089-02.0-03.0	15-20862-APZ0O	EPA 1613B	OCDF	76.2	pg/g		J	13L
APZ0	PM-089-02.0-03.0	15-20862-APZ0O	EPA 1613B	Total HpCDF	89.7	pg/g	EMPC	J	25
APZ0	PM-089-02.0-03.0	15-20862-APZ0O	EPA 1613B	Total HxCDD	42.5	pg/g	EMPC	J	25
APZ0	PM-089-02.0-03.0	15-20862-APZ0O	EPA 1613B	Total HxCDF	44.3	pg/g	EMPC	J	25
APZ0	PM-089-02.0-03.0	15-20862-APZ0O	EPA 1613B	Total PeCDD	7.96	pg/g	EMPC	J	25
APZ0	PM-089-02.0-03.0	15-20862-APZ0O	EPA 1613B	Total PeCDF	28.2	pg/g	EMPC	J	25
APZ0	PM-089-02.0-03.0	15-20862-APZ0O	EPA 1613B	Total TCDD	3.14	pg/g	EMPC	J	25
APZ0	PM-089-02.0-03.0	15-20862-APZ0O	EPA 1613B	Total TCDF	10.8	pg/g	EMPC	J	25
APZ0	PM-102-02.0-03.0	15-20863-APZ0P	EPA 1613B	Total HpCDF	21300	pg/g	EMPC	J	25
APZ0	PM-102-02.0-03.0	15-20863-APZ0P	EPA 1613B	Total HxCDD	3060	pg/g	EMPC	J	25
APZ0	PM-102-02.0-03.0	15-20863-APZ0P	EPA 1613B	Total HxCDF	4230	pg/g	EMPC	J	25
APZ0	PM-102-02.0-03.0	15-20863-APZ0P	EPA 1613B	Total PeCDD	247	pg/g	EMPC	J	25
APZ0	PM-102-02.0-03.0	15-20863-APZ0P	EPA 1613B	Total PeCDF	613	pg/g	EMPC	J	25
APZ0	PM-102-02.0-03.0	15-20863-APZ0P	EPA 1613B	Total TCDD	55.5	pg/g	EMPC	J	25
APZ0	PM-102-02.0-03.0	15-20863-APZ0P	EPA 1613B	Total TCDF	77.6	pg/g	EMPC	J	25
APZ0	PM-102-02.0-03.0	15-20863-APZ0PDL	EPA 1613B	OCDD	208000	pg/g	E	J	13L,20
APZ0	PM-102-02.0-03.0	15-20863-APZ0PDL	EPA 1613B	OCDF	23700	pg/g		J	13L

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
APZ0	PM-108-04.0-05.0	15-20865-APZ0R	EPA 1613B	1,2,3,4,7,8,9-HpCDF	2.68	pg/g		J	13L
APZ0	PM-108-04.0-05.0	15-20865-APZ0R	EPA 1613B	1,2,3,4,7,8-HxCDF	1.77	pg/g	EMPC	U	25
APZ0	PM-108-04.0-05.0	15-20865-APZ0R	EPA 1613B	1,2,3,6,7,8-HxCDF	0.985	pg/g	EMPC	U	25
APZ0	PM-108-04.0-05.0	15-20865-APZ0R	EPA 1613B	1,2,3,7,8,9-HxCDF	0.457	pg/g	BJEMPC	U	25
APZ0	PM-108-04.0-05.0	15-20865-APZ0R	EPA 1613B	2,3,7,8-TCDD	0.359	pg/g	JEMPC	U	25
APZ0	PM-108-04.0-05.0	15-20865-APZ0R	EPA 1613B	2,3,7,8-TCDF	0.313	pg/g	JEMPC	U	25
APZ0	PM-108-04.0-05.0	15-20865-APZ0R	EPA 1613B	OCDD	2440	pg/g		J	13L
APZ0	PM-108-04.0-05.0	15-20865-APZ0R	EPA 1613B	OCDF	236	pg/g		J	13L
APZ0	PM-108-04.0-05.0	15-20865-APZ0R	EPA 1613B	Total HpCDF	235	pg/g	EMPC	J	25
APZ0	PM-108-04.0-05.0	15-20865-APZ0R	EPA 1613B	Total HxCDD	62.2	pg/g	EMPC	J	25
APZ0	PM-108-04.0-05.0	15-20865-APZ0R	EPA 1613B	Total HxCDF	61.4	pg/g	EMPC	J	25
APZ0	PM-108-04.0-05.0	15-20865-APZ0R	EPA 1613B	Total PeCDD	11.5	pg/g	EMPC	J	25
APZ0	PM-108-04.0-05.0	15-20865-APZ0R	EPA 1613B	Total PeCDF	22.7	pg/g	EMPC	J	25
APZ0	PM-108-04.0-05.0	15-20865-APZ0R	EPA 1613B	Total TCDD	8.62	pg/g	EMPC	J	25
APZ0	PM-108-04.0-05.0	15-20865-APZ0R	EPA 1613B	Total TCDF	12.2	pg/g	EMPC	J	25
ARI3	PM-006-00.0.0-01.0	15-22737-ARI3A	EPA 1613B	1,2,3,4,6,7,8-HpCDF	1950	pg/g		J	13L
ARI3	PM-006-00.0.0-01.0	15-22737-ARI3A	EPA 1613B	1,2,3,4,7,8,9-HpCDF	67	pg/g		J	13L
ARI3	PM-006-00.0.0-01.0	15-22737-ARI3A	EPA 1613B	1,2,3,6,7,8-HxCDF	18.6	pg/g	EMPC	U	25
ARI3	PM-006-00.0.0-01.0	15-22737-ARI3A	EPA 1613B	2,3,7,8-TCDD	4.15	pg/g	JEMPC	U	25
ARI3	PM-006-00.0.0-01.0	15-22737-ARI3A	EPA 1613B	OCDD	70700	pg/g	E	J	13L,20
ARI3	PM-006-00.0.0-01.0	15-22737-ARI3A	EPA 1613B	OCDF	9040	pg/g		J	13L
ARI3	PM-006-00.0.0-01.0	15-22737-ARI3A	EPA 1613B	Total HxCDF	1310	pg/g	EMPC	J	25
ARI3	PM-006-00.0.0-01.0	15-22737-ARI3A	EPA 1613B	Total PeCDF	163	pg/g	EMPC	J	25
ARI3	PM-006-00.0.0-01.0	15-22737-ARI3A	EPA 1613B	Total TCDD	23.5	pg/g	EMPC	J	25
ARI3	PM-006-00.0.0-01.0	15-22737-ARI3A	EPA 1613B	Total TCDF	79.4	pg/g	EMPC	J	25
ARI3	PM-011-00.0.0-01.0	15-22738-ARI3B	EPA 1613B	1,2,3,4,7,8,9-HpCDF	5.76	pg/g		J	13L
ARI3	PM-011-00.0.0-01.0	15-22738-ARI3B	EPA 1613B	1,2,3,4,7,8-HxCDD	1.68	pg/g	EMPC	U	25
ARI3	PM-011-00.0.0-01.0	15-22738-ARI3B	EPA 1613B	1,2,3,7,8-PeCDF	1.04	pg/g	X	J	23H
ARI3	PM-011-00.0.0-01.0	15-22738-ARI3B	EPA 1613B	2,3,7,8-TCDD	0.764	pg/g	JEMPC	U	25
ARI3	PM-011-00.0.0-01.0	15-22738-ARI3B	EPA 1613B	OCDD	1840	pg/g		J	13L
ARI3	PM-011-00.0.0-01.0	15-22738-ARI3B	EPA 1613B	OCDF	340	pg/g		J	13L

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
ARI3	PM-011-00.0.0-01.0	15-22738-ARI3B	EPA 1613B	Total HpCDF	358	pg/g	EMPC	J	25
ARI3	PM-011-00.0.0-01.0	15-22738-ARI3B	EPA 1613B	Total HxCDD	52.8	pg/g	EMPC	J	25
ARI3	PM-011-00.0.0-01.0	15-22738-ARI3B	EPA 1613B	Total HxCDF	91.5	pg/g	EMPC	J	25
ARI3	PM-011-00.0.0-01.0	15-22738-ARI3B	EPA 1613B	Total PeCDD	18.5	pg/g	EMPC	J	25
ARI3	PM-011-00.0.0-01.0	15-22738-ARI3B	EPA 1613B	Total PeCDF	33.1	pg/g	EMPC	J	25
ARI3	PM-011-00.0.0-01.0	15-22738-ARI3B	EPA 1613B	Total TCDD	14.8	pg/g	EMPC	J	25
ARI3	PM-011-00.0.0-01.0	15-22738-ARI3B	EPA 1613B	Total TCDF	36.5	pg/g	EMPC	J	25
ARI3	PM-012-01.0-02.0	15-22739-ARI3C	EPA 1613B	Total HpCDF	195	pg/g	EMPC	J	25
ARI3	PM-012-01.0-02.0	15-22739-ARI3C	EPA 1613B	Total HxCDD	107	pg/g	EMPC	J	25
ARI3	PM-012-01.0-02.0	15-22739-ARI3C	EPA 1613B	Total HxCDF	64.8	pg/g	EMPC	J	25
ARI3	PM-012-01.0-02.0	15-22739-ARI3C	EPA 1613B	Total PeCDD	39.9	pg/g	EMPC	J	25
ARI3	PM-012-01.0-02.0	15-22739-ARI3C	EPA 1613B	Total PeCDF	45.3	pg/g	EMPC	J	25
ARI3	PM-012-01.0-02.0	15-22739-ARI3C	EPA 1613B	Total TCDD	43.9	pg/g	EMPC	J	25
ARI3	PM-012-01.0-02.0	15-22739-ARI3C	EPA 1613B	Total TCDF	43.1	pg/g	EMPC	J	25
ARI3	PM-047-01.0-02.0	15-22740-ARI3D	EPA 1613B	1,2,3,4,7,8,9-HpCDF	28	pg/g	EMPC	U	25
ARI3	PM-047-01.0-02.0	15-22740-ARI3D	EPA 1613B	1,2,3,7,8,9-HxCDF	3.85	pg/g	EMPC	U	25
ARI3	PM-047-01.0-02.0	15-22740-ARI3D	EPA 1613B	2,3,7,8-TCDF	0.269	pg/g	JEMPC	U	25
ARI3	PM-047-01.0-02.0	15-22740-ARI3D	EPA 1613B	OCDD	15300	pg/g	E	J	20
ARI3	PM-047-01.0-02.0	15-22740-ARI3D	EPA 1613B	Total HpCDD	3130	pg/g	EMPC	J	25
ARI3	PM-047-01.0-02.0	15-22740-ARI3D	EPA 1613B	Total HpCDF	3400	pg/g	EMPC	J	25
ARI3	PM-047-01.0-02.0	15-22740-ARI3D	EPA 1613B	Total HxCDD	245	pg/g	EMPC	J	25
ARI3	PM-047-01.0-02.0	15-22740-ARI3D	EPA 1613B	Total HxCDF	609	pg/g	EMPC	J	25
ARI3	PM-047-01.0-02.0	15-22740-ARI3D	EPA 1613B	Total PeCDD	15.6	pg/g	EMPC	J	25
ARI3	PM-047-01.0-02.0	15-22740-ARI3D	EPA 1613B	Total PeCDF	68	pg/g	EMPC	J	25
ARI3	PM-047-01.0-02.0	15-22740-ARI3D	EPA 1613B	Total TCDD	4.01	pg/g	EMPC	J	25
ARI3	PM-047-01.0-02.0	15-22740-ARI3D	EPA 1613B	Total TCDF	15	pg/g	EMPC	J	25
ARI3	PM-052-00.0-01.0	15-22741-ARI3E	EPA 1613B	1,2,3,4,7,8,9-HpCDF	43	pg/g		J	13L
ARI3	PM-052-00.0-01.0	15-22741-ARI3E	EPA 1613B	2,3,4,7,8-PeCDF	5.79	pg/g		J	13L
ARI3	PM-052-00.0-01.0	15-22741-ARI3E	EPA 1613B	Total HpCDF	4560	pg/g	EMPC	J	25
ARI3	PM-052-00.0-01.0	15-22741-ARI3E	EPA 1613B	Total HxCDD	566	pg/g	EMPC	J	25
ARI3	PM-052-00.0-01.0	15-22741-ARI3E	EPA 1613B	Total HxCDF	908	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
ARI3	PM-052-00.0-01.0	15-22741-ARI3E	EPA 1613B	Total PeCDD	34.1	pg/g	EMPC	J	25
ARI3	PM-052-00.0-01.0	15-22741-ARI3E	EPA 1613B	Total PeCDF	123	pg/g	EMPC	J	25
ARI3	PM-052-00.0-01.0	15-22741-ARI3E	EPA 1613B	Total TCDD	8.72	pg/g	EMPC	J	25
ARI3	PM-052-00.0-01.0	15-22741-ARI3E	EPA 1613B	Total TCDF	56.9	pg/g	EMPC	J	25
ARI3	PM-090-01.0-02.0	15-22742-ARI3F	EPA 1613B	1,2,3,4,7,8,9-HpCDF	10.5	pg/g	EMPC	UJ	13L,25
ARI3	PM-090-01.0-02.0	15-22742-ARI3F	EPA 1613B	1,2,3,4,7,8-HxCDF	9.1	pg/g	EMPC	U	25
ARI3	PM-090-01.0-02.0	15-22742-ARI3F	EPA 1613B	1,2,3,6,7,8-HxCDF	4.17	pg/g	EMPC	U	25
ARI3	PM-090-01.0-02.0	15-22742-ARI3F	EPA 1613B	2,3,4,7,8-PeCDF	2.52	pg/g	EMPC	UJ	13L,25
ARI3	PM-090-01.0-02.0	15-22742-ARI3F	EPA 1613B	2,3,7,8-TCDD	0.701	pg/g	JEMPC	U	25
ARI3	PM-090-01.0-02.0	15-22742-ARI3F	EPA 1613B	OCDD	9580	pg/g	E	J	13L,20
ARI3	PM-090-01.0-02.0	15-22742-ARI3F	EPA 1613B	OCDF	925	pg/g		J	13L
ARI3	PM-090-01.0-02.0	15-22742-ARI3F	EPA 1613B	Total HpCDF	926	pg/g	EMPC	J	25
ARI3	PM-090-01.0-02.0	15-22742-ARI3F	EPA 1613B	Total HxCDD	192	pg/g	EMPC	J	25
ARI3	PM-090-01.0-02.0	15-22742-ARI3F	EPA 1613B	Total HxCDF	232	pg/g	EMPC	J	25
ARI3	PM-090-01.0-02.0	15-22742-ARI3F	EPA 1613B	Total PeCDD	30	pg/g	EMPC	J	25
ARI3	PM-090-01.0-02.0	15-22742-ARI3F	EPA 1613B	Total PeCDF	60.1	pg/g	EMPC	J	25
ARI3	PM-090-01.0-02.0	15-22742-ARI3F	EPA 1613B	Total TCDD	169	pg/g	EMPC	J	25
ARI3	PM-090-01.0-02.0	15-22742-ARI3F	EPA 1613B	Total TCDF	21.7	pg/g	EMPC	J	25
ARI3	PM-105-02.0-03.0	15-22743-ARI3G	EPA 1613B	1,2,3,4,6,7,8-HpCDD	80.5	pg/g		J	13L
ARI3	PM-105-02.0-03.0	15-22743-ARI3G	EPA 1613B	1,2,3,4,6,7,8-HpCDF	13.7	pg/g		J	13L
ARI3	PM-105-02.0-03.0	15-22743-ARI3G	EPA 1613B	1,2,3,4,7,8,9-HpCDF	0.616	pg/g	JEMPC	UJ	13L,25
ARI3	PM-105-02.0-03.0	15-22743-ARI3G	EPA 1613B	1,2,3,4,7,8-HxCDD	0.614	pg/g	JEMPC	U	25
ARI3	PM-105-02.0-03.0	15-22743-ARI3G	EPA 1613B	1,2,3,4,7,8-HxCDF	0.494	pg/g	JEMPC	U	25
ARI3	PM-105-02.0-03.0	15-22743-ARI3G	EPA 1613B	1,2,3,7,8,9-HxCDF	0.96	pg/g	BJEMPC	U	25
ARI3	PM-105-02.0-03.0	15-22743-ARI3G	EPA 1613B	1,2,3,7,8-PeCDD	0.634	pg/g	J	J	13L
ARI3	PM-105-02.0-03.0	15-22743-ARI3G	EPA 1613B	1,2,3,7,8-PeCDF	0.158	pg/g	JEMPC	UJ	13L,25
ARI3	PM-105-02.0-03.0	15-22743-ARI3G	EPA 1613B	2,3,4,7,8-PeCDF	0.259	pg/g	J	J	13L
ARI3	PM-105-02.0-03.0	15-22743-ARI3G	EPA 1613B	2,3,7,8-TCDD	0.276	pg/g	JEMPC	U	25
ARI3	PM-105-02.0-03.0	15-22743-ARI3G	EPA 1613B	OCDD	1190	pg/g		J	13L
ARI3	PM-105-02.0-03.0	15-22743-ARI3G	EPA 1613B	OCDF	49.5	pg/g		J	13L
ARI3	PM-105-02.0-03.0	15-22743-ARI3G	EPA 1613B	Total HpCDD	158	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
ARI3	PM-105-02.0-03.0	15-22743-ARI3G	EPA 1613B	Total HpCDF	48.2	pg/g	EMPC	J	25
ARI3	PM-105-02.0-03.0	15-22743-ARI3G	EPA 1613B	Total HxCDD	43.3	pg/g	EMPC	J	25
ARI3	PM-105-02.0-03.0	15-22743-ARI3G	EPA 1613B	Total HxCDF	16	pg/g	EMPC	J	25
ARI3	PM-105-02.0-03.0	15-22743-ARI3G	EPA 1613B	Total PeCDD	6.33	pg/g	EMPC	J	25
ARI3	PM-105-02.0-03.0	15-22743-ARI3G	EPA 1613B	Total PeCDF	10.8	pg/g	EMPC	J	25
ARI3	PM-105-02.0-03.0	15-22743-ARI3G	EPA 1613B	Total TCDD	4.51	pg/g	EMPC	J	25
ARI3	PM-105-02.0-03.0	15-22743-ARI3G	EPA 1613B	Total TCDF	4.21	pg/g	EMPC	J	25
ARI3	PM-088-01.0-02.0	15-22744-ARI3H	EPA 1613B	1,2,3,4,6,7,8-HpCDD	1.56	pg/g	B	U	7
ARI3	PM-088-01.0-02.0	15-22744-ARI3H	EPA 1613B	1,2,3,4,7,8,9-HpCDF	0.177	pg/g	U	UJ	13L
ARI3	PM-088-01.0-02.0	15-22744-ARI3H	EPA 1613B	1,2,3,7,8,9-HxCDD	0.124	pg/g	BJEMPC	U	25
ARI3	PM-088-01.0-02.0	15-22744-ARI3H	EPA 1613B	OCDD	19	pg/g	B	UJ	7,13L
ARI3	PM-088-01.0-02.0	15-22744-ARI3H	EPA 1613B	OCDF	1.75	pg/g	BJ	UJ	7,13L
ARI3	PM-088-01.0-02.0	15-22744-ARI3H	EPA 1613B	Total HpCDF	1.11	pg/g	EMPC	J	25
ARI3	PM-088-01.0-02.0	15-22744-ARI3H	EPA 1613B	Total HxCDD	0.385	pg/g	EMPC	J	25
ARI3	PM-088-01.0-02.0	15-22744-ARI3H	EPA 1613B	Total HxCDF	0.256	pg/g	EMPC	J	25
ARI3	PM-088-01.0-02.0	15-22744-ARI3H	EPA 1613B	Total PeCDF	0.357	pg/g	EMPC	J	25
ARI3	PM-088-01.0-02.0	15-22744-ARI3H	EPA 1613B	Total TCDF	0.144	pg/g	EMPC	J	25
ARI3	PM-088-09.0-10.0	15-22745-ARI3I	EPA 1613B	1,2,3,4,6,7,8-HpCDD	4.67	pg/g	B	UJ	7,13L
ARI3	PM-088-09.0-10.0	15-22745-ARI3I	EPA 1613B	1,2,3,4,6,7,8-HpCDF	4.18	pg/g		J	13L
ARI3	PM-088-09.0-10.0	15-22745-ARI3I	EPA 1613B	1,2,3,4,7,8,9-HpCDF	1.82	pg/g		J	13L
ARI3	PM-088-09.0-10.0	15-22745-ARI3I	EPA 1613B	1,2,3,6,7,8-HxCDD	0.321	pg/g	JEMPC	U	25
ARI3	PM-088-09.0-10.0	15-22745-ARI3I	EPA 1613B	1,2,3,7,8,9-HxCDD	0.234	pg/g	BJEMPC	U	25
ARI3	PM-088-09.0-10.0	15-22745-ARI3I	EPA 1613B	1,2,3,7,8,9-HxCDF	1.16	pg/g	B	J	13L
ARI3	PM-088-09.0-10.0	15-22745-ARI3I	EPA 1613B	1,2,3,7,8-PeCDD	0.0958	pg/g	JEMPC	UJ	13L,25
ARI3	PM-088-09.0-10.0	15-22745-ARI3I	EPA 1613B	1,2,3,7,8-PeCDF	3.57	pg/g		J	13L
ARI3	PM-088-09.0-10.0	15-22745-ARI3I	EPA 1613B	2,3,4,6,7,8-HxCDF	0.321	pg/g	JEMPC	U	25
ARI3	PM-088-09.0-10.0	15-22745-ARI3I	EPA 1613B	2,3,4,7,8-PeCDF	1.41	pg/g		J	13L
ARI3	PM-088-09.0-10.0	15-22745-ARI3I	EPA 1613B	2,3,7,8-TCDD	0.2	pg/g	JEMPC	U	25
ARI3	PM-088-09.0-10.0	15-22745-ARI3I	EPA 1613B	OCDD	34.4	pg/g	B	UJ	7,13L
ARI3	PM-088-09.0-10.0	15-22745-ARI3I	EPA 1613B	OCDF	9.75	pg/g	B	UJ	7,13L
ARI3	PM-088-09.0-10.0	15-22745-ARI3I	EPA 1613B	Total HxCDD	3.52	pg/g	EMPC	J	25

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
ARI3	PM-088-09.0-10.0	15-22745-ARI3I	EPA 1613B	Total HxCDF	14.7	pg/g	EMPC	J	25
ARI3	PM-088-09.0-10.0	15-22745-ARI3I	EPA 1613B	Total PeCDD	0.401	pg/g	EMPC	J	25
ARI3	PM-088-09.0-10.0	15-22745-ARI3I	EPA 1613B	Total PeCDF	11	pg/g	EMPC	J	25
ARI3	PM-088-09.0-10.0	15-22745-ARI3I	EPA 1613B	Total TCDD	1.15	pg/g	EMPC	J	25
ARI3	PM-088-09.0-10.0	15-22745-ARI3I	EPA 1613B	Total TCDF	6.78	pg/g	EMPC	J	25
ARJ1	PM-109-09.0-10.0	15-22791-ARJ1A	EPA 1613B	Total HxCDD	451	pg/g	EMPC	J	25
ARJ1	PM-109-09.0-10.0	15-22791-ARJ1A	EPA 1613B	Total HxCDF	443	pg/g	EMPC	J	25
ARJ1	PM-109-09.0-10.0	15-22791-ARJ1A	EPA 1613B	Total PeCDD	55.2	pg/g	EMPC	J	25
ARJ1	PM-109-09.0-10.0	15-22791-ARJ1A	EPA 1613B	Total PeCDF	106	pg/g	EMPC	J	25
ARJ1	PM-109-09.0-10.0	15-22791-ARJ1A	EPA 1613B	Total TCDD	15.8	pg/g	EMPC	J	25
ARJ1	PM-109-09.0-10.0	15-22791-ARJ1A	EPA 1613B	Total TCDF	31.5	pg/g	EMPC	J	25
ARJ1	PM-109-09.0-10.0-D	15-22792-ARJ1B	EPA 1613B	1,2,3,7,8-PeCDF	1.02	pg/g	X	J	23H
ARJ1	PM-109-09.0-10.0-D	15-22792-ARJ1B	EPA 1613B	2,3,7,8-TCDD	1.36	pg/g	EMPC	U	25
ARJ1	PM-109-09.0-10.0-D	15-22792-ARJ1B	EPA 1613B	2,3,7,8-TCDF	0.975	pg/g	JEMPC	U	25
ARJ1	PM-109-09.0-10.0-D	15-22792-ARJ1B	EPA 1613B	Total HpCDF	2190	pg/g	EMPC	J	25
ARJ1	PM-109-09.0-10.0-D	15-22792-ARJ1B	EPA 1613B	Total HxCDF	511	pg/g	EMPC	J	25
ARJ1	PM-109-09.0-10.0-D	15-22792-ARJ1B	EPA 1613B	Total PeCDD	59.1	pg/g	EMPC	J	25
ARJ1	PM-109-09.0-10.0-D	15-22792-ARJ1B	EPA 1613B	Total PeCDF	109	pg/g	EMPC	J	25
ARJ1	PM-109-09.0-10.0-D	15-22792-ARJ1B	EPA 1613B	Total TCDD	16.2	pg/g	EMPC	J	25
ARJ1	PM-109-09.0-10.0-D	15-22792-ARJ1B	EPA 1613B	Total TCDF	31.7	pg/g	EMPC	J	25
ARJ1	PM-104-04.0-05.0	15-22793-ARJ1C	EPA 1613B	1,2,3,4,7,8,9-HpCDF	228	pg/g		J	13L
ARJ1	PM-104-04.0-05.0	15-22793-ARJ1C	EPA 1613B	1,2,3,7,8,9-HxCDF	31.5	pg/g		J	13L
ARJ1	PM-104-04.0-05.0	15-22793-ARJ1C	EPA 1613B	1,2,3,7,8-PeCDD	264	pg/g		J	13L
ARJ1	PM-104-04.0-05.0	15-22793-ARJ1C	EPA 1613B	1,2,3,7,8-PeCDF	13.5	pg/g		J	13L
ARJ1	PM-104-04.0-05.0	15-22793-ARJ1C	EPA 1613B	2,3,7,8-TCDF	2.47	pg/g	JEMPC	U	25
ARJ1	PM-104-04.0-05.0	15-22793-ARJ1C	EPA 1613B	Total HpCDF	21200	pg/g	EMPC	J	25
ARJ1	PM-104-04.0-05.0	15-22793-ARJ1C	EPA 1613B	Total HxCDD	10000	pg/g	EMPC	J	25
ARJ1	PM-104-04.0-05.0	15-22793-ARJ1C	EPA 1613B	Total HxCDF	5280	pg/g	EMPC	J	25
ARJ1	PM-104-04.0-05.0	15-22793-ARJ1C	EPA 1613B	Total PeCDD	3210	pg/g	EMPC	J	25
ARJ1	PM-104-04.0-05.0	15-22793-ARJ1C	EPA 1613B	Total PeCDF	1200	pg/g	EMPC	J	25
ARJ1	PM-104-04.0-05.0	15-22793-ARJ1C	EPA 1613B	Total TCDF	271	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
ARJ1	PM-104-04.0-05.0	15-22793-ARJ1CDL	EPA 1613B	OCDD	263000	pg/g	E	J	20
ARJ1	PM-098-04.0-05.0	15-22794-ARJ1D	EPA 1613B	2,3,7,8-TCDF	1.23	pg/g	EMPC	U	25
ARJ1	PM-098-04.0-05.0	15-22794-ARJ1D	EPA 1613B	Total HpCDD	13500	pg/g	EMPC	J	25
ARJ1	PM-098-04.0-05.0	15-22794-ARJ1D	EPA 1613B	Total HpCDF	6270	pg/g	EMPC	J	25
ARJ1	PM-098-04.0-05.0	15-22794-ARJ1D	EPA 1613B	Total HxCDD	1320	pg/g	EMPC	J	25
ARJ1	PM-098-04.0-05.0	15-22794-ARJ1D	EPA 1613B	Total HxCDF	1400	pg/g	EMPC	J	25
ARJ1	PM-098-04.0-05.0	15-22794-ARJ1D	EPA 1613B	Total PeCDF	283	pg/g	EMPC	J	25
ARJ1	PM-098-04.0-05.0	15-22794-ARJ1D	EPA 1613B	Total TCDD	33.6	pg/g	EMPC	J	25
ARJ1	PM-098-04.0-05.0	15-22794-ARJ1D	EPA 1613B	Total TCDF	58.9	pg/g	EMPC	J	25
ARJ1	PM-098-04.0-05.0	15-22794-ARJ1DDL	EPA 1613B	OCDD	69500	pg/g	E	J	20
ARJ1	PM-114-09.0-10.0	15-22795-ARJ1E	EPA 1613B	1,2,3,4,6,7,8-HpCDD	15.8	pg/g		J	13L
ARJ1	PM-114-09.0-10.0	15-22795-ARJ1E	EPA 1613B	1,2,3,4,6,7,8-HpCDF	3.08	pg/g		J	13L
ARJ1	PM-114-09.0-10.0	15-22795-ARJ1E	EPA 1613B	1,2,3,4,7,8,9-HpCDF	0.238	pg/g	U	UJ	13L
ARJ1	PM-114-09.0-10.0	15-22795-ARJ1E	EPA 1613B	1,2,3,4,7,8-HxCDF	0.161	pg/g	JEMPC	U	25
ARJ1	PM-114-09.0-10.0	15-22795-ARJ1E	EPA 1613B	1,2,3,6,7,8-HxCDD	0.669	pg/g	BJEMPC	U	25
ARJ1	PM-114-09.0-10.0	15-22795-ARJ1E	EPA 1613B	1,2,3,7,8,9-HxCDF	0.131	pg/g	U	UJ	13L
ARJ1	PM-114-09.0-10.0	15-22795-ARJ1E	EPA 1613B	1,2,3,7,8-PeCDD	0.218	pg/g	JEMPC	UJ	13L,25
ARJ1	PM-114-09.0-10.0	15-22795-ARJ1E	EPA 1613B	1,2,3,7,8-PeCDF	0.109	pg/g	JEMPC	UJ	13L,25
ARJ1	PM-114-09.0-10.0	15-22795-ARJ1E	EPA 1613B	2,3,4,6,7,8-HxCDF	0.181	pg/g	JEMPC	U	25
ARJ1	PM-114-09.0-10.0	15-22795-ARJ1E	EPA 1613B	2,3,7,8-TCDD	0.195	pg/g	JEMPC	U	25
ARJ1	PM-114-09.0-10.0	15-22795-ARJ1E	EPA 1613B	OCDD	161	pg/g		J	13L
ARJ1	PM-114-09.0-10.0	15-22795-ARJ1E	EPA 1613B	OCDF	11.9	pg/g		J	13L
ARJ1	PM-114-09.0-10.0	15-22795-ARJ1E	EPA 1613B	Total HpCDF	9.12	pg/g	EMPC	J	25
ARJ1	PM-114-09.0-10.0	15-22795-ARJ1E	EPA 1613B	Total HxCDD	7.31	pg/g	EMPC	J	25
ARJ1	PM-114-09.0-10.0	15-22795-ARJ1E	EPA 1613B	Total HxCDF	2.86	pg/g	EMPC	J	25
ARJ1	PM-114-09.0-10.0	15-22795-ARJ1E	EPA 1613B	Total PeCDD	3.99	pg/g	EMPC	J	25
ARJ1	PM-114-09.0-10.0	15-22795-ARJ1E	EPA 1613B	Total PeCDF	1.57	pg/g	EMPC	J	25
ARJ1	PM-114-09.0-10.0	15-22795-ARJ1E	EPA 1613B	Total TCDD	3.47	pg/g	EMPC	J	25
ARJ1	PM-114-09.0-10.0	15-22795-ARJ1E	EPA 1613B	Total TCDF	15.2	pg/g	EMPC	J	25
ARJ1	PM-102-04.0-05.0	15-22796-ARJ1F	EPA 1613B	1,2,3,7,8-PeCDF	3.85	pg/g	X	J	23H
ARJ1	PM-102-04.0-05.0	15-22796-ARJ1F	EPA 1613B	Total HpCDF	11600	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
ARJ1	PM-102-04.0-05.0	15-22796-ARJ1F	EPA 1613B	Total PeCDD	172	pg/g	EMPC	J	25
ARJ1	PM-102-04.0-05.0	15-22796-ARJ1F	EPA 1613B	Total PeCDF	390	pg/g	EMPC	J	25
ARJ1	PM-102-04.0-05.0	15-22796-ARJ1F	EPA 1613B	Total TCDD	41.1	pg/g	EMPC	J	25
ARJ1	PM-102-04.0-05.0	15-22796-ARJ1F	EPA 1613B	Total TCDF	126	pg/g	EMPC	J	25
ARJ1	PM-102-04.0-05.0	15-22796-ARJ1FDL	EPA 1613B	OCDD	119000	pg/g	E	J	20
ARJ1	PM-100-03.0-04.0	15-22797-ARJ1G	EPA 1613B	1,2,3,7,8-PeCDF	2.38	pg/g	JXEMPC	U	25
ARJ1	PM-100-03.0-04.0	15-22797-ARJ1G	EPA 1613B	2,3,4,6,7,8-HxCDF	64.3	pg/g	EMPC	U	25
ARJ1	PM-100-03.0-04.0	15-22797-ARJ1G	EPA 1613B	2,3,7,8-TCDD	5.3	pg/g	EMPC	U	25
ARJ1	PM-100-03.0-04.0	15-22797-ARJ1G	EPA 1613B	2,3,7,8-TCDF	1.86	pg/g	JEMPC	U	25
ARJ1	PM-100-03.0-04.0	15-22797-ARJ1G	EPA 1613B	Total HpCDF	14100	pg/g	EMPC	J	25
ARJ1	PM-100-03.0-04.0	15-22797-ARJ1G	EPA 1613B	Total HxCDD	2610	pg/g	EMPC	J	25
ARJ1	PM-100-03.0-04.0	15-22797-ARJ1G	EPA 1613B	Total HxCDF	2930	pg/g	EMPC	J	25
ARJ1	PM-100-03.0-04.0	15-22797-ARJ1G	EPA 1613B	Total PeCDF	454	pg/g	EMPC	J	25
ARJ1	PM-100-03.0-04.0	15-22797-ARJ1G	EPA 1613B	Total TCDD	87.8	pg/g	EMPC	J	25
ARJ1	PM-100-03.0-04.0	15-22797-ARJ1G	EPA 1613B	Total TCDF	85.8	pg/g	EMPC	J	25
ARJ1	PM-100-09.0-10.0	15-22798-ARJ1H	EPA 1613B	1,2,3,4,7,8-HxCDF	0.93	pg/g	JEMPC	U	25
ARJ1	PM-100-09.0-10.0	15-22798-ARJ1H	EPA 1613B	2,3,4,6,7,8-HxCDF	1.42	pg/g	JEMPC	U	25
ARJ1	PM-100-09.0-10.0	15-22798-ARJ1H	EPA 1613B	2,3,7,8-TCDD	0.332	pg/g	JEMPC	U	25
ARJ1	PM-100-09.0-10.0	15-22798-ARJ1H	EPA 1613B	2,3,7,8-TCDF	0.298	pg/g	JEMPC	U	25
ARJ1	PM-100-09.0-10.0	15-22798-ARJ1H	EPA 1613B	OCDD	992	pg/g		J	13L
ARJ1	PM-100-09.0-10.0	15-22798-ARJ1H	EPA 1613B	OCDF	74.7	pg/g		J	13L
ARJ1	PM-100-09.0-10.0	15-22798-ARJ1H	EPA 1613B	Total HpCDF	74.1	pg/g	EMPC	J	25
ARJ1	PM-100-09.0-10.0	15-22798-ARJ1H	EPA 1613B	Total HxCDD	27.4	pg/g	EMPC	J	25
ARJ1	PM-100-09.0-10.0	15-22798-ARJ1H	EPA 1613B	Total HxCDF	28.9	pg/g	EMPC	J	25
ARJ1	PM-100-09.0-10.0	15-22798-ARJ1H	EPA 1613B	Total PeCDD	6.34	pg/g	EMPC	J	25
ARJ1	PM-100-09.0-10.0	15-22798-ARJ1H	EPA 1613B	Total PeCDF	25.1	pg/g	EMPC	J	25
ARJ1	PM-100-09.0-10.0	15-22798-ARJ1H	EPA 1613B	Total TCDD	3.26	pg/g	EMPC	J	25
ARJ1	PM-100-09.0-10.0	15-22798-ARJ1H	EPA 1613B	Total TCDF	12.6	pg/g	EMPC	J	25
ARJ1	PM-087-11.0-12.0	15-22799-ARJ1I	EPA 1613B	1,2,3,4,7,8,9-HpCDF	35	pg/g		J	13L
ARJ1	PM-087-11.0-12.0	15-22799-ARJ1I	EPA 1613B	2,3,7,8-TCDD	1.26	pg/g	EMPC	U	25
ARJ1	PM-087-11.0-12.0	15-22799-ARJ1I	EPA 1613B	OCDF	3880	pg/g		J	13L

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
ARJ1	PM-087-11.0-12.0	15-22799-ARJ1I	EPA 1613B	Total HxCDD	711	pg/g	EMPC	J	25
ARJ1	PM-087-11.0-12.0	15-22799-ARJ1I	EPA 1613B	Total HxCDF	754	pg/g	EMPC	J	25
ARJ1	PM-087-11.0-12.0	15-22799-ARJ1I	EPA 1613B	Total PeCDD	154	pg/g	EMPC	J	25
ARJ1	PM-087-11.0-12.0	15-22799-ARJ1I	EPA 1613B	Total PeCDF	205	pg/g	EMPC	J	25
ARJ1	PM-087-11.0-12.0	15-22799-ARJ1I	EPA 1613B	Total TCDD	52.1	pg/g	EMPC	J	25
ARJ1	PM-087-11.0-12.0	15-22799-ARJ1I	EPA 1613B	Total TCDF	60.9	pg/g	EMPC	J	25
ARJ1	PM-087-11.0-12.0	15-22799-ARJ1IDL	EPA 1613B	OCDD	32800	pg/g		J	13L
ARJ1	PM-078-02.0-03.0	15-22800-ARJ1J	EPA 1613B	Total HpCDF	4650	pg/g	EMPC	J	25
ARJ1	PM-078-02.0-03.0	15-22800-ARJ1J	EPA 1613B	Total HxCDF	1180	pg/g	EMPC	J	25
ARJ1	PM-078-02.0-03.0	15-22800-ARJ1J	EPA 1613B	Total PeCDD	181	pg/g	EMPC	J	25
ARJ1	PM-078-02.0-03.0	15-22800-ARJ1J	EPA 1613B	Total PeCDF	296	pg/g	EMPC	J	25
ARJ1	PM-078-02.0-03.0	15-22800-ARJ1J	EPA 1613B	Total TCDD	140	pg/g	EMPC	J	25
ARJ1	PM-078-02.0-03.0	15-22800-ARJ1J	EPA 1613B	Total TCDF	73.8	pg/g	EMPC	J	25
ARJ1	PM-078-02.0-03.0	15-22800-ARJ1JDL	EPA 1613B	OCDD	48500	pg/g	E	J	20
ARJ1	PM-078-07.0-08.0	15-22801-ARJ1K	EPA 1613B	1,2,3,4,7,8,9-HpCDF	1.76	pg/g	EMPC	UJ	13L,25
ARJ1	PM-078-07.0-08.0	15-22801-ARJ1K	EPA 1613B	1,2,3,6,7,8-HxCDF	0.653	pg/g	JEMPC	U	25
ARJ1	PM-078-07.0-08.0	15-22801-ARJ1K	EPA 1613B	1,2,3,7,8,9-HxCDF	0.678	pg/g	BJEMPC	U	25
ARJ1	PM-078-07.0-08.0	15-22801-ARJ1K	EPA 1613B	2,3,4,7,8-PeCDF	0.305	pg/g	JEMPC	U	25
ARJ1	PM-078-07.0-08.0	15-22801-ARJ1K	EPA 1613B	OCDD	1660	pg/g		J	13L
ARJ1	PM-078-07.0-08.0	15-22801-ARJ1K	EPA 1613B	OCDF	240	pg/g		J	13L
ARJ1	PM-078-07.0-08.0	15-22801-ARJ1K	EPA 1613B	Total HpCDF	201	pg/g	EMPC	J	25
ARJ1	PM-078-07.0-08.0	15-22801-ARJ1K	EPA 1613B	Total HxCDD	31.5	pg/g	EMPC	J	25
ARJ1	PM-078-07.0-08.0	15-22801-ARJ1K	EPA 1613B	Total HxCDF	38.4	pg/g	EMPC	J	25
ARJ1	PM-078-07.0-08.0	15-22801-ARJ1K	EPA 1613B	Total PeCDD	5.04	pg/g	EMPC	J	25
ARJ1	PM-078-07.0-08.0	15-22801-ARJ1K	EPA 1613B	Total PeCDF	6.33	pg/g	EMPC	J	25
ARJ1	PM-078-07.0-08.0	15-22801-ARJ1K	EPA 1613B	Total TCDD	2.82	pg/g	EMPC	J	25
ARJ1	PM-078-07.0-08.0	15-22801-ARJ1K	EPA 1613B	Total TCDF	1.41	pg/g	EMPC	J	25
ARJ1	PM-119-01.0-02.0	15-22802-ARJ1L	EPA 1613B	1,2,3,4,7,8,9-HpCDF	1.16	pg/g		J	13L
ARJ1	PM-119-01.0-02.0	15-22802-ARJ1L	EPA 1613B	1,2,3,4,7,8-HxCDD	0.627	pg/g	JEMPC	U	25
ARJ1	PM-119-01.0-02.0	15-22802-ARJ1L	EPA 1613B	1,2,3,6,7,8-HxCDF	0.491	pg/g	JEMPC	U	25
ARJ1	PM-119-01.0-02.0	15-22802-ARJ1L	EPA 1613B	1,2,3,7,8-PeCDF	0.154	pg/g	JEMPC	U	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
ARJ1	PM-119-01.0-02.0	15-22802-ARJ1L	EPA 1613B	2,3,4,7,8-PeCDF	0.332	pg/g	JEMPC	U	25
ARJ1	PM-119-01.0-02.0	15-22802-ARJ1L	EPA 1613B	2,3,7,8-TCDD	0.216	pg/g	JEMPC	U	25
ARJ1	PM-119-01.0-02.0	15-22802-ARJ1L	EPA 1613B	OCDD	1110	pg/g		J	13L
ARJ1	PM-119-01.0-02.0	15-22802-ARJ1L	EPA 1613B	OCDF	114	pg/g		J	13L
ARJ1	PM-119-01.0-02.0	15-22802-ARJ1L	EPA 1613B	Total HxCDD	22.9	pg/g	EMPC	J	25
ARJ1	PM-119-01.0-02.0	15-22802-ARJ1L	EPA 1613B	Total HxCDF	27.1	pg/g	EMPC	J	25
ARJ1	PM-119-01.0-02.0	15-22802-ARJ1L	EPA 1613B	Total PeCDD	3.06	pg/g	EMPC	J	25
ARJ1	PM-119-01.0-02.0	15-22802-ARJ1L	EPA 1613B	Total PeCDF	5.84	pg/g	EMPC	J	25
ARJ1	PM-119-01.0-02.0	15-22802-ARJ1L	EPA 1613B	Total TCDD	1.31	pg/g	EMPC	J	25
ARJ1	PM-119-01.0-02.0	15-22802-ARJ1L	EPA 1613B	Total TCDF	1.19	pg/g	EMPC	J	25
ARJ1	PM-096-02.0-03.0	15-22803-ARJ1M	EPA 1613B	1,2,3,7,8,9-HxCDF	1.37	pg/g	EMPC	U	25
ARJ1	PM-096-02.0-03.0	15-22803-ARJ1M	EPA 1613B	1,2,3,7,8-PeCDF	1.17	pg/g	X	J	23H
ARJ1	PM-096-02.0-03.0	15-22803-ARJ1M	EPA 1613B	OCDD	7510	pg/g	E	J	20
ARJ1	PM-096-02.0-03.0	15-22803-ARJ1M	EPA 1613B	Total HpCDF	845	pg/g	EMPC	J	25
ARJ1	PM-096-02.0-03.0	15-22803-ARJ1M	EPA 1613B	Total HxCDD	274	pg/g	EMPC	J	25
ARJ1	PM-096-02.0-03.0	15-22803-ARJ1M	EPA 1613B	Total HxCDF	273	pg/g	EMPC	J	25
ARJ1	PM-096-02.0-03.0	15-22803-ARJ1M	EPA 1613B	Total PeCDD	72.9	pg/g	EMPC	J	25
ARJ1	PM-096-02.0-03.0	15-22803-ARJ1M	EPA 1613B	Total PeCDF	165	pg/g	EMPC	J	25
ARJ1	PM-096-02.0-03.0	15-22803-ARJ1M	EPA 1613B	Total TCDD	55.2	pg/g	EMPC	J	25
ARJ1	PM-096-02.0-03.0	15-22803-ARJ1M	EPA 1613B	Total TCDF	80	pg/g	EMPC	J	25
ARJ1	PM-048-00.0-01.0	15-22804-ARJ1N	EPA 1613B	1,2,3,4,7,8,9-HpCDF	0.804	pg/g	JEMPC	UJ	13L,25
ARJ1	PM-048-00.0-01.0	15-22804-ARJ1N	EPA 1613B	1,2,3,4,7,8-HxCDD	0.588	pg/g	JEMPC	U	25
ARJ1	PM-048-00.0-01.0	15-22804-ARJ1N	EPA 1613B	1,2,3,6,7,8-HxCDF	0.358	pg/g	JEMPC	U	25
ARJ1	PM-048-00.0-01.0	15-22804-ARJ1N	EPA 1613B	1,2,3,7,8,9-HxCDF	0.302	pg/g	BJ	U	7
ARJ1	PM-048-00.0-01.0	15-22804-ARJ1N	EPA 1613B	1,2,3,7,8-PeCDD	0.435	pg/g	JEMPC	U	25
ARJ1	PM-048-00.0-01.0	15-22804-ARJ1N	EPA 1613B	1,2,3,7,8-PeCDF	0.14	pg/g	JXEMPC	U	25
ARJ1	PM-048-00.0-01.0	15-22804-ARJ1N	EPA 1613B	2,3,4,6,7,8-HxCDF	0.529	pg/g	JEMPC	U	25
ARJ1	PM-048-00.0-01.0	15-22804-ARJ1N	EPA 1613B	2,3,4,7,8-PeCDF	0.26	pg/g	JEMPC	U	25
ARJ1	PM-048-00.0-01.0	15-22804-ARJ1N	EPA 1613B	2,3,7,8-TCDD	0.279	pg/g	JEMPC	U	25
ARJ1	PM-048-00.0-01.0	15-22804-ARJ1N	EPA 1613B	OCDD	760	pg/g		J	13L
ARJ1	PM-048-00.0-01.0	15-22804-ARJ1N	EPA 1613B	OCDF	70.3	pg/g		J	13L

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
ARJ1	PM-048-00.0-01.0	15-22804-ARJ1N	EPA 1613B	Total HpCDF	58.4	pg/g	EMPC	J	25
ARJ1	PM-048-00.0-01.0	15-22804-ARJ1N	EPA 1613B	Total HxCDD	17.2	pg/g	EMPC	J	25
ARJ1	PM-048-00.0-01.0	15-22804-ARJ1N	EPA 1613B	Total HxCDF	15.1	pg/g	EMPC	J	25
ARJ1	PM-048-00.0-01.0	15-22804-ARJ1N	EPA 1613B	Total PeCDD	3.74	pg/g	EMPC	J	25
ARJ1	PM-048-00.0-01.0	15-22804-ARJ1N	EPA 1613B	Total PeCDF	4.25	pg/g	EMPC	J	25
ARJ1	PM-048-00.0-01.0	15-22804-ARJ1N	EPA 1613B	Total TCDD	2.16	pg/g	EMPC	J	25
ARJ1	PM-048-00.0-01.0	15-22804-ARJ1N	EPA 1613B	Total TCDF	2.68	pg/g	EMPC	J	25
ARJ1	PM-036-04.0-05.0	15-22805-ARJ1O	EPA 1613B	1,2,3,4,6,7,8-HpCDF	1060	pg/g		J	13L
ARJ1	PM-036-04.0-05.0	15-22805-ARJ1O	EPA 1613B	1,2,3,4,7,8,9-HpCDF	31.1	pg/g		J	13L
ARJ1	PM-036-04.0-05.0	15-22805-ARJ1O	EPA 1613B	1,2,3,7,8,9-HxCDF	7.66	pg/g		J	13L
ARJ1	PM-036-04.0-05.0	15-22805-ARJ1O	EPA 1613B	2,3,4,7,8-PeCDF	5.31	pg/g		J	13L
ARJ1	PM-036-04.0-05.0	15-22805-ARJ1O	EPA 1613B	OCDF	3020	pg/g		J	13L
ARJ1	PM-036-04.0-05.0	15-22805-ARJ1O	EPA 1613B	Total HpCDF	3380	pg/g	EMPC	J	25
ARJ1	PM-036-04.0-05.0	15-22805-ARJ1O	EPA 1613B	Total HxCDD	804	pg/g	EMPC	J	25
ARJ1	PM-036-04.0-05.0	15-22805-ARJ1O	EPA 1613B	Total HxCDF	849	pg/g	EMPC	J	25
ARJ1	PM-036-04.0-05.0	15-22805-ARJ1O	EPA 1613B	Total PeCDF	256	pg/g	EMPC	J	25
ARJ1	PM-036-04.0-05.0	15-22805-ARJ1O	EPA 1613B	Total TCDD	60.9	pg/g	EMPC	J	25
ARJ1	PM-036-04.0-05.0	15-22805-ARJ1O	EPA 1613B	Total TCDF	103	pg/g	EMPC	J	25
ARJ1	PM-036-04.0-05.0	15-22805-ARJ1ODL	EPA 1613B	1,2,3,4,6,7,8-HpCDD	3350	pg/g		J	13L
ARJ1	PM-036-04.0-05.0	15-22805-ARJ1ODL	EPA 1613B	OCDD	32400	pg/g		J	13L
ARJ1	PM-040-00.0-01.0	15-22806-ARJ1P	EPA 1613B	1,2,3,4,7,8,9-HpCDF	3.69	pg/g		J	13L
ARJ1	PM-040-00.0-01.0	15-22806-ARJ1P	EPA 1613B	1,2,3,6,7,8-HxCDF	1.4	pg/g	EMPC	U	25
ARJ1	PM-040-00.0-01.0	15-22806-ARJ1P	EPA 1613B	1,2,3,7,8-PeCDF	0.275	pg/g	JEMPC	U	25
ARJ1	PM-040-00.0-01.0	15-22806-ARJ1P	EPA 1613B	2,3,4,7,8-PeCDF	0.471	pg/g	JEMPC	U	25
ARJ1	PM-040-00.0-01.0	15-22806-ARJ1P	EPA 1613B	2,3,7,8-TCDD	0.572	pg/g	JEMPC	U	25
ARJ1	PM-040-00.0-01.0	15-22806-ARJ1P	EPA 1613B	2,3,7,8-TCDF	0.172	pg/g	JEMPC	U	25
ARJ1	PM-040-00.0-01.0	15-22806-ARJ1P	EPA 1613B	OCDD	3170	pg/g		J	13L
ARJ1	PM-040-00.0-01.0	15-22806-ARJ1P	EPA 1613B	OCDF	332	pg/g		J	13L
ARJ1	PM-040-00.0-01.0	15-22806-ARJ1P	EPA 1613B	Total HpCDF	329	pg/g	EMPC	J	25
ARJ1	PM-040-00.0-01.0	15-22806-ARJ1P	EPA 1613B	Total HxCDF	77.1	pg/g	EMPC	J	25
ARJ1	PM-040-00.0-01.0	15-22806-ARJ1P	EPA 1613B	Total PeCDD	25.4	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
ARJ1	PM-040-00.0-01.0	15-22806-ARJ1P	EPA 1613B	Total PeCDF	17.7	pg/g	EMPC	J	25
ARJ1	PM-040-00.0-01.0	15-22806-ARJ1P	EPA 1613B	Total TCDD	12.4	pg/g	EMPC	J	25
ARJ1	PM-040-00.0-01.0	15-22806-ARJ1P	EPA 1613B	Total TCDF	5.4	pg/g	EMPC	J	25
ARJ1	PM-046-00.0-01.0	15-22807-ARJ1Q	EPA 1613B	1,2,3,7,8,9-HxCDF	12.1	pg/g	EMPC	U	25
ARJ1	PM-046-00.0-01.0	15-22807-ARJ1Q	EPA 1613B	Total HxCDF	2400	pg/g	EMPC	J	25
ARJ1	PM-046-00.0-01.0	15-22807-ARJ1Q	EPA 1613B	Total PeCDF	370	pg/g	EMPC	J	25
ARJ1	PM-046-00.0-01.0	15-22807-ARJ1Q	EPA 1613B	Total TCDD	100	pg/g	EMPC	J	25
ARJ1	PM-046-00.0-01.0	15-22807-ARJ1Q	EPA 1613B	Total TCDF	101	pg/g	EMPC	J	25
ARJ1	PM-046-00.0-01.0	15-22807-ARJ1QDL	EPA 1613B	OCDD	94300	pg/g	E	J	20
ARJ1	PM-085-22.0-23.0	15-22808-ARJ1R	EPA 1613B	1,2,3,4,6,7,8-HpCDF	661	pg/g		J	13L
ARJ1	PM-085-22.0-23.0	15-22808-ARJ1R	EPA 1613B	1,2,3,4,7,8,9-HpCDF	41.9	pg/g		J	13L
ARJ1	PM-085-22.0-23.0	15-22808-ARJ1R	EPA 1613B	1,2,3,4,7,8-HxCDF	15.8	pg/g		J	13L
ARJ1	PM-085-22.0-23.0	15-22808-ARJ1R	EPA 1613B	1,2,3,6,7,8-HxCDD	80.8	pg/g		J	13L
ARJ1	PM-085-22.0-23.0	15-22808-ARJ1R	EPA 1613B	1,2,3,6,7,8-HxCDF	8.68	pg/g		J	13L
ARJ1	PM-085-22.0-23.0	15-22808-ARJ1R	EPA 1613B	1,2,3,7,8,9-HxCDF	2.3	pg/g	EMPC	UJ	13L,25
ARJ1	PM-085-22.0-23.0	15-22808-ARJ1R	EPA 1613B	1,2,3,7,8-PeCDD	6.9	pg/g		J	13L
ARJ1	PM-085-22.0-23.0	15-22808-ARJ1R	EPA 1613B	1,2,3,7,8-PeCDF	0.916	pg/g	J	J	13L
ARJ1	PM-085-22.0-23.0	15-22808-ARJ1R	EPA 1613B	2,3,4,6,7,8-HxCDF	25.2	pg/g		J	13L
ARJ1	PM-085-22.0-23.0	15-22808-ARJ1R	EPA 1613B	2,3,4,7,8-PeCDF	2.96	pg/g		J	13L
ARJ1	PM-085-22.0-23.0	15-22808-ARJ1R	EPA 1613B	2,3,7,8-TCDD	2.22	pg/g	EMPC	UJ	13L,25
ARJ1	PM-085-22.0-23.0	15-22808-ARJ1R	EPA 1613B	2,3,7,8-TCDF	0.51	pg/g	JEMPC	UJ	13L,25
ARJ1	PM-085-22.0-23.0	15-22808-ARJ1R	EPA 1613B	OCDF	1770	pg/g		J	13L
ARJ1	PM-085-22.0-23.0	15-22808-ARJ1R	EPA 1613B	Total HpCDF	2540	pg/g	EMPC	J	25
ARJ1	PM-085-22.0-23.0	15-22808-ARJ1R	EPA 1613B	Total HxCDF	627	pg/g	EMPC	J	25
ARJ1	PM-085-22.0-23.0	15-22808-ARJ1R	EPA 1613B	Total PeCDD	40.6	pg/g	EMPC	J	25
ARJ1	PM-085-22.0-23.0	15-22808-ARJ1R	EPA 1613B	Total TCDD	13.3	pg/g	EMPC	J	25
ARJ1	PM-085-22.0-23.0	15-22808-ARJ1R	EPA 1613B	Total TCDF	15.3	pg/g	EMPC	J	25
ARJ1	PM-085-22.0-23.0	15-22808-ARJ1RDL	EPA 1613B	1,2,3,4,6,7,8-HpCDD	2880	pg/g		J	13L
ARJ1	PM-085-22.0-23.0	15-22808-ARJ1RDL	EPA 1613B	OCDD	39600	pg/g	E	J	13L,20
ASQ3	PM-001-00.0-01.0	15-24352-ASQ3A	EPA 1613B	1,2,3,4,6,7,8-HpCDF	23	pg/g		J	13L
ASQ3	PM-001-00.0-01.0	15-24352-ASQ3A	EPA 1613B	1,2,3,4,7,8,9-HpCDF	0.98	pg/g	J	J	13L

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
ASQ3	PM-001-00.0-01.0	15-24352-ASQ3A	EPA 1613B	1,2,3,4,7,8-HxCDF	0.419	pg/g	JEMPC	U	25
ASQ3	PM-001-00.0-01.0	15-24352-ASQ3A	EPA 1613B	1,2,3,7,8-PeCDD	0.843	pg/g	J	J	13L
ASQ3	PM-001-00.0-01.0	15-24352-ASQ3A	EPA 1613B	2,3,4,6,7,8-HxCDF	0.407	pg/g	JEMPC	U	25
ASQ3	PM-001-00.0-01.0	15-24352-ASQ3A	EPA 1613B	2,3,4,7,8-PeCDF	0.222	pg/g	JEMPC	UJ	13L,25
ASQ3	PM-001-00.0-01.0	15-24352-ASQ3A	EPA 1613B	2,3,7,8-TCDD	0.508	pg/g	JEMPC	U	25
ASQ3	PM-001-00.0-01.0	15-24352-ASQ3A	EPA 1613B	2,3,7,8-TCDF	0.0833	pg/g	JEMPC	U	25
ASQ3	PM-001-00.0-01.0	15-24352-ASQ3A	EPA 1613B	OCDD	969	pg/g		J	10H,13L
ASQ3	PM-001-00.0-01.0	15-24352-ASQ3A	EPA 1613B	OCDF	86.5	pg/g		J	13L
ASQ3	PM-001-00.0-01.0	15-24352-ASQ3A	EPA 1613B	Total HpCDF	75.1	pg/g	EMPC	J	25
ASQ3	PM-001-00.0-01.0	15-24352-ASQ3A	EPA 1613B	Total HxCDD	30.5	pg/g	EMPC	J	25
ASQ3	PM-001-00.0-01.0	15-24352-ASQ3A	EPA 1613B	Total HxCDF	18.9	pg/g	EMPC	J	25
ASQ3	PM-001-00.0-01.0	15-24352-ASQ3A	EPA 1613B	Total PeCDD	5.42	pg/g	EMPC	J	25
ASQ3	PM-001-00.0-01.0	15-24352-ASQ3A	EPA 1613B	Total PeCDF	4.43	pg/g	EMPC	J	25
ASQ3	PM-001-00.0-01.0	15-24352-ASQ3A	EPA 1613B	Total TCDD	2.79	pg/g	EMPC	J	25
ASQ3	PM-001-00.0-01.0	15-24352-ASQ3A	EPA 1613B	Total TCDF	1.23	pg/g	EMPC	J	25
ASQ3	PM-007-00.0-01.0	15-24353-ASQ3B	EPA 1613B	1,2,3,4,6,7,8-HpCDD	36.3	pg/g		J	13L
ASQ3	PM-007-00.0-01.0	15-24353-ASQ3B	EPA 1613B	1,2,3,4,6,7,8-HpCDF	7.93	pg/g		J	13L
ASQ3	PM-007-00.0-01.0	15-24353-ASQ3B	EPA 1613B	1,2,3,4,7,8,9-HpCDF	0.449	pg/g	J	J	13L
ASQ3	PM-007-00.0-01.0	15-24353-ASQ3B	EPA 1613B	1,2,3,7,8,9-HxCDD	0.693	pg/g	BJEMPC	U	25
ASQ3	PM-007-00.0-01.0	15-24353-ASQ3B	EPA 1613B	1,2,3,7,8,9-HxCDF	0.109	pg/g	JEMPC	UJ	13L,25
ASQ3	PM-007-00.0-01.0	15-24353-ASQ3B	EPA 1613B	1,2,3,7,8-PeCDD	0.342	pg/g	J	J	13L
ASQ3	PM-007-00.0-01.0	15-24353-ASQ3B	EPA 1613B	1,2,3,7,8-PeCDF	0.197	pg/g	JEMPC	UJ	13L,25
ASQ3	PM-007-00.0-01.0	15-24353-ASQ3B	EPA 1613B	2,3,4,6,7,8-HxCDF	0.322	pg/g	JEMPC	U	25
ASQ3	PM-007-00.0-01.0	15-24353-ASQ3B	EPA 1613B	2,3,4,7,8-PeCDF	0.166	pg/g	J	J	13L
ASQ3	PM-007-00.0-01.0	15-24353-ASQ3B	EPA 1613B	2,3,7,8-TCDD	0.418	pg/g	JEMPC	U	25
ASQ3	PM-007-00.0-01.0	15-24353-ASQ3B	EPA 1613B	OCDD	412	pg/g		J	10H,13L
ASQ3	PM-007-00.0-01.0	15-24353-ASQ3B	EPA 1613B	OCDF	32.9	pg/g		J	13L
ASQ3	PM-007-00.0-01.0	15-24353-ASQ3B	EPA 1613B	Total HpCDD	68.6	pg/g	EMPC	J	25
ASQ3	PM-007-00.0-01.0	15-24353-ASQ3B	EPA 1613B	Total HxCDD	9.84	pg/g	EMPC	J	25
ASQ3	PM-007-00.0-01.0	15-24353-ASQ3B	EPA 1613B	Total HxCDF	7.49	pg/g	EMPC	J	25
ASQ3	PM-007-00.0-01.0	15-24353-ASQ3B	EPA 1613B	Total PeCDD	3.15	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
ASQ3	PM-007-00.0-01.0	15-24353-ASQ3B	EPA 1613B	Total PeCDF	4.04	pg/g	EMPC	J	25
ASQ3	PM-007-00.0-01.0	15-24353-ASQ3B	EPA 1613B	Total TCDD	2.81	pg/g	EMPC	J	25
ASQ3	PM-007-00.0-01.0	15-24353-ASQ3B	EPA 1613B	Total TCDF	3.22	pg/g	EMPC	J	25
ASQ3	PM-006-01.0-02.0	15-24354-ASQ3C	EPA 1613B	1,2,3,4,6,7,8-HpCDF	3230	pg/g		J	13L
ASQ3	PM-006-01.0-02.0	15-24354-ASQ3C	EPA 1613B	1,2,3,4,7,8,9-HpCDF	105	pg/g	EMPC	UJ	13L,25
ASQ3	PM-006-01.0-02.0	15-24354-ASQ3C	EPA 1613B	1,2,3,7,8,9-HxCDF	10.4	pg/g		J	13L
ASQ3	PM-006-01.0-02.0	15-24354-ASQ3C	EPA 1613B	1,2,3,7,8-PeCDD	23.3	pg/g		J	13L
ASQ3	PM-006-01.0-02.0	15-24354-ASQ3C	EPA 1613B	1,2,3,7,8-PeCDF	3	pg/g	J	J	13L
ASQ3	PM-006-01.0-02.0	15-24354-ASQ3C	EPA 1613B	2,3,4,7,8-PeCDF	19.6	pg/g		J	13L
ASQ3	PM-006-01.0-02.0	15-24354-ASQ3C	EPA 1613B	2,3,7,8-TCDD	5.79	pg/g	EMPC	U	25
ASQ3	PM-006-01.0-02.0	15-24354-ASQ3C	EPA 1613B	2,3,7,8-TCDF	1.52	pg/g	JEMPC	U	25
ASQ3	PM-006-01.0-02.0	15-24354-ASQ3C	EPA 1613B	OCDD	104000	pg/g	E	J	10H,13L,20
ASQ3	PM-006-01.0-02.0	15-24354-ASQ3C	EPA 1613B	OCDF	11900	pg/g		J	13L
ASQ3	PM-006-01.0-02.0	15-24354-ASQ3C	EPA 1613B	Total HpCDD	19200	pg/g	EMPC	J	25
ASQ3	PM-006-01.0-02.0	15-24354-ASQ3C	EPA 1613B	Total HpCDF	11100	pg/g	EMPC	J	25
ASQ3	PM-006-01.0-02.0	15-24354-ASQ3C	EPA 1613B	Total HxCDD	1640	pg/g	EMPC	J	25
ASQ3	PM-006-01.0-02.0	15-24354-ASQ3C	EPA 1613B	Total HxCDF	2150	pg/g	EMPC	J	25
ASQ3	PM-006-01.0-02.0	15-24354-ASQ3C	EPA 1613B	Total PeCDD	137	pg/g	EMPC	J	25
ASQ3	PM-006-01.0-02.0	15-24354-ASQ3C	EPA 1613B	Total PeCDF	299	pg/g	EMPC	J	25
ASQ3	PM-006-01.0-02.0	15-24354-ASQ3C	EPA 1613B	Total TCDD	32	pg/g	EMPC	J	25
ASQ3	PM-006-01.0-02.0	15-24354-ASQ3C	EPA 1613B	Total TCDF	107	pg/g	EMPC	J	25
ASQ3	PM-005-00.0-01.0	15-24355-ASQ3D	EPA 1613B	2,3,7,8-TCDF	1.45	pg/g	EMPC	U	25
ASQ3	PM-005-00.0-01.0	15-24355-ASQ3D	EPA 1613B	Total HpCDF	3700	pg/g	EMPC	J	25
ASQ3	PM-005-00.0-01.0	15-24355-ASQ3D	EPA 1613B	Total HxCDD	524	pg/g	EMPC	J	25
ASQ3	PM-005-00.0-01.0	15-24355-ASQ3D	EPA 1613B	Total HxCDF	739	pg/g	EMPC	J	25
ASQ3	PM-005-00.0-01.0	15-24355-ASQ3D	EPA 1613B	Total PeCDD	52.9	pg/g	EMPC	J	25
ASQ3	PM-005-00.0-01.0	15-24355-ASQ3D	EPA 1613B	Total PeCDF	117	pg/g	EMPC	J	25
ASQ3	PM-005-00.0-01.0	15-24355-ASQ3D	EPA 1613B	Total TCDD	20.4	pg/g	EMPC	J	25
ASQ3	PM-005-00.0-01.0	15-24355-ASQ3D	EPA 1613B	Total TCDF	53.9	pg/g	EMPC	J	25
ASQ3	PM-005-00.0-01.0	15-24355-ASQ3DDL	EPA 1613B	OCDD	31900	pg/g		J	10H
ASQ3	PM-046-01.0-02.0	15-24356-ASQ3E	EPA 1613B	1,2,3,4,7,8,9-HpCDF	87.4	pg/g		J	13L

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
ASQ3	PM-046-01.0-02.0	15-24356-ASQ3E	EPA 1613B	1,2,3,7,8,9-HxCDF	13.9	pg/g	EMPC	U	25
ASQ3	PM-046-01.0-02.0	15-24356-ASQ3E	EPA 1613B	1,2,3,7,8-PeCDF	2.31	pg/g	JEMPC	U	25
ASQ3	PM-046-01.0-02.0	15-24356-ASQ3E	EPA 1613B	2,3,7,8-TCDD	3.1	pg/g	JEMPC	U	25
ASQ3	PM-046-01.0-02.0	15-24356-ASQ3E	EPA 1613B	2,3,7,8-TCDF	1.37	pg/g	JEMPC	U	25
ASQ3	PM-046-01.0-02.0	15-24356-ASQ3E	EPA 1613B	OCDD	73800	pg/g	E	J	10H,13L,20
ASQ3	PM-046-01.0-02.0	15-24356-ASQ3E	EPA 1613B	OCDF	10400	pg/g		J	13L
ASQ3	PM-046-01.0-02.0	15-24356-ASQ3E	EPA 1613B	Total HpCDF	10200	pg/g	EMPC	J	25
ASQ3	PM-046-01.0-02.0	15-24356-ASQ3E	EPA 1613B	Total HxCDD	1210	pg/g	EMPC	J	25
ASQ3	PM-046-01.0-02.0	15-24356-ASQ3E	EPA 1613B	Total HxCDF	2090	pg/g	EMPC	J	25
ASQ3	PM-046-01.0-02.0	15-24356-ASQ3E	EPA 1613B	Total PeCDD	101	pg/g	EMPC	J	25
ASQ3	PM-046-01.0-02.0	15-24356-ASQ3E	EPA 1613B	Total PeCDF	277	pg/g	EMPC	J	25
ASQ3	PM-046-01.0-02.0	15-24356-ASQ3E	EPA 1613B	Total TCDD	24.7	pg/g	EMPC	J	25
ASQ3	PM-046-01.0-02.0	15-24356-ASQ3E	EPA 1613B	Total TCDF	66.2	pg/g	EMPC	J	25
ASQ3	PM-045-00.0-01.0	15-24357-ASQ3F	EPA 1613B	1,2,3,7,8-PeCDD	13.2	pg/g		J	13L
ASQ3	PM-045-00.0-01.0	15-24357-ASQ3F	EPA 1613B	1,2,3,7,8-PeCDF	1.83	pg/g	EMPC	UJ	13L,25
ASQ3	PM-045-00.0-01.0	15-24357-ASQ3F	EPA 1613B	2,3,4,7,8-PeCDF	10	pg/g		J	13L
ASQ3	PM-045-00.0-01.0	15-24357-ASQ3F	EPA 1613B	2,3,7,8-TCDF	1	pg/g	EMPC	U	25
ASQ3	PM-045-00.0-01.0	15-24357-ASQ3F	EPA 1613B	Total HxCDD	756	pg/g	EMPC	J	25
ASQ3	PM-045-00.0-01.0	15-24357-ASQ3F	EPA 1613B	Total HxCDF	795	pg/g	EMPC	J	25
ASQ3	PM-045-00.0-01.0	15-24357-ASQ3F	EPA 1613B	Total PeCDF	173	pg/g	EMPC	J	25
ASQ3	PM-045-00.0-01.0	15-24357-ASQ3F	EPA 1613B	Total TCDD	58.1	pg/g	EMPC	J	25
ASQ3	PM-045-00.0-01.0	15-24357-ASQ3F	EPA 1613B	Total TCDF	75.1	pg/g	EMPC	J	25
ASQ3	PM-045-00.0-01.0	15-24357-ASQ3FDL	EPA 1613B	OCDD	35600	pg/g		J	10H
ASQ3	PM-104-05.0-06.0	15-24358-ASQ3G	EPA 1613B	1,2,3,4,7,8,9-HpCDF	51.9	pg/g		J	13L
ASQ3	PM-104-05.0-06.0	15-24358-ASQ3G	EPA 1613B	OCDD	58700	pg/g	E	J	10H,20
ASQ3	PM-104-05.0-06.0	15-24358-ASQ3G	EPA 1613B	Total HpCDF	5340	pg/g	EMPC	J	25
ASQ3	PM-104-05.0-06.0	15-24358-ASQ3G	EPA 1613B	Total HxCDF	1180	pg/g	EMPC	J	25
ASQ3	PM-104-05.0-06.0	15-24358-ASQ3G	EPA 1613B	Total PeCDD	361	pg/g	EMPC	J	25
ASQ3	PM-104-05.0-06.0	15-24358-ASQ3G	EPA 1613B	Total PeCDF	224	pg/g	EMPC	J	25
ASQ3	PM-104-05.0-06.0	15-24358-ASQ3G	EPA 1613B	Total TCDD	206	pg/g	EMPC	J	25
ASQ3	PM-104-05.0-06.0	15-24358-ASQ3G	EPA 1613B	Total TCDF	43.7	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
ASQ3	PM-102-07.0-08.0	15-24359-ASQ3H	EPA 1613B	Total HpCDF	104000	pg/g	EMPC	J	25
ASQ3	PM-102-07.0-08.0	15-24359-ASQ3H	EPA 1613B	Total HxCDD	14600	pg/g	EMPC	J	25
ASQ3	PM-102-07.0-08.0	15-24359-ASQ3H	EPA 1613B	Total HxCDF	19300	pg/g	EMPC	J	25
ASQ3	PM-102-07.0-08.0	15-24359-ASQ3H	EPA 1613B	Total PeCDF	2770	pg/g	EMPC	J	25
ASQ3	PM-102-07.0-08.0	15-24359-ASQ3H	EPA 1613B	Total TCDD	340	pg/g	EMPC	J	25
ASQ3	PM-102-07.0-08.0	15-24359-ASQ3H	EPA 1613B	Total TCDF	1030	pg/g	EMPC	J	25
ASQ3	PM-102-07.0-08.0	15-24359-ASQ3HDL	EPA 1613B	OCDD	906000	pg/g	E	J	10H,20
ASQ3	PM-036-05.0-06.0	15-24360-ASQ3I	EPA 1613B	1,2,3,7,8-PeCDF	1.96	pg/g	EMPC	U	25
ASQ3	PM-036-05.0-06.0	15-24360-ASQ3I	EPA 1613B	2,3,7,8-TCDF	0.718	pg/g	JEMPC	U	25
ASQ3	PM-036-05.0-06.0	15-24360-ASQ3I	EPA 1613B	Total HpCDF	8210	pg/g	EMPC	J	25
ASQ3	PM-036-05.0-06.0	15-24360-ASQ3I	EPA 1613B	Total HxCDF	1590	pg/g	EMPC	J	25
ASQ3	PM-036-05.0-06.0	15-24360-ASQ3I	EPA 1613B	Total PeCDF	175	pg/g	EMPC	J	25
ASQ3	PM-036-05.0-06.0	15-24360-ASQ3I	EPA 1613B	Total TCDD	64.2	pg/g	EMPC	J	25
ASQ3	PM-036-05.0-06.0	15-24360-ASQ3I	EPA 1613B	Total TCDF	39.2	pg/g	EMPC	J	25
ASQ3	PM-036-05.0-06.0	15-24360-ASQ3IDL	EPA 1613B	OCDD	66000	pg/g	E	J	10H,20
ATT8	PM-046-02.0-03.0	16-192-ATT8A	EPA 1613B	1,2,3,7,8-PeCDF	0.578	pg/g	JX	J	23H
ATT8	PM-046-02.0-03.0	16-192-ATT8A	EPA 1613B	2,3,7,8-TCDD	0.753	pg/g	JEMPC	U	25
ATT8	PM-046-02.0-03.0	16-192-ATT8A	EPA 1613B	OCDD	17000	pg/g	E	J	20
ATT8	PM-046-02.0-03.0	16-192-ATT8A	EPA 1613B	OCDF	4140	pg/g	E	J	20
ATT8	PM-046-02.0-03.0	16-192-ATT8A	EPA 1613B	Total HpCDD	3540	pg/g	EMPC	J	25
ATT8	PM-046-02.0-03.0	16-192-ATT8A	EPA 1613B	Total HxCDD	269	pg/g	EMPC	J	25
ATT8	PM-046-02.0-03.0	16-192-ATT8A	EPA 1613B	Total HxCDF	572	pg/g	EMPC	J	25
ATT8	PM-046-02.0-03.0	16-192-ATT8A	EPA 1613B	Total PeCDD	18.7	pg/g	EMPC	J	25
ATT8	PM-046-02.0-03.0	16-192-ATT8A	EPA 1613B	Total PeCDF	59.2	pg/g	EMPC	J	25
ATT8	PM-046-02.0-03.0	16-192-ATT8A	EPA 1613B	Total TCDD	6.24	pg/g	EMPC	J	25
ATT8	PM-046-02.0-03.0	16-192-ATT8A	EPA 1613B	Total TCDF	17.8	pg/g	EMPC	J	25
ATT8	PM-104-07.0-08.0	16-193-ATT8B	EPA 1613B	OCDD	6110	pg/g	E	J	20
ATT8	PM-104-07.0-08.0	16-193-ATT8B	EPA 1613B	Total HpCDF	588	pg/g	EMPC	J	25
ATT8	PM-104-07.0-08.0	16-193-ATT8B	EPA 1613B	Total PeCDF	29.8	pg/g	EMPC	J	25
ATT8	PM-104-07.0-08.0	16-193-ATT8B	EPA 1613B	Total TCDF	14.9	pg/g	EMPC	J	25
AVG1	PM-133-0.0-1.0	16-1522-AVG1A	EPA 1613B	1,2,3,4,6,7,8-HpCDD	3.84	pg/g	B	U	7

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AVG1	PM-133-0.0-1.0	16-1522-AVG1A	EPA 1613B	1,2,3,4,6,7,8-HpCDF	0.685	pg/g	BJ	U	7
AVG1	PM-133-0.0-1.0	16-1522-AVG1A	EPA 1613B	1,2,3,4,7,8-HxCDF	0.0853	pg/g	BJEMPC	U	25
AVG1	PM-133-0.0-1.0	16-1522-AVG1A	EPA 1613B	1,2,3,6,7,8-HxCDD	0.173	pg/g	BJEMPC	U	25
AVG1	PM-133-0.0-1.0	16-1522-AVG1A	EPA 1613B	1,2,3,7,8,9-HxCDD	0.143	pg/g	BJEMPC	U	25
AVG1	PM-133-0.0-1.0	16-1522-AVG1A	EPA 1613B	1,2,3,7,8-PeCDD	0.113	pg/g	U	UJ	13L
AVG1	PM-133-0.0-1.0	16-1522-AVG1A	EPA 1613B	1,2,3,7,8-PeCDF	0.125	pg/g	JEMPC	U	25
AVG1	PM-133-0.0-1.0	16-1522-AVG1A	EPA 1613B	OCDD	72	pg/g	B	UJ	7,13L
AVG1	PM-133-0.0-1.0	16-1522-AVG1A	EPA 1613B	OCDF	3.74	pg/g	B	UJ	7,13L
AVG1	PM-133-0.0-1.0	16-1522-AVG1A	EPA 1613B	Total HpCDF	1.97	pg/g	EMPC	J	25
AVG1	PM-133-0.0-1.0	16-1522-AVG1A	EPA 1613B	Total HxCDD	1.81	pg/g	EMPC	J	25
AVG1	PM-133-0.0-1.0	16-1522-AVG1A	EPA 1613B	Total HxCDF	0.601	pg/g	EMPC	J	25
AVG1	PM-133-0.0-1.0	16-1522-AVG1A	EPA 1613B	Total PeCDF	0.125	pg/g	EMPC	J	25
AVG1	PM-006-2.0-3.0	16-1523-AVG1B	EPA 1613B	Total HxCDD	5940	pg/g	EMPC	J	25
AVG1	PM-006-2.0-3.0	16-1523-AVG1B	EPA 1613B	Total PeCDD	448	pg/g	EMPC	J	25
AVG1	PM-006-2.0-3.0	16-1523-AVG1B	EPA 1613B	Total PeCDF	878	pg/g	EMPC	J	25
AVG1	PM-006-2.0-3.0	16-1523-AVG1B	EPA 1613B	Total TCDD	85.7	pg/g	EMPC	J	25
AVG1	PM-006-2.0-3.0	16-1523-AVG1B	EPA 1613B	Total TCDF	229	pg/g	EMPC	J	25
AVG1	PM-006-2.0-3.0	16-1523-AVG1BDL	EPA 1613B	OCDD	409000	pg/g	E	J	10H,13L,20
AVG1	PM-006-2.0-3.0	16-1523-AVG1BDL	EPA 1613B	OCDF	90100	pg/g		J	10H,13L
AVG1	PM-036-6.0-7.0	16-1526-AVG1E	EPA 1613B	2,3,7,8-TCDF	0.314	pg/g	BJ	U	7
AVG1	PM-036-6.0-7.0	16-1526-AVG1E	EPA 1613B	OCDD	12600	pg/g	E	J	10H,13L,20
AVG1	PM-036-6.0-7.0	16-1526-AVG1E	EPA 1613B	OCDF	1620	pg/g		J	10H,13L
AVG1	PM-036-6.0-7.0	16-1526-AVG1E	EPA 1613B	Total HpCDF	1440	pg/g	EMPC	J	25
AVG1	PM-036-6.0-7.0	16-1526-AVG1E	EPA 1613B	Total HxCDD	335	pg/g	EMPC	J	25
AVG1	PM-036-6.0-7.0	16-1526-AVG1E	EPA 1613B	Total HxCDF	343	pg/g	EMPC	J	25
AVG1	PM-036-6.0-7.0	16-1526-AVG1E	EPA 1613B	Total PeCDD	60.2	pg/g	EMPC	J	25
AVG1	PM-036-6.0-7.0	16-1526-AVG1E	EPA 1613B	Total PeCDF	72.6	pg/g	EMPC	J	25
AVG1	PM-036-6.0-7.0	16-1526-AVG1E	EPA 1613B	Total TCDD	24.5	pg/g	EMPC	J	25
AVG1	PM-036-6.0-7.0	16-1526-AVG1E	EPA 1613B	Total TCDF	21.5	pg/g	EMPC	J	25
AVG1	PM-134-0.0-1.0	16-1530-AVG1I	EPA 1613B	1,2,3,7,8-PeCDD	3.95	pg/g		J	13L
AVG1	PM-134-0.0-1.0	16-1530-AVG1I	EPA 1613B	1,2,3,7,8-PeCDF	0.522	pg/g	JX	J	23H

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AVG1	PM-134-0.0-1.0	16-1530-AVG1I	EPA 1613B	2,3,7,8-TCDD	0.667	pg/g	JEMPC	U	25
AVG1	PM-134-0.0-1.0	16-1530-AVG1I	EPA 1613B	2,3,7,8-TCDF	0.349	pg/g	BJ	U	7
AVG1	PM-134-0.0-1.0	16-1530-AVG1I	EPA 1613B	OCDD	8600	pg/g	E	J	10H,13L,20
AVG1	PM-134-0.0-1.0	16-1530-AVG1I	EPA 1613B	OCDF	1460	pg/g		J	10H,13L
AVG1	PM-134-0.0-1.0	16-1530-AVG1I	EPA 1613B	Total HpCDF	1310	pg/g	EMPC	J	25
AVG1	PM-134-0.0-1.0	16-1530-AVG1I	EPA 1613B	Total HxCDD	178	pg/g	EMPC	J	25
AVG1	PM-134-0.0-1.0	16-1530-AVG1I	EPA 1613B	Total HxCDF	223	pg/g	EMPC	J	25
AVG1	PM-134-0.0-1.0	16-1530-AVG1I	EPA 1613B	Total PeCDD	30.2	pg/g	EMPC	J	25
AVG1	PM-134-0.0-1.0	16-1530-AVG1I	EPA 1613B	Total PeCDF	41.5	pg/g	EMPC	J	25
AVG1	PM-134-0.0-1.0	16-1530-AVG1I	EPA 1613B	Total TCDD	14.5	pg/g	EMPC	J	25
AVG1	PM-134-0.0-1.0	16-1530-AVG1I	EPA 1613B	Total TCDF	15.2	pg/g	EMPC	J	25
AVG1	PM-132-1.5-2.0	16-1531-AVG1J	EPA 1613B	1,2,3,7,8-PeCDD	4.63	pg/g		J	13L
AVG1	PM-132-1.5-2.0	16-1531-AVG1J	EPA 1613B	2,3,7,8-TCDD	0.565	pg/g	JEMPC	U	25
AVG1	PM-132-1.5-2.0	16-1531-AVG1J	EPA 1613B	OCDD	4770	pg/g	E	J	10H,13L,20
AVG1	PM-132-1.5-2.0	16-1531-AVG1J	EPA 1613B	OCDF	1070	pg/g		J	10H,13L
AVG1	PM-132-1.5-2.0	16-1531-AVG1J	EPA 1613B	Total HpCDF	942	pg/g	EMPC	J	25
AVG1	PM-132-1.5-2.0	16-1531-AVG1J	EPA 1613B	Total PeCDD	42.6	pg/g	EMPC	J	25
AVG1	PM-132-1.5-2.0	16-1531-AVG1J	EPA 1613B	Total PeCDF	59.3	pg/g	EMPC	J	25
AVG1	PM-132-1.5-2.0	16-1531-AVG1J	EPA 1613B	Total TCDD	13.2	pg/g	EMPC	J	25
AVG1	PM-132-1.5-2.0	16-1531-AVG1J	EPA 1613B	Total TCDF	28	pg/g	EMPC	J	25
AVG1	PM-102-8.0-9.0	16-1532-AVG1K	EPA 1613B	1,2,3,7,8-PeCDD	1.05	pg/g	EMPC	UJ	13L,25
AVG1	PM-102-8.0-9.0	16-1532-AVG1K	EPA 1613B	2,3,7,8-TCDD	0.612	pg/g	JEMPC	U	25
AVG1	PM-102-8.0-9.0	16-1532-AVG1K	EPA 1613B	OCDD	5070	pg/g	E	J	10H,13L,20
AVG1	PM-102-8.0-9.0	16-1532-AVG1K	EPA 1613B	OCDF	333	pg/g		J	10H,13L
AVG1	PM-102-8.0-9.0	16-1532-AVG1K	EPA 1613B	Total HpCDF	384	pg/g	EMPC	J	25
AVG1	PM-102-8.0-9.0	16-1532-AVG1K	EPA 1613B	Total HxCDF	134	pg/g	EMPC	J	25
AVG1	PM-102-8.0-9.0	16-1532-AVG1K	EPA 1613B	Total PeCDD	15.6	pg/g	EMPC	J	25
AVG1	PM-102-8.0-9.0	16-1532-AVG1K	EPA 1613B	Total PeCDF	55	pg/g	EMPC	J	25
AVG1	PM-102-8.0-9.0	16-1532-AVG1K	EPA 1613B	Total TCDD	10.3	pg/g	EMPC	J	25
AVG1	PM-102-8.0-9.0	16-1532-AVG1K	EPA 1613B	Total TCDF	48.6	pg/g	EMPC	J	25
AVG1	PM-102-9.0-10.0	16-1533-AVG1L	EPA 1613B	2,3,7,8-TCDD	0.369	pg/g	JEMPC	U	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AVG1	PM-102-9.0-10.0	16-1533-AVG1L	EPA 1613B	2,3,7,8-TCDF	0.186	pg/g	BJEMPC	U	25
AVG1	PM-102-9.0-10.0	16-1533-AVG1L	EPA 1613B	OCDD	3660	pg/g		J	10H,13L,20
AVG1	PM-102-9.0-10.0	16-1533-AVG1L	EPA 1613B	OCDF	213	pg/g		J	10H,13L
AVG1	PM-102-9.0-10.0	16-1533-AVG1L	EPA 1613B	Total HpCDF	344	pg/g	EMPC	J	25
AVG1	PM-102-9.0-10.0	16-1533-AVG1L	EPA 1613B	Total HxCDD	113	pg/g	EMPC	J	25
AVG1	PM-102-9.0-10.0	16-1533-AVG1L	EPA 1613B	Total HxCDF	195	pg/g	EMPC	J	25
AVG1	PM-102-9.0-10.0	16-1533-AVG1L	EPA 1613B	Total PeCDD	12.1	pg/g	EMPC	J	25
AVG1	PM-102-9.0-10.0	16-1533-AVG1L	EPA 1613B	Total PeCDF	38.5	pg/g	EMPC	J	25
AVG1	PM-102-9.0-10.0	16-1533-AVG1L	EPA 1613B	Total TCDD	4.54	pg/g	EMPC	J	25
AVG1	PM-102-9.0-10.0	16-1533-AVG1L	EPA 1613B	Total TCDF	17.3	pg/g	EMPC	J	25
AVG1	PM-129-2.0-3.0	16-1539-AVG1R	EPA 1613B	2,3,7,8-TCDF	0.244	pg/g	BJEMPC	U	25
AVG1	PM-129-2.0-3.0	16-1539-AVG1R	EPA 1613B	OCDD	9930	pg/g	E	J	10H,13L,20
AVG1	PM-129-2.0-3.0	16-1539-AVG1R	EPA 1613B	OCDF	1380	pg/g		J	10H,13L
AVG1	PM-129-2.0-3.0	16-1539-AVG1R	EPA 1613B	Total HpCDF	1120	pg/g	EMPC	J	25
AVG1	PM-129-2.0-3.0	16-1539-AVG1R	EPA 1613B	Total HxCDD	478	pg/g	EMPC	J	25
AVG1	PM-129-2.0-3.0	16-1539-AVG1R	EPA 1613B	Total HxCDF	284	pg/g	EMPC	J	25
AVG1	PM-129-2.0-3.0	16-1539-AVG1R	EPA 1613B	Total PeCDF	64.5	pg/g	EMPC	J	25
AVG1	PM-129-2.0-3.0	16-1539-AVG1R	EPA 1613B	Total TCDD	16.7	pg/g	EMPC	J	25
AVG1	PM-129-2.0-3.0	16-1539-AVG1R	EPA 1613B	Total TCDF	16.2	pg/g	EMPC	J	25
AVG1	PM-128-2.0-3.0	16-1541-AVG1T	EPA 1613B	1,2,3,7,8-PeCDF	0.95	pg/g	JX	J	23H
AVG1	PM-128-2.0-3.0	16-1541-AVG1T	EPA 1613B	OCDD	16700	pg/g	E	J	10H,13L,20
AVG1	PM-128-2.0-3.0	16-1541-AVG1T	EPA 1613B	OCDF	1990	pg/g		J	10H,13L
AVG1	PM-128-2.0-3.0	16-1541-AVG1T	EPA 1613B	Total HxCDF	347	pg/g	EMPC	J	25
AVG1	PM-128-2.0-3.0	16-1541-AVG1T	EPA 1613B	Total PeCDF	74.2	pg/g	EMPC	J	25
AVG1	PM-128-2.0-3.0	16-1541-AVG1T	EPA 1613B	Total TCDD	25.2	pg/g	EMPC	J	25
AVG1	PM-128-2.0-3.0	16-1541-AVG1T	EPA 1613B	Total TCDF	35.4	pg/g	EMPC	J	25
AVG1	PM-128-2.0-3.0-D	16-1542-AVG1U	EPA 1613B	1,2,3,7,8-PeCDF	0.962	pg/g	JX	J	23H
AVG1	PM-128-2.0-3.0-D	16-1542-AVG1U	EPA 1613B	OCDD	14800	pg/g	E	J	10H,13L,20
AVG1	PM-128-2.0-3.0-D	16-1542-AVG1U	EPA 1613B	OCDF	1660	pg/g		J	10H,13L
AVG1	PM-128-2.0-3.0-D	16-1542-AVG1U	EPA 1613B	Total HpCDF	1370	pg/g	EMPC	J	25
AVG1	PM-128-2.0-3.0-D	16-1542-AVG1U	EPA 1613B	Total HxCDD	414	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AVG1	PM-128-2.0-3.0-D	16-1542-AVG1U	EPA 1613B	Total HxCDF	317	pg/g	EMPC	J	25
AVG1	PM-128-2.0-3.0-D	16-1542-AVG1U	EPA 1613B	Total PeCDF	65.1	pg/g	EMPC	J	25
AVG1	PM-128-2.0-3.0-D	16-1542-AVG1U	EPA 1613B	Total TCDD	24.8	pg/g	EMPC	J	25
AVG1	PM-128-2.0-3.0-D	16-1542-AVG1U	EPA 1613B	Total TCDF	32.2	pg/g	EMPC	J	25
AVG1	PM-131-4.0-6.0	16-1545-AVG1X	EPA 1613B	1,2,3,7,8-PeCDF	0.505	pg/g	JX	J	23H
AVG1	PM-131-4.0-6.0	16-1545-AVG1X	EPA 1613B	2,3,7,8-TCDD	0.501	pg/g	JEMPC	U	25
AVG1	PM-131-4.0-6.0	16-1545-AVG1X	EPA 1613B	2,3,7,8-TCDF	0.507	pg/g	BJEMPC	U	25
AVG1	PM-131-4.0-6.0	16-1545-AVG1X	EPA 1613B	OCDD	4190	pg/g	E	J	10H,13L,20
AVG1	PM-131-4.0-6.0	16-1545-AVG1X	EPA 1613B	OCDF	472	pg/g		J	10H,13L
AVG1	PM-131-4.0-6.0	16-1545-AVG1X	EPA 1613B	Total HpCDF	407	pg/g	EMPC	J	25
AVG1	PM-131-4.0-6.0	16-1545-AVG1X	EPA 1613B	Total HxCDD	142	pg/g	EMPC	J	25
AVG1	PM-131-4.0-6.0	16-1545-AVG1X	EPA 1613B	Total HxCDF	115	pg/g	EMPC	J	25
AVG1	PM-131-4.0-6.0	16-1545-AVG1X	EPA 1613B	Total PeCDF	49.8	pg/g	EMPC	J	25
AVG1	PM-131-4.0-6.0	16-1545-AVG1X	EPA 1613B	Total TCDD	8.98	pg/g	EMPC	J	25
AVG1	PM-131-4.0-6.0	16-1545-AVG1X	EPA 1613B	Total TCDF	23.7	pg/g	EMPC	J	25
AVG1	PM-130-9.0-10.0	16-1548-AVG1AA	EPA 1613B	1,2,3,7,8-PeCDF	0.48	pg/g	JEMPC	U	25
AVG1	PM-130-9.0-10.0	16-1548-AVG1AA	EPA 1613B	2,3,7,8-TCDF	0.463	pg/g	BJEMPC	U	25
AVG1	PM-130-9.0-10.0	16-1548-AVG1AA	EPA 1613B	OCDD	18800	pg/g	E	J	10H,13L,20
AVG1	PM-130-9.0-10.0	16-1548-AVG1AA	EPA 1613B	OCDF	1630	pg/g		J	10H,13L
AVG1	PM-130-9.0-10.0	16-1548-AVG1AA	EPA 1613B	Total HxCDD	501	pg/g	EMPC	J	25
AVG1	PM-130-9.0-10.0	16-1548-AVG1AA	EPA 1613B	Total PeCDD	110	pg/g	EMPC	J	25
AVG1	PM-130-9.0-10.0	16-1548-AVG1AA	EPA 1613B	Total PeCDF	117	pg/g	EMPC	J	25
AVG1	PM-130-9.0-10.0	16-1548-AVG1AA	EPA 1613B	Total TCDD	81.8	pg/g	EMPC	J	25
AVG1	PM-130-9.0-10.0	16-1548-AVG1AA	EPA 1613B	Total TCDF	32.2	pg/g	EMPC	J	25
AVG1	PM-101-2.0-3.0	16-1549-AVG1AB	SW6010C	Lead	53	mg/kg		J	9
AVG1	PM-121-1.0-2.0	16-1553-AVG1AF	SW6010C	Lead	768	mg/kg		J	9
AVG1	PM-121-1.0-2.0-D	16-1554-AVG1AG	SW6010C	Lead	93	mg/kg		J	9
AVG1	PM-124-1.0-2.0	16-1556-AVG1AI	SW6010C	Lead	157	mg/kg		J	9
AVG1	PM-122-1.0-2.0	16-1558-AVG1AK	SW6010C	Lead	179	mg/kg		J	9
AVG1	PM-123-1.0-2.0	16-1560-AVG1AM	SW6010C	Lead	1180	mg/kg		J	9
AVG1	PM-125-1.0-2.0	16-1562-AVG1AO	EPA 1613B	2,3,7,8-TCDD	1.3	pg/g	EMPC	U	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AVG1	PM-125-1.0-2.0	16-1562-AVG1AO	EPA 1613B	OCDD	12500	pg/g	E	J	10H,13L,20
AVG1	PM-125-1.0-2.0	16-1562-AVG1AO	EPA 1613B	OCDF	1610	pg/g		J	10H,13L
AVG1	PM-125-1.0-2.0	16-1562-AVG1AO	EPA 1613B	Total HpCDF	1360	pg/g	EMPC	J	25
AVG1	PM-125-1.0-2.0	16-1562-AVG1AO	EPA 1613B	Total HxCDD	355	pg/g	EMPC	J	25
AVG1	PM-125-1.0-2.0	16-1562-AVG1AO	EPA 1613B	Total HxCDF	457	pg/g	EMPC	J	25
AVG1	PM-125-1.0-2.0	16-1562-AVG1AO	EPA 1613B	Total PeCDF	440	pg/g	EMPC	J	25
AVG1	PM-125-1.0-2.0	16-1562-AVG1AO	EPA 1613B	Total TCDD	16.7	pg/g	EMPC	J	25
AVG1	PM-125-1.0-2.0	16-1562-AVG1AO	EPA 1613B	Total TCDF	164	pg/g	EMPC	J	25
AVG1	PM-125-9.0-10.0	16-1563-AVG1AP	EPA 1613B	1,2,3,4,6,7,8-HpCDD	6.93	pg/g	B	U	7
AVG1	PM-125-9.0-10.0	16-1563-AVG1AP	EPA 1613B	1,2,3,4,6,7,8-HpCDF	0.711	pg/g	BJ	UJ	7,13L
AVG1	PM-125-9.0-10.0	16-1563-AVG1AP	EPA 1613B	1,2,3,4,7,8-HxCDD	0.181	pg/g	BJEMPC	U	25
AVG1	PM-125-9.0-10.0	16-1563-AVG1AP	EPA 1613B	1,2,3,6,7,8-HxCDD	0.238	pg/g	BJEMPC	U	25
AVG1	PM-125-9.0-10.0	16-1563-AVG1AP	EPA 1613B	1,2,3,7,8,9-HxCDD	0.296	pg/g	BJEMPC	U	25
AVG1	PM-125-9.0-10.0	16-1563-AVG1AP	EPA 1613B	1,2,3,7,8-PeCDD	0.177	pg/g	JEMPC	U	25
AVG1	PM-125-9.0-10.0	16-1563-AVG1AP	EPA 1613B	2,3,7,8-TCDD	0.167	pg/g	JEMPC	U	25
AVG1	PM-125-9.0-10.0	16-1563-AVG1AP	EPA 1613B	OCDD	112	pg/g	B	UJ	7,13L
AVG1	PM-125-9.0-10.0	16-1563-AVG1AP	EPA 1613B	OCDF	4.41	pg/g	B	UJ	7,13L
AVG1	PM-125-9.0-10.0	16-1563-AVG1AP	EPA 1613B	Total HxCDD	4.37	pg/g	EMPC	J	25
AVG1	PM-125-9.0-10.0	16-1563-AVG1AP	EPA 1613B	Total HxCDF	0.166	pg/g	EMPC	J	25
AVG1	PM-125-9.0-10.0	16-1563-AVG1AP	EPA 1613B	Total PeCDD	0.753	pg/g	EMPC	J	25
AVG1	PM-125-9.0-10.0	16-1563-AVG1AP	EPA 1613B	Total TCDD	1.02	pg/g	EMPC	J	25
AVG1	PM-125-9.0-10.0	16-1563-AVG1AP	EPA 1613B	Total TCDF	0.0885	pg/g	EMPC	J	25
AVG1	PM-126-1.0-2.0	16-1565-AVG1AR	EPA 1613B	1,2,3,4,6,7,8-HpCDF	9.12	pg/g		J	13L
AVG1	PM-126-1.0-2.0	16-1565-AVG1AR	EPA 1613B	1,2,3,4,7,8,9-HpCDF	0.281	pg/g	JEMPC	U	25
AVG1	PM-126-1.0-2.0	16-1565-AVG1AR	EPA 1613B	1,2,3,4,7,8-HxCDD	0.289	pg/g	BJEMPC	U	25
AVG1	PM-126-1.0-2.0	16-1565-AVG1AR	EPA 1613B	1,2,3,4,7,8-HxCDF	0.361	pg/g	BJEMPC	U	25
AVG1	PM-126-1.0-2.0	16-1565-AVG1AR	EPA 1613B	1,2,3,7,8,9-HxCDD	0.74	pg/g	BJ	U	7
AVG1	PM-126-1.0-2.0	16-1565-AVG1AR	EPA 1613B	2,3,4,6,7,8-HxCDF	0.591	pg/g	JEMPC	U	25
AVG1	PM-126-1.0-2.0	16-1565-AVG1AR	EPA 1613B	2,3,4,7,8-PeCDF	0.44	pg/g	JEMPC	U	25
AVG1	PM-126-1.0-2.0	16-1565-AVG1AR	EPA 1613B	2,3,7,8-TCDD	0.192	pg/g	JEMPC	U	25
AVG1	PM-126-1.0-2.0	16-1565-AVG1AR	EPA 1613B	2,3,7,8-TCDF	0.183	pg/g	BJEMPC	U	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AVG1	PM-126-1.0-2.0	16-1565-AVG1AR	EPA 1613B	OCDD	215	pg/g	B	UJ	7,13L
AVG1	PM-126-1.0-2.0	16-1565-AVG1AR	EPA 1613B	OCDF	21.9	pg/g	B	J	13L
AVG1	PM-126-1.0-2.0	16-1565-AVG1AR	EPA 1613B	Total HpCDF	20.9	pg/g	EMPC	J	25
AVG1	PM-126-1.0-2.0	16-1565-AVG1AR	EPA 1613B	Total HxCDD	10.8	pg/g	EMPC	J	25
AVG1	PM-126-1.0-2.0	16-1565-AVG1AR	EPA 1613B	Total HxCDF	9.83	pg/g	EMPC	J	25
AVG1	PM-126-1.0-2.0	16-1565-AVG1AR	EPA 1613B	Total PeCDD	5.22	pg/g	EMPC	J	25
AVG1	PM-126-1.0-2.0	16-1565-AVG1AR	EPA 1613B	Total PeCDF	9.45	pg/g	EMPC	J	25
AVG1	PM-126-1.0-2.0	16-1565-AVG1AR	EPA 1613B	Total TCDD	1.54	pg/g	EMPC	J	25
AVG1	PM-126-1.0-2.0	16-1565-AVG1AR	EPA 1613B	Total TCDF	6.14	pg/g	EMPC	J	25
AVG1	PM-127-1.0-2.0	16-1567-AVG1AT	EPA 1613B	1,2,3,7,8-PeCDF	2.88	pg/g	X	J	23H
AVG1	PM-127-1.0-2.0	16-1567-AVG1AT	EPA 1613B	2,3,7,8-TCDD	0.456	pg/g	JEMPC	U	25
AVG1	PM-127-1.0-2.0	16-1567-AVG1AT	EPA 1613B	OCDD	2450	pg/g		J	10H,13L
AVG1	PM-127-1.0-2.0	16-1567-AVG1AT	EPA 1613B	OCDF	341	pg/g		J	10H,13L
AVG1	PM-127-1.0-2.0	16-1567-AVG1AT	EPA 1613B	Total PeCDD	40.4	pg/g	EMPC	J	25
AVG1	PM-127-1.0-2.0	16-1567-AVG1AT	EPA 1613B	Total PeCDF	563	pg/g	EMPC	J	25
AVG1	PM-127-1.0-2.0	16-1567-AVG1AT	EPA 1613B	Total TCDD	16.2	pg/g	EMPC	J	25
AVG1	PM-127-1.0-2.0	16-1567-AVG1AT	EPA 1613B	Total TCDF	338	pg/g	EMPC	J	25
AVG1	PM-120-1.0-2.0	16-1569-AVG1AV	SW6010C	Lead	11	mg/kg		J	9
AWO1	PM-071-1.0-2.0	16-2984-AWO1A	EPA 1613B	Total HxCDD	5960	pg/g	EMPC	J	25
AWO1	PM-071-1.0-2.0	16-2984-AWO1A	EPA 1613B	Total HxCDF	8270	pg/g	EMPC	J	25
AWO1	PM-071-1.0-2.0	16-2984-AWO1A	EPA 1613B	Total PeCDD	380	pg/g	EMPC	J	25
AWO1	PM-071-1.0-2.0	16-2984-AWO1A	EPA 1613B	Total PeCDF	852	pg/g	EMPC	J	25
AWO1	PM-071-1.0-2.0	16-2984-AWO1A	EPA 1613B	Total TCDD	70.7	pg/g	EMPC	J	25
AWO1	PM-071-1.0-2.0	16-2984-AWO1A	EPA 1613B	Total TCDF	268	pg/g	EMPC	J	25
AWO1	PM-071-1.0-2.0	16-2984-AWO1ADL	EPA 1613B	OCDD	363000	pg/g	E	J	13L, 20
AWO1	PM-070-1.0-2.0	16-2985-AWO1B	EPA 1613B	1,2,3,4,6,7,8-HpCDF	313	pg/g		J	13L
AWO1	PM-070-1.0-2.0	16-2985-AWO1B	EPA 1613B	2,3,7,8-TCDD	0.541	pg/g	JEMPC	U	25
AWO1	PM-070-1.0-2.0	16-2985-AWO1B	EPA 1613B	OCDD	8220	pg/g	E	J	13L, 20
AWO1	PM-070-1.0-2.0	16-2985-AWO1B	EPA 1613B	Total HxCDD	177	pg/g	EMPC	J	25
AWO1	PM-070-1.0-2.0	16-2985-AWO1B	EPA 1613B	Total PeCDD	17.6	pg/g	EMPC	J	25
AWO1	PM-070-1.0-2.0	16-2985-AWO1B	EPA 1613B	Total PeCDF	59.1	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AWO1	PM-070-1.0-2.0	16-2985-AWO1B	EPA 1613B	Total TCDD	5.56	pg/g	EMPC	J	25
AWO1	PM-070-1.0-2.0	16-2985-AWO1B	EPA 1613B	Total TCDF	19.3	pg/g	EMPC	J	25
AWO1	PM-082-1.0-2.0	16-2986-AWO1C	EPA 1613B	2,3,7,8-TCDD	0.249	pg/g	JEMPC	U	25
AWO1	PM-082-1.0-2.0	16-2986-AWO1C	EPA 1613B	OCDD	1260	pg/g		J	13L
AWO1	PM-082-1.0-2.0	16-2986-AWO1C	EPA 1613B	Total HxCDD	39	pg/g	EMPC	J	25
AWO1	PM-082-1.0-2.0	16-2986-AWO1C	EPA 1613B	Total HxCDF	24.8	pg/g	EMPC	J	25
AWO1	PM-082-1.0-2.0	16-2986-AWO1C	EPA 1613B	Total PeCDD	6.52	pg/g	EMPC	J	25
AWO1	PM-082-1.0-2.0	16-2986-AWO1C	EPA 1613B	Total PeCDF	13	pg/g	EMPC	J	25
AWO1	PM-082-1.0-2.0	16-2986-AWO1C	EPA 1613B	Total TCDD	4.22	pg/g	EMPC	J	25
AWO1	PM-082-1.0-2.0	16-2986-AWO1C	EPA 1613B	Total TCDF	9.67	pg/g	EMPC	J	25
AWO1	PM-084-1.0-2.0	16-2987-AWO1D	EPA 1613B	Total HpCDF	22100	pg/g	EMPC	J	25
AWO1	PM-084-1.0-2.0	16-2987-AWO1D	EPA 1613B	Total HxCDD	3400	pg/g	EMPC	J	25
AWO1	PM-084-1.0-2.0	16-2987-AWO1D	EPA 1613B	Total HxCDF	3910	pg/g	EMPC	J	25
AWO1	PM-084-1.0-2.0	16-2987-AWO1D	EPA 1613B	Total PeCDD	247	pg/g	EMPC	J	25
AWO1	PM-084-1.0-2.0	16-2987-AWO1D	EPA 1613B	Total PeCDF	435	pg/g	EMPC	J	25
AWO1	PM-084-1.0-2.0	16-2987-AWO1D	EPA 1613B	Total TCDD	44.5	pg/g	EMPC	J	25
AWO1	PM-084-1.0-2.0	16-2987-AWO1D	EPA 1613B	Total TCDF	78.5	pg/g	EMPC	J	25
AWO1	PM-084-1.0-2.0	16-2987-AWO1DDL	EPA 1613B	OCDD	231000	pg/g	E	J	20
AWO5	PM-006-3.0-4.0	16-3615-AWO5A	EPA 1613B	1,2,3,6,7,8-HxCDF	17.4	pg/g	EMPC	U	25
AWO5	PM-006-3.0-4.0	16-3615-AWO5A	EPA 1613B	1,2,3,7,8-PeCDD	12.7	pg/g		J	13L
AWO5	PM-006-3.0-4.0	16-3615-AWO5A	EPA 1613B	1,2,3,7,8-PeCDF	1.91	pg/g	X	J	23H
AWO5	PM-006-3.0-4.0	16-3615-AWO5A	EPA 1613B	Total HpCDF	7500	pg/g	EMPC	J	25
AWO5	PM-006-3.0-4.0	16-3615-AWO5A	EPA 1613B	Total HxCDD	979	pg/g	EMPC	J	25
AWO5	PM-006-3.0-4.0	16-3615-AWO5A	EPA 1613B	Total HxCDF	1350	pg/g	EMPC	J	25
AWO5	PM-006-3.0-4.0	16-3615-AWO5A	EPA 1613B	Total PeCDD	87.3	pg/g	EMPC	J	25
AWO5	PM-006-3.0-4.0	16-3615-AWO5A	EPA 1613B	Total PeCDF	192	pg/g	EMPC	J	25
AWO5	PM-006-3.0-4.0	16-3615-AWO5A	EPA 1613B	Total TCDD	20.8	pg/g	EMPC	J	25
AWO5	PM-006-3.0-4.0	16-3615-AWO5A	EPA 1613B	Total TCDF	85.6	pg/g	EMPC	J	25
AWO5	PM-006-3.0-4.0	16-3615-AWO5ADL	EPA 1613B	OCDD	83000	pg/g	E	J	20
AWO5	PM-006-4.0-5.0	16-3616-AWO5B	EPA 1613B	1,2,3,4,6,7,8-HpCDF	781	pg/g		J	13L
AWO5	PM-006-4.0-5.0	16-3616-AWO5B	EPA 1613B	1,2,3,4,7,8,9-HpCDF	25.3	pg/g		J	13L

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AWO5	PM-006-4.0-5.0	16-3616-AWO5B	EPA 1613B	1,2,3,7,8-PeCDF	1.19	pg/g	X	J	23H
AWO5	PM-006-4.0-5.0	16-3616-AWO5B	EPA 1613B	2,3,7,8-TCDD	1.68	pg/g	EMPC	U	25
AWO5	PM-006-4.0-5.0	16-3616-AWO5B	EPA 1613B	OCDF	3430	pg/g		J	13L
AWO5	PM-006-4.0-5.0	16-3616-AWO5B	EPA 1613B	Total HxCDD	504	pg/g	EMPC	J	25
AWO5	PM-006-4.0-5.0	16-3616-AWO5B	EPA 1613B	Total PeCDF	99.7	pg/g	EMPC	J	25
AWO5	PM-006-4.0-5.0	16-3616-AWO5B	EPA 1613B	Total TCDD	23.1	pg/g	EMPC	J	25
AWO5	PM-006-4.0-5.0	16-3616-AWO5B	EPA 1613B	Total TCDF	60.5	pg/g	EMPC	J	25
AWO5	PM-006-4.0-5.0	16-3616-AWO5BDL	EPA 1613B	OCDD	31600	pg/g		J	13L
AWO5	PM-058-2.0-3.0	16-3617-AWO5C	EPA 1613B	1,2,3,4,6,7,8-HpCDF	37.2	pg/g		J	13L
AWO5	PM-058-2.0-3.0	16-3617-AWO5C	EPA 1613B	1,2,3,4,7,8,9-HpCDF	1.6	pg/g		J	13L
AWO5	PM-058-2.0-3.0	16-3617-AWO5C	EPA 1613B	1,2,3,4,7,8-HxCDF	0.952	pg/g	JEMPC	U	25
AWO5	PM-058-2.0-3.0	16-3617-AWO5C	EPA 1613B	1,2,3,7,8,9-HxCDD	1.63	pg/g	EMPC	U	25
AWO5	PM-058-2.0-3.0	16-3617-AWO5C	EPA 1613B	2,3,7,8-TCDD	0.418	pg/g	JEMPC	U	25
AWO5	PM-058-2.0-3.0	16-3617-AWO5C	EPA 1613B	OCDD	1330	pg/g		J	13L
AWO5	PM-058-2.0-3.0	16-3617-AWO5C	EPA 1613B	OCDF	130	pg/g		J	13L
AWO5	PM-058-2.0-3.0	16-3617-AWO5C	EPA 1613B	Total HpCDF	135	pg/g	EMPC	J	25
AWO5	PM-058-2.0-3.0	16-3617-AWO5C	EPA 1613B	Total HxCDD	28.7	pg/g	EMPC	J	25
AWO5	PM-058-2.0-3.0	16-3617-AWO5C	EPA 1613B	Total HxCDF	30.9	pg/g	EMPC	J	25
AWO5	PM-058-2.0-3.0	16-3617-AWO5C	EPA 1613B	Total PeCDD	5.15	pg/g	EMPC	J	25
AWO5	PM-058-2.0-3.0	16-3617-AWO5C	EPA 1613B	Total PeCDF	9.27	pg/g	EMPC	J	25
AWO5	PM-058-2.0-3.0	16-3617-AWO5C	EPA 1613B	Total TCDD	4.86	pg/g	EMPC	J	25
AWO5	PM-058-2.0-3.0	16-3617-AWO5C	EPA 1613B	Total TCDF	6.39	pg/g	EMPC	J	25
AYG4	PM-083-01.0-02.0	16-5012-AYG4A	EPA 1613B	1,2,3,4,6,7,8-HpCDD	1370	pg/g		J	13L
AYG4	PM-083-01.0-02.0	16-5012-AYG4A	EPA 1613B	1,2,3,4,6,7,8-HpCDF	453	pg/g		J	13L
AYG4	PM-083-01.0-02.0	16-5012-AYG4A	EPA 1613B	1,2,3,4,7,8,9-HpCDF	10.5	pg/g	JEMPC	UJ	13L,25
AYG4	PM-083-01.0-02.0	16-5012-AYG4A	EPA 1613B	1,2,3,4,7,8-HxCDF	7.64	pg/g	JEMPC	U	25
AYG4	PM-083-01.0-02.0	16-5012-AYG4A	EPA 1613B	1,2,3,6,7,8-HxCDF	9.4	pg/g	JEMPC	U	25
AYG4	PM-083-01.0-02.0	16-5012-AYG4A	EPA 1613B	1,2,3,7,8,9-HxCDF	7.99	pg/g	JEMPC	UJ	13L,25
AYG4	PM-083-01.0-02.0	16-5012-AYG4A	EPA 1613B	1,2,3,7,8-PeCDD	4.6	pg/g	JEMPC	UJ	13L,25
AYG4	PM-083-01.0-02.0	16-5012-AYG4A	EPA 1613B	2,3,4,7,8-PeCDF	3.25	pg/g	JEMPC	U	25
AYG4	PM-083-01.0-02.0	16-5012-AYG4A	EPA 1613B	2,3,7,8-TCDD	1.66	pg/g	JEMPC	U	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AYG4	PM-083-01.0-02.0	16-5012-AYG4A	EPA 1613B	OCDD	14900	pg/g		J	13L
AYG4	PM-083-01.0-02.0	16-5012-AYG4A	EPA 1613B	Total HpCDD	2820	pg/g	EMPC	J	25
AYG4	PM-083-01.0-02.0	16-5012-AYG4A	EPA 1613B	Total HpCDF	1530	pg/g	EMPC	J	25
AYG4	PM-083-01.0-02.0	16-5012-AYG4A	EPA 1613B	Total HxCDF	339	pg/g	EMPC	J	25
AYG4	PM-083-01.0-02.0	16-5012-AYG4A	EPA 1613B	Total PeCDD	22.3	pg/g	EMPC	J	25
AYG4	PM-083-01.0-02.0	16-5012-AYG4A	EPA 1613B	Total PeCDF	57.1	pg/g	EMPC	J	25
AYG4	PM-083-01.0-02.0	16-5012-AYG4A	EPA 1613B	Total TCDD	3.36	pg/g	EMPC	J	25
AYG4	PM-083-01.0-02.0	16-5012-AYG4A	EPA 1613B	Total TCDF	7.39	pg/g	EMPC	J	25
AYG4	PM-083-10.0-11.0	16-5013-AYG4B	EPA 1613B	1,2,3,4,7,8-HxCDF	28.3	pg/g	JEMPC	U	25
AYG4	PM-083-10.0-11.0	16-5013-AYG4B	EPA 1613B	1,2,3,6,7,8-HxCDF	11.1	pg/g	JEMPC	U	25
AYG4	PM-083-10.0-11.0	16-5013-AYG4B	EPA 1613B	1,2,3,7,8,9-HxCDF	9.14	pg/g	JEMPC	U	25
AYG4	PM-083-10.0-11.0	16-5013-AYG4B	EPA 1613B	2,3,4,6,7,8-HxCDF	11	pg/g	JEMPC	U	25
AYG4	PM-083-10.0-11.0	16-5013-AYG4B	EPA 1613B	2,3,4,7,8-PeCDF	5.74	pg/g	JEMPC	U	25
AYG4	PM-083-10.0-11.0	16-5013-AYG4B	EPA 1613B	OCDD	43600	pg/g		J	13L
AYG4	PM-083-10.0-11.0	16-5013-AYG4B	EPA 1613B	Total HpCDF	3380	pg/g	EMPC	J	25
AYG4	PM-083-10.0-11.0	16-5013-AYG4B	EPA 1613B	Total HxCDF	647	pg/g	EMPC	J	25
AYG4	PM-083-10.0-11.0	16-5013-AYG4B	EPA 1613B	Total PeCDD	29.6	pg/g	EMPC	J	25
AYG4	PM-083-10.0-11.0	16-5013-AYG4B	EPA 1613B	Total PeCDF	68.4	pg/g	EMPC	J	25
AYG4	PM-083-10.0-11.0	16-5013-AYG4B	EPA 1613B	Total TCDD	4.86	pg/g	EMPC	J	25
AYG4	PM-083-10.0-11.0	16-5013-AYG4B	EPA 1613B	Total TCDF	4.23	pg/g	EMPC	J	25
AYG4	PM-071-3.0-4.0	16-5014-AYG4C	EPA 1613B	1,2,3,6,7,8-HxCDF	102	pg/g	JEMPC	U	25
AYG4	PM-071-3.0-4.0	16-5014-AYG4C	EPA 1613B	1,2,3,7,8,9-HxCDF	93.6	pg/g	JEMPC	U	25
AYG4	PM-071-3.0-4.0	16-5014-AYG4C	EPA 1613B	2,3,4,7,8-PeCDF	57.1	pg/g	JEMPC	U	25
AYG4	PM-071-3.0-4.0	16-5014-AYG4C	EPA 1613B	OCDD	434000	pg/g	E	J	13L,20
AYG4	PM-071-3.0-4.0	16-5014-AYG4C	EPA 1613B	Total HpCDF	39600	pg/g	EMPC	J	25
AYG4	PM-071-3.0-4.0	16-5014-AYG4C	EPA 1613B	Total HxCDD	4810	pg/g	EMPC	J	25
AYG4	PM-071-3.0-4.0	16-5014-AYG4C	EPA 1613B	Total HxCDF	7190	pg/g	EMPC	J	25
AYG4	PM-071-3.0-4.0	16-5014-AYG4C	EPA 1613B	Total PeCDD	388	pg/g	EMPC	J	25
AYG4	PM-071-3.0-4.0	16-5014-AYG4C	EPA 1613B	Total PeCDF	857	pg/g	EMPC	J	25
AYG4	PM-071-3.0-4.0	16-5014-AYG4C	EPA 1613B	Total TCDD	66.9	pg/g	EMPC	J	25
AYG4	PM-071-3.0-4.0	16-5014-AYG4C	EPA 1613B	Total TCDF	165	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AYG4	PM-071-7.0-8.0	16-5015-AYG4D	EPA 1613B	1,2,3,6,7,8-HxCDF	7.31	pg/g	JEMPC	U	25
AYG4	PM-071-7.0-8.0	16-5015-AYG4D	EPA 1613B	2,3,4,6,7,8-HxCDF	10.6	pg/g	JEMPC	U	25
AYG4	PM-071-7.0-8.0	16-5015-AYG4D	EPA 1613B	OCDD	17600	pg/g		J	13L
AYG4	PM-071-7.0-8.0	16-5015-AYG4D	EPA 1613B	Total HpCDF	1990	pg/g	EMPC	J	25
AYG4	PM-071-7.0-8.0	16-5015-AYG4D	EPA 1613B	Total HxCDD	284	pg/g	EMPC	J	25
AYG4	PM-071-7.0-8.0	16-5015-AYG4D	EPA 1613B	Total HxCDF	417	pg/g	EMPC	J	25
AYG4	PM-071-7.0-8.0	16-5015-AYG4D	EPA 1613B	Total PeCDD	38.1	pg/g	EMPC	J	25
AYG4	PM-071-7.0-8.0	16-5015-AYG4D	EPA 1613B	Total PeCDF	79.2	pg/g	EMPC	J	25
AYG4	PM-071-7.0-8.0	16-5015-AYG4D	EPA 1613B	Total TCDD	11.9	pg/g	EMPC	J	25
AYG4	PM-071-7.0-8.0	16-5015-AYG4D	EPA 1613B	Total TCDF	21.8	pg/g	EMPC	J	25
AYG4	PM-071-9.0-10.0	16-5016-AYG4E	EPA 1613B	1,2,3,4,7,8,9-HpCDF	6.63	pg/g	JEMPC	U	25
AYG4	PM-071-9.0-10.0	16-5016-AYG4E	EPA 1613B	1,2,3,4,7,8-HxCDD	2.69	pg/g	JEMPC	U	25
AYG4	PM-071-9.0-10.0	16-5016-AYG4E	EPA 1613B	1,2,3,7,8,9-HxCDF	1.97	pg/g	JEMPC	U	25
AYG4	PM-071-9.0-10.0	16-5016-AYG4E	EPA 1613B	2,3,4,6,7,8-HxCDF	4.77	pg/g	JEMPC	U	25
AYG4	PM-071-9.0-10.0	16-5016-AYG4E	EPA 1613B	2,3,4,7,8-PeCDF	1.15	pg/g	JEMPC	U	25
AYG4	PM-071-9.0-10.0	16-5016-AYG4E	EPA 1613B	2,3,7,8-TCDD	0.458	pg/g	JEMPC	U	25
AYG4	PM-071-9.0-10.0	16-5016-AYG4E	EPA 1613B	OCDD	8030	pg/g		J	13L
AYG4	PM-071-9.0-10.0	16-5016-AYG4E	EPA 1613B	Total HpCDF	869	pg/g	EMPC	J	25
AYG4	PM-071-9.0-10.0	16-5016-AYG4E	EPA 1613B	Total HxCDD	131	pg/g	EMPC	J	25
AYG4	PM-071-9.0-10.0	16-5016-AYG4E	EPA 1613B	Total HxCDF	180	pg/g	EMPC	J	25
AYG4	PM-071-9.0-10.0	16-5016-AYG4E	EPA 1613B	Total PeCDD	10.3	pg/g	EMPC	J	25
AYG4	PM-071-9.0-10.0	16-5016-AYG4E	EPA 1613B	Total PeCDF	26.6	pg/g	EMPC	J	25
AYG4	PM-071-9.0-10.0	16-5016-AYG4E	EPA 1613B	Total TCDD	1.13	pg/g	EMPC	J	25
AYG4	PM-071-9.0-10.0	16-5016-AYG4E	EPA 1613B	Total TCDF	5.3	pg/g	EMPC	J	25
AYG4	PM-084-3.0-4.0	16-5017-AYG4F	EPA 1613B	1,2,3,4,7,8,9-HpCDF	58.7	pg/g	EMPC	U	25
AYG4	PM-084-3.0-4.0	16-5017-AYG4F	EPA 1613B	2,3,7,8-TCDD	4.16	pg/g	JEMPC	U	25
AYG4	PM-084-3.0-4.0	16-5017-AYG4F	EPA 1613B	2,3,7,8-TCDF	1.37	pg/g	JEMPC	U	25
AYG4	PM-084-3.0-4.0	16-5017-AYG4F	EPA 1613B	OCDD	90600	pg/g	E	J	20
AYG4	PM-084-3.0-4.0	16-5017-AYG4F	EPA 1613B	Total HpCDD	15200	pg/g	EMPC	J	25
AYG4	PM-084-3.0-4.0	16-5017-AYG4F	EPA 1613B	Total HpCDF	8760	pg/g	EMPC	J	25
AYG4	PM-084-3.0-4.0	16-5017-AYG4F	EPA 1613B	Total HxCDD	1370	pg/g	EMPC	J	25

Qualified Data Summary Table
Lora Lake Apartments RIFS

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	Validation Qualifier	Validation Reason
AYG4	PM-084-3.0-4.0	16-5017-AYG4F	EPA 1613B	Total HxCDF	1710	pg/g	EMPC	J	25
AYG4	PM-084-3.0-4.0	16-5017-AYG4F	EPA 1613B	Total PeCDD	120	pg/g	EMPC	J	25
AYG4	PM-084-3.0-4.0	16-5017-AYG4F	EPA 1613B	Total PeCDF	234	pg/g	EMPC	J	25
AYG4	PM-084-3.0-4.0	16-5017-AYG4F	EPA 1613B	Total TCDD	18.9	pg/g	EMPC	J	25
AYG4	PM-084-3.0-4.0	16-5017-AYG4F	EPA 1613B	Total TCDF	40.2	pg/g	EMPC	J	25
AYG4	PM-084-7.0-8.0	16-5018-AYG4G	EPA 1613B	1,2,3,4,7,8,9-HpCDF	37.8	pg/g	EMPC	U	25
AYG4	PM-084-7.0-8.0	16-5018-AYG4G	EPA 1613B	2,3,4,6,7,8-HxCDF	22.4	pg/g	JEMPC	U	25
AYG4	PM-084-7.0-8.0	16-5018-AYG4G	EPA 1613B	2,3,4,7,8-PeCDF	7.77	pg/g	JEMPC	U	25
AYG4	PM-084-7.0-8.0	16-5018-AYG4G	EPA 1613B	2,3,7,8-TCDD	2.73	pg/g	JEMPC	U	25
AYG4	PM-084-7.0-8.0	16-5018-AYG4G	EPA 1613B	OCDD	44100	pg/g		J	13L
AYG4	PM-084-7.0-8.0	16-5018-AYG4G	EPA 1613B	Total HpCDD	8070	pg/g	EMPC	J	25
AYG4	PM-084-7.0-8.0	16-5018-AYG4G	EPA 1613B	Total HpCDF	4680	pg/g	EMPC	J	25
AYG4	PM-084-7.0-8.0	16-5018-AYG4G	EPA 1613B	Total HxCDD	900	pg/g	EMPC	J	25
AYG4	PM-084-7.0-8.0	16-5018-AYG4G	EPA 1613B	Total HxCDF	926	pg/g	EMPC	J	25
AYG4	PM-084-7.0-8.0	16-5018-AYG4G	EPA 1613B	Total PeCDD	81.9	pg/g	EMPC	J	25
AYG4	PM-084-7.0-8.0	16-5018-AYG4G	EPA 1613B	Total PeCDF	150	pg/g	EMPC	J	25
AYG4	PM-084-7.0-8.0	16-5018-AYG4G	EPA 1613B	Total TCDD	32.4	pg/g	EMPC	J	25
AYG4	PM-084-7.0-8.0	16-5018-AYG4G	EPA 1613B	Total TCDF	51.1	pg/g	EMPC	J	25
AYG4	PM-084-9.0-10.0	16-5019-AYG4H	EPA 1613B	1,2,3,6,7,8-HxCDF	21.1	pg/g	EMPC	U	25
AYG4	PM-084-9.0-10.0	16-5019-AYG4H	EPA 1613B	OCDD	38300	pg/g		J	13L
AYG4	PM-084-9.0-10.0	16-5019-AYG4H	EPA 1613B	Total HpCDD	6860	pg/g	EMPC	J	25
AYG4	PM-084-9.0-10.0	16-5019-AYG4H	EPA 1613B	Total HxCDD	1770	pg/g	EMPC	J	25
AYG4	PM-084-9.0-10.0	16-5019-AYG4H	EPA 1613B	Total HxCDF	987	pg/g	EMPC	J	25
AYG4	PM-084-9.0-10.0	16-5019-AYG4H	EPA 1613B	Total PeCDD	277	pg/g	EMPC	J	25
AYG4	PM-084-9.0-10.0	16-5019-AYG4H	EPA 1613B	Total PeCDF	254	pg/g	EMPC	J	25
AYG4	PM-084-9.0-10.0	16-5019-AYG4H	EPA 1613B	Total TCDD	83.9	pg/g	EMPC	J	25
AYG4	PM-084-9.0-10.0	16-5019-AYG4H	EPA 1613B	Total TCDF	40.4	pg/g	EMPC	J	25

Port of Seattle
Lora Lake Apartments Site

Engineering Design Report

Appendix C
Lora Lake Apartments Parcel Soil Performance Monitoring Data Report

Attachment C.4
Non-Hazardous Waste Manifest

NON-HAZARDOUS WASTE MANIFEST

DI 1601203667-00

Please print or type (Form designed for use on elite (12 pitch) typewriter)

NON-HAZARDOUS WASTE MANIFEST	1. Generator's US EPA ID No. CESQG	Manifest Document No. 03667	2. Page 1 of 2

3. Generator's Name and Mailing Address
Lora Lake Apartments
PO Box 68727
Seattle WA 98168

Site Address :
15001 Des Moines Memorial Drive
Burien, WA 98148

4. Generator's Phone ((206) 728-3763

5. Transporter 1 Company Name: Clean Harbors Environmental Service, Inc.	6. US EPA ID Number: MAD039322250	A. State Transporter's ID	B. Transporter 1 Phone (781) 792-5000
7. Transporter 2 Company Name: Steve [illegible] Trucking	8. US EPA ID Number: [illegible]	C. State Transporter's ID	D. Transporter 2 Phone
9. Designated Facility Name and Site Address: Clean Harbors Grassy Mountain LLC, 3 Miles East 7 Miles North of Knolls, Grantsville, UT 84029	10. US EPA ID Number: UTD991301748	E. State Facility's ID	F. Facility's Phone (435) 884-8900

11. WASTE DESCRIPTION	12. Containers No.	Type	13. Total Quantity	14. Unit Wt./Vol.
a. NON DOT REGULATED, (DRILLING SOILS)	016	DM	11,200	P
b. NON DOT REGULATED, (PURGE WATER)	007	DM	2,800	P
c.				
d.				

GENERATOR

G. Additional Descriptions for Materials Listed Above
11a.CH1175165 16 x 55
11b.CH1175142 07 x 55

H. Handling Codes for Wastes Listed Above
HB2
HB2

15. Special Handling Instructions and Additional Information

EMERGENCY PHONE #: (800) 483-3718
GENERATOR: Lora Lake Apartments

16. GENERATOR'S CERTIFICATION: I hereby certify that the contents of this shipment are fully and accurately described and are in all respects in proper condition for transport. The materials described on this manifest are not subject to federal hazardous waste regulations.

on behalf of the Port
Chris Mileasi, Port of Seattle
Printed/Typed Name — on behalf of the Port: Chris Mileasi
Signature: [signature]
Date Month 4 Day 27 Year 16

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Yeung Keo
Signature: [signature]
Date Month 04 Day 27 Year 16

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name: Tim Ogg
Signature: [signature]
Date Month 4 Day 29 Year 16

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of the waste materials covered by this manifest, except as noted in item 19.
2014005887
Printed/Typed Name: Samantha Thomas
Signature: [signature]
Date Month 5 Day 11 Year 16

NON-HAZARDOUS WASTE

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST (Continuation Sheet)	21. Generator ID Number C 8546	22. Page 2	23. Manifest Tracking Number D 3667

24. Generator's Name

Lena Lake Apartments

25. Transporter 2 Company Name Clean Harbors Environmental Services — U.S. EPA ID Number MAD039322250

26. Transporter ______ Company Name — U.S. EPA ID Number

27a. HM	27b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	28. Containers No.	28. Containers Type	29. Total Quantity	30. Unit Wt./Vol.	31. Waste Codes
	TPO					

32. Special Handling Instructions and Additional Information

GENERATOR

33. Transporter 2 Acknowledgment of Receipt of Materials

Printed/Typed Name: Cathy Soffel — Signature: [signature] — Month 5 Day 2 Year 16

34. Transporter ______ Acknowledgment of Receipt of Materials

Printed/Typed Name — Signature — Month Day Year

TRANSPORTER

35. Discrepancy

36. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

DESIGNATED FACILITY

EPA Form 8700-22A (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO GENERATOR

Port of Seattle
Lora Lake Apartments Site

Engineering Design Report

Appendix D
Hazardous Materials Testing and Disposal Documentation

Memorandum

Date: 03 April 2016

To: File

From: Port of Seattle Aviation Environmental Programs
Hazardous Waste Management Program

Subject: Former Lora Lake Apartments Parcel Cleanup
Dangerous Waste Designation of Soil

This memorandum summarizes the waste designation[1] that has been conducted for disposal of approximately 26,000 cubic yards of soil to be removed from the Lora Lake Cleanup Site at 15001 Des Moines Memorial Drive, Burien, WA as part of the Cleanup Action Plan to be executed by the Port of Seattle under a Consent Decree with the Washington State Department of Ecology. The designation applies to all soil removed from the site including the Lora Lake Apartments Parcel and the Lora Lake Parcel. The designation concluded the soil should not be regulated as a Hazardous Waste under RCRA or as Dangerous Waste under the WA State Dangerous Waste Regulations based on soil sampling and analysis compiled for various reports and investigations at the site.

WASTE DESIGNATION

1. **RCRA Solid Waste**
   The soil to be removed from the site meets the definition of a solid waste under 40 CFR 261.2.

2. **RCRA Hazardous Waste**
   The soil is not excluded from regulation as a hazardous waste under CFR 261.4(b); therefore, the waste was evaluated to determine if the soil met any of the criteria that would classify it as a RCRA hazardous waste.

   <u>Discarded Chemical Products List (U, P Series):</u> Sample analysis indicated trace constituents listed in 40 CFR 261.33, Discarded commercial chemical products, off-specification species, container residues and spill residues. However, the original processes generating any of these trace constituents are unknown and any previously applicable waste codes are unknown. Therefore, none of the RCRA U and P Series listings are applicable.[2]

   <u>Non-Specific Sources (RCRA F Series):</u> Sample analysis indicated trace constituents listed in 40 CFR 261.31, Wastes from Non-Specific Sources. However, the original processes generating any

[1] WAC 173-303-070

[2] Where a facility owner/operator makes a good faith effort to determine if a material is a listed hazardous waste but cannot make such a determination because documentation regarding a source of contamination, contaminant, or waste is unavailable or inconclusive, EPA has stated that one may assume the source, contaminant or waste is not listed hazardous waste. Management of Remediation Waste Under RCRA, EPA530-F-98-026.

of these trace constituents are unknown and any previously applicable waste codes are unknown. Therefore, none of the RCRA F Series listings are applicable.[2]

Specific Sources (RCRA K Series): The original processes generating any trace constituents at the site are unknown and any previously applicable waste codes are unknown. Therefore, none of the RCRA K Series listings are applicable.[2]

Characteristic Waste (RCRA D Series): After review and evaluation of all soil data complied, only one sample point exceeded the 20 times threshold screening value for toxicity characteristic contaminants.[3] The toxicity characteristic contaminant of concern was lead at concentration of 2,880 mg/kg at sample point PSB-11, located within the Lora Lake Apartments Parcel, Area A1. This sample point was resampled for TCLP lead analysis in December 2015. The results of the lead TCLP were non-detect for lead in the TCLP extract. This analysis, based on the highest concentration of toxicity characteristic contaminants known at the site, indicates that the soil does not meet the RCRA regulatory threshold standard for any toxic characteristics nor does it meet the RCRA regulatory threshold for characteristic codes of ignitibility, corrosivity or reactivity.

Dioxin Discussion – RCRA: If a waste containing dioxin does not meet the listing criteria of F020, F021, F022, F023, F026, F027, F028, F032 or any other listing criteria, then the waste containing dioxin is by definition, not a RCRA hazardous waste. As discussed previously, no F Series listing applied to the subject soil and therefore this waste is not a RCRA hazardous waste due to dioxin contamination. However, dioxin-containing waste can be regulated in WA State under the Dangerous Waste Regulations as a criteria waste due to toxicity (WAC-173-303-100), as discussed below.

3. WA State Dangerous Waste Designation

Persistent Dangerous Waste, HOCs: In accordance with WAC-173-303-100, a waste will designate as a persistent dangerous waste and carry a WA State Dangerous Waste code of WP02 if it contains a halogenated organic compound (HOC) total concentration of 0.01% - 1.0 % (100 – 10,000 ppm) and a WA State Dangerous Waste code of WP01 if HOCs exceed 1.0% (10,000 ppm). Taking a conservative screening approach, the highest individual HOC sample concentration reported from the available data[4] was used to calculate the sum of the HOC's. The worksheet used to calculate the HOC mass percent value is included as an attachment to this memorandum. The worksheet displays a total HOC mass percent of 0.0023. Therefore, based on this methodology, the soil does not meet the criteria for HOC Persistent Dangerous Waste.

Persistent Dangerous Waste, PAHs: In accordance with WAC-173-303-100, a waste will designate as a persistent dangerous waste and carry a WA State Dangerous Waste code of WP03 if it contains a total polycyclic aromatic hydrocarbon (PAH) concentration of greater than 1.0% (10,000 ppm). Taking a conservative screening approach, the highest individual PAH sample

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[3] From http://www3.epa.gov/epawaste/hazard/testmethods/faq/faq_tclp.htm:
"Section 1.2 of the TCLP does allow for a total constituent analysis in lieu of the TCLP extraction. If a waste is 100% solid, as defined by the TCLP method, then the results of the total constituent analysis may be divided by twenty to convert the total results into the maximum leachable concentration. This factor is derived from the 20:1 liquid-to-solid ratio employed in the TCLP."
[4] Floyd | Snider, Lora Lake Apartments RI/FS, January 2015, Table 4.3

concentration reported from the available data[5] was used to calculate the sum of the PAHs. The worksheet used to calculate the PAH mass percent value is included as an attachment to this memorandum. The worksheet displays a total PAH mass percent of 0.0029. Therefore, the based on this methodology, the soil does not meet the criteria for PAH Persistent Dangerous Waste.

Toxic Dangerous Waste: In accordance with WAC 173-303-100, a waste will designate as toxic dangerous waste and carry a WA State Dangerous Waste code of WT02 if the waste has an equivalent concentration equal to 0.001% and less than 1.0%. Equivalent concentration calculations are based on toxicity data obtained by direct bioassay testing or by book designation which utilizes toxicity data available from approved sources such as the Registry of Toxic Effects of Chemical Substances (RTECS), The National Library of Medicine's Hazardous Substances Database and The USEPA's ECOTOX Database.

The book designation approach was performed using all sample data available. Instead of designating each sample individually, a conservative screening measure was used where the highest concentration reported for each analyte was included to calculate a worst case equivalent concentration. Limited dioxin and furan toxicity data are available in the approved literature that is compatible with the book designation procedures of WAC 173-303-100. Therefore, the total calculated dioxin/furan Toxic Equivalent (TEQ) was used and placed in Toxic Category X, as that is the toxic category for the reference compound, TCDD (2,3,7,8-Tetrachlorodibenzo-p-dioxin).

Similar to dioxin and furan, limited toxicity data is available for many of the carcinogenic PAHs detected. Therefore, the total calculated PAH Toxic Equivalent (TEQ) was used and placed in Toxic Category C, as that is the toxic category for the reference compound, benzo(a)pyrene.

The book designation procedure for the evaluation of the Lora Lake soil produced an estimated toxic equivalent concentration (EC) of 0.0055. This value assigns a Dangerous Waste Designation of WT02 to this hypothetical, worst case sample.

Therefore, in accordance with WAC 173-303-100(5)(c), the Port conducted a fish bioassay on a sample collected from the vicinity of sample point PSB-11 in order to refute the book designation. This sample location was selected because it contained the highest levels of dioxin/furan, and the highest levels of lead. The fish bioassay resulted in zero mortality of the population tested. These results concluded that the soil is not a toxic Dangerous Waste under WAC 173-303-100.

DESIGNATION SUMMARY

Based on all available data, the soil planned for removal from the Lora Lake Apartments Cleanup Site under the Lora Lake Apartments Cleanup Action Plan should not be regulated as a Hazardous Waste under RCRA or as Dangerous Waste under the WA State Dangerous Waste Regulations.

However, because the soil exceeds certain cleanup criteria under MTCA, the soil should be managed as non-hazardous industrial solid waste and disposed in accordance with RCRA Subtitle D and at a facility that meets the requirements of 40 CFR 258 and WAC 173-351, which requires the facility to have a municipal solid waste handling permit.

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[5] Floyd | Snider, Lora Lake Apartments RI/FS, January 2015, Table 4.3

Attachments

1) Lora Lake Apartments Site RI/FS, Table 4.1 - Frequency of Detections for Lora Lake Apartments Parcel Soil Analytical Results
2) Toxic Criteria Book Designation
3) Total Halogenated Organic Compounds Calculation
4) Total Polycyclic Aromatic Hydrocarbons Calculation
5) TCLP Analysis for location PSB-11
6) Fish Bioassay for Location PSB-11

Table 4.1
Frequency of Detections for Lora Lake Apartments Parcel Soil Analytical Results

Analyte	Unit	Number of Results	Number of Detects	% Detect	Minimum Detected Value	Maximum Detected Value	Location of Maximum Detect	Date of Maximum Detect	Depth of Maximum Detect (feet)	Number of Non-detects	% Non-detect	Minimum Non-detected Value	Maximun Non-detected Value
Conventionals													
Moisture	%	8	8	100%	6	14	LLP-03	7/25/2007	6–7	0	0%	--	--
Total Organic Carbon	%	43	43	100%	0.029	14.5	PSB-21	8/25/2010	6–7	0	0%	--	--
Total Solids	%	99	99	100%	24.5	95.5	PSB-12	7/28/2010	8–10	0	0%	--	--
Metals													
Antimony	mg/kg	42	42	100%	0.05	3.51	LL-08	4/3/2008	2–4	0	0%	--	--
Arsenic	mg/kg	163	60	37%	0.89	11.2	MW-2	3/18/2008	0–0.5	103	63%	2	20
Barium	mg/kg	2	2	100%	49	51	LLP-04	7/25/2007	14.5–15.5	0	0%	--	--
Beryllium	mg/kg	42	42	100%	0.14	0.323	MW-3	3/18/2008	6.5–8	0	0%	--	--
Cadmium	mg/kg	44	42	95%	0.031	4.49	MW-5	3/17/2008	0–0.5	2	5%	0.56	0.56
Chromium	mg/kg	44	44	100%	18.9	52.9	MW-6	3/18/2008	0–0.5	0	0%	--	--
Copper	mg/kg	42	42	100%	6.13	72.6	MW-5	3/17/2008	0–0.5	0	0%	--	--
Lead	mg/kg	161	128	80%	1.82	2,880	PSB-11	7/30/2010	2–4	33	20%	1	2.14
Mercury	mg/kg	44	41	93%	0.01	0.215	MW-6	3/18/2008	0–0.5	3	7%	0.02	0.28
Nickel	mg/kg	42	42	100%	21.7	44.6	MW-4	3/17/2008	14–15.5	0	0%	--	--
Selenium	mg/kg	44	16	36%	0.3	1.1	MW-4 MW-3	3/17/2008 3/18/2008	9–10.5 0–0.5	28	64%	1	11
Silver	mg/kg	44	42	95%	0.015	0.188	MW-4	3/17/2008	0–0.5	2	5%	0.56	0.56
Thallium	mg/kg	42	42	100%	0.03	0.096	MW-5	3/17/2008	0–0.5	0	0%	--	--
Zinc	mg/kg	42	42	100%	18.8	641	MW-5	3/17/2008	0–0.5	0	0%	--	--
Total Petroleum Hydrocarbons													
Gasoline Range Hydrocarbons	mg/kg	140	19	14%	0.65	1,900	LLP-04	7/25/2007	14.5–15.5	121	86%	2.6	440
Diesel Range Hydrocarbons	mg/kg	171	63	37%	1.4	8,900	MW-1	10/25/2007	14–15	108	63%	5	95
Heavy Oil Range Hydrocarbons[1]	mg/kg	171	79	46%	12	17,000	LLP-04	7/25/2007	14.5–15.5	92	54%	10	380
Semivolatile Organic Compounds													
1,2-Diphenylhydrazine	µg/kg	2	0	--	--	--	--	–	–	2	100%	190	740
1-Methylnaphthalene	µg/kg	2	1	50%	4,300	4,300	LLP-04	7/25/2007	14.5–15.5	1	50%	15	15
2,3,4,6-Tetrachlorophenol	µg/kg	2	0	--	--	--	--	–	–	2	100%	190	740
2,3,5,6-Tetrachlorophenol	µg/kg	2	0	--	--	--	--	–	–	2	100%	190	740
2,4,5-Trichlorophenol	µg/kg	46	0	--	--	--	--	–	–	46	100%	5.3	740
2,4,6-Trichlorophenol	µg/kg	46	0	--	--	--	--	–	–	46	100%	5.3	740
2,4-Dichlorophenol	µg/kg	46	0	--	--	--	--	–	–	46	100%	5.3	740
2,4-Dimethylphenol	µg/kg	45	0	--	--	--	--	–	–	45	100%	27	1,000
2,4-Dinitrophenol	µg/kg	46	0	--	--	--	--	–	–	46	100%	110	5,700
2-Chloronaphthalene	µg/kg	46	0	--	--	--	--	–	–	46	100%	5.3	740
2-Chlorophenol	µg/kg	46	0	--	--	--	--	–	–	46	100%	5.3	740
2-Methylnaphthalene	µg/kg	46	9	20%	2.4	12,000	MW-1	10/25/2007	14–15	37	80%	5.3	200
2-Methylphenol	µg/kg	46	0	--	--	--	--	–	–	46	100%	5.3	740
2-Nitrophenol	µg/kg	46	0	--	--	--	--	–	–	46	100%	5.3	740
3- & 4-Methylphenol	µg/kg	3	0	--	--	--	--	–	–	3	100%	190	740
4,6-Dinitro-o-cresol	µg/kg	46	0	--	--	--	--	–	–	46	100%	53	3,700
4-Chloro-3-methylphenol	µg/kg	46	0	--	--	--	--	–	–	46	100%	5.3	740
4-Methylphenol	µg/kg	43	4	9%	1.6	39	LL-08	4/3/2008	2–4	39	91%	5.3	290
4-Nitrophenol	µg/kg	46	0	--	--	--	--	–	–	46	100%	53	2,900
Acenaphthene	µg/kg	46	8	17%	2.2	1,200	MW-1	10/25/2007	14–15	38	83%	5.3	99
Acenaphthylene	µg/kg	46	13	28%	1.2	450	MW-1	10/25/2007	14–15	33	72%	5.3	200
Aniline	µg/kg	2	0	--	--	--	--	–	–	2	100%	190	740

Table 4.1
Frequency of Detections for Lora Lake Apartments Parcel Soil Analytical Results

Analyte	Unit	Number of Results	Number of Detects	% Detect	Minimum Detected Value	Maximum Detected Value	Location of Maximum Detect	Date of Maximum Detect	Depth of Maximum Detect (feet)	Number of Non-detects	% Non-detect	Minimum Non-detected Value	Maximun Non-detected Value
Semivolatile Organic Compounds (continued)													
Anthracene	µg/kg	46	15	33%	1.6	2,300	MW-1	10/25/2007	14–15	31	67%	5.3	200
Benzidine	µg/kg	2	0	--	--	--	--	–	–	2	100%	1900	7,400
Benzo(b)fluoranthene	µg/kg	46	27	59%	2	880	LLP-04	7/25/2007	14.5–15.5	19	41%	5.3	200
Benzo(g,h,i)perylene	µg/kg	46	26	57%	2.2	320	MW-1	10/25/2007	14–15	20	43%	5.3	55
Benzo(k)fluoranthene	µg/kg	46	19	41%	1.5	260	MW-1	10/25/2007	14–15	27	59%	5.3	200
Benzoic acid	µg/kg	27	5	19%	110	270	LL-01	4/3/2008	0–0.5	22	81%	110	5,700
Benzyl alcohol	µg/kg	46	5	11%	2.7	51	LL-07	4/3/2008	0–0.5	41	89%	11	740
bis(2-chloroethoxy)methane	µg/kg	46	0	--	--	--	--	–	–	46	100%	5.3	740
bis(2-ethylhexyl)phthalate	µg/kg	46	32	70%	7.1	470	MW-5	3/17/2008	6.5–8	14	30%	53	2,900
Butyl benzyl phthalate	µg/kg	46	6	13%	4.4	49	LL-08	4/3/2008	2–4	40	87%	5.3	740
Carbazole	µg/kg	2	0	--	--	--	--	–	–	2	100%	190	740
Dibenzofuran	µg/kg	46	7	15%	1.5	1,000	MW-1	10/25/2007	14–15	39	85%	5.3	740
Diethylphthalate	µg/kg	46	4	9%	5.5	7.3	LL-07	4/3/2008	0–0.5	42	91%	5.3	740
Dimethyl phthalate	µg/kg	46	1	2%	740	740	LLP-04	7/25/2007	14.5–15.5	45	98%	5.3	290
Di-n-butyl phthalate	µg/kg	46	5	11%	8.2	330	MW-5	3/17/2008	0–0.5	41	89%	11	740
Di-n-octyl phthalate	µg/kg	46	0	--	--	--	--	–	–	46	100%	5.3	740
Fluoranthene	µg/kg	46	31	67%	2.6	3,000	MW-1	10/25/2007	14–15	15	33%	5.3	55
Fluorene	µg/kg	46	12	26%	1.1	2,700	MW-1	10/25/2007	14–15	34	74%	5.3	200
Hexachlorobutadiene	µg/kg	71	0	--	--	--	--	–	–	71	100%	5.5	740
Hexachlorocyclopentadiene	µg/kg	46	0	--	--	--	--	–	–	46	100%	29	1,500
Isophorone	µg/kg	46	0	--	--	--	--	–	–	46	100%	5.3	740
Naphthalene	µg/kg	90	25	28%	0.17	7,900	LLP-04	7/25/2007	14.5–15.5	65	72%	1.1	200
N-Nitrosodimethylamine	µg/kg	2	0	--	--	--	--	–	–	2	100%	190	740
N-Nitroso-di-n-propylamine	µg/kg	46	0	--	--	--	--	–	–	46	100%	5.3	740
N-Nitrosodiphenylamine	µg/kg	46	1	2%	1,900	1,900	LLP-04	7/25/2007	14.5–15.5	45	98%	5.3	290
Pentachlorophenol	µg/kg	157	69	44%	8.5	15,000	MW-4	3/17/2008	0–0.5	88	56%	5.9	3,700
Phenanthrene	µg/kg	46	32	70%	1.7	8,800	MW-1	10/25/2007	14–15	14	30%	5.3	55
Phenol	µg/kg	46	1	2%	5.1	5.1	MW-1	10/25/2007	7–8	45	98%	16	850
Pyrene	µg/kg	46	35	76%	1.5	2,700	MW-1	10/25/2007	14–15	11	24%	5.3	9.9
Total HPAH	µg/kg	45	34	76%	7	10,350	MW-1	10/25/2007	14–15	11	24%	5.3	9.9
Total LPAH	µg/kg	45	33	73%	1.7	18,950	MW-1	10/25/2007	14–15	12	27%	5.3	21
Total PAH	µg/kg	45	35	78%	5.5	29,300	MW-1	10/25/2007	14–15	10	22%	5.3	9.9
Carcinogenic Polycyclic Aromatic Hydrocarbons													
Benzo(a)pyrene	µg/kg	158	28	18%	1.9	630	MW-1	10/25/2007	14–15	130	82%	5.3	390
Benzo(a)anthracene	µg/kg	158	35	22%	2	890	MW-1	10/25/2007	14–15	123	78%	5.3	390
Benzofluoranthenes (total)	µg/kg	157	42	27%	2	1,030	LLP-04	7/25/2007	14.5–15.5	115	73%	5.3	390
Chrysene	µg/kg	158	53	34%	1.6	1,500	MW-1	10/25/2007	14–15	105	66%	5.3	390
Dibenzo(a,h)anthracene	µg/kg	158	12	8%	1.8	88	LLP-04	7/25/2007	14.5–15.5	146	92%	5.3	390
Indeno(1,2,3-cd)pyrene	µg/kg	158	27	17%	1.6	370	MW-1	10/25/2007	14–15	131	83%	5.3	390
Summed cPAH TEQ[2,3]	µg/kg	158	56	35%	0.022	870	MW-1	10/25/2007	14–15	102	65%	0	0
Summed cPAH TEQ with One-half of the Reporting Limit[2,4]	µg/kg	158	56	35%	3.8	880	MW-1	10/25/2007	14–15	102	65%	4	270
Volatile Organic Compounds													
1,1,1,2-Tetrachloroethane	µg/kg	44	0	--	--	--	--	–	–	44	100%	1.1	110
1,1,1-Trichloroethane	µg/kg	44	1	2%	0.28	0.28	LL-12	4/3/2008	0–0.5	43	98%	1.1	110
1,1,2,2-Tetrachloroethane	µg/kg	44	0	--	--	--	--	–	–	44	100%	1.1	110

Table 4.1
Frequency of Detections for Lora Lake Apartments Parcel Soil Analytical Results

Analyte	Unit	Number of Results	Number of Detects	% Detect	Minimum Detected Value	Maximum Detected Value	Location of Maximum Detect	Date of Maximum Detect	Depth of Maximum Detect (feet)	Number of Non-detects	% Non-detect	Minimum Non-detected Value	Maximun Non-detected Value
Volatile Organic Compounds (continued)													
1,1,2-Trichloroethane	µg/kg	44	0	--	--	--	--	--	--	44	100%	1.1	110
1,1-Dichloroethane	µg/kg	44	0	--	--	--	--	--	--	44	100%	1.1	110
1,1-Dichloroethene	µg/kg	44	0	--	--	--	--	--	--	44	100%	1.1	110
1,1-Dichloropropene	µg/kg	44	0	--	--	--	--	--	--	44	100%	1.1	110
1,2,3-Trichlorobenzene	µg/kg	44	0	--	--	--	--	--	--	44	100%	1.1	110
1,2,3-Trichloropropane	µg/kg	44	0	--	--	--	--	--	--	44	100%	1.1	110
1,2,4-Trichlorobenzene	µg/kg	90	1	1%	0.35	0.35	MW-5	3/17/2008	0–0.5	89	99%	1.1	740
1,2,4-Trimethylbenzene	µg/kg	44	7	16%	0.097	18,000	LLP-04	7/25/2007	14.5–15.5	37	84%	11	31
1,2-Dibromo-3-chloropropane	µg/kg	44	0	--	--	--	--	--	--	44	100%	5.6	560
1,2-Dibromoethane	µg/kg	44	0	--	--	--	--	--	--	44	100%	1.1	110
1,2-Dichlorobenzene	µg/kg	89	0	--	--	--	--	--	--	89	100%	1.1	740
1,2-Dichloroethane	µg/kg	146	0	--	--	--	--	--	--	146	100%	0.4	110
1,2-Dichloropropane	µg/kg	44	0	--	--	--	--	--	--	44	100%	1.1	110
1,3,5-Trimethylbenzene	µg/kg	44	2	5%	0.13	7,400	LLP-04	7/25/2007	14.5–15.5	42	95%	1.1	39
1,3-Dichlorobenzene	µg/kg	89	0	--	--	--	--	--	--	89	100%	1.1	740
1,3-Dichloropropane	µg/kg	44	0	--	--	--	--	--	--	44	100%	1.1	110
1,4-Dichlorobenzene	µg/kg	89	8	9%	0.14	20	MW-5	3/17/2008	0–0.5	81	91%	1.1	740
2,2-Dichloropropane	µg/kg	44	0	--	--	--	--	--	--	44	100%	1.1	110
2,4-Dinitrotoluene	µg/kg	46	0	--	--	--	--	--	--	46	100%	5.3	740
2,6-Dinitrotoluene	µg/kg	46	0	--	--	--	--	--	--	46	100%	5.3	740
2-Chloroethyl vinyl ether	µg/kg	2	0	--	--	--	--	--	--	2	100%	11	1,100
2-Chlorotoluene	µg/kg	44	0	--	--	--	--	--	--	44	100%	1.1	110
2-Hexanone	µg/kg	44	0	--	--	--	--	--	--	44	100%	5.6	560
2-Nitroaniline	µg/kg	46	0	--	--	--	--	--	--	46	100%	11	740
3,3'-Dichlorobenzidine	µg/kg	46	0	0%	--	--	--	--	--	46	100%	53	7,400
3-Nitroaniline	µg/kg	46	0	0%	--	--	--	--	--	46	100%	11	740
4-Bromophenyl phenyl ether	µg/kg	46	0	0%	--	--	--	--	--	46	100%	5.3	740
4-Chloroaniline	µg/kg	46	0	0%	--	--	--	--	--	46	100%	5.3	740
4-Chlorophenyl phenyl ether	µg/kg	46	0	0%	--	--	--	--	--	46	100%	5.3	740
4-Chlorotoluene	µg/kg	44	0	0%	--	--	--	--	--	44	100%	1.1	110
4-Nitroaniline	µg/kg	46	0	0%	--	--	--	--	--	46	100%	11	740
Acetone	µg/kg	44	42	95%	3	410	MW-5	3/17/2008	0–0.5	2	5%	20	560
Benzene	µg/kg	141	2	1%	0.96	1.7	MW-5	3/17/2008	0–0.5	139	99%	0.5	1,100
bis(2-chloroethyl)ether	µg/kg	46	0	0%	--	--	--	--	--	46	100%	5.3	740
bis(2-chloroisopropyl)ether	µg/kg	46	0	0%	--	--	--	--	--	46	100%	5.3	740
Bromobenzene	µg/kg	44	0	0%	--	--	--	--	--	44	100%	1.1	110
Bromochloromethane	µg/kg	44	0	0%	--	--	--	--	--	44	100%	1.1	110
Bromodichloromethane	µg/kg	44	0	0%	--	--	--	--	--	44	100%	1.1	110
Bromoform	µg/kg	44	0	0%	--	--	--	--	--	44	100%	1.1	110
Bromomethane	µg/kg	44	0	0%	--	--	--	--	--	44	100%	2.8	560
Carbon disulfide	µg/kg	44	18	41%	0.059	2.2	MW-2	3/18/2008	1.5–2	26	59%	1.1	110
Carbon tetrachloride	µg/kg	44	0	0%	--	--	--	--	--	44	100%	1.1	110
Chlorobenzene	µg/kg	44	0	0%	--	--	--	--	--	44	100%	1.1	110
Chloroethane	µg/kg	44	0	0%	--	--	--	--	--	44	100%	1.1	110
Chloroform	µg/kg	44	0	0%	--	--	--	--	--	44	100%	1.1	110
Chloromethane	µg/kg	44	0	0%	--	--	--	--	--	44	100%	1.1	110

Table 4.1
Frequency of Detections for Lora Lake Apartments Parcel Soil Analytical Results

Analyte	Unit	Number of Results	Number of Detects	% Detect	Minimum Detected Value	Maximum Detected Value	Location of Maximum Detect	Date of Maximum Detect	Depth of Maximum Detect (feet)	Number of Non-detects	% Non-detect	Minimum Non-detected Value	Maximun Non-detected Value
Volatile Organic Compounds (continued)													
cis-1,2-Dichloroethene	µg/kg	146	0	0%	--	--	--	--	--	146	100%	0.4	110
cis-1,3-Dichloropropene	µg/kg	44	0	0%	--	--	--	--	--	44	100%	1.1	110
Cymene	µg/kg	44	7	16%	0.11	5,500	LLP-04	7/25/2007	14.5–15.5	37	84%	11	39
Dibromochloromethane	µg/kg	44	0	0%	--	--	--	--	--	44	100%	1.1	110
Dibromomethane	µg/kg	44	0	0%	--	--	--	--	--	44	100%	1.1	110
Dichlorodifluoromethane	µg/kg	44	21	48%	0.14	12	MW-6	3/18/2008	0–0.5	23	52%	1.1	110
Ethylbenzene	µg/kg	141	8	6%	0.23	1,400	LLP-04	7/25/2007	14.5–15.5	133	94%	0.5	1,100
Hexachlorobenzene	µg/kg	46	1	2%	1.7	1.7	LL-01	4/3/2008	1.5–2	45	98%	5.3	740
Hexachloroethane	µg/kg	46	0	0%	--	--	--	--	--	46	100%	5.3	740
Iodomethane	µg/kg	2	0	0%	--	--	--	--	--	2	100%	5.6	560
iso-Propylbenzene	µg/kg	44	1	2%	1,500	1,500	LLP-04	7/25/2007	14.5–15.5	43	98%	1.1	39
Methyl ethyl ketone	µg/kg	44	22	50%	1.5	26	MW-6	3/18/2008	0–0.5	22	50%	15	560
Methyl iso butyl ketone	µg/kg	44	1	2%	0.95	0.95	MW-5	3/17/2008	0–0.5	43	98%	5.6	560
Methylene Chloride	µg/kg	44	20	45%	0.34	6.4	MW-6	3/18/2008	0–0.5	24	55%	5.6	560
Methyl-tert-butyl ether	µg/kg	2	0	0%	--	--	--	--	--	2	100%	1.1	110
n-Butylbenzene	µg/kg	44	2	5%	5.7	2,700	LLP-04	7/25/2007	14.5–15.5	42	95%	11	39
Nitrobenzene	µg/kg	46	0	0%	--	--	--	--	--	46	100%	5.3	740
n-Propylbenzene	µg/kg	44	1	2%	2,800	2,800	LLP-04	7/25/2007	14.5–15.5	43	98%	1.1	39
Pyridine	µg/kg	2	0	0%	--	--	--	--	--	2	100%	190	740
sec-Butylbenzene	µg/kg	44	2	5%	9.6	1,600	LLP-04	7/25/2007	14.5–15.5	42	95%	11	39
Styrene	µg/kg	44	1	2%	0.12	0.12	MW-5	3/17/2008	0–0.5	43	98%	1.1	110
tert-Butylbenzene	µg/kg	44	1	2%	120	120	LLP-04	7/25/2007	14.5–15.5	43	98%	1.1	39
Tetrachloroethene	µg/kg	146	3	2%	0.6	0.9	MW-12	8/2/2010	5.5–7.5	143	98%	0.4	110
Toluene	µg/kg	141	43	30%	0.22	620	LLP-04	7/25/2007	14.5–15.5	98	70%	0.5	1100
trans-1,2-Dichloroethene	µg/kg	146	0	0%	--	--	--	--	--	146	100%	0.4	110
trans-1,3-Dichloropropene	µg/kg	44	0	0%	--	--	--	--	--	44	100%	1.1	110
Trichloroethene	µg/kg	146	1	1%	0.8	0.8	PSB-11	7/30/2010	1.5–2	145	99%	0.4	110
Trichlorofluoromethane	µg/kg	44	4	9%	0.21	2.7	MW-3	3/18/2008	14–15.5	40	91%	1.1	110
Vinyl acetate	µg/kg	2	0	0%	--	--	--	--	--	2	100%	5.6	560
Vinyl chloride	µg/kg	44	0	0%	--	--	--	--	--	44	100%	1.1	110
m,p-Xylene	µg/kg	141	23	16%	0.18	8,400	LLP-04	7/25/2007	14.5–15.5	118	84%	0.5	2,200
o-Xylene	µg/kg	141	16	11%	0.17	4,100	LLP-04	7/25/2007	14.5–15.5	125	89%	0.5	69
Dioxins/Furans													
2,3,7,8-TCDD	pg/g	165	88	53%	0.098	446	PSB-11	7/30/2010	1.5–2	77	47%	0.0197	0.84
1,2,3,7,8-PeCDD	pg/g	165	119	72%	0.108	1,540	PSB-11	7/30/2010	1.5–2	46	28%	0.0161	1.27
1,2,3,4,7,8-HxCDD	pg/g	165	125	76%	0.15	2,670	PSB-11	7/30/2010	1.5–2	40	24%	0.0146	1.47
1,2,3,6,7,8-HxCDD	pg/g	165	136	82%	0.0966	24,600	PSB-11	7/30/2010	1.5–2	29	18%	0.0142	1.86
1,2,3,7,8,9-HxCDD	pg/g	165	132	80%	0.0946	8,970	PSB-11	7/30/2010	1.5–2	33	20%	0.0154	1.66
1,2,3,4,6,7,8-HpCDD	pg/g	165	160	97%	1.38	922,000	PSB-11	7/30/2010	1.5–2	5	3%	0.546	2.42
Total OCDD	pg/g	165	164	99%	6.68	6,050,000	PSB-11	7/30/2010	1.5–2	1	1%	4.58	4.58
2,3,7,8-TCDF	pg/g	165	97	59%	0.2	36.9	PSB-11	7/30/2010	1.5–2	68	41%	0.0142	0.51
1,2,3,7,8-PeCDF	pg/g	165	86	52%	0.0999	174	PSB-11	7/30/2010	1.5–2	79	48%	0.0118	1.04
2,3,4,7,8-PeCDF	pg/g	165	117	71%	0.0429	849	PSB-11	7/30/2010	1.5–2	48	29%	0.0114	1.07
1,2,3,4,7,8-HxCDF	pg/g	165	127	77%	0.0614	5,050	PSB-11	7/30/2010	1.5–2	38	23%	0.00876	1.06
2,3,4,6,7,8-HxCDF	pg/g	165	126	76%	0.109	3,680	PSB-11	7/30/2010	1.5–2	39	24%	0.00993	1.23
1,2,3,7,8,9-HxCDF	pg/g	165	74	45%	0.266	805	PSB-11	7/30/2010	1.5–2	91	55%	0.0119	2.88

Table 4.1
Frequency of Detections for Lora Lake Apartments Parcel Soil Analytical Results

Analyte	Unit	Number of Results	Number of Detects	% Detect	Minimum Detected Value	Maximum Detected Value	Location of Maximum Detect	Date of Maximum Detect	Depth of Maximum Detect (feet)	Number of Non-detects	% Non-detect	Minimum Non-detected Value	Maximun Non-detected Value
Dioxins/Furans (continued)													
1,2,3,4,6,7,8-HpCDF	pg/g	165	154	93%	0.53	257,000	PSB-11	7/30/2010	1.5–2	11	7%	0.0321	0.887
1,2,3,6,7,8-HxCDF	pg/g	165	125	76%	0.119	2,230	PSB-11	7/30/2010	1.5–2	40	24%	0.00899	11
1,2,3,4,7,8,9-HpCDF	pg/g	165	128	78%	0.185	9,580	PSB-11	7/30/2010	1.5–2	37	22%	0.023	1.3
Total OCDF	pg/g	165	153	93%	1.4	1,380,000	PSB-11	7/30/2010	1.5–2	12	7%	0.186	4.66
Summed Dioxin/Furan TEQ[5,6]	pg/g	165	164	99%	0.00417	21,200	PSB-11	7/30/2010	1.5–2	1	1%	0	0
Summed Dioxin/Furan TEQ with One-half of the Detection Limit[5,7]	pg/g	165	164	99%	0.0402	21,200	PSB-11	7/30/2010	1.5–2	1	1%	0.034	0.034
Polychlorinated Biphenyls													
PCB Aroclor 1016	µg/kg	4	0	0%	--	--	--	--	--	4	100%	5.5	7.1
PCB Aroclor 1221	µg/kg	4	0	0%	--	--	--	--	--	4	100%	11	15
PCB Aroclor 1232	µg/kg	4	0	0%	--	--	--	--	--	4	100%	5.5	12
PCB Aroclor 1242	µg/kg	4	1	25%	14	14	LL-08	4/3/2008	2–4	3	75%	5.5	7.1
PCB Aroclor 1248	µg/kg	4	0	0%	--	--	--	--	--	4	100%	5.5	7.1
PCB Aroclor 1254	µg/kg	4	1	25%	39	39	LL-08	4/3/2008	2–4	3	75%	5.5	80
PCB Aroclor 1260	µg/kg	4	2	50%	8.9	51	LL-08	4/3/2008	2–4	2	50%	5.5	7.1
PCBs (Total, Aroclors)	µg/kg	6	2	33%	8.9	104	LL-08	4/3/2008	2–4	4	67%	11	80
Miscellaneous													
2,3-Dichloroaniline	µg/kg	2	0	0%	--	--	--	--	--	2	100%	190	740
Di(2-ethylhexyl)adipate	µg/kg	2	0	0%	--	--	--	--	--	2	100%	190	740
m-Dinitrobenzene	µg/kg	2	0	0%	--	--	--	--	--	2	100%	190	740
o-Dinitrobenzene	µg/kg	2	0	0%	--	--	--	--	--	2	100%	190	740
p-Dinitrobenzene	µg/kg	2	0	0%	--	--	--	--	--	2	100%	190	740

Notes:

-- Indicates not applicable.
1 Heavy oil-range hydrocarbons includes motor oil-range, lube oil-range, and residual-range hydrocarbons.
2 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivancy Factors as presented in Table 708-2 of WAC 173-340-900 (WSDOE 2007).
3 Calculated using detected cPAH concentrations.
4 Calculated using detected cPAH concentrations plus one-half the reporting limit for cPAHs that were not detected.
5 World Health Organization 2005 Toxic Equivalency Factors used for calculation of dioxin/furan TEQ (Van den Berg et al. 2006).
6 Calculated using detected dioxin/furan concentrations.
7 Calculated using detected dioxin/furan concentrations plus one-half the detection limit for dioxins/furans that were not detected.

Abbreviations:

HPAH High molecular weight polycyclic aromatic hydrocarbon
LPAH Low molecular weight polycyclic aromatic hydrocarbon
ND Non-detect
OCDD Octachlorodibenzo-p-dioxin
OCDF Octachlorodibenzofuran
PAH Polycyclic aromatic hydrocarbon
PCB Polychlorinated biphenyl
TEQ Toxic equivalency quotient
WAC Washington Administrative Code
WSDOE Washington State Department of Ecology

Dangerous Waste Book Designation - Lora Lake Apartments Soil

Sample ID: Theoretical Sample Based on Maximum Detected Values
Reference: Lora Lake Apartments Remedial Investigation/Feasibility Study - Table 4.1 Fre□uency of Detections for Lora Lake Surface Sediment Analytical Results
Designation conducted by: David J. Hill, PE, CHMM, CPEA (DH Environmental, Inc.)

Conversions
1 pg/g and 1 ng/kg = 10□-10 %
1 ug/kg = 10□-7 %
1 mg/kg = 10□-4 %
(mass %)

Analyte	Sample Location	CAS	Concentration□	Toxicity[Source]	Toxic Category	Concentration (mass □) □	A	B	C	D
TOTAL METALS by 6010C/7471B (mg/kg)										
Arsenic	MW-2	7440-38-2	11.2	LC50 Oncorhynchus mykiss (Rainbow Trout) □170 - <15,610 ug/L/96hr [3]	**B**			**1.12E-03**		
Barium	LLP-04	7440-39-3	51	LC50 Lepomis macrochirus (Bluegill) 198000 ug/L/96hr□	**NOT APPLICABLE**					
Cadmium	MW-5	7440-43-9	4.49	LC50 Oncorhynchus mykiss (Rainbow Trout) 0.003 mg/L/96 hr[3]	□	**4.49E-04**				
Chromium	MW-6	7440-47-3	18.9	LC50 Danio rerio (Zebra Danio) 3.9 mg/kg/24 hr□	**C**				**1.89E-03**	
Copper	MW-5	7440-50-8	72.6	LC50 Pimephales promelas (fathead minnow) 0.02 mg/l/96 hr□	**A**		**7.26E-03**			
Lead	PSB-11	7439-92-1	2880	LC50 Oncorhynchus mykiss (Rainbow Trout) 0.14 mg/L/336 hr[3]	**B**			**2.88E-01**		
Mercury	MW-6	7439-97-6	0.215	LC50 Oncorhynchus mykiss (Rainbow Trout) 5 ug/L/192 hr[3]	□	**2.15E-05**				
Nickel	MW-4	7440-02-0	44.6	LC50 Oncorhynchus mykiss (Rainbow Trout) 50 ug/L/672 hr[3]	**A**		**4.46E-03**			
Selenium		7782-49-2	1.1	LC50 Oncorhynchus mykiss (Rainbow Trout) 5000 ug/L/672 hr[3]	**C**				**1.10E-04**	
Silver	MW-4	7440-22-4	0.188	LC50 Oncorhynchus mykiss (Rainbow Trout) 6.2 ug/L/ 96hr[3]	□	**1.88E-05**				
Zinc	MW-5	7440-66-6	641	LC50 Oncorhynchus tshawytscha (Chinook Salmon) 0.182 mg/L/96 hr□	**B**			**6.41E-02**		
VOLATILES by EPA 8260C (ug/kg)										
Dichlorodifluoromethane	MW-6	75-71-8	12	LD 50 Rat Inhalation □800,000 mg/L[2]	**NOT APPLICABLE**					
Cymene	LLP-04	527-84-4	5500	LD50 Oral Rat 2130 mg/kg□	**D**					**5.50E-04**
Trichlorofluoromethane	MW-3	75-69-4	2.7	LD50 Oral Rat 352 mg/kg[1]	**C**				**2.70E-07**	
Acetone	MW-5	67-64-1	410	LC Rat Inhalation 50.10 mg/kg[1]	**D**					**4.10E-05**
Carbon Disulfide	MW-2	75-15-0	2.2	LD50 Oral Rat 1200 mg/kg□	**D**					**2.20E-07**
Methylene Chloride	MW-6	75-09-2	6.4	LD50 Oral Rat 985 mg/kg□	**D**					**6.40E-07**
2-Butanone	MW-6	78-93-3	26	LD50 Oral Rat 2737 mg/kg□	**D**					**2.60E-06**
1,1,1-Trichloroethane	LL-12	71-55-6	0.28	LC50 Oncorhynchus mykiss (Rainbow Trout) 42.3 mg/L/96hr[3]	**D**					**2.80E-08**
Benzene	MW-5	71-43-2	1.7	LC50 Oncorhynchus mykiss (Rainbow Trout) 9.2 mg/L/96hr[3]	**C**				**1.70E-07**	
Trichloroethene	PSB-11	79-01-6	0.8	LC50 Pimephales promelas (fathead minnow) 40.7 mg/l/96 hr[2]	**D**					**8.00E-08**
Methyl Isobutyl Ketone	MW-5	108-10-1	0.95	LD50 Rat oral 4600 mg/kg[2]	**D**					**9.50E-08**
Toluene	LLP-04	108-88-3	620	LC50 Oncorhynchus mykiss (Rainbow Trout) 6.78 mg/L/96hr[3]	**C**				**6.20E-05**	
Tetrachloroethene	MW-12	127-18-4	0.9	LC50 Salmo gairdneri (Oncorhynchus mykiss - rainbow trout) 5 mg/l/96 hr[2]	**C**				**9.00E-08**	
Ethylbenzene	LLP-04	100-41-4	1400	Oncorhynchus mykiss (Rainbow Trout) 4.2 mg/L/96 hr[3]	**C**				**1.40E-04**	
m,p-Xylene	LLP-04	108-38-3, 106-42-3	8400	LC50 Oncorhynchus mykiss (Rainbow Trout) 2.6 mg/L/96hr[3]	**C**				**8.40E-04**	
o-Xylene	LLP-04	95-47-6	4100	LC50 Oncorhynchus mykiss (Rainbow Trout) 7.6 mg/L/96hr□	**C**				**4.10E-04**	
Styrene	MW-05	100-42-5	0.12	LC50 Rat Inhalation 0.18 mg/kg□	**A**		**1.20E-08**			
Bromoform		75-25-2		LD50 Rat 414 mg/kg[2]	**C**					
Hexachlorobenzene	LL-01	118-74-1	1.7	LC50; Species: Oncorhynchus kisutch (coho salmon) weight 0.5 g; Conditions: static bioassay, 7 deg C; Concentration: □50 mg/L for 96 hr[2]	**D**					**1.70E-07**
Isopropylbenzene	LLP04	98-82-8	1500	1400 mg/kg Oral Rat LD50[2]	**D**					**1.50E-04**
n-propyl benzene	LLP-04	103-65-1	2800	6040 mg/kg Oral Rat LD50[2]	**NOT APPLICABLE**					
1,3,5-Trimethylbenzene	LLP-04	108-67-8	7400	LD50 Oral Rat 5000 mg/kg[1]	**D**					**7.40E-04**
tert-Butylbenzene	LLP-04	98-06-6	120	NO TOXICITY DATA AVAILABLE TAKEN FROM SEC-BUTYLBENZENE LD50 Rat oral 2240 mg/kg[2]	**D**					**1.20E-05**
1,2,4-Trimethylbenzene	LLP-04	95-63-6	18000	LC50 Pimephales promelas (fathead minnow) 7.720 mg/l/96 hr□	**C**				**1.80E-03**	
sec-Butylbenzene	LLP-04	135-98-8	1600	2240 mg/kg Oral Rat LD50[2]	**D**					**1.60E-04**
1,4-Dichlorobenzene	MW-5	106-46-7	20	LD50 Rat oral 500 mg/kg[2]	**C**				**2.00E-06**	
n-Butylbenzene	LLP-04	104-51-8	2700	LD50 Mouse sc 1994.5 mg/kg[2]	**D**					**2.70E-04**
1,2,4-Trichlorobenzene	MW-5	120-82-1	0.35	LD50 Rat oral 756 mg/kg□	**D**					**3.50E-08**
Semivolatiles by EPA 8270 (ug/kg)										
Naphthalene	LLP-04	91-20-3	7900	LC50 Oncorhynchus gorbuscha (pink salmon) 1.4 mg/L/96 hr[2]	**C**				**7.90E-04**	
bis(2-ethylhexyl)phthalate	MW-5	117-81-7	470	LC50; Species: Oncorhynchus mykiss (Rainbow trout) embryo to larva lifestages; 139500 ug/L for 96 hr (95% confidence interval: 123200-165200 ug/L)	**NOT APPLICABLE**					
Butyl benzyl phthalate	LL-08	85-68-7	49	LC50; Species: Oncorhynchus mykiss (Fish); Conditions: fresh water, flow through; Concentration: 0.82 mg/L for 96 hr	**B**			**4.90E-06**		
Fluorene	MW-1	86-73-7	2700	LC50 Oncorhynchus mykiss (Rainbow trout) 820 ug/L 96hr[3]	**B**			**2.70E-04**		
Phenanthrene	MW-1	85-01-8	8800	LC50 Oncorhynchus mykiss (Rainbow trout, larvae) 40 ug/L 27 days[2]	**A**		**8.80E-04**			
Anthracene	MW-1	120-12-7	2300	LC50 Lepomis macrochirus (bluegill) 1.27 ug/L 96hr[2]	□	**2.30E-04**				
Fluoranthene	MW-1	206-44-0	3000	LC50 Lepomis macrochirus (bluegill) 3980 ug/L 96hr[2]	**C**				**3.00E-04**	
Dimethyl phthalate	LL-07	131-11-3	7.3	LC50 Oncorhynchus mykiss (Rainbow trout) 56 ug/L 96 hr[2]	**D**					**7.30E-07**
Di-n-butyl phthalate	MW-5	84-74-2	330	LC50 Oncorhynchus mykiss (Rainbow trout) 1240 ug/L 96 hr2	**C**				**3.30E-05**	
Pentachlorophenol	MW-4	87-86-5	1500	LC50 Oncorhynchus mykiss (Rainbow trout) 52 ug/L 96hr[2]	**A**		**1.50E-04**			
Phenol	MW-1	108-95-2	5.1	LC50 Fathead minnow 32 mg/l/96 hr in a static bioassay[2]	**D**					**5.10E-07**
Pyrene	MW-1	129-00-0	2700	LC50 Oncorhynchus mykiss (Rainbow trout) 2000 ug/L 96hr[3]	**C**				**2.70E-04**	
Benzoic Acid	LL-01	65-85-0	270	LD50 Rat oral 1700 mg/kg[2]	**D**					**2.70E-05**
Benzyl alcohol	LL-07	100-51-6	51	LC50; Species: Lepomis macrochirus (bluegill sunfish); Conditions: static bioassay in fresh water at 23 deg C, mild aeration after 24 hr; Concentration: 10 ppm for 96 hr	**D**					**5.10E-06**
Benzo(g,h,i)perylene	MW-1	198-55-0	320	NO DATA AVAILABLE: Taken as equivalent to Benzo(a)pyrene, LC50 Poeciliopsis lucida (Clearfin livebearer) 1.2-3.7 mg/l 24-hr[2]	**C**					
Carcinogenic PAHs as cPAH TEQ (ug/kg)										
Total Summed cPAH TEQ (ref: Benzo(a)pyrene)	MW-1	50-32-8	880	Taken as equivalent to Benzo(a)pyrene, LC50 Poeciliopsis lucida (Clearfin livebearer) 1.2-3.7 mg/l 24-hr[2]	**C**			**8.80E-05**		
Dioxins/Furans as TCDD TEQ (pg/g)										
Total TCDD TEQ (ref: 2,3,7,8-Tetrachlorodibenzo-p-dioxin)		1746-01-6	21200	Taken as TCDD: 0.022 mg/kg Dermal Rabit LD50[2]	□	**2.12E-06**				
Total (SUM)						**0.0007214**	**0.0127500**	**0.3535829**	**0.0066475**	**0.0020**

	∑X% / 1	∑A% / 10	∑B% / 100	∑C% / 1000	∑D% / 10000	EC	Designation
Toxic Category Mass Total % →	7.21E-04	1.28E-02	3.54E-01	6.65E-03	1.96E-03		
	7.21E-04	1.28E-03	3.54E-03	6.65E-06	1.96E-07	**0.0055**	**WT02**

Sources
1 RTECS: Registry of Toxic Effects of Chemical Substances
2 HSDB: Hazardous Substances Data Bank, National Library of Medicine
3 ECOTOX Database: United States Environmental Protection Agency

□Concentration assumed from highest possible value from all samples

Lora Lake Apartments Site
Soil Halogenated Organic Compounds Mass % Calculation

Analyte	Maximum Concentration Detected	Concentration (mass %)
SEMIVOLATILES (ug/kg)		
Pentachlorophenol	15000	1.50E-03
VOLATILE ORGANIC COMPOUNDS (ug/kg)		
1,1,1-Trichloroethane	0.28	2.80E-08
1,2,4-Trichlorobenzene	0.35	3.50E-08
1,4-Dichlorobenzene	20	2.00E-06
Dichlorodifluoromethane	12	1.20E-06
Hexachlorobenzene	1.7	1.70E-07
Methylene Chloride	6.4	6.40E-07
Tetrachloroethene	0.9	9.00E-08
Trichloroethene	0.8	8.00E-08
Trichlorofluoromethane	2.7	2.70E-07
DIOXINS/FURANS (pg/g)		
2,3,7,8-TCDD	446	4.46E-08
1,2,3,7,8-PeCDD	1540	1.54E-07
1,2,3,4,7,8-HxCDD	2670	2.67E-07
1,2,3,6,7,8-HxCDD	24600	2.46E-06
1,2,3,7,8,9-HxCDD	8970	8.97E-07
1,2,3,4,6,7,8-HpCDD	922000	9.22E-05
Total OCDD	6050000	6.05E-04
2,3,7,8-TCDF	36.9	3.69E-09
1,2,3,7,8-PeCDF	174	1.74E-08
2,3,4,7,8-PeCDF	849	8.49E-08
1,2,3,4,7,8-HxCDF	5050	5.05E-07
2,3,4,6,7,8-HxCDF	3680	3.68E-07
1,2,3,7,8,9-HxCDF	805	8.05E-08
1,2,3,4,6,7,8-HpCDF	257000	2.57E-05
1,2,3,6,7,8-HxCDF	2230	2.23E-07
1,2,3,4,7,8,9-HpCDF	9580	9.58E-07
PCBS (ug/kg)		
TOTAL AROCLORS	104	1.04E-04

MAX THEORETICAL HOC MASS % 0.0023

Dangerous Waste Designation of WP02 Requires an HOC Mass % of 1.0%

Lora Lake Apartments Site

Soil PAH Mass Calculation

Analyte	Concentration (ug/kg)	Concentration (mass %)
SEMIVOLATILES		
TOTAL PAH (from Table 4.1 of Lora Lake RI/FS, January 2015)	29300	0.00293

MAX THEORETICAL PAH MASS % 0.0029

***Dangerous Waste Designation of WP03 Requires an PAH Mass% of 1.0%**

OnSite Environmental Inc.
14648 NE 95th Street, Redmond, WA 98052 • (425) 883-3881

TRANSMITTAL MEMORANDUM

From: OnSite Environmental Inc.
To: Don Robbins, Port of Seattle (Airport)

Date: December 11, 2015
Project Name: Lora Lake Apartments; 104395
Reference: S-00317836
Laboratory Reference Number: 1512-084
Subject: Tier 3 Data Deliverables

Description: Results of TCLP Metals EPA 1311/6010C/7470A.

OnSite Environmental Inc.

14648 NE 95th Street, Redmond, WA 98052 • (425) 883-3881

December 11, 2015

Don Robbins
Port of Seattle
SeaTac International Airport
17801 Pacific Hwy. South, Room A6012M
Seattle, WA 98158

Re: Analytical Data for Project Lora Lake Apartments; 104395
Laboratory Reference No. 1512-084

Dear Don:

Enclosed are the analytical results and associated quality control data for samples submitted on December 8, 2015.

The standard policy of OnSite Environmental Inc. is to store your samples for 30 days from the date of receipt. If you require longer storage, please contact the laboratory.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the data, or need additional information, please feel free to call me.

Sincerely,

David Baumeister
Project Manager

Enclosures

Date of Report: December 11, 2015
Samples Submitted: December 8, 2015
Laboratory Reference: 1512-084
Project: Lora Lake Apartments; 104395
Professional Service Agreement: S-00317836

Case Narrative

Samples were collected on November 23, 2015 and received by the laboratory on December 8, 2015. They were maintained at the laboratory at a temperature of 2°C to 6°C. Please see Sample/Cooler Receipt form at the end of the report.

General QA/QC issues associated with the analytical data enclosed in this laboratory report will be indicated with a reference to a comment or explanation on the Data Qualifier page. More complex and involved QA/QC issues will be discussed in detail below.

Date of Report: December 11, 2015
Samples Submitted: December 8, 2015
Laboratory Reference: 1512-084
Project: Lora Lake Apartments; 104395
Professional Service Agreement: S-00317836

ANALYTICAL REPORT FOR SAMPLES

Client ID	Laboratory ID	Matrix	Date Sampled	Date Received	Notes
PM-085-00.00-10.0-TCLP	12-084-01	Soil	11-23-15	12-8-15	

Date of Report: December 11, 2015
Samples Submitted: December 8, 2015
Laboratory Reference: 1512-084
Project: Lora Lake Apartments; 104395
Professional Service Agreement: S-00317836

TCLP METALS
EPA 1311/6010C/7470A

Matrix: TCLP Extract
Units: mg/L (ppm)

Analyte	Result	PQL	EPA Method	Date Prepared	Date Analyzed	Flags
Lab ID:	12-084-01					
Client ID:	**PM-085-00.00-10.0-TCLP**					
Arsenic	**ND**	0.40	6010C	12-9-15	12-9-15	
Barium	**0.64**	0.20	6010C	12-9-15	12-9-15	
Cadmium	**ND**	0.020	6010C	12-9-15	12-9-15	
Chromium	**ND**	0.020	6010C	12-9-15	12-9-15	
Lead	**ND**	0.20	6010C	12-9-15	12-9-15	
Mercury	**ND**	0.0050	7470A	12-9-15	12-9-15	
Selenium	**ND**	0.40	6010C	12-9-15	12-9-15	
Silver	**ND**	0.040	6010C	12-9-15	12-9-15	

Date of Report: December 11, 2015
Samples Submitted: December 8, 2015
Laboratory Reference: 1512-084
Project: Lora Lake Apartments; 104395
Professional Service Agreement: S-00317836

TCLP METALS
EPA 1311/6010C
METHOD BLANK QUALITY CONTROL

Date Prepared: 12-8-15
Date Extracted: 12-9-15
Date Analyzed: 12-9-15

Matrix: TCLP Extract
Units: mg/L (ppm)

Lab ID: MB1209TM1

Analyte	Method	Result	PQL
Arsenic	6010C	**ND**	0.40
Barium	6010C	**ND**	0.20
Cadmium	6010C	**ND**	0.020
Chromium	6010C	**ND**	0.020
Lead	6010C	**ND**	0.20
Selenium	6010C	**ND**	0.40
Silver	6010C	**ND**	0.040

Date of Report: December 11, 2015
Samples Submitted: December 8, 2015
Laboratory Reference: 1512-084
Project: Lora Lake Apartments; 104395
Professional Service Agreement: S-00317836

TCLP MERCURY
EPA 1311/7470A
METHOD BLANK QUALITY CONTROL

Date Prepared: 12-8-15
Date Extracted: 12-9-15
Date Analyzed: 12-9-15

Matrix: TCLP Extract
Units: mg/L (ppm)

Lab ID: MB1209T1

Analyte	Method	Result	PQL
Mercury	7470A	**ND**	0.0050

Date of Report: December 11, 2015
Samples Submitted: December 8, 2015
Laboratory Reference: 1512-084
Project: Lora Lake Apartments; 104395
Professional Service Agreement: S-00317836

TCLP METALS
EPA 1311/6010C
DUPLICATE QUALITY CONTROL

Date Prepared: 12-8-15
Date Extracted: 12-9-15
Date Analyzed: 12-9-15

Matrix: TCLP Extract
Units: mg/L (ppm)

Lab ID: 12-079-01

Analyte	Sample Result	Duplicate Result	RPD	PQL	Flags
Arsenic	**ND**	**ND**	NA	0.40	
Barium	**0.534**	**0.522**	2	0.20	
Cadmium	**ND**	**ND**	NA	0.020	
Chromium	**ND**	**ND**	NA	0.020	
Lead	**ND**	**ND**	NA	0.20	
Selenium	**ND**	**ND**	NA	0.40	
Silver	**ND**	**ND**	NA	0.040	

Date of Report: December 11, 2015
Samples Submitted: December 8, 2015
Laboratory Reference: 1512-084
Project: Lora Lake Apartments; 104395
Professional Service Agreement: S-00317836

TCLP MERCURY
EPA 1311/7470A
DUPLICATE QUALITY CONTROL

Date Prepared: 12-8-15
Date Extracted: 12-9-15
Date Analyzed: 12-9-15

Matrix: TCLP Extract
Units: mg/L (ppm)

Lab ID: 12-078-01

Analyte	Sample Result	Duplicate Result	RPD	PQL	Flags
Mercury	**ND**	**ND**	NA	0.0050	

Date of Report: December 11, 2015
Samples Submitted: December 8, 2015
Laboratory Reference: 1512-084
Project: Lora Lake Apartments; 104395
Professional Service Agreement: S-00317836

TCLP METALS
EPA 1311/6010C
MS/MSD QUALITY CONTROL

Date Prepared: 12-8-15
Date Extracted: 12-9-15
Date Analyzed: 12-9-15

Matrix: TCLP Extract
Units: mg/L (ppm)

Lab ID: 12-079-01

Analyte	Spike Level	MS	Percent Recovery	MSD	Percent Recovery	RPD	Flags
Arsenic	4.00	**4.37**	109	**4.23**	106	3	
Barium	4.00	**4.56**	101	**4.47**	98	2	
Cadmium	2.00	**2.16**	108	**2.04**	102	6	
Chromium	4.00	**4.14**	103	**3.90**	98	6	
Lead	10.0	**10.3**	103	**9.66**	97	6	
Selenium	4.00	**4.49**	112	**4.26**	107	5	
Silver	1.00	**0.936**	94	**0.938**	94	0	

Date of Report: December 11, 2015
Samples Submitted: December 8, 2015
Laboratory Reference: 1512-084
Project: Lora Lake Apartments; 104395
Professional Service Agreement: S-00317836

TCLP MERCURY
EPA 1311/7470A
MS/MSD QUALITY CONTROL

Date Prepared: 12-8-15
Date Extracted: 12-9-15
Date Analyzed: 12-9-15

Matrix: TCLP Extract
Units: mg/L (ppm)

Lab ID: 12-078-01

Analyte	Spike Level	MS	Percent Recovery	MSD	Percent Recovery	RPD	Flags
Mercury	0.0500	**0.0528**	106	**0.0509**	102	4	

Date of Report: December 11, 2015
Samples Submitted: December 8, 2015
Laboratory Reference: 1512-084
Project: Lora Lake Apartments; 104395
Professional Service Agreement: S-00317836

TCLP METALS
EPA 1311/6010C/7470A
CONTINUING CALIBRATION SUMMARY

Lab ID	True Value (ppm)	Calc. Value	Percent Difference	Control Limits
CCV3120915P	10.0	10.4	-4.0	+/- 10%
CCV3120915P	2.00	2.09	-4.5	+/- 10%
CCV3120915P	1.00	1.04	-4.0	+/- 10%
CCV3120915P	1.00	1.04	-4.0	+/- 10%
CCV3120915P	10.0	10.2	-2.0	+/- 10%
CCV3120915Y	0.00500	0.00491	1.8	+/- 20%
CCV3120915P	10.0	10.3	-3.0	+/- 10%
CCV3120915P	1.00	1.06	-6.0	+/- 10%
LLCCV3120915P	0.100	0.115	-15	+/- 30%
LLCCV3120915P	0.0200	0.0245	-23	+/- 30%
LLCCV3120915P	0.0100	0.0112	-12	+/- 30%
LLCCV3120915P	0.0100	0.0116	-16	+/- 30%
LLCCV3120915P	0.100	0.106	-6.0	+/- 30%
LLCCV3120915P	0.100	0.126	-26	+/- 30%
LLCCV3120915P	0.0200	0.0217	-8.5	+/- 30%
CCV4120915P	10.0	10.5	-5.0	+/- 10%
CCV4120915P	2.00	2.11	-5.5	+/- 10%
CCV4120915P	1.00	1.05	-5.0	+/- 10%
CCV4120915P	1.00	1.04	-4.0	+/- 10%
CCV4120915P	10.0	10.4	-4.0	+/- 10%
CCV4120915P	10.0	10.4	-4.0	+/- 10%
CCV4120915P	1.00	1.06	-6.0	+/- 10%
LLCCV4120915P	0.100	0.118	-18	+/- 30%
LLCCV4120915P	0.0200	0.0248	-24	+/- 30%
LLCCV4120915P	0.0100	0.0106	-6.0	+/- 30%
LLCCV4120915P	0.0100	0.0113	-13	+/- 30%
LLCCV4120915P	0.100	0.111	-11	+/- 30%
LLCCV4120915P	0.100	0.119	-19	+/- 30%
LLCCV4120915P	0.0200	0.0196	2.0	+/- 30%

Date of Report: December 11, 2015
Samples Submitted: December 8, 2015
Laboratory Reference: 1512-084
Project: Lora Lake Apartments; 104395
Professional Service Agreement: S-00317836

TCLP METALS
EPA 1311/6010C/7470A
CONTINUING CALIBRATION SUMMARY

Analyte	Lab ID	True Value (ppm)	Calc. Value	Percent Difference	Control Limits
Arsenic	CCV5120915P	10.0	10.3	-3.0	+/- 10%
Barium	CCV5120915P	2.00	2.05	-2.5	+/- 10%
Cadmium	CCV5120915P	1.00	1.03	-3.0	+/- 10%
Chromium	CCV5120915P	1.00	1.03	-3.0	+/- 10%
Lead	CCV5120915P	10.0	9.96	0.40	+/- 10%
Selenium	CCV5120915P	10.0	10.1	-1.0	+/- 10%
Silver	CCV5120915P	1.00	1.04	-4.0	+/- 10%
Arsenic	LLCCV5120915P	0.100	0.113	-13	+/- 30%
Barium	LLCCV5120915P	0.0200	0.0244	-22	+/- 30%
Cadmium	LLCCV5120915P	0.0100	0.0105	-5.0	+/- 30%
Chromium	LLCCV5120915P	0.0100	0.0123	-23	+/- 30%
Lead	LLCCV5120915P	0.100	0.0951	4.9	+/- 30%
Selenium	LLCCV5120915P	0.100	0.128	-28	+/- 30%
Silver	LLCCV5120915P	0.0200	0.0219	-9.5	+/- 30%

OnSite Environmental Inc.

Data Qualifiers

A - Due to a high sample concentration, the amount spiked is insufficient for meaningful MS/MSD recovery data.

B - The analyte indicated was also found in the blank sample.

C - The duplicate RPD is outside control limits due to high result variability when analyte concentrations are within five times the quantitation limit.

E - The value reported exceeds the quantitation range and is an estimate.

F - Surrogate recovery data is not available due to the high concentration of coeluting target compounds.

H - The analyte indicated is a common laboratory solvent and may have been introduced during sample preparation, and be impacting the sample result.

I - Compound recovery is outside of the control limits.

J - The value reported was below the practical quantitation limit. The value is an estimate.

K - Sample duplicate RPD is outside control limits due to sample inhomogeneity. The sample was re-extracted and re-analyzed with similar results.

L - The RPD is outside of the control limits.

M - Hydrocarbons in the gasoline range are impacting the diesel range result.

M1 - Hydrocarbons in the gasoline range (toluene-napthalene) are present in the sample.

N - Hydrocarbons in the lube oil range are impacting the diesel range result.

N1 - Hydrocarbons in diesel range are impacting lube oil range results.

O - Hydrocarbons indicative of heavier fuels are present in the sample and are impacting the gasoline result.

P - The RPD of the detected concentrations between the two columns is greater than 40.

Q - Surrogate recovery is outside of the control limits.

S - Surrogate recovery data is not available due to the necessary dilution of the sample.

T - The sample chromatogram is not similar to a typical ____________.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

U1 - The practical quantitation limit is elevated due to interferences present in the sample.

V - Matrix Spike/Matrix Spike Duplicate recoveries are outside control limits due to matrix effects.

W - Matrix Spike/Matrix Spike Duplicate RPD are outside control limits due to matrix effects.

X - Sample extract treated with a mercury cleanup procedure.

X1- Sample extract treated with a sulfuric acid/silica gel cleanup procedure.

Y - The calibration verification for this analyte exceeded the 20% drift specified in method 8260C, and therefore the reported result should be considered an estimate. The overall performance of the calibration verification standard met the acceptance criteria of the method.

Z -

OnSite Environmental Inc.

Analytical Laboratory Testing Services
14648 NE 95th Street • Redmond, WA 98052
Phone: (425) 883-3881 • www.onsite-env.com

Chain of Custody

Page 1 of 1

Laboratory Number: 12-084

Company: Port of Seattle

Project Number:

Project Name: Lora Lake Apartments

Project Manager: Don Robbins

Sampled by: K. Anderson

Turnaround Request (in working days)
(Check One)

- [ ] Same Day
- [ ] 1 Day
- [ ] 2 Days
- [ ] 3 Days
- [x] Standard (7 Days) (TPH analysis 5 Days)
- [ ] ______ (other)

Lab ID	Sample Identification	Date Sampled	Time Sampled	Matrix	Number of Containers	NWTPH-HCID	NWTPH-Gx/BTEX	NWTPH-Gx	NWTPH-Dx	Volatiles 8260C	Halogenated Volatiles 8260C	Semivolatiles 8270D/SIM (with low-level PAHs)	PAHs 8270D/SIM (low-level)	PCBs 8082A	Organochlorine Pesticides 8081B	Organophosphorus Pesticides 8270D/SIM	Chlorinated Acid Herbicides 8151A	Total RCRA Metals	Total MTCA Metals	TCLP Metals	HEM (oil and grease) 1664A						% Moisture
1	PM-085-00.00-10.0 - TCLP	11/23/15	1440	S	6															X							

	Signature	Company	Date	Time
Relinquished	David S. Hill	DH Environmental, Inc.	12/8/15	1730
Received	[signature]	OSE	12/8/15	1730
Relinquished				
Received				
Relinquished				
Received				
Reviewed/Date		Reviewed/Date		

Comments/Special Instructions

Send results to: Robbins.D@portseattle.org, davehill@dhenviro.com fox.s@portseattle.org; megan.mccullough@floydsnider.com

Chromatograms with final report ☐

Data Package: Standard ☐ Level III ☐ Level IV ☐

Electronic Data Deliverables (EDDs) ☐ ____________

Sample/Cooler Receipt and Acceptance Checklist

Client: POS

Client Project Name/Number: 104395

OnSite Project Number: 12-084

Initiated by: [signature]

Date Initiated: 12/8/15

1.0 Cooler Verification

1.1 Were there custody seals on the outside of the cooler?	Yes	No	(N/A)	1 2 3 4
1.2 Were the custody seals intact?	Yes	No	(N/A)	1 2 3 4
1.3 Were the custody seals signed and dated by last custodian?	Yes	No	(N/A)	1 2 3 4
1.4 Were the samples delivered on ice or blue ice?	(Yes)	No		1 2 3 4
1.5 Were samples received between 0-6 degrees Celsius?	(Yes)	No	Temperature: 5	
1.6 Have shipping bills (if any) been attached to the back of this form?	Yes	(N/A)		
1.7 How were the samples delivered?	Client	(Courier)	UPS/FedEx	OSE Pickup Other

2.0 Chain of Custody Verification

2.1 Was a Chain of Custody submitted with the samples?	Yes	(No)	1 2 3 4
2.2 Was the COC legible and written in permanent ink?	Yes	(No)	1 2 3 4
2.3 Have samples been relinquished and accepted by each custodian?	Yes	(No)	1 2 3 4
2.4 Did the sample labels (ID, date, time, preservative) agree with COC?	(Yes)	No	1 2 3 4
2.5 Were all of the samples listed on the COC submitted?	(Yes)	No	1 2 3 4
2.6 Were any of the samples submitted omitted from the COC?	Yes	(No)	1 2 3 4

3.0 Sample Verification

3.1 Were any sample containers broken or compromised?	(Yes)	No		1 2 3 4
3.2 Were any sample labels missing or illegible?	Yes	(No)		1 2 3 4
3.3 Have the correct containers been used for each analysis requested?	(Yes)	No		1 2 3 4
3.4 Have the samples been correctly preserved?	Yes	No	(N/A)	1 2 3 4
3.5 Are volatiles samples free from headspace and bubbles greater than 6mm?	Yes	No	(N/A)	1 2 3 4
3.6 Is there sufficient sample submitted to perform requested analyses?	(Yes)	No		1 2 3 4
3.7 Have any holding times already expired or will expire in 24 hours?	Yes	(No)		1 2 3 4
3.8 Was method 5035A used?	Yes	No	(N/A)	1 2 3 4
3.9 If 5035A was used, which sampling option was used (#1, 2, or 3).	#		(N/A)	1 2 3 4

Explain any discrepancies:

3.1) 2 8oz jars broken upon receipt

1 - Discuss issue in Case Narrative

2 - Process Sample As-is

3 - Client contacted to discuss problem

4 - Sample cannot be analyzed or client does not wish to proceed

//SERVER\OSE\Administration\forms\cooler_checklist.xls

Rainier
ENVIRONMENTAL

Dangerous Waste Characterization

Sample ID: PM-085-00.0-10.0

Report date: December 11, 2015

Submitted to:

DH Environmental, Inc.
1011 SW Klickitat Way, Suite 210C
Seattle, WA 98134

Rainier Environmental
5013 Pacific Hwy East
Suite 20
Tacoma, WA 98424

1.0 INTRODUCTION

A dangerous waste characterization using the test organism *Oncorhynchus mykiss* (rainbow trout) was conducted on one sample submitted by DH Environmental, Inc. to Rainier Environmental. Testing was conducted following the Washington State Department of Ecology Publication 80-12.

2.0 METHODS

The sample, identified as PM-085-00.0-10.0, was received in the laboratory on November 27, 2015. Upon arrival at the laboratory the sample was inspected and contents verified against information provided on the chain-of-custody form. The sample was stored at 4°C in the dark until use. The test procedure is outlined in Table 1.

Table 1. Summary of Dangerous Waste Characterization Test Conditions

Parameter	Standard Fish Toxicity Test
Test number	1512-010
Sample ID	PM-085-00.0-10.0
Test initiation date; time	12/3/2015; 1420h
Test termination date; time	12/7/2015; 1430h
Endpoint	Mortality at 96-hours
Test chamber	7.5 L Plastic tank
Test temperature	12 ± 1°C
Dilution water	Moderately hard synthetic water
Test solution volume	6 L
Test concentrations (mg/L)	100, 10, 0
Number of organisms/ chamber	10
Number of replicates	3
Test organism	*Oncorhynchus mykiss* (rainbow trout)
Feeding	No feeding during test
Photoperiod	16 hours light/ 8 hours dark
Extraction	Rotary agitation (30 +/- 2 rpm) for 18 hours
Reference Toxicant	Copper sulfate
Deviations	None

The test organisms used in the test are outlined in Table 2. The sample was tested using fish received on September 30, 2015.

Table 2. Test organisms (*Oncorhynchus mykiss*)

Test organism age	72 days post swim-up (hatch date 8/30/2015)
Mean weight	0.36 g
Mean length	36 mm
Ratio of longest to shortest	1.4
Loading	0.60 g/L
Test organism source	Trout Lodge; Sumner, WA

3.0 RESULTS

A summary of results for the dangerous waste characterization conducted on sample PM-085-00.0-10.0 is contained in Table 3. There was no mortality during the test. Based on these results, the sample does not designate as dangerous or extremely hazardous waste. Copies of the laboratory bench sheets, statistical summaries of reference toxicant tests, and chain-of-custody form are provided in Appendices A through C.

Table 3. Summary of Results

Sample ID	Concentration (mg/L)	Survival (# fish, N=30)	Percent Mortality	Dangerous Waste Designation
Control	0	30	0	NA
PM-085-00.0-10.0	10 100	30 30	0 0	None

4.0 QUALITY ASSURANCE

The most recently completed reference toxicant test was initiated December 3, 2015. The LC_{50} of 109.2 μg/L copper fell within the acceptable range of mean ± two standard deviations of historical test results indicating that the test organisms were of an appropriate degree of sensitivity. The coefficient of variation (CV) for the last 21 tests was 27.9 percent, which is considered excellent by the Biomonitoring Science Advisory Board.

5.0 REFERENCES

WDOE. 2008. Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria. Washington State Department of Ecology. Water Quality Program. Publication number: WQ-R-95-80, Revised December 2008.

WDOE. 2009. Biological Testing Methods 80-12 for the Designation of Dangerous Waste. Washington State Department of Ecology. Hazardous Waste and Toxics Reduction Program. Publication number: 80-12, Revised June 2009.

Appendix A
Oncorhynchus mykiss Dangerous Waste Toxicity Test
Raw Bench Sheets

Dangerous Waste Toxicity Test

Client: DH Environmental
Sample ID: PM-085-00.0-10.0
Test # 1512-010
Log In # T15-323

Start Date & Time: 12/3/15 1420
End Date & Time: 12/7/15 1430
Test Organism: *Oncorhynchus mykiss*
Test Protocol: **Washington State Department of Ecology Publ. 80-12**

Rep	Conc.	Cont #	Number of Live Organisms					Dissolved Oxygen (mg/L)					pH (units)					Conductivity (umhos/cm)					Temperature (°C)					Percent Survival
			0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	
1	CON	6	10	10	10	10	10	9.9	9.2	9.0	8.7	8.1	7.85	7.62	7.46	7.33	7.18	255				[illegible]	11.2	11.7	11.4	11.8	11.4	
2		9	10	10	10	10	10	9.8	9.1	8.9	8.7	8.5	7.82	7.65	7.61	7.31	7.25	256				271						
3		3	10	10	10	10	10	9.8	9.1	9.1	9.0	8.8	7.84	7.63	7.55	7.31	7.25	256				268						
1	10 ppm	21	10	10	10	10	10	10.0	9.4	9.1	9.0	8.1	7.88	7.63	7.48	7.29	7.15	262				270	11.3	11.5	11.4	11.6	11.2	
2		4	10	10	10	10	10	9.9	9.1	9.0	8.5	8.6	7.89	7.55	7.50	7.22	7.20	264				274						
3		20	10	10	10	10	10	9.9	9.0	8.8	8.4	8.4	7.89	7.59	7.51	7.26	7.21	264				277						
1	100 ppm	25	10	10	10	10	10	9.8	8.9	8.7	8.5	8.3	7.91	7.57	7.61	7.23	7.21	268				274	11.3	11.5	11.4	11.5	11.4	
2		17	10	10	10	10	10	9.9	8.9	8.9	8.6	8.2	7.90	7.54	7.53	7.24	7.17	270				261						
3		23	10	10	10	10	10	9.9	9.2	9.1	8.8	8.2	7.93	7.55	7.44	7.21	7.18	270				274						
1																												
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3																												
Technician Initials			GW	Et	Et	Et	Et	GW	Et	Et	Et	Et																

Sample	Alk. (init.)	Hard. (init.)	Alk. (fin.)	Hard. (fin.)	Chlorine
	(mg/L as CaCO3)				(mg/L Cl2)
Control	68	88	68	88	<0.03
100ppm	70	96	68	96	

Animal Source: Trout Lodge
Date Received: 9/30/15
Test Volume: 6L
Date of Hatch: 8/30/15
Date of Swim up: 9/21/15

Weights (g): .37 .38 .36 .32 .31 .41 .40 .35 .35 .34 μ = .36
Lengths(mm): 35 37 37 35 30 42 41 36 34 34 μ = 36
Length max/min: 42/30 1.4
Loading: 0.60 g/L

Rainier Environmental
Washington Laboratory
5013 Pacific HWY E Suite 20
Tacoma, WA 98424

Dilution Water Source: MHSW 092
QA Check Et

Appendix B

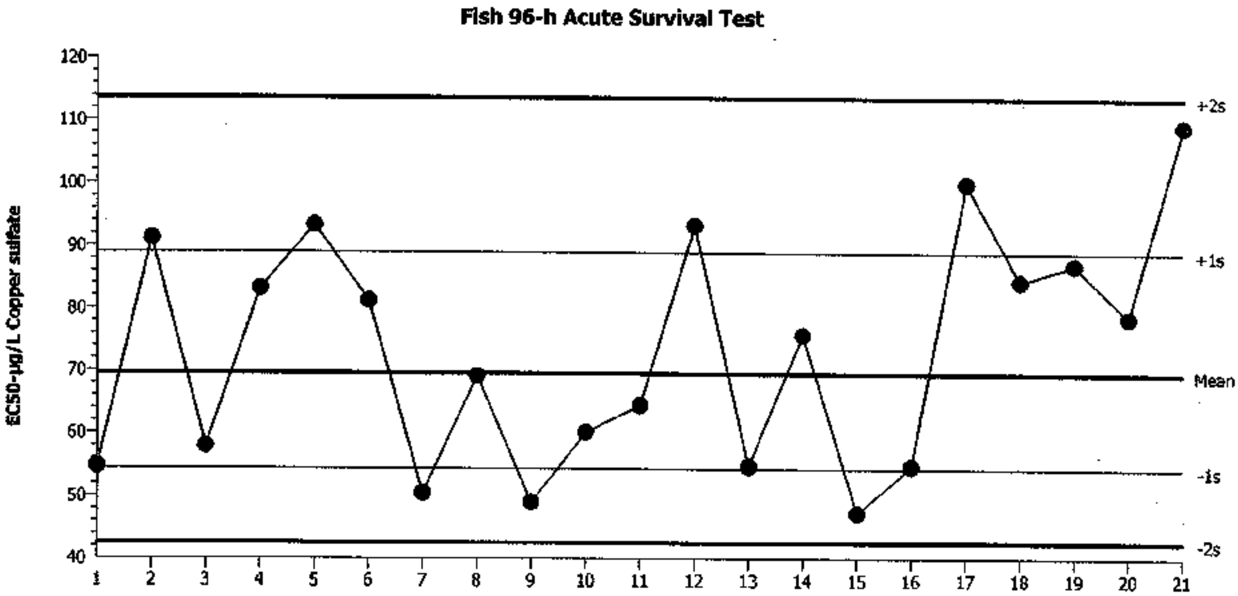
Reference Toxicant Test

Control Chart and Statistical Summary

CETIS QC Plot

Fish 96-h Acute Survival Test | **Rainier Environmental Laboratory**

Test Type:	Survival (96h)	**Organism:**	Oncorhynchus mykiss (Rainbow Tro	**Material:**	Copper sulfate
Protocol:	Not Applicable	**Endpoint:**	96h Survival Rate	**Source:**	Reference Toxicant-REF



Mean:	69.55	**Count:**	20	**-1s Warning Limit:**	54.39	**-2s Action Limit:**	42.54
Sigma:	NA	**CV:**	27.90%	**+1s Warning Limit:**	88.93	**+2s Action Limit:**	113.7

Quality Control Data

Point	Year	Month	Day	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID
1	2014	Apr	16	54.7	-14.85	-0.9769			19-9848-2715	04-2789-7256
2		May	15	91.17	21.63	1.102	(+)		19-9757-6408	01-1506-8089
3		Jun	15	57.87	-11.67	-0.7476			17-7770-2611	08-9048-4188
4		Jul	15	83.12	13.58	0.7255			20-9533-3105	00-9643-5040
5		Aug	12	93.3	23.76	1.196	(+)		16-9419-2603	03-8467-1697
6		Sep	11	81.23	11.68	0.6315			01-4702-9532	04-7171-0994
7		Oct	8	50.48	-19.06	-1.303	(-)		19-9965-4133	06-8257-8888
8		Nov	5	69.1	-0.4512	-0.02648			12-4414-2221	18-6944-2941
9		Dec	6	49.06	-20.49	-1.42	(-)		11-5776-2415	18-8302-9953
10	2015	Jan	1	60.15	-9.396	-0.5905			07-7597-4197	17-7560-4766
11			31	64.47	-5.078	-0.3085			15-5281-5142	00-2323-2143
12		Mar	5	93.3	23.76	1.196	(+)		02-0547-6463	12-5775-2701
13		Apr	3	54.84	-14.71	-0.9665			05-4256-3553	21-3677-7651
14		May	6	75.79	6.239	0.3495			17-0309-5731	08-3430-0742
15		Jun	3	47.32	-22.22	-1.566	(-)		10-2761-8033	20-2414-3583
16			29	54.84	-14.71	-0.9665			20-0524-2368	17-1047-3702
17		Aug	1	100	30.45	1.478	(+)		04-9563-2562	07-9301-1324
18			27	84.34	14.79	0.7845			14-9278-6104	03-1603-2957
19		Oct	2	87.06	17.51	0.9135			07-5049-7357	00-0455-0404
20		Nov	4	78.6	9.05	0.4977			15-5309-1620	09-4295-1286
21		Dec	3	109.2	39.66	1.836	(+)		00-4302-0811	06-8646-3269

CETIS Summary Report

Report Date:	08 Dec-15 07:50 (p 1 of 1)
Test Code:	RA120315OM | 00-4302-0811

Fish 96-h Acute Survival Test — **Rainier Environmental Laboratory**

Batch ID:	05-8899-8065	**Test Type:**	Survival (96h)	**Analyst:**	Eric Tollefson
Start Date:	03 Dec-15 15:10	**Protocol:**	Not Applicable	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	07 Dec-15 15:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	96h	**Source:**	Trout Lodge Fish Farm	**Age:**	72
Sample ID:	18-8355-7202	**Code:**	RA120315OM	**Client:**	Internal Lab
Sample Date:	03 Dec-15	**Material:**	Copper sulfate	**Project:**	
Receive Date:	03 Dec-15	**Source:**	Reference Toxicant		
Sample Age:	15h	**Station:**	In House		

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
00-6202-4235	96h Survival Rate	50	100	70.71	16.8%		Dunnett Multiple Comparison Test

Point Estimate Summary

Analysis ID	Endpoint	Level	µg/L	95% LCL	95% UCL	TU	Method
06-8646-3269	96h Survival Rate	LC50	109.2	94.85	125.7		Spearman-Kärber

96h Survival Rate Summary

C-µg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	3	0.9667	0.9451	0.9882	0.9	1	0.03333	0.05774	5.97%	0.0%
25		3	1	1	1	1	1	0	0	0.0%	-3.45%
50		3	0.9333	0.9118	0.9549	0.9	1	0.03333	0.05774	6.19%	3.45%
100		3	0.6333	0.5556	0.7111	0.4	0.8	0.1202	0.2082	32.87%	34.48%
200		3	0.03333	0.01177	0.05489	0	0.1	0.03333	0.05774	173.2%	96.55%
400		3	0	0	0	0	0	0	0		100.0%

96h Survival Rate Detail

C-µg/L	Control Type	Rep 1	Rep 2	Rep 3
0	Dilution Water	1	1	0.9
25		1	1	1
50		0.9	1	0.9
100		0.8	0.7	0.4
200		0.1	0	0
400		0	0	0

96h Survival Rate Binomials

C-µg/L	Control Type	Rep 1	Rep 2	Rep 3
0	Dilution Water	10/10	10/10	9/10
25		10/10	10/10	10/10
50		9/10	10/10	9/10
100		8/10	7/10	4/10
200		1/10	0/10	0/10
400		0/10	0/10	0/10

 Analyst: ET QA: ET

Appendix C
Chain-of-Custody Form

Rainier ENVIRONMENTAL

Washington
5013 Pacific Highway East, Suite 20 Fife, WA 98424
Phone253.922.8898

Chain of Custody

Date 11/25/15 Page 1 of 1

Sample Collection By: G. Cisneros & K. Anderson

Report to:

- Company: DH Environmental, Inc
- Address: 1011 SW Klickitat Way, Ste 210C
- City/State/Zip: Seattle, WA 98134
- Contact: David J. Hill
- Phone: 206-293-3126
- Email: davehill@dhenviro.com

Invoice To:

- Company: DH Environmental Inc
- Address: 1011 SW Klickitat Way, Ste. 210C
- City/State/Zip: Seattle, WA 98134
- Contact: David J. Hill
- Phone: 206-293-3126
- Email: davehill@dhenviro.com

ANALYSES REQUIRED: Dangerous Waste Test 80-12; Receipt Temperature (°C)

	SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	NO. OF CONTAINERS	COMMENTS	Dangerous Waste Test 80-12									Receipt Temperature (°C)
1	PM-085-00.0-10.0	11/23/15	1440	Soil	8oz Amber	6		X									
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

PROJECT INFORMATION

Client:	Port of Seattle
PO No.:	Lora Lake Apart. Task 8110
Shipped Via:	Fed Ex

SAMPLE RECEIPT

Total No. of Containers	6
Received Good Condition?	Y
Matches Test Schedule?	Y

RELINQUISHED BY (CLIENT)

(Signature) [signature] (Time) 1205
(Printed Name) Gabriel Cisneros (Date) 11/25/15
(Company) Floyd|Snider

RELINQUISHED BY (COURIER)

(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY (COURIER)

(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY (LABORATORY)

(Signature) [signature] (Time) 930
(Printed Name) ERIC TOLLEFSON (Date) 11/27/15
(Log In #) TJS-323

SPECIAL INSTRUCTIONS/COMMENTS:

Also Report to: Megan McCullough – INVOICE TO
Floyd|Snider
601 Union Street, Ste. 600
Seattle, WA 98101
206-292-2078
Megan.McCullough@Floydsnider.com

Port of Seattle

PORT OF SEATTLE DANGEROUS WASTE DESIGNATION FORM

A. WASTE STREAM NAME AND GENERATION INFORMATION

Painted Concrete from Lora Lake Project

Generation Process: **Debris from Lora Lake Apartments Remediation Project**

RCRA ID Number that waste will be managed under:	**Total Quantity and/or Estimated Generation rate:**
☐ **Port Construction Services** — **WAH000017301** ☐ **Seattle-Tacoma International Airport** — **WAD980980106** ☒ **Other:** **Other Descriptions (ie. Shop, Project, Etc.):** **Lora Lake Apartments Project. No RCRA ID Established**	To Be Determined. This project is still in the survey phase.

B. WASTE PROPERTIES, CHARACTERISTICS, and CONSTITUENTS:

Physical State:	**pH:** / **Flashpoint:**
☒ Solid (pass paint filter) ☐ Solid w/freestanding or absorbed liquid ☐ Liquid (If liquid, indicate if the liquid is: ☐ Single Layer ☐ Multi-layer ☐ Gas	**pH:** ☒ N/A ☐ ≤ 2 **[D002]** ☐ > 2 but < 12.5 ☐ ≥ 12.5 **[D002]** **Flashpoint:** ☒ N/A ☐ < 140 °F **[D001]** ☐ > 140 °F but < 200 °F ☐ > 200 °F

Characteristic	**PCB Content**	**TCLP Metals**	**Total Metals**
☐ Ignitable **[D001]** ☐ Corrosive **[D002]** ☐ Reactive **[D003]** ☐ Toxic **[D004 – D043]** **List Here:**	☒ Not Sampled ☐ Not Detected **[non TSCA or State Regulated]** ☐ ≥ 2 ppm and < 50 ppm **[Potentially TSCA Regulated or State Regulated PCB Waste-WPCB]** ☐ ≥ 50 ppm **[TSCA Regulated]** Note: **IF WASTE STREAM IS BEING MANAGED AS TSCA WASTE, DO NOT USE WPCB STATE CODE PER WAC 173-303-071(3)(k)**	☐ Arsenic ≥ 5.0 mg/L **[D004]** ☐ Barium ≥ 100.0 mg/L **[D005]** ☐ Cadmium ≥ 1.0 mg/L **[D006]** ☐ Chromium ≥ 5.0 mg/L **[D007]** ☐ Lead ≥ 5.0 mg/L **[D008]** ☐ Mercury ≥ 0.2 mg/L **[D009]** ☐ Selenium ≥ 1.0 mg/L **[D010]** ☐ Silver ≥ 5.0 mg/L **[D011]** ☒ All TCLP metals are below the maximum concentration of metals for the Toxicity Characteristic Check if: ☐ Assumed ☒ TCLP Conducted ☐ TCLP Not Conducted	Arsenic: ☐ND Barium: ☐ND Cadmium: ☐ND Chromium: ☐ND Copper ☐ND Lead ☐ND Mercury ☐ND Nickel ☐ND Selenium: ☐ND Silver: ☐ND Comments:

Composition (list all constituents, including debris, any absorbents, liquid range, etc.).

Constituent	**Volume (Range %)**
Concrete	98-100%
Paint/coating	0-2%

Port of Seattle

C. LISTED WASTE

Is the waste:

☐ **A Discarded Listed Chemical Product (U or P List):**
☐ **A Listed Source Waste (F or K List):**
☒ **Not Applicable**

D. WA STATE CRITERIA WASTE

WA Toxic Criteria Equivalent Concentration (E.C):		WA Persistent Criteria Total HOC		WA Persistent Criteria Total PAH	
☒ < 0.001	[not a Toxic Criteria DW]	☒ < 0.01	[NOT APPLICABLE]	☒ ≤ 1.0%	[NOT APPLICABLE]
☐ 0.001 ≥ 1.0 %	[WT02 – DW]	☐ 0.01 to 1.0%	[WP02 – DW]	☐ > 1.0%	[WP03 – EHW]
☐ ≥ 1.0%	[WT01 – EHW]	☐ > 1.0 %	[WP01 – EHW]		

DW: Dangerous Waste EHW: Extremely Hazardous Waste HOC: Halogenated Organic Compounds PAH: Polycyclic Aromatic Hydrocarbons

E. ADDITIONAL INFORMATION (Describe any additional information about the waste (e.g. process knowledge statement, regulatory exemptions, assumptions made, etc.)

This Designation is based on a follow-up TCLP analysis for a Limited Good Faith Inspection performed by The Port of Seattle. Initial sample results for the painted concrete revealed total RCRA metals exceeding 20 times the Toxicity Characteristic Leachate Procedure (TCLP) threshold value. Therefore, TCLP was required to determine if the painted concrete must be managed as Dangerous Waste for RCRA metals characteristic. All TCLP metals are below the maximum concentration of metals for the Toxicity Characteristic for this waste stream. This designation follows the guidelines for building debris disposal provided by the WA State Department of Ecology: http://www.ecy.wa.gov/programs/hwtr/dangermat/samplePlans.html

Attachments:
☒ **Field Report/Sample Log**
☒ **Laboratory Data**

F. WASTE DESIGNATION SUMMARY

☐ **RCRA Hazardous Waste**
RCRA Waste Codes:

☐ **TSCA Regulated Waste**
TSCA Description:

☒ **Non Hazardous Solid Waste**
Solid Waste Description: Non-Regulated Solid

Designation Performed by:	**Brian Lilly**	
Title:	**Hazardous Materials Specialist**	**Date: 4/22/16**
Reviewed by:	**David J. Hill, PE, CHMM, CPEA**	
Title:	**Principal**	**Date: 4/22/16**

DH Environmental Inc.	**FIELD REPORT**		File Name: FR_LoraLakeApt_040416
1011 SW Klickitat Way Suite 210 Seattle, Washington 98134 (206) 293-3126	Project: SD50-On Call Sampling Support		Date: 4/04/2016
	Owner: Port of Seattle	Time of Arrival: 0830	Report Number: 1
Prepared by: Brian Lilly	Location: 5001 Des Moines Memorial Drive S Burien, WA 98148	Time of Departure: 1000	Page: 1 of 2
Purpose of Site Visit: Designation Sampling of paint chips from concrete curb and concrete foundation.	Weather: Clear, not raining	Travel/Prep. Time: 1.5 hours	Project/Contract Number: SD50-On Call Sampling Support

Upon arrival to the site I assessed personal safety hazards: ☒ Yes or ☐ Referred to Site Safety Plan and Safety Tailgate if applicable
Safety Hazards Were Addressed by : ☒ Performing tool box safety meeting ☒ Donning PPE, and observing safety standards

Site Visit Purpose and Details:

The purpose of the site visit was to perform follow-up sampling after a limited pre-demolition "Good Faith Survey" of the site for ACM and lead containing materials. Paint chips were taken from two sources. The first was a painted concrete curb at the entrance of the property, and the second was a painted concrete foundation located near the north end of the property. Initial sample results for the painted concreted revealed total RCRA metals exceeding 20 times the Toxicity Characteristic Leachate Procedure (TCLP) threshold value. Therefore, TCLP was required to determine if the painted concrete must be managed as Dangerous Waste for RCRA metals characteristic.

Summary of Field Activities:

All samples were collected using standard industry practices to prevent sample contamination. All samples were immediately placed on ice and delivered to the laboratory for requested analysis within the required hold times following standard chain of custody procedures.

Concrete Curb Near Entrance: Using decontaminated hand tools, a representative composite sample was collected by scraping chips into the appropriate sample container which was immediately placed on ice. Samples were transported to Onsite Environmental laboratory within the required hold times for TCLP Metals analysis by EPA 1311/6010C/7470A.

Painted Concrete Foundation: Using decontaminated hand tools, a representative composite sample was collected by scraping chips into the appropriate sample container which was immediately placed on ice. Samples were transported to Onsite Environmental laboratory within the required hold times for TCLP Metals analysis by EPA 1311/6010C/7470A.

Sample Log:

Sample ID	Date/Time	Time	Comments
LLA-L01-032516	3-25-16	08:45	TCLP Metals analysis at OnSite Environmental
LLA-L06-032516	3-25-16	09:20	TCLP Metals analysis at OnSite Environmental

Site Photos/Sketch

☐**THIS FIELD REPORT IS PRELIMINARY** A preliminary report is provided solely as evidence that field observation was performed.	**FIELD REPRESENTATIVE:** **BRIAN LILLY** Sr. Hazardous Materials Specialist	**DATE:** **4-22-16**
☒**THIS FIELD REPORT IS FINAL** Observations and/or conclusions and/or recommendations conveyed in the final report may vary from and shall take precedence over those indicated in a preliminary report.	**REVIEWED BY:** David J. Hill, PE, CHMM, CPEA Principal	**DATE:** **4-22-16**

ATTACHMENTS:

☒Site Photos ☐Sketch ☒Chain of Custody ☒Other: Designation form
☒Sample Log ☐Drawing(s) ☐Calibration Records

Photo 01 (LLA- L01): Painted Concrete Curb Near Property Entrance. (3/25/16)

Photo 02 (LLA- L06): Painted Concrete Foundation Near North End of Property (3/25/16)

OnSite
Environmental Inc.
14648 NE 95th Street, Redmond, WA 98052 • (425) 883-3881

TRANSMITTAL MEMORANDUM

From: OnSite Environmental Inc.
To: Stacy Fox, Port of Seattle (Airport)

Date: April 4, 2016
Project Name: SD50; Lora Lake Apartments
Reference: S-00317836
Laboratory Reference Number: 1603-240
Subject: Tier 3 Data Deliverables

Description: Results of TCLP Metals EPA 1311/6010C/7470A.

OnSite Environmental Inc.
14648 NE 95th Street, Redmond, WA 98052 • (425) 883-3881

April 4, 2016

Stacy Fox
Port of Seattle (Airport)
Airport Office Building
17801 Pacific Highway S., #A6012M
Seattle, WA 98158

Re: Analytical Data for Project SD50; Lora Lake Apartments
Laboratory Reference No. 1603-240

Dear Stacy:

Enclosed are the analytical results and associated quality control data for samples submitted on March 25, 2016.

The standard policy of OnSite Environmental Inc. is to store your samples for 30 days from the date of receipt. If you require longer storage, please contact the laboratory.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the data, or need additional information, please feel free to call me.

Sincerely,

David Baumeister
Project Manager

Enclosures

Date of Report: April 4, 2016
Samples Submitted: March 25, 2016
Laboratory Reference: 1603-240
Project: SD50; Lora Lake Apartments
Professional Service Agreement: S-00317836

Case Narrative

Samples were collected on March 25, 2016 and received by the laboratory on March 25, 2016. They were maintained at the laboratory at a temperature of 2^oC to 6^oC. Please see Sample/Cooler Receipt form at the end of the report.

General QA/QC issues associated with the analytical data enclosed in this laboratory report will be indicated with a reference to a comment or explanation on the Data Qualifier page. More complex and involved QA/QC issues will be discussed in detail below.

Date of Report: April 4, 2016
Samples Submitted: March 25, 2016
Laboratory Reference: 1603-240
Project: SD50; Lora Lake Apartments
Professional Service Agreement: S-00317836

ANALYTICAL REPORT FOR SAMPLES

Client ID	Laboratory ID	Matrix	Date Sampled	Date Received	Notes
LLA-L01-032516	03-240-01	Paint chips	3-25-16	3-25-16	
LLA-L06-032516	03-240-02	Paint chips	3-25-16	3-25-16	

Date of Report: April 4, 2016
Samples Submitted: March 25, 2016
Laboratory Reference: 1603-240
Project: SD50; Lora Lake Apartments
Professional Service Agreement: S-00317836

TCLP METALS
EPA 1311/6010C/7470A

Matrix: TCLP Extract
Units: mg/L (ppm)

Analyte	Result	PQL	EPA Method	Date Prepared	Date Analyzed	Flags
Lab ID:	03-240-01					
Client ID:	**LLA-L01-032516**					
Arsenic	**ND**	0.40	6010C	3-29-16	3-29-16	
Barium	**0.66**	0.20	6010C	3-29-16	3-29-16	
Cadmium	**ND**	0.020	6010C	3-29-16	3-29-16	
Chromium	**0.084**	0.020	6010C	3-29-16	3-29-16	
Lead	**2.1**	0.20	6010C	3-29-16	3-29-16	
Mercury	**ND**	0.0050	7470A	3-31-16	3-31-16	
Selenium	**ND**	0.40	6010C	3-29-16	3-29-16	
Silver	**ND**	0.040	6010C	3-29-16	3-29-16	
Lab ID:	03-240-02					
Client ID:	**LLA-L06-032516**					
Arsenic	**ND**	0.40	6010C	3-29-16	3-29-16	
Barium	**0.43**	0.20	6010C	3-29-16	3-29-16	
Cadmium	**ND**	0.020	6010C	3-29-16	3-29-16	
Chromium	**ND**	0.020	6010C	3-29-16	3-29-16	
Lead	**ND**	0.20	6010C	3-29-16	3-29-16	
Mercury	**ND**	0.0050	7470A	3-31-16	3-31-16	
Selenium	**ND**	0.40	6010C	3-29-16	3-29-16	
Silver	**ND**	0.040	6010C	3-29-16	3-29-16	

Date of Report: April 4, 2016
Samples Submitted: March 25, 2016
Laboratory Reference: 1603-240
Project: SD50; Lora Lake Apartments
Professional Service Agreement: S-00317836

TCLP METALS
EPA 1311/6010C/7470A
METHOD BLANK QUALITY CONTROL

Date Prepared: 3-28-16
Date Extracted: 3-29&31-16
Date Analyzed: 3-29&31-16

Matrix: TCLP Extract
Units: mg/L (ppm)

Lab ID: MB0329TM1&MB0331T1

Analyte	Method	Result	PQL
Arsenic	6010C	**ND**	0.40
Barium	6010C	**ND**	0.20
Cadmium	6010C	**ND**	0.020
Chromium	6010C	**ND**	0.020
Lead	6010C	**ND**	0.20
Mercury	7470A	**ND**	0.0050
Selenium	6010C	**ND**	0.40
Silver	6010C	**ND**	0.040

Date of Report: April 4, 2016
Samples Submitted: March 25, 2016
Laboratory Reference: 1603-240
Project: SD50; Lora Lake Apartments
Professional Service Agreement: S-00317836

TCLP METALS
EPA 1311/6010C/7470A
DUPLICATE QUALITY CONTROL

Date Prepared: 3-28-16
Date Extracted: 3-29&31-16
Date Analyzed: 3-29&31-16

Matrix: TCLP Extract
Units: mg/L (ppm)

Lab ID: 03-240-02

Analyte	Sample Result	Duplicate Result	RPD	PQL	Flags
Arsenic	**ND**	**ND**	NA	0.40	
Barium	**0.430**	**0.466**	8	0.20	
Cadmium	**ND**	**ND**	NA	0.020	
Chromium	**ND**	**ND**	NA	0.020	
Lead	**ND**	**ND**	NA	0.20	
Mercury	**ND**	**ND**	NA	0.0050	
Selenium	**ND**	**ND**	NA	0.40	
Silver	**ND**	**ND**	NA	0.040	

Date of Report: April 4, 2016
Samples Submitted: March 25, 2016
Laboratory Reference: 1603-240
Project: SD50; Lora Lake Apartments
Professional Service Agreement: S-00317836

TCLP METALS
EPA 1311/6010C/7470A
MS/MSD QUALITY CONTROL

Date Prepared: 3-28-16
Date Extracted: 3-29&31-16
Date Analyzed: 3-29&31-16

Matrix: TCLP Extract
Units: mg/L (ppm)

Lab ID: 03-240-02

Analyte	Spike Level	MS	Percent Recovery	MSD	Percent Recovery	RPD	Flags
Arsenic	4.00	**4.05**	101	**3.96**	99	2	
Barium	4.00	**4.14**	93	**4.14**	93	0	
Cadmium	2.00	**1.90**	95	**1.87**	93	2	
Chromium	4.00	**3.69**	92	**3.64**	91	2	
Lead	10.0	**9.13**	91	**8.91**	89	2	
Mercury	0.0500	**0.0450**	90	**0.0469**	94	4	
Selenium	4.00	**4.16**	104	**4.28**	107	3	
Silver	1.00	**0.940**	94	**0.930**	93	1	

Date of Report: April 4, 2016
Samples Submitted: March 25, 2016
Laboratory Reference: 1603-240
Project: SD50; Lora Lake Apartments
Professional Service Agreement: S-00317836

TCLP METALS
EPA 1311/6010C/7470A
CONTINUING CALIBRATION SUMMARY

Analyte	Lab ID	True Value (ppm)	Calc. Value	Percent Difference	Control Limits
Arsenic	ICV032916P	1.00	1.02	-2.0	+/- 10%
Barium	ICV032916P	1.00	1.02	-2.0	+/- 10%
Cadmium	ICV032916P	1.00	1.02	-2.0	+/- 10%
Chromium	ICV032916P	1.00	1.04	-4.0	+/- 10%
Lead	ICV032916P	1.00	1.01	-1.0	+/- 10%
Mercury	ICV033116Y	0.00500	0.00515	-3.0	+/- 10%
Selenium	ICV032916P	1.00	0.998	0.20	+/- 10%
Silver	ICV032916P	1.00	1.06	-6.0	+/- 10%
Arsenic	LLICV032916P	0.100	0.0942	5.8	+/- 30%
Barium	LLICV032916P	0.0200	0.0211	-5.5	+/- 30%
Cadmium	LLICV032916P	0.0100	0.0102	-2.0	+/- 30%
Chromium	LLICV032916P	0.0100	0.0100	0	+/- 30%
Lead	LLICV032916P	0.100	0.103	-3.0	+/- 30%
Selenium	LLICV032916P	0.100	0.0905	9.5	+/- 30%
Silver	LLICV032916P	0.0200	0.0187	6.5	+/- 30%
Arsenic	CCV1032916P	10.0	10.0	0	+/- 10%
Barium	CCV1032916P	2.00	1.92	4.0	+/- 10%
Cadmium	CCV1032916P	1.00	0.922	7.8	+/- 10%
Chromium	CCV1032916P	1.00	1.00	0	+/- 10%
Lead	CCV1032916P	10.0	9.81	1.9	+/- 10%
Mercury	CCV1033116Y	0.00500	0.00530	-6.0	+/- 20%
Selenium	CCV1032916P	10.0	9.99	0.10	+/- 10%
Silver	CCV1032916P	1.00	0.944	5.6	+/- 10%
Arsenic	CCV2032916P	10.0	10.3	-3.0	+/- 10%
Barium	CCV2032916P	2.00	1.99	0.50	+/- 10%
Cadmium	CCV2032916P	1.00	0.929	7.1	+/- 10%
Chromium	CCV2032916P	1.00	1.02	-2.0	+/- 10%
Lead	CCV2032916P	10.0	9.87	1.3	+/- 10%
Mercury	CCV2033116Y	0.00500	0.00534	-6.8	+/- 20%
Selenium	CCV2032916P	10.0	10.3	-3.0	+/- 10%
Silver	CCV2032916P	1.00	0.968	3.2	+/- 10%
Arsenic	LLCCV2032916P	0.100	0.109	-9.0	+/- 30%
Barium	LLCCV2032916P	0.0200	0.0216	-8.0	+/- 30%
Cadmium	LLCCV2032916P	0.0100	0.00949	5.1	+/- 30%
Chromium	LLCCV2032916P	0.0100	0.00933	6.7	+/- 30%
Lead	LLCCV2032916P	0.100	0.0953	4.7	+/- 30%
Selenium	LLCCV2032916P	0.100	0.0953	4.7	+/- 30%
Silver	LLCCV2032916P	0.0200	0.0164	18	+/- 30%

Date of Report: April 4, 2016
Samples Submitted: March 25, 2016
Laboratory Reference: 1603-240
Project: SD50; Lora Lake Apartments
Professional Service Agreement: S-00317836

TCLP METALS
EPA 1311/6010C/7470A
CONTINUING CALIBRATION SUMMARY

Analyte	Lab ID	True Value (ppm)	Calc. Value	Percent Difference	Control Limits
Arsenic	CCV3032916P	10.0	10.4	-4.0	+/- 10%
Barium	CCV3032916P	2.00	2.00	0	+/- 10%
Cadmium	CCV3032916P	1.00	0.935	6.5	+/- 10%
Chromium	CCV3032916P	1.00	1.03	-3.0	+/- 10%
Lead	CCV3032916P	10.0	10.0	0	+/- 10%
Selenium	CCV3032916P	10.0	10.2	-2.0	+/- 10%
Silver	CCV3032916P	1.00	0.973	2.7	+/- 10%
Arsenic	LLCCV3032916P	0.100	0.0983	1.7	+/- 30%
Barium	LLCCV3032916P	0.0200	0.0211	-5.5	+/- 30%
Cadmium	LLCCV3032916P	0.0100	0.0101	-1.0	+/- 30%
Chromium	LLCCV3032916P	0.0100	0.00969	3.1	+/- 30%
Lead	LLCCV3032916P	0.100	0.0957	4.3	+/- 30%
Selenium	LLCCV3032916P	0.100	0.115	-15	+/- 30%
Silver	LLCCV3032916P	0.0200	0.0192	4.0	+/- 30%

OnSite Environmental Inc.

Data Qualifiers

A - Due to a high sample concentration, the amount spiked is insufficient for meaningful MS/MSD recovery data.

B - The analyte indicated was also found in the blank sample.

C - The duplicate RPD is outside control limits due to high result variability when analyte concentrations are within five times the quantitation limit.

E - The value reported exceeds the quantitation range and is an estimate.

F - Surrogate recovery data is not available due to the high concentration of coeluting target compounds.

H - The analyte indicated is a common laboratory solvent and may have been introduced during sample preparation, and be impacting the sample result.

I - Compound recovery is outside of the control limits.

J - The value reported was below the practical quantitation limit. The value is an estimate.

K - Sample duplicate RPD is outside control limits due to sample inhomogeneity. The sample was re-extracted and re-analyzed with similar results.

L - The RPD is outside of the control limits.

M - Hydrocarbons in the gasoline range are impacting the diesel range result.

M1 - Hydrocarbons in the gasoline range (toluene-napthalene) are present in the sample.

N - Hydrocarbons in the lube oil range are impacting the diesel range result.

N1 - Hydrocarbons in diesel range are impacting lube oil range results.

O - Hydrocarbons indicative of heavier fuels are present in the sample and are impacting the gasoline result.

P - The RPD of the detected concentrations between the two columns is greater than 40.

Q - Surrogate recovery is outside of the control limits.

S - Surrogate recovery data is not available due to the necessary dilution of the sample.

T - The sample chromatogram is not similar to a typical ____________.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

U1 - The practical quantitation limit is elevated due to interferences present in the sample.

V - Matrix Spike/Matrix Spike Duplicate recoveries are outside control limits due to matrix effects.

W - Matrix Spike/Matrix Spike Duplicate RPD are outside control limits due to matrix effects.

X - Sample extract treated with a mercury cleanup procedure.

X1- Sample extract treated with a sulfuric acid/silica gel cleanup procedure.

Y - The calibration verification for this analyte exceeded the 20% drift specified in method 8260C, and therefore the reported result should be considered an estimate. The overall performance of the calibration verification standard met the acceptance criteria of the method.

Z -

OnSite Environmental Inc.
Analytical Laboratory Testing Services
14648 NE 95th Street • Redmond, WA 98052
Phone: (425) 883-3881 • www.onsite-env.com

Chain of Custody

Company: PORT OF SEATTLE
Project Number: SD50
Project Name: LORA LAKE APARTMENTS
Project Manager: STACY FOX
Sampled by: Travis Forslow

Turnaround Request (in working days)
(Check One)
☐ Same Day ☐ 1 Day
☐ 2 Days ☐ 3 Days
☒ Standard (7 Days) (TPH analysis 5 Days)
☐ ______ (other)

Laboratory Number: 03-240

Lab ID	Sample Identification	Date Sampled	Time Sampled	Matrix	Number of Containers	NWTPH-HCID	NWTPH-Gx/BTEX	NWTPH-Gx	NWTPH-Dx	Volatiles 8260C	Halogenated Volatiles 8260C	Semivolatiles 8270D/SIM (with low-level PAHs)	PAHs 8270D/SIM (low-level)	PCBs 8082A	Organochlorine Pesticides 8081B	Organophosphorus Pesticides 8270D/SIM	Chlorinated Acid Herbicides 8151A	Total RCRA Metals	Total MTCA Metals	TCLP Metals	HEM (oil and grease) 1664A	% Moisture
1	LLA-L01-032516	032516	8:45	Product Paint chips	1															X		
2	LLA-L06-032516	032516	7:20	Product Paint chips	1															X		

	Signature	Company	Date	Time
Relinquished	[signature]	DH Env.	3-25-16	1:17
Received	[signature]	alpha (Speedy)	3-25-16	1:17
Relinquished	[signature]	alpha	3-25-16	1:55
Received	[signature]	OSE	3/25/16	1355
Relinquished				
Received				
Reviewed/Date		Reviewed/Date		

Comments/Special Instructions
Please reference State Contract
Account: 64100
Fund: 03040
Org: 4580
Program: 8905
Subclass: 4580

Chromatograms with final report ☐

Data Package: Standard ☐ Level III ☐ Level IV ☐ Electronic Data Deliverables (EDDs) ☐ ______

Sample/Cooler Receipt and Acceptance Checklist

Client: POS

Client Project Name/Number: SD50

OnSite Project Number: 03-240

Initiated by: [signature]

Date Initiated: 3/25/16

1.0 Cooler Verification

1.1 Were there custody seals on the outside of the cooler?	Yes	No	N/A (circled)	1 2 3 4
1.2 Were the custody seals intact?	Yes	No	N/A (circled)	1 2 3 4
1.3 Were the custody seals signed and dated by last custodian?	Yes	No	N/A (circled)	1 2 3 4
1.4 Were the samples delivered on ice or blue ice?	Yes (circled)	No		1 2 3 4
1.5 Were samples received between 0-6 degrees Celsius?	Yes (circled)	No	Temperature: 2	
1.6 Have shipping bills (if any) been attached to the back of this form?	Yes	N/A (circled)		
1.7 How were the samples delivered?	Client	Courier (circled)	UPS/FedEx	OSE Pickup Other

2.0 Chain of Custody Verification

2.1 Was a Chain of Custody submitted with the samples?	Yes (circled)	No	1 2 3 4
2.2 Was the COC legible and written in permanent ink?	Yes (circled)	No	1 2 3 4
2.3 Have samples been relinquished and accepted by each custodian?	Yes (circled)	No	1 2 3 4
2.4 Did the sample labels (ID, date, time, preservative) agree with COC?	Yes (circled)	No	1 2 3 4
2.5 Were all of the samples listed on the COC submitted?	Yes (circled)	No	1 2 3 4
2.6 Were any of the samples submitted omitted from the COC?	Yes	No (circled)	1 2 3 4

3.0 Sample Verification

3.1 Were any sample containers broken or compromised?	Yes	No (circled)		1 2 3 4
3.2 Were any sample labels missing or illegible?	Yes	No (circled)		1 2 3 4
3.3 Have the correct containers been used for each analysis requested?	Yes (circled)	No		1 2 3 4
3.4 Have the samples been correctly preserved?	Yes	No	N/A (circled)	1 2 3 4
3.5 Are volatiles samples free from headspace and bubbles greater than 6mm?	Yes	No	N/A (circled)	1 2 3 4
3.6 Is there sufficient sample submitted to perform requested analyses?	Yes (circled)	No		1 2 3 4
3.7 Have any holding times already expired or will expire in 24 hours?	Yes	No (circled)		1 2 3 4
3.8 Was method 5035A used?	Yes	No	N/A (circled)	1 2 3 4
3.9 If 5035A was used, which sampling option was used (#1, 2, or 3).	#		N/A (circled)	1 2 3 4

Explain any discrepancies:

1 - Discuss issue in Case Narrative

2 - Process Sample As-is

3 - Client contacted to discuss problem

4 - Sample cannot be analyzed or client does not wish to proceed

Port of Seattle

Limited Good Faith Inspection

Lora Lake Apartments Site MTCA Remedial Action (104395)
15001 Des Moines Memorial Drive S
Burien, WA 98148

Executive Summary

A limited "good faith" inspection was performed to support the Lora Lake Apartments Site MTCA Remedial Action Project (104395). Results of the inspection are summarized below.

Asbestos

Asbestos was not detected in any of the materials sampled during this survey.

Lead

Lead was detected in the following paints:

Material	Substrate	Material Location
Yellow paint	Concrete curbs	Throughout the LLA Site
Yellow paint	Concrete foundations	Throughout the LLA Site

Introduction

A limited "good faith" inspection was performed for the Lora Lake Apartments Site MTCA Remedial Action Project (104395). The inspection was limited to the Project Work Area Limits, as shown on the 30% submittal drawings dated December 2, 2015.

This inspection was performed in December 2015 by the following Asbestos Hazard Emergency Response Act (AHERA) Building Inspector:

- Brian Nichols, Port Construction Services (PCS)
  Certification Number: 152826, Expiration: 8/18/2016
  Email: nichols.b@portseattle.org
  Desk: (206) 787-7903 / Cell: (206) 245-8446

Methods

Asbestos

This inspection was conducted in accordance with the requirements of Washington Administrative Code (WAC) 296-62-07721 and Puget Sound Clean Air Agency (PCSCAA) Regulation III, Article 4, Section 4.02. Suspect asbestos-containing materials were sampled in accordance with AHERA sampling guidelines (40 CFR 763.86) and analyzed by a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory using polarized light microscopy (PLM) by United States Environmental Protection Agency (EPA) Method 600.

Port of Seattle

Lead

This lead inspection was performed in order to facilitate compliance with the Washington State Department of Labor & Industries (L&I) lead standard for the construction industry (WAC 296-155-176) during demolition and construction. Representative chip samples of suspect lead-containing paints were collected and analyzed by an American Industrial Hygiene Association (AIHA) accredited laboratory using flame atomic absorption spectroscopy by EPA Method 7000B.

Results

Table 1 – Asbestos Sample Results

Sample Number	Material	Sample Location	Lab Result	Quantity
LLA-A01	Layer 1: White ceramic tile with brown mastic Layer 2: Brown grout	LLA Site, near filled swimming pool	Layer 1: ND Layer 2: ND	500 SF

Notes:

1. Bold type indicates positive lab results for asbestos, or material is presumed to contain asbestos.
2. ND - None detected
3. SF - Square feet

Table 2 – Lead Sample Results

Sample Number	Color	Substrate	Location	Lab Results	
				Results in mg/kg	Results in percent
LLA-L01	**Yellow paint**	**Concrete curb**	**LLA Site – entrance**	**33,000.0**	**3.3000**
LLA-L02	Green paint	Concrete foundation	LLA Site – NE corner	<51.0	0.0051
LLA -L03	Black paint	Concrete foundation	LLA Site – NE corner	<66.0	0.0066
LLA -L04	Red paint	Concrete foundation	LLA Site – west side	<49.0	0.0049
LLA -L05	Green paint	Sport court	LLA Site – west side	<53.0	0.0053
LLA-L06	**Yellow paint**	**Concrete foundation**	**LLA Site – north central**	**9,700.0**	**0.9700**

Notes:

1. Bold type indicates positive lab results for lead.
2. mg/kg - Milligrams lead per kilogram

Recommendations

Asbestos

Asbestos-containing material (ACM) and presumed asbestos-containing material (PACM) that may be impacted by demolition/renovation activities must be removed by a licensed asbestos abatement contractor prior to disturbance. The asbestos work must be performed in compliance with Washington State worker protection and environmental protection regulations. See WAC 296-62, WAC 296-65, and Puget Sound Clean Air Agency Regulation III, Article 4 for additional information.

Lead

Materials that have been shown to contain detectable levels of lead are regulated by L&I due to the potential for occupational exposure to lead if these materials are disturbed. Necessary precautions (e.g., exposure assessments, respiratory protection) must be taken to prevent or minimize worker exposure to lead, as outlined in WAC 296-155-176. Demolition waste that contains lead must be characterized and disposed in accordance with the provisions of the Dangerous Waste Regulations (WAC 173-303).

Limiting Conditions

This survey was limited to observation, minimal destructive sampling, and analysis of suspect building materials in accessible portions of the Lora Lake Apartments Site that may be impacted by demolition and construction. Inaccessible areas should be presumed to contain asbestos and lead until extensive destructive sampling is performed in those areas. In addition, any suspect materials that were not sampled during the referenced survey activities should be presumed to contain asbestos and lead until otherwise indicated by sampling and analysis.

Limitations of the Assessment

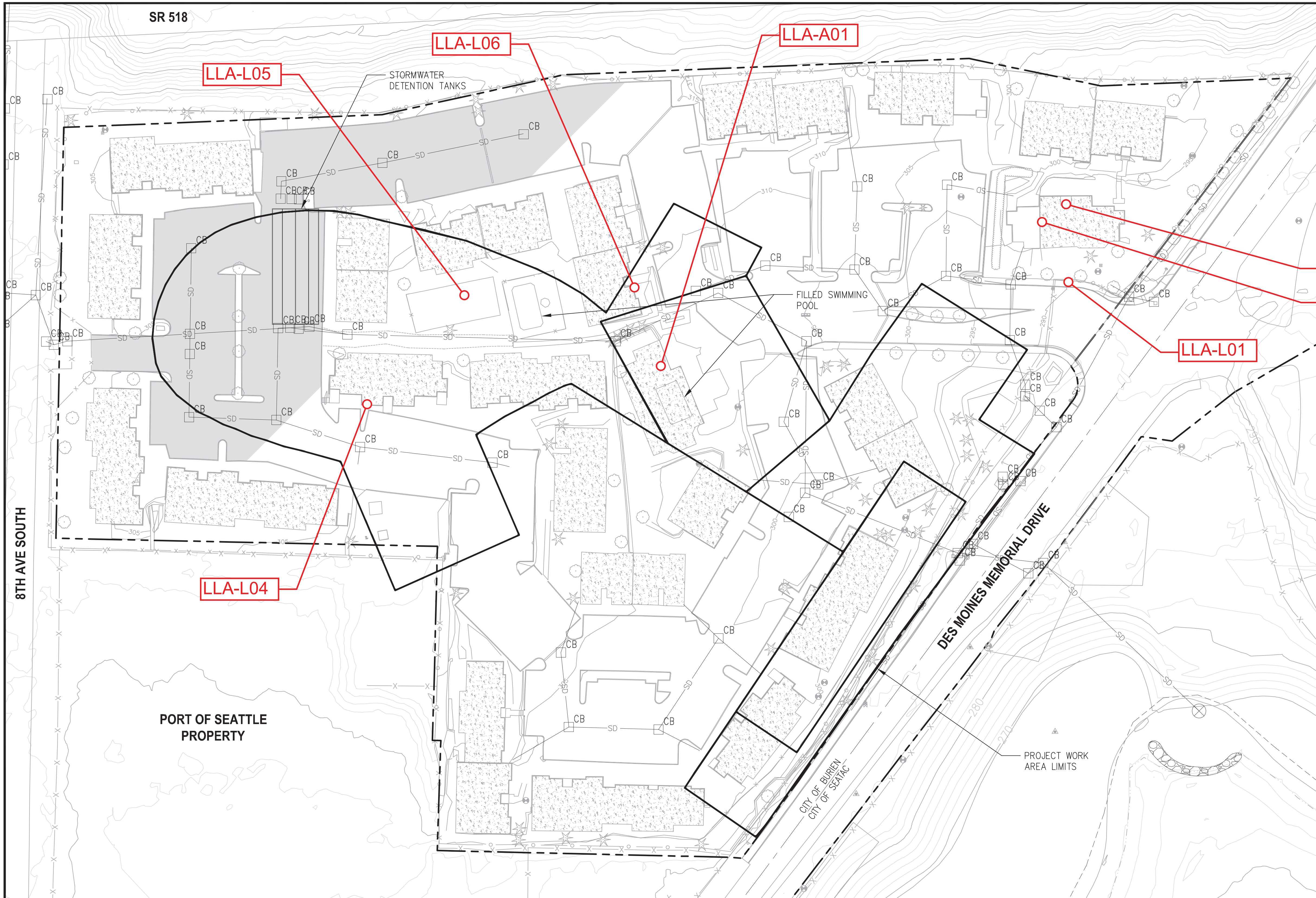
The conclusions of this report are based solely upon visual site observations and interpretations of laboratory analyses, as described in this report. The opinions presented herein apply to the site conditions existing at the time of the investigation and interpretation of current regulations pertaining to asbestos and lead. Therefore, these opinions and recommendations may not apply to future conditions that may exist at the site which we have not had the opportunity to evaluate. All applicable state, federal, and local regulations should always be verified prior to any work that will disturb materials containing asbestos and lead.

Attachments

Figure 1 – Sample Locations
Bulk Sample Analytical Reports

Port of Seattle

Figures



NOTES:

1. THIS PLAN PROVIDES AN OVERVIEW OF THE PROJECT ELEMENTS AND DOES NOT COMPLETELY DESCRIBE THE PROJECT. SEE COMPLETE CONTRACT DOCUMENTS FOR ALL CONTRACT AND PROJECT REQUIREMENTS.

LEGEND:

- PROJECT WORK AREA LIMITS
- CITY BOUNDARY
- EXISTING CONCRETE FOUNDATIONS
- SOIL EXCAVATION AREAS
- STORM DRAIN LINES
- CATCH BASINS
- PROTECTED MONITORING WELLS
- TOPOGRAPHY
- MONITORING WELL

PLAN

LLA SITE PLAN
SCALE: 1" = 40'

1"=40' Scale 40 0 40 80 Feet

N

FLOYD | SNIDER
strategy • science • engineering
kpff

PROJECT ENGR./ARCH: MEGAN McCULLOUGH
DESIGNER: MMM
DRAWN BY: JKH
SCALE: AS SHOWN
DATE: RELEASE
CHECKED BY: JSM
CHECKED/APPROVED BY: MMM

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D
1	XX/XX/2015	JSM	30% DESIGN REVIEW	MMM					

POS PROJECT MANAGER:
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE:
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: LORA LAKE APARTMENTS SITE
MTCA REMEDIAL ACTION
SHEET TITLE: SAMPLE LOCATIONS

POS WORK PROJECT NUMBER
104395
CONSULTANT'S PROJECT NUMBER
POS PROJECT TRACKING NUMBER
FIGURE 1

Port of Seattle

Bulk Sample Analytical Reports

December 21, 2015

Brian Nichols
Port of Seattle - PCS
AOB 5th Floor Seattle-Tacoma International Airport, P.O. Box 68727
Seattle, WA 98168

NVL LABS
INDUSTRIAL HYGIENE SERVICES
Laboratory | Management | Training

RE: Bulk Asbestos Fiber Analysis; NVL Batch # 1522986.00

Client Project: 105198 PCSRMM2
Location: Lora Lake

Dear Mr. Nichols,

Enclosed please find test results for the 1 sample(s) submitted to our laboratory for analysis on 12/17/2015.

Examination of these samples was conducted for the presence of identifiable asbestos fibers using polarized light microscopy (PLM) with dispersion staining in accordance with both **EPA 600/M4-82-020**, Interim Method for the Determination of Asbestos in Bulk Insulation Samples and **EPA 600/R-93/116** Method for the Determination of Asbestos in Bulk Building Materials.

For samples containing more than one separable layer of materials, the report will include findings for each layer (labeled Layer 1 and Layer 2, etc. for each individual layer). The asbestos concentration in the sample is determined by calibrated visual estimation.

For those samples with asbestos concentrations between 1 and 10 percent based on visual estimation, the EPA recommends a procedure known as point counting (NESHAPS, 40 CFR Part 61). Point counting is a statistically more accurate means of quantification for samples with low concentrations of asbestos.

The detection limit for the calibrated visual estimation is <1%, 400 point counts is 0.25% and 1000 point counts is 0.1%

Samples are archived for two weeks following analysis. Samples that are not retrieved by the client are discarded after two weeks.

Thank you for using our laboratory services. Please do not hesitate to call if there is anything further we can assist you with.

Sincerely,

Nick Ly, Technical Director

Enc.: Sample Results

NVLAP
Lab Code: 102063-0

1.888.NVL.LABS
1.888.(685.5227)
www.nvllabs.com

NVL Laboratories, Inc.
4708 Aurora Ave N, Seattle, WA 98103
p 206.547.0100 | f 206.634.1936

NVL Laboratories, Inc.
4708 Aurora Ave N, Seattle, WA 98103
p 206.547.0100 | f 206.634.1936 | www.nvllabs.com

Bulk Asbestos Fibers Analysis

By Polarized Light Microscopy

Client: Port of Seattle - PCS
Address: AOB 5th Floor Seattle-Tacoma International Airport, P.O. Box 68727 Seattle, WA 98168
Attention: Mr. Brian Nichols
Project Location: Lora Lake

Batch #: 1522986.00
Client Project #: 105198 PCSRMM2
Date Received: 12/17/2015
Samples Received: 1
Samples Analyzed: 1
Method: EPA/600/R-93/116 & EPA/600/M4-82-020

Lab ID: 15137720 **Client Sample #: LLA-A01**
Location: Lora Lake

Layer 1 of 2 **Description:** Brown brittle material with white glaze

Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
Ceramic/Binder, Fine grains	None Detected	ND	**None Detected ND**

Layer 2 of 2 **Description:** Tan brittle cementitious material

Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
Cement/Binder, Fine grains, Mineral grains	Cellulose	2%	**None Detected ND**
Organic debris, Fine particles, Miscellaneous particles	Hair	<1%	

Sampled by: Client
Analyzed by: Matt Macfarlane **Date:** 12/17/2015
Reviewed by: Nick Ly **Date:** 12/21/2015

Nick Ly, Technical Director

Note: If samples are not homogeneous, then subsamples of the components were analyzed separately. All bulk samples are analyzed using both EPA 600/R-93/116 and 600/M4-82-020 Methods with the following measurement uncertainties for the reported % Asbestos (1%=0-3%, 5%=1-9%, 10%=5-15%, 20%=10-30%, 50%=40-60%). This report relates only to the items tested. If sample was not collected by NVL personnel, then the accuracy of the results is limited by the methodology and acuity of the sample collector. This report shall not be reproduced except in full, without written approval of NVL Laboratories, Inc. It shall not be used to claim product endorsement by NVLAP or any other agency of the US Government

NVL Laboratories, Inc.
4708 Aurora Ave N, Seattle, WA 98103
p 206.547.0100 | f 206.634.1936 | www.nvllabs.com

ASBESTOS LABORATORY SERVICES

NVL LABS

Company	Port of Seattle - PCS	**NVL Batch Number**	**1522986.00**
Address	AOB 5th Floor Seattle-Tacoma International Airport, P.O. Box 68727	**TAT**	1 Day **AH** No
		Rush TAT	
Project Manager	Mr. Brian Nichols	**Due Date**	12/18/2015 **Time** 10:30 AM
Phone	(206) 787-5390	**Email**	nichols.b@portseattle.org
		Fax	(206) 787-5198

Project Name/Number: 105198 PCSRMM2 **Project Location:** Lora Lake

Subcategory PLM Bulk

Item Code ASB-02 EPA 600/R-93-116 Asbestos by PLM <bulk>

Total Number of Samples 1 Rush Samples

	Lab ID	Sample ID	Description	A/R
1	15137720	LLA-A01		A

	Print Name	Signature	Company	Date	Time
Sampled by	Client				
Relinquished by	Client				

Office Use Only	Print Name	Signature	Company	Date	Time
Received by	Matt Macfarlane		NVL	12/17/15	1030
Analyzed by	Matt Macfarlane		NVL	12/17/15	8:39 AM
Results Called by					
☐ **Faxed** ☐ **Emailed**					

Special Instructions:

Date: 12/17/2015
Time: 2:39 PM
Entered By: Matt Macfarlane

1522986

NVL LABS
INDUSTRIAL HYGIENE SERVICES
Laboratory | Management | Training

ASBESTOS CHAIN OF CUSTODY

Turn Around Time

☐ 1 Hour	☒ 24 Hours	☐ 4 Days
☐ 2 Hours	☐ 2 Days	☐ 5 Days
☐ 4 Hours	☐ 3 Days	☐ 10 Days

Please call for TAT less than 24 Hours

Company: Port Construction Services
Address:
Phone:
Project Manager: Brian Nichols
Cell: (206) 245-8496
Email: Nichols.B@portseattle.org
Fax: ( ) -

Project Name/Number: 105198 PCSRHM2
Project Location: Lora Lake

☐ PCM Air (NIOSH 7400) ☐ TEM (NIOSH 7402) ☐ TEM (AHERA) ☐ TEM (EPA Level II Modified)
☒ PLM (EPA 600/R-93-116) ☐ EPA 400 Points (600/R-93-116) ☐ EPA 1000Points (600/R-93-116)
☐ PLM Gravimetry (600/R-93-116) ☐ Asbestos in Vermiculite (EPA 600/R-04/004) ☐ Asbestos in Sediment (EPA 1900 Points)
☐ Asbestos Friable/Non-Friable (EPA 600/R-93/116) ☐ Other

Reporting Instructions: Email
☐ Call ( ) - ☐ Fax ( ) - ☒ Email Nichols.B@portseattle.org

Total Number of Samples 1

	Sample ID	Description	A/P
1	LLA-A01		
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

	Print Name	Signature	Company	Date	Time
Sampled by	B. Nichols	[signature]	PCS	12/16	3pm
Relinquish by	B. Nichols	[signature]	PCS	12/17	10:30am

Office Use Only

	Print Name	Signature	Company	Date	Time
Received by	Matth	[signature]	[illegible]	12/17/15	1030
Analyzed by					
Called by					
Faxed/Email by					

December 21, 2015

Brian Nichols
Port of Seattle - PCS
AOB 5th Floor Seattle-Tacoma International Airport, P.O. Box 68727
Seattle, WA 98168

Laboratory | Management | Training

RE: Metals Analysis; NVL Batch # 1522998.00

Dear Mr. Nichols,

Enclosed please find the test results for samples submitted to our laboratory for analysis. Preparation of these samples was conducted following protocol outlined in EPA Method SW 846 -3051 unless stated otherwise. Analysis of these samples was performed using analytical instruments in accordance with U.S. EPA, NIOSH, OSHA and other ASTM methods.

For matrix materials submitted as paint, dust wipe, soil or TCLP samples, analysis for the presence of total metals is conducted using published U.S. EPA Methods. Paint and soil results are usually expressed in mg/Kg which is equivalent to parts per million (ppm). Lead (Pb) in paint is usually expressed in mg/Kg (ppm) , Percent (%) or mg/cm^2 by area. Dust wipe sample results are usually expressed in ug/wipe and ug/ft^2. TCLP samples are reported in mg/L (ppm). For air filter samples, analyses are conducted using NIOSH and OSHA Methods. Results are expressed in ug/filter and ug/m^3. Other matrix materials are analyzed accordingly using published methods or specified by client. The reported test results pertain only to items tested and are not blank corrected.

For recent regulation updates pertaining to current regulatory levels or permissible exposure levels, please call your local regulatory agencies for more details.

This report is considered highly confidential and will not be released without your approval. Samples are archived for two weeks following analysis. Samples that are not retrieved by the client are discarded after two weeks.

Thank you for using our laboratory services. if you need further assistance please feel free to call us at 206-547-0100 or 1-888-NVLLABS.

Sincerely,

Shalini Patel, Laboratory Analyst

AIHA LAP, LLC
ACCREDITED LABORATORY
INDUSTRIAL HYGIENE & ENVIRONMENTAL LEAD
ISO/IEC 17025:2005
WWW.AIHAACCREDITEDLABS.ORG
LAB # 101861

NVL Laboratories, Inc.
4708 Aurora Ave N, Seattle, WA 98103
p 206.547.0100 | f 206.634.1936 | www.nvllabs.com

Analysis Report

Total Lead (Pb)

Client: Port of Seattle - PCS
Address: AOB 5th Floor Seattle-Tacoma International Airport, P.O. Box 68727 Seattle, WA 98168
Attention: Mr. Brian Nichols
Project Location: Lora Lake

Batch #: 1522998.00
Matrix: Paint
Method: EPA 3051/7000B
Client Project #: 105198 PCSRMM2
Date Received: 12/17/2015
Samples Received: 6
Samples Analyzed: 6

Lab ID	Client Sample #	Sample Weight (g)	RL in mg/Kg	Results in mg/Kg	Results in percent
15137809	LLA-L01	0.1969	50.0	33000.0	3.3000
15137810	LLA-L02	0.1941	51.0	< 51.0	<0.0051
15137811	LLA-L03	0.1512	66.0	< 66.0	<0.0066
15137812	LLA-L04	0.2013	49.0	< 49.0	<0.0049
15137813	LLA-L05	0.1864	53.0	< 53.0	<0.0053
15137814	LLA-L06	0.1921	52.0	9700.0	0.9700

Sampled by: Client
Analyzed by: Yasuyuki Hida
Reviewed by: Shalini Patel

Date Analyzed: 12/21/2015
Date Issued: 12/21/2015

Shalini Patel, Laboratory Analyst

mg/ Kg =Milligrams per kilogram
Percent = Milligrams per kilogram / 10000

RL = Reporting Limit
'<' = Below the reporting Limit

Note : Method QC results are acceptable unless stated otherwise.
Unless otherwise indicated, the condition of all samples was acceptable at time of receipt.

Bench Run No: 35-1221-2

NVL Laboratories, Inc.
4708 Aurora Ave N, Seattle, WA 98103
p 206.547.0100 | f 206.634.1936 | www.nvllabs.com

LEAD LABORATORY SERVICES

NVL LABS

Company Port of Seattle - PCS
Address AOB 5th Floor Seattle-Tacoma International Airport, P.O. Box 68727
Project Manager Mr. Brian Nichols
Phone (206) 787-5390

NVL Batch Number 1522998.00
TAT 1 Day **AH** No
Rush TAT
Due Date 12/21/2015 **Time** 5:30 PM
Email nichols.b@portseattle.org
Fax (206) 787-5198

Project Name/Number: 105198 PCSRMM2 **Project Location:** Lora Lake

Subcategory Flame AA (FAA)
Item Code FAA-02 EPA 7000B Lead by FAA <paint>

Total Number of Samples 6 Rush Samples

	Lab ID	Sample ID	Description	A/R
1	15137809	LLA-L01		A
2	15137810	LLA-L02		A
3	15137811	LLA-L03		A
4	15137812	LLA-L04		A
5	15137813	LLA-L05		A
6	15137814	LLA-L06		A

	Print Name	Signature	Company	Date	Time
Sampled by	Client				
Relinquished by	Client				

Office Use Only	Print Name	Signature	Company	Date	Time
Received by	Matt Macfarlane		NVL	12/17/15	1030
Analyzed by	Yasuyuki Hida		NVL	12/21/15	
Results Called by					
☐ **Faxed** ☐ **Emailed**					

Special Instructions: Arrived at Aurora office @1730 12/18/15; TAT adjusted accordingly.

Date: 12/17/2015
Time: 3:34 PM
Entered By: Matt Macfarlane

NVL LABS
INDUSTRIAL HYGIENE SERVICES
Laboratory | Management | Training

M 1522998

CHAIN OF CUSTODY

Turn Around Time
☐ 2 Hour ☐ 4 Hours ☒ 24 Hours
☐ 2 Days ☐ 3 Days ☐ 4 Days
☐ 5 Days ☐ 6-10 Days
Please call for TAT less than 24 Hours

Company: Port Construction Services
Project Manager: Brian Nichols
Address:
Cell: (206) 245-8446
Email: Nichols.B@portseattle.org
Phone:
Fax: ( ) -

Project Name/Number: 105198 PCSRAH2
Project Location: Lora Lake

☒ Total Metals ☐ TCLP | ☒ FAA (ppm) ☐ ICP (PPM) ☐ GFAA (ppb) ☐ CVAA (ppb) | ☐ Air Filter ☐ Paint Chips (cm) ☐ Drinking Water ☐ Other | ☒ Paint Chips (%) ☐ Dust Wipes ☐ Waste Water | ☐ Soil | RCRA 8: ☐ Barium ☐ Chromium ☐ Silver ☐ Arsenic ☐ Mercury ☒ Lead ☐ Selenium ☐ Cadmium | RCRA 11: ☐ Copper ☐ Zinc ☐ Other

Reporting Instructions: EMAIL
☐ Call ( ) - ☐ Fax ( ) - ☒ Email Nichols.B@portseattle.org

Total Number of Samples 6

#	Sample ID	Description	A/R
1	LLA-L01		
2	LLA-L02		
3	LLA-L03		
4	LLA-L04		
5	LLA-L05		
6	LLA-L06		
7			
8			
9			
10			
11			
12			
13			
14			
15			

	Print Name	Signature	Company	Date	Time
Sampled by	B. Nichols	[signature]	PCS	12/16	3pm
Relinquish by	B. Nichols	[signature]	PCS	12/17	10:30AM

Office Use Only

	Print Name	Signature	Company	Date	Time
Received by	MATTM	[signature]	NV	12/17/15	10:30
Analyzed by					
Called by					
Faxed/Email by					

Port of Seattle
Lora Lake Apartments Site

Engineering Design Report

Appendix E
Draft Construction Stormwater Pollution Prevention Plan

Table of Contents

List of Tables

List of Figures

List of Attachments

List of Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
BMP	Best management practice
CESCL	Certified Erosion and Sediment Control Lead
COC	Contaminant of concern
CSWGP	Construction Stormwater General Permit
DMCA	1982 Dredged Material Containment Area
EDR	Engineering Design Report
LL Apartments Parcel	Lora Lake Apartments Parcel
LL Parcel	Lora Lake Parcel
NTU	Nephelometric turbidity unit
pg/g	Picograms per gram
Port	Port of Seattle
Site	Lora Lake Apartments Site
SR	State Route
STIA	Seattle-Tacoma International Airport
SWMMWW	Stormwater Management Manual for Western Washington
SWPPP	Stormwater Pollution Prevention Plan
TEQ	Toxicity equivalent
WSDOE	Washington State Department of Ecology

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1.0 Introduction

This Draft Construction Stormwater Pollution Prevention Plan (SWPPP) has been prepared on behalf of the Port of Seattle (Port) as part of the Engineering Design Report (EDR) for the Lora Lake Apartments Site (Site) in Burien, Washington.

It is expected that construction stormwater will be treated as needed and discharged to the State Route 518 (SR 518) Construction Stormwater Pond, which would not require a National Pollution Discharge Elimination System (NPDES) Construction Stormwater General Permit (CSWGP, Attachment E.1) because this water body is not a water of the state. However, a CSWGP may be obtained by the Port for stormwater management from the construction activities associated with Site cleanup actions, which will include excavation of contaminated soils at the Lora Lake Apartments Parcel (LL Apartments Parcel) and the Lora Lake Parcel (LL Parcel) and all associated backfilling, grading, site preparation and staging, including activities in the 1982 Dredged Material Containment Area (DMCA). If a permit is obtained, it would allow for discharge to Miller Creek as an option for water management, and would be transferred to the Contractor after it is obtained.

The Contractor hired by the Port to implement remedial activities at the Site will be required to revise and finalize this Draft SWPPP, and to develop a separate SWPPP that covers remedial activities associated with the filling of Lora Lake and the construction of the rehabilitated wetland that will be based on the specific construction methodologies implemented by the Contractor.

Monitoring and implementation of best management practices (BMPs) will be conducted to ensure that stormwater discharges from the Site do not adversely affect surface waters, in substantial compliance with state and local rules and in accordance with the CSWGP if obtained. This Draft SWPPP addresses the management of stormwater run-off and identifies the BMPs planned for preventing contaminated soils at the Site from entering the stormwater drainage systems. The Contractor will be responsible for finalizing this Draft SWPPP to be specific to the Contractor personnel and the planned construction methods. The Contractor will also be responsible for providing a Certified Erosion and Sediment Control Lead (CESCL) who can inspect and repair, as necessary, BMPs on a regular schedule.

In addition to these BMPs, a Spill Prevention, Control, and Countermeasures Plan (Attachment E.2) will be prepared by the Contractor to detail how to prevent spills of petroleum products or hazardous materials and provide efficient and timely cleanup if a spill occurs during the remedial action construction activities.

The objectives of this Draft SWPPP are as follows:

- Describe the BMPs to prevent erosion and sedimentation and identify, reduce, and eliminate or prevent stormwater contamination and water pollution due to construction activities.
- Describe measures to prevent violations of surface water quality, groundwater quality, or sediment management standards.

- Describe measures to control peak volumetric flow rates and velocities of stormwater discharges.

This Draft SWPPP was prepared to meet the requirements set forth in the *Stormwater Management Manual for Western Washington* (SWMMWW), Volume II, *Construction Stormwater Pollution Prevention* (WSDOE 2014) and other applicable or relevant and appropriate requirements. These include, but are not limited to, the erosion and sediment control standards in King County's, Surface Water Design Manual (King County 2009) as locally amended (City of SeaTac 2011), SeaTac's Stormwater Management Plan (City of SeaTac 2015), and the Port's Stormwater Management Manual (Port of Seattle 2008).

This Draft SWPPP is divided into the following main sections:

- **Section 1—Introduction.** This section describes the objectives and organization of the Draft SWPPP.
- **Section 2—Work Area Description.** This section describes the project background, existing conditions in the work area, and construction activities.
- **Section 3—Construction Stormwater BMPs.** This section details the BMPs to be implemented based on the 12 required elements in the SWMMWW.
- **Section 4—Construction Phasing and BMP Implementation.** This section describes the timing of the BMP implementation in relation to the project schedule.
- **Section 5—Pollution Prevention Team.** This section identifies the appropriate contacts (emergency and non-emergency), monitoring personnel, and on-site temporary erosion and sediment control inspector.
- **Section 6—Site Inspections and Monitoring.** This section describes the inspection and monitoring requirements, including parameters of concern and sampling locations, frequencies, and methods.
- **Section 7—Reporting and Recordkeeping.** This section describes the requirements for documentation of the BMP implementation, site inspections and monitoring, and changes to the implementation of certain BMPs necessitated by construction activities. It also describes notification procedures in the event of a discharge from the work area.
- **Section 8—References.** This section includes all reference material cited in this document.

Supporting documentation and the site inspection form are provided in the attachments.

2.0 Work Area Description

2.1 EXISTING CONDITIONS IN THE WORK AREA

The Site straddles the boundary between the cities of Burien and SeaTac, Washington (Figure E.1 and Drawing G03.1 in Attachment E.3). The LL Apartments Parcel is located within the City of Burien, at 15001 Des Moines Memorial Drive. The LL Parcel is located immediately across Des Moines Memorial Drive to the southeast, and the DMCA is located northeast of the LL Parcel, both within the City of SeaTac.

Under current conditions, described in greater detail in the following text, drainage from the Site ultimately flows to the southwest in Miller Creek to Puget Sound. Stormwater from the LL Apartments Parcel, along with upstream stormwater from the City of Burien and stormwater from Des Moines Memorial Drive, is currently conveyed by a stormwater system to Lora Lake, which overflows to Miller Creek. This system will be reconfigured as part of a separate construction project that is currently planned for completion before the beginning of the Site remedial activities so that the City of Burien mainline stormwater and the LL Apartments Parcel stormwater are discharged to a new (or existing) stormwater drainage system west of the Site (the 8th Avenue Stormwater Line). The LL Parcel and the DMCA both consist of pervious surfaces of wetland soils and vegetation or gravel in a portion of the DMCA that facilitate infiltration of surface stormwater. Any overland surface flow from both parcels follows the site topography and drains to either Lora Lake, the surrounding wetlands, or directly to Miller Creek and will continue to do so after the remedial action construction is completed.

Miller Creek west of 1st Avenue South, approximately 1 mile southwest of the Site, is listed as an impaired water body by the state of Washington under Section 303(d) of the Clean Water Act due to dissolved oxygen, bacteria, pH, and lead.

2.1.1 Lora Lake Apartments Parcel

The LL Apartments Parcel occupies approximately 8.3 acres of currently vacant land that is bounded to the north by SR 518, to the east and southeast by Des Moines Memorial Drive, to the west by 8th Avenue South, and to the south by an open area of Port-owned property, previously used as a commercial area, and the former Seattle City Light Sunnydale Substation, which was purchased by the Port in 2011. Land use west and north of the LL Apartments Parcel is primarily residential and light commercial. East of the LL Apartments Parcel is the LL Parcel.

The LL Apartments Parcel is currently vacant land covered by asphalt parking areas, concrete building foundations, and landscaped areas remaining from the previous Lora Lake Apartments complex. An active City of Burien stormwater system currently runs through the LL Apartments Parcel, including a main stormwater line that conveys stormwater drainage from the upstream City of Burien drainage network. This main stormwater line enters on the west side of the LL Apartments Parcel and exits on the east side of the parcel. A second, smaller subsystem drains the northeast portion of the LL Apartments Parcel and conveys water through smaller pipes. The two systems connect to the adjacent Des Moines Memorial Drive drainage system downstream of the LL Apartments Parcel and discharge, with the additional stormwater from Des Moines Memorial Drive, to Lora Lake through an outfall located at the northwestern edge of the lake (Figure E.2).

2.1.2 Lora Lake Parcel

The LL Parcel is located southeast of the LL Apartments Parcel, on the east side of Des Moines Memorial Drive. The LL Parcel consists of approximately 7.1 acres of land, including the approximately 3-acre Lora Lake and a Port-constructed wetland aquatic habitat mitigation area. It is bounded to the north by the SR 518 highway interchange, to the east and south by a Port-owned habitat mitigation area and the northern boundary of the Seattle-Tacoma International Airport (STIA) air operations area, and to the west and northwest by Des Moines Memorial Drive. Miller Creek runs from northeast of the DMCA and LL Parcel, around the southeast corner of the lake, and continues to the west, south of Lora Lake. (Figure E.2). The LL Parcel and surrounding areas are located within the Miller Creek Watershed, which eventually drains to Puget Sound (Figure E.1).

The LL Parcel currently lies within a series of habitat mitigation areas developed and enhanced by the Port in compliance with the requirements of Clean Water Act Section 404 Permit No. 1996-4-02325, issued by the U.S. Army Corps of Engineers to support aquatic, amphibian, and wetland habitat as part of the mitigation requirements. The mitigation area is designated in the Natural Resource Mitigation Plan (NRMP) as the Miller Creek/Lora Lake/Vacca Farm Wetland and Floodplain Mitigation Area (Port Mitigation Area; Parametrix 2001). Restrictive covenants prohibit any future development on the LL Parcel, which, after remedy implementation, will be maintained as a protected wetland habitat area in perpetuity.

Lora Lake currently receives stormwater run-off from the LL Apartments Parcel, the City of Burien drainage areas upstream of the LL Apartments Parcel, and Des Moines Memorial Drive east of the LL Apartments Parcel through a single outfall located near the northwestern edge of the lake. This outfall discharges into a sediment settling basin in the northwest corner of the lake that was constructed in the 1980s using a rock berm. Additionally, the lake receives non-point source overland flow from the LL Parcel and surrounding land including the DMCA. An overflow discharge culvert connects Lora Lake and Miller Creek at the southeast end of the lake (refer to Attachment E.3, Drawing CE02.1).

2.1.3 1982 Dredged Material Containment Area

The dredged spoil containment area referred to as the DMCA, which contains sediment dredged from the bottom of Lora Lake in 1982, is located on Port property northeast of the LL Parcel, separated by an existing Port paved access road. The DMCA covers an area of approximately 2.75 acres. The eastern half of the DMCA is an approximately 1.5-acre vegetated area covered by a few trees and a mix of grasses and invasive and pioneering plant species, including Scotch broom, alder saplings, Himalayan blackberry, and butterfly bush. The remaining approximately 1.25 acres of land is the location of the approach lighting system for the STIA 3rd Runway, which was constructed in 2006. This area has been regraded and covered with gravel and is kept free of vegetation by the Port. The DMCA is located northeast of Lora Lake (Figure E.2) and is outside the Port Mitigation Area.

2.2 CONSTRUCTION ACTIVITIES

The planned construction activities addressed under this Draft SWPPP are summarized in this section. Additional details are provided in the EDR. Stormwater erosion, and sediment controls are described in Section 3.0.

2.2.1 Lora Lake Apartments Parcel

Construction at the LL Apartments Parcel includes demolition and removal of vegetation, concrete and asphalt structures and surfaces; excavation of contaminated soil; removal of existing utilities that could interfere with earthwork activities; and site regrading. In particular, the stormwater conveyances that currently drain the LL Apartments Parcel and the City of Burien stormwater main line that traverses the parcel will be removed such that after completion of the remedial action construction on the LL Apartments Parcel and LL Parcel, the only stormwater that will continue to discharge to the newly constructed wetland from the existing outfall at the northwestern edge of the lake is the limited stormwater flows from Des Moines Memorial Drive. At the conclusion of the remedial action, the LL Apartments Parcel will be mostly covered with pervious, vegetated surface and graded to an armored reservoir at its southern edge that will be connected to the 8th Avenue Stormwater Line by means of an overflow structure (refer to Attachment E.3, Drawing CG05.1). The only unvegetated surface will be a gravel road installed to allow vehicle access throughout the parcel for site monitoring and inspections.

The remedial action involves excavation of approximately 24,000 cubic yards of contaminated soil with dioxins/furans toxicity equivalent (TEQ) concentrations greater than 100 picograms per gram (pg/g) for off-site disposal at a properly permitted and Port-approved facility. The excavation will also remove soil contaminated with other contaminants of concern (COCs), including lead, pentachlorophenol (PCP), gasoline range hydrocarbons, diesel range hydrocarbons, and heavy oil range hydrocarbons, at concentrations greater than their respective cleanup levels. The LL Apartments Parcel excavation areas are referred to as Excavation Areas 1 through 4 (refer to Attachment E.3, Drawing CG01.1).

Groundwater that is encountered during excavation and removed from the subsurface for excavation dewatering is expected to be treated as needed and discharged to the SR 518 Construction Stormwater Pond (Figure E.2) or discharged to another permitted location that drains to Miller Creek.

The LL Apartments Parcel soil excavations will be backfilled to final grade using a combination of imported material and on-site soil/crushed concrete. During regrading activities, approximately 38,200 cubic yards of soil will be generated and used for backfilling the excavation. During backfilling and regrading, on-site soil with dioxins/furans TEQ concentrations as great as 100 pg/g will remain on the LL Apartments Parcel as needed to reach the proposed final elevation. When grading on the parcel has achieved the final elevation, the LL Apartments Parcel will be stabilized and hydroseeded to control erosion, stormwater run-off, and dust generation, and a temporary road will be constructed for access and future site development. A barrier to wildlife, consisting of impervious surfaces (asphalt, building foundations, etc.) installed as part of site redevelopment, will be established within 4 years, and will not be completed under the CSWGP if obtained, or this Draft SWPPP.

Other construction activities associated with the remedial action include clearing and grubbing, preparation of staging and stockpile areas, preparation of access routes and haul routes, and monitoring well decommissioning and removal.

2.2.2 Lora Lake Parcel

Remedial action at the LL Parcel includes two components, one related to the isolation of contaminated Lora Lake sediments and the rehabilitation of the lake area to historical wetland conditions and the other one related to the removal of contaminated shallow soil located along the western boundary of the parcel. This Draft SWPPP applies only to the removal of shallow soil and the construction and removal of temporary access roads, as described in the following text.

Shallow soil along the western boundary of the LL Parcel is contaminated with dioxins/furans and lead at concentrations slightly greater than those required to protect wildlife. This contaminated soil will be excavated and disposed of off-site at a permitted and approved Subtitle D landfill or used as backfill at the LL Apartments Parcel if geotechnically suitable for use. Excavation will occur in two areas (totaling approximately 8,600 square feet) along this steeply sloping parcel boundary, and approximately 900 cubic yards of contaminated soil will be removed. The two LL Parcel excavation areas are referred to as Excavation Areas 5 and 6. After excavation, these two excavated areas will be backfilled to the area's original grade, and the excavation areas will be replanted (refer to Attachment E.3, Drawing CG06.1).

Other construction activities under this Draft SWPPP associated with the remedial action on the LL Parcel include the construction of a temporary access road and restoration of the excavation areas and temporary road areas. As part of the Contractor's site preparation activities for remedial action construction on the LL Parcel, a temporary construction access road will be constructed along the northern shoreline of the lake on the LL Parcel. A single temporary construction lake access road will be constructed from the northwest corner of the LL Parcel, near Des Moines Memorial Drive, down the steep slope on a diagonal route to a point near the eastern end of the lake's rock berm to be removed (located in the northwest corner of the lake), a distance of about 270 feet. This first leg of the temporary construction lake access road will require both cutting and filling to provide safe access for the construction equipment needed to place the sand cap in the lake. The access road will then traverse the low, flat lake shoreline for an additional distance of 200 feet to the east. The temporary access road will then continue northeast an additional distance of 180 feet to connect to the existing paved access road at a point just west of the STIA 3rd Runway approach lighting system. The road will generally be less than 25 feet wide, with wider turnouts near the rock berm area and the eastern lake edge for access during lake filling and cap placement (Attachment E.3, Drawing G05.1). Construction of this road will result in the temporary disturbance of approximately 0.2 acre of previously planted area within the Vacca Farms/Lora Lake wetland boundary. After the completion of the remedial action construction at the end of Construction Season 2 in 2018, the temporary construction lake access road will be removed, backfilled, and revegetated.

2.2.3 1982 Dredged Material Containment Area

A small stockpile area will be prepared in the DMCA to accommodate a few thousand cubic yards of imported fill material. A portion of the DMCA will also serve as a construction staging area to provide access and turnaround space for dump trucks and allow stockpiling of fill material. The excess material to be excavated and consolidated within the DMCA is expected to be up to 10,000 cubic yards and is dependent on the redevelopment plans for the property. An engineered surface will be constructed to prevent the exposure of terrestrial plants and wildlife to Site contaminants and the exposure of workers by means of direct contact with the soil and to improve the area for Port uses. The final surface will be pervious, and the final grade will generally resemble the existing drainage to the south, directing stormwater from the entire DMCA to a planted filter strip along the southern edge of the DMCA (refer to Attachment E.3, Drawing CG03.1).

2.2.4 Summary of Site Area and Stormwater Drainage Details

The estimated surface condition in the work area before and after construction is summarized in the following list:

- Total work area: 16.5 acres (includes 7.7 acres on the LL Apartments Parcel, 0.9 acre on the LL Parcel, 3.1 acres in the DMCA, and 4.8 acres on the Port property south of the LL Apartments Parcel)
- Percentage of impervious area before construction: 9.3 acres; 56 percent (includes 4.7 acres on the LL Apartments Parcel, 0.9 acre on the LL Parcel, 1.3 acres in the DMCA, and 2.4 acres on the Port property south of the LL Apartments Parcel)
- Percentage of impervious area after construction: 4.2 acres; 25 percent (includes 0.9 acre on the LL Apartments Parcel, 0.9 acre on the LL Parcel, and 2.4 acres on the Port property south of the LL Apartments Parcel)
- Disturbed area during construction: 11.7 acres
- Disturbed area that is characterized as impervious (i.e., access roads, staging, parking): 2.1 acres

The project will result in a substantial decrease in impervious area associated with the removal of 4.67 acres of asphalt and concrete foundation on the LL Apartments Parcel. This impervious surface will be replaced with a pervious vegetated surface and a 0.9-acre temporary access road constructed of crushed rock, which will decrease the peak stormwater run-off from the LL Apartments Parcel during and after construction. The 10-year peak run-off for post-construction stormwater at the LL Apartments Parcel has been calculated to be 0.6 cubic feet per second, which is being used to size the new stormwater detention reservoir and conveyance pipes for the new connection to the 8th Avenue Stormwater Line (refer to EDR Section 3.2.3 and Drawing CG05.1).

This new connection and rerouting of stormwater from Burien and the LL Apartments Parcel to the west will substantially decrease the volume of stormwater entering Lora Lake and the associated wetlands, enhancing the ability of water bodies in this area to receive stormwater from the LL Parcel and the DMCA. On the LL Parcel, grading will be performed to match the pre-construction drainage conditions. In the DMCA, post-construction surfacing will be pervious, and the grading will generally match the pre-construction drainage to the south. Post-construction grading in the DMCA will direct stormwater to the south, where run-off will flow to a planted filter strip and drain into vegetated areas adjacent to Lora Lake and Miller Creek (refer to Attachment E.3, Drawing CG03.1). These changes will not increase the stormwater velocity or peak volumetric flow rate; therefore, no additional stormwater flow calculations were necessary to protect downstream properties or wetlands.

3.0 Construction Stormwater Best Management Practices

3.1 BEST MANAGEMENT PRACTICES: ELEMENTS 1 THROUGH 12

The planned BMPs are shown in Attachment E.3, on Drawing CE01.2 for the LL Apartments Parcel, Drawing CE01.3 for the DMCA, and Drawing CE02.1 for the LL Parcel. The construction BMPs are described in detail in Attachment E.4. The Contractor responsible for finalizing the Draft SWPPP may modify the planned BMPs shown on the drawings and described in this section or replace them with equivalent BMPs, on the basis of the planned construction methods.

3.1.1 Element 1—Mark Clearing Limits

To protect adjacent properties and to reduce the area of soil exposed to construction, the limits of construction will be clearly marked before land-disturbing activities begin. Trees that are to be preserved, as well as all sensitive areas and their buffers, shall be clearly delineated, both in the field and on the plans. In general, natural vegetation and native topsoil shall be retained in an undisturbed state to the maximum extent possible, and natural vegetation will be preserved outside the delineated work area. The BMPs relevant to marking the clearing limits that will be applied to this project include the following:

- Preserving Natural Vegetation (BMP C101)
- Buffer Zones (BMP C102)
- High-Visibility Plastic or Metal Fence (BMP C103)

3.1.2 Element 2—Establish Construction Access

Construction access will be minimized where necessary. Access points will be stabilized to minimize the tracking of sediment onto public roads, and wheel washing, street sweeping, and street cleaning will be used as needed to prevent sediment from entering state waters. All wash wastewater will be controlled on-site and will not be discharged to surface waters. The specific BMPs related to establishing construction access that may be used on this project include the following:

- Stabilized Construction Entrance (BMP C105)
- Wheel Wash (BMP C106)
- Construction Road/Parking Area Stabilization (BMP C107)

For the LL Apartments Parcel, all vehicles will access the parcel from Des Moines Memorial Drive, and the haul route will extend from Des Moines Memorial Drive through the Port property south of the LL Apartments Parcel (refer to Attachment E.3, Drawing G05.1). For the LL Parcel and the DMCA, Excavation Areas 5 and 6 will be accessed from the sidewalk and shoulder of Des Moines Memorial Drive, and a temporary access road from Des Moines Memorial Drive will be constructed and stabilized with a layer of crushed rock before remedial action construction begins (refer to Attachment E.3, Drawing G04.1). Both the LL Apartments Parcel haul route and the LL Parcel temporary access road will be equipped with a wheel wash, or an equivalent means of controlling the transport of soil from the construction area to public roadways. Any stabilization/decontamination equipment that is installed will be available on-site for the duration of the construction work, with the methods of stabilization/decontamination determined by the Contractor.

3.1.3 Element 3—Control Flow Rates

Stormwater discharges from the Site will be controlled to protect the properties from erosion and prevent discharges from the constructions areas from entering Lora Lake and Miller Creek downstream of the construction areas. The Site is located west of the Cascade Mountain crest; therefore, it must comply with Minimum Requirement 7 of the SWMMWW, which states that projects must provide flow control to reduce the impacts of stormwater run-off from impervious surfaces and land cover conversions (WSDOE 2014).

Temporary erosion and sediment controls will be implemented around the construction areas to control run-on and run-off of stormwater into and out of the construction areas. The grade of portions of the construction areas on the LL Apartments Parcel and the DMCA are relatively flat; therefore, a reduction in run-off rates in these areas is expected to require minimal controls. On the other portions of the LL Apartments Parcel and on the LL Parcel, steeper slopes are present in the location of Excavation Areas 3, 4, 5, and 6 and two sections of the LL Parcel temporary access road (refer to Attachment E.3, Drawings CE01.1 and CE02.1). During construction, affected areas of both parcels will be maintained and graded as needed to allow continued infiltration of stormwater to the maximum extent. Stormwater that does not infiltrate and is within an active construction area (i.e., disturbed ground or an area with a potential for contaminated soil) will be collected and treated by means of an on-site water treatment system to achieve the appropriate stormwater discharge criteria before its discharge, as directed by the Engineer. Run-on controls will be used as needed to prevent stormwater from the sidewalk along Des Moines Memorial Drive from entering Excavation Areas 3, 4, 5, and 6.

Construction is scheduled to occur primarily during the dry season (approximately June to September), and precipitation falling within the construction area is generally expected to infiltrate naturally. As a result, no increase in the volume, velocity, and peak flow rate of stormwater run-off from the work area is expected to occur.

3.1.4 Element 4—Install Sediment Controls

Discharge of stormwater run-off from the disturbed areas during construction is expected to be zero, because the affected areas of both parcels and the DMCA will be maintained and graded as needed to allow continued infiltration of stormwater. Stormwater that does not infiltrate and is within an active construction area will be collected and treated before its discharge.

The existing stormwater line between the LL Apartments Parcel and the LL Parcel will be plugged, and stormwater will be pumped to an alternative location. The following additional specific BMPs are expected to be used to control sediment:

- Storm Drain Inlet Protection (BMP C220)
- Silt Fence (BMP C233)
- Straw Wattles (BMP C235)

Other potential BMPs for sediment control, including gravel berms and compost socks, will be implemented as needed. If earthen containment berms are used to control sediment, they will be wrapped in plastic sheeting to prevent erosion and release of sediments.

Alternative sediment control BMPs are included in Attachment E.4 as a quick reference tool for the on-site inspector in the event that during construction the BMP(s) in the previous list are deemed ineffective or inappropriate to satisfy the requirements set forth in the CSWGP if obtained. To avoid potential erosion and sediment control issues that may cause a violation(s) of the CSWGP if obtained, the CESCL will promptly initiate the implementation of one or more of the alternative BMPs listed Attachment E.4 after the first sign that existing BMPs are ineffective or failing.

In addition, sediment will be removed from paved areas in and adjacent to construction work areas manually or by means of mechanical sweepers, as needed, to minimize tracking of sediments on vehicle tires away from the Site and to minimize wash-off of sediments from adjacent streets in run-off.

3.1.5 Element 5—Stabilize Soils

Exposed and unworked soils will be stabilized by the application of effective BMPs to prevent erosion throughout the life of the project. The specific BMPs for soil stabilization that may be used on this project include the following:

- Temporary and Permanent Seeding (BMP C120)
- Mulching (BMP C121)
- Nets and Blankets (BMP C122)
- Plastic Covering (BMP C123)
- Sodding (BMP C124)
- Topsoiling (BMP C125)
- Polyacrylamide (PAM) for Soil Erosion Protection (BMP C126)
- Surface Roughening (BMP C130)
- Gradient Terraces (BMP C131)
- Dust Control (BMP C140)
- Materials on Hand (BMP C150)

The Contractor and the Engineer will choose one or more of these 11 BMPs on the basis of on the time of year, the site conditions, and the estimated duration of work activities. Alternative soil stabilization BMPs are included in Attachment E.4 as a quick reference tool for the on-site inspector in the event that, during construction, the BMP(s) in the previous list are deemed ineffective. To avoid potential erosion and sediment control issues, the CESCL will promptly initiate the implementation of one or more of the alternative BMPs listed Attachment E.4 after the first sign that the existing BMPs are ineffective or failing.

The Site is located west of the Cascade Mountain crest. As such, areas with disturbed soils that will remain exposed and unworked for more than 7 days during the dry season (May 1 to September 30) and for more than 2 days during the wet season (October 1 to April 30) must be stabilized. Regardless of the time of year, all soils shall be stabilized at the end of the shift before a holiday or weekend, if needed based on weather forecasts.

In general, cut-and-fill slopes will be stabilized as soon as possible, and soil stockpiles will be temporarily covered with plastic sheeting. Stockpiled soils will be stabilized to prevent erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets and drainage channels. Stormwater containment berms will be covered with 10-mil plastic sheeting. All stockpiled soils will be stabilized to prevent erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets and drainage channels.

After backfill and grading is completed on the LL Apartments Parcel, the final surface will be hydroseeded, with the exception of the temporary access road that is surfaced with crushed rock, the stormwater depression that is surfaced with quarry spall, and the area of the overflow structure that will be connected to the new 8th Avenue Stormwater Line (refer to Attachment E.3, Drawing CG05.1). In the DMCA, the final surface will consist of a crushed rock wildlife barrier, with a planted filter strip along the southern, downgradient edge (refer to Attachment E.3, Drawing CG03.1). On the LL Parcel, Excavation Areas 5 and 6 will be replanted after backfilling and grading, and the temporary access road will be removed and replanted (refer to Attachment E.3, Drawing CG07.1).

3.1.6 Element 6—Protect Slopes

All cut-and-fill slopes will be designed, constructed, and protected in a manner that minimizes erosion. The following specific BMPs may be used to protect slopes for this project:

- Interceptor Dike and Swale (BMP C200)
- Outlet Protection (BMP C209)
- Materials on Hand (BMP C150)

Additionally, permanent slopes, such as the east side of the LL Apartments Parcel grading to Des Moines Memorial Drive and the restored areas of the LL Parcel will be constructed at a 2-foot horizontal to 1-foot vertical (2H:1V) grade for stabilization.

3.1.7 Element 7—Protect Drain Inlets

The existing stormwater drains and conveyance system on the LL Apartments Parcel that intersect earthwork activities on-site, including the City of Burien main line, will be demolished and removed as part of the construction activities. Flow into the parcel via the City of Burien main line will be diverted, with the system cut and plugged before the beginning of remedial actions. Conveyance piping outside or beneath the planned earthwork activities on the LL Apartments Parcel will be cut, capped, and abandoned in place. Downstream of the LL Apartments Parcel, the existing stormwater main line between the LL Apartments Parcel and the LL Parcel will be plugged, and stormwater entering this line from the Des Moines Memorial Drive right-of-way will be temporarily rerouted to an alternative location during construction at the LL Parcel. The LL Apartments Parcel will be regraded so that post-construction stormwater drains to an armored infiltration pond that will be connected to the 8^{th} Avenue Stormwater Line by means of an overflow structure.

During construction, stormwater drain inlets that will not be removed and those that may still drain to the LL Parcel will be protected using BMP C220 (Storm Drain Inlet Protection) catch basin inserts. They include inlets in the 8^{th} Avenue South right-of-way, inlets along Des Moines Memorial Drive, and inlets within the LL Apartments Parcel before their abandonment.

3.1.8 Element 8—Stabilize Channels and Outlets

Where site run-off is to be conveyed in channels, or discharged to the SR 518 Construction Stormwater Pond or to another natural drainage point, efforts will be taken to prevent erosion. Stabilization, including armoring material, adequate to prevent erosion of outlets and adjacent slopes, shall be provided at the outlets of all conveyance systems. The specific BMPs for channel and outlet stabilization that shall be used on this project include:

- Outlet Protection (BMP C209)

Alternate channel and outlet stabilization BMPs are included in Attachment E.4 as a quick reference tool for the on-site inspector in the event the BMP listed above is deemed ineffective or inappropriate during construction, to satisfy the requirements set forth in the CSWGP, if applicable. To avoid potential erosion and sediment control issues, the CESCL will promptly initiate the implementation of one or more of the alternative BMPs listed in Attachment E.4 after the first sign that existing BMPs are ineffective or failing.

The Site is located west of the Cascade Mountain Crest. As such, all temporary on-site conveyance channels shall be designed, constructed, and stabilized to prevent erosion from the expected peak 10-minute velocity of flow from a Type 1A, 10-year, 24-hour recurrence interval storm for the developed condition.

3.1.9 Element 9—Control Pollutants

All pollutants, including waste materials and construction debris, that occur on-site will be handled and disposed of in a manner that does not cause contamination of stormwater. Good housekeeping and preventive measures will be implemented to ensure that the Site is kept clean, well-organized, and free of debris. (Refer to the Spill Prevention, Control, and Countermeasures Plan [Attachment E.2] for details of the storage and handling of oil and chemical products.) If required, BMPs will be implemented to control the following potential sources of pollutants: chemicals associated with vehicle maintenance and repair, wastewater, and contaminated groundwater or surface water.

Chemicals Associated with Vehicle Maintenance and Repair

- All on-site fuel storage tank(s) will have secondary containment.
- All vehicles and construction equipment will be regularly inspected to detect any leaks or spills and to identify maintenance needs to prevent leaks or spills.
- Spill prevention measures, such as drip pans, will be used when conducting maintenance and repair of vehicles or equipment.
- When performing emergency repairs, temporary plastic will be placed beneath and, if raining, over the vehicle.
- Contaminated surfaces will be immediately cleaned after any discharge or spill incident.
- The provisions of the Spill Prevention, Control, and Countermeasures Plan will be followed.

Wastewater

- Portable sanitation facilities will be firmly secured, regularly maintained, and emptied by vacuum trucks.
- If BMP C106 (Wheel Wash) is implemented, wastewater from the wheel wash or tire bath will be collected and disposed of off-site at an appropriate, Port-approved facility.

Contaminated Groundwater or Surface Water

- Can be contained in tanks or other similar settling structures to allow settlement before discharge.
- May be treated on-site and discharged to the sanitary sewer under a discharge authorization or treated off-site and disposed of, depending on Contractor preference.

3.1.10 Element 10—Control Dewatering

Deeper soil excavations on the LL Apartments Parcel (Excavation Areas 3 and 4) are expected to encounter contaminated groundwater, and soil excavation on the LL Parcel may encounter groundwater. All excavation dewatering water will be assumed contaminated until it is demonstrated otherwise. Contaminated groundwater encountered during excavation and removed from the subsurface for excavation dewatering will be either infiltrated or treated as necessary and discharged to the SR 518 Construction Stormwater Pond under applicable permit conditions. Groundwater from the LL Parcel, if encountered, may be discharged to the SR 518 Construction Stormwater Pond.

Before mobilization to the Site, the Contractor will develop a dewatering plan for the Site. This plan will outline the Contractor's proposed method for dewatering and excavation and will also include contingency planning.

3.1.11 Element 11—Maintain Best Management Practices

The applied temporary erosion and sediment control BMPs, if any, will be visually inspected at least once a week and within 24 hours of any rainfall event. All temporary BMPs will be maintained and repaired as needed to ensure continued performance of their intended function. All temporary BMPs will be removed within 30 days of the final site stabilization or after the temporary BMPs are no longer needed. Disturbed soil resulting from the removal of BMPs or vegetation will be permanently stabilized.

3.1.12 Element 12—Manage the Project

The construction will be managed in accordance with the following key project components:

- The majority of earthwork will be conducted in the dry season (between May 1 and September 30).
- Once earthwork is completed in any area, the exposed soil in this area will be immediately stabilized per BMP C162 (Scheduling).
- Inspection of BMPs will be conducted by a person knowledgeable in the principles and practices of erosion and sediment control.
- A CESCL will be on-call at all times.
- Whenever inspection and/or monitoring indicates that the BMPs identified in this Draft SWPPP are inadequate, appropriate BMPs or design changes will be implemented as soon as possible.
- This Draft SWPPP shall be retained on-site.
- When a change is made in the design, construction, operation, or maintenance that has, or could have, a significant effect on the zero stormwater discharge status at this construction site, this Draft SWPPP will be modified as necessary.

- If an inspection indicates that the Draft SWPPP is ineffective in achieving zero discharge from disturbed areas or in eliminating or significantly minimizing pollutants in stormwater discharges from the construction site, this Draft SWPPP shall be modified as necessary within 7 days of the inspection to include additional or modified BMPs designed to correct the identified problems.

3.2 SITE-SPECIFIC BEST MANAGEMENT PRACTICES

The planned site-specific BMPs are shown in Attachment E.3, on Drawing CE01.2 for the LL Apartments Parcel, Drawing CE01.3 for the DMCA, and Drawing CE02.1 for the LL Parcel.

4.0 Construction Phasing and Best Management Practices Implementation

The implementation schedule for the BMPs will be driven by the construction schedule, which has not been developed in detail. This section serves as a placeholder for a sequential list of the proposed construction schedule milestones and the corresponding BMP implementation schedule to be prepared by the Contractor, and updated prior to mobilization to the Site. The Contractor will submit a detailed construction schedule before the beginning of construction.

The following is a brief summary of construction sequencing; refer to the EDR, Section 3.0, for additional details of the planned sequencing of work on the three Site parcels. On the LL Apartments Parcel, the majority of the remedial action construction is expected to occur in 2017 during Construction Season 1, including site preparation, excavation, backfilling, and grading. Remedial action construction on the LL Parcel will occur over both Construction Season 1 and Season 2. During Construction Season 1, work on the LL Parcel covered under this Draft SWPPP includes site preparation and excavation of the areas of shallow soil contamination. The Contractor will return to the LL Parcel in the summer of 2018, and construction, including the removal of temporary roads from the LL Apartments Parcel, is expected to be completed by the fall of 2018.

The BMP implementation schedule to be provided in this section is keyed to proposed phases of the construction project and reflects differences in BMP installations and inspections that relate to wet season construction. Because of the Site's location (west of the Cascade Mountain crest), the dry season is considered to be from May 1 to September 30, and the wet season is considered to be from October 1 to April 30.

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5.0 Pollution Prevention Team

5.1 ROLES AND RESPONSIBILITIES

The pollution prevention team consists of personnel responsible for implementation of the Draft SWPPP, including the following:

- CESCL—to be called upon in case of failure of any erosion and sediment control measures.
- Construction manager—primary construction contact; Site representative for the Port; responsible for conducting site inspections of BMPs and issuing instructions and drawings to the Contractor's site superintendent.
- Contractor's superintendent—the Contractor's superintendent will assist the CESCL in observations for erosion control issues and implementation and maintenance of BMPs.
- Emergency Washington State Department of Ecology (WSDOE) contact—individual at WSDOE to be contacted in the case of an emergency.
- Emergency Port contact—Port representative to be contacted in the case of an emergency.
- Non-Emergency WSDOE contact—individual at WSDOE who can be contacted if required.
- Monitoring personnel—individual(s) responsible for conducting water quality monitoring; for most sites, this person is also the CESCL.

5.2 TEAM MEMBERS

The names and contact information for individuals identified as members of the pollution prevention team are provided in Table E.1. These designated personnel will be responsible for assigning their project responsibilities to a qualified and competent person at times when they may be unavailable.

Table E.1
Contact Information for Pollution Prevention Team

Title	Name(s)	Phone Number
Certified Erosion and Sediment Control Lead	To be determined	Not yet available
Construction manager	To be determined	Not yet available
Contractor’s superintendent	To be determined	Not yet available
Emergency WSDOE contact	24-hour emergency response	Not yet available
Emergency Port contact	To be determined	Not yet available
Non-Emergency WSDOE contact	To be determined	Not yet available
Monitoring personnel	To be determined	Not yet available

6.0 Site Inspections and Monitoring

Monitoring includes visual inspection and documentation of the inspection and monitoring findings in a Site logbook (discussed further in Section 7.0).

6.1 SITE INSPECTION

All BMPs will be inspected, maintained, and repaired as needed to ensure continued performance of their intended function. Inspections will be conducted by or under the direction of the Site CESCL. The name and contact information for the Site CESCL is provided in Section 5.0.

The Site CESCL will evaluate and document the effectiveness of the installed BMPs and determine whether it is necessary to repair or replace any of the BMPs. All maintenance and repairs will be documented in the Site logbook or on the Site Inspection Form (Attachment E.5). All new BMPs or design changes will be documented in the Draft SWPPP as soon as possible. Site inspections will be conducted at least once each week and within 24 hours of any rainfall event. Stormwater quality from the disturbed areas will be inspected for turbidity during rainfall events that occur while construction work is underway.

6.2 STORMWATER QUALITY MONITORING (SECTION TO BE UPDATED IN FINAL SWPPP)

Under normal precipitation conditions, stormwater run-off from the disturbed areas will be addressed by the BMPs. Stormwater that does not infiltrate and is within an active construction area (i.e., disturbed ground or an area with a potential for contaminated soil) will be collected and managed as described in this Draft SWPPP.

6.2.1 Turbidity Monitoring

Various methods can be used to reduce the turbidity of the collected stormwater. The water may be allowed time for solids to settle out naturally or may undergo treatment as determined by the Contractor. Stormwater will be treated prior to discharge to the SR 518 Construction Stormwater Pond. If a CSWGP allowing discharge to Miller Creek is obtained, turbidity requirements are expected, and treatment and discharge would be in compliance with the permit.

Any turbidity monitoring conducted would follow the analytical methodologies described in Section S4 of the CSWGP (if obtained), and associated benchmarks.

6.2.2 Monitoring of Other Parameters or Constituents

The CSWGP, if obtained for the project, may require monitoring of additional parameters, such as pH, Site COCs, or other constituents. Parameters and constituents, sampling methods, frequencies and locations, laboratory analytical methods, and benchmarks requiring action are specific to the CSWGP, and have not yet been determined.

A section of Miller Creek downstream of the Site is a 303(d)-listed water body due to dissolved oxygen (Category 5), bacteria (Category 5), pH (Category 2), and lead (Category 1). Numeric effluent limits may be required for certain discharges to 303(d)-listed water bodies.

7.0 Reporting and Recordkeeping

7.1 RECORDKEEPING

A Site logbook will be maintained for all on-site construction activities including the following:

- Actions related to the implementation of the Draft SWPPP
- Completion of Site inspection forms

A site inspection form is included in Attachment E.5.

The Site logbook, the site inspection forms, the Draft SWPPP, and any other relevant documentation will be retained during the life of the construction project and for a minimum of 3 years after construction.

The Draft SWPPP and Site logbook will be retained on-site or within reasonable access to the construction site and will be made available to WSDOE or representatives of local jurisdictions immediately upon request. A copy of the Draft SWPPP or access to the Draft SWPPP will be provided to the public within a reasonable amount of time when requested in writing.

7.2 UPDATING THE STORMWATER POLLUTION PREVENTION PLAN

This Draft SWPPP will be modified if it is determined to be ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the work areas, or if there has been a change in design, construction, operation, or maintenance at the Site that has a significant effect on the discharge, or the potential for discharge, of pollutants to the waters of the state. The Draft SWPPP will be modified within 7 days of a determination by the CESCL based on inspection(s) that additional or modified BMPs are necessary to correct identified problems, and an updated timeline for BMP implementation will be prepared.

7.3 NOTIFICATION OF DISCHARGE

If there is discharge from the work area and it poses a potential threat to human health or the environment, the following steps will be taken:

1. WSDOE will be notified immediately.
2. Immediate action will be taken to sample and control the discharge and to correct the problem. If applicable, sampling and analysis results will be submitted to WSDOE within 5 days of the initial discharge.
3. A detailed written report describing the discharge will be submitted to WSDOE within 5 days, unless otherwise requested by WSDOE.

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8.0 References

City of SeaTac. 2011. *Addendum to the King County Surface Water Design Manual*. Effective date February 15, 2010. 1 September.

_____. 2016*. Stormwater Management Program Plan.* Permit No. WAR 04-5541. March.

Federal Aviation Administration (FAA). 2014. "Airport Design*." Advisory Circular*. AC No. 150/5300-13A. U.S. Department of Transportation. 26 February.

King County. 2009. *King County, Washington, Surface Water Design Manual*. King County Department of Natural Resources and Parks. 24 April.

Parametrix, Inc. (Parametrix). 2001. *Natural Resource Mitigation Plan Seattle-Tacoma International Airport Master Plan Update Improvements*. Prepared for the Port of Seattle. November.

Port of Seattle. 2008. *Stormwater Management Manual for Port Aviation Division Property*. Port of Seattle Aviation Division. October.

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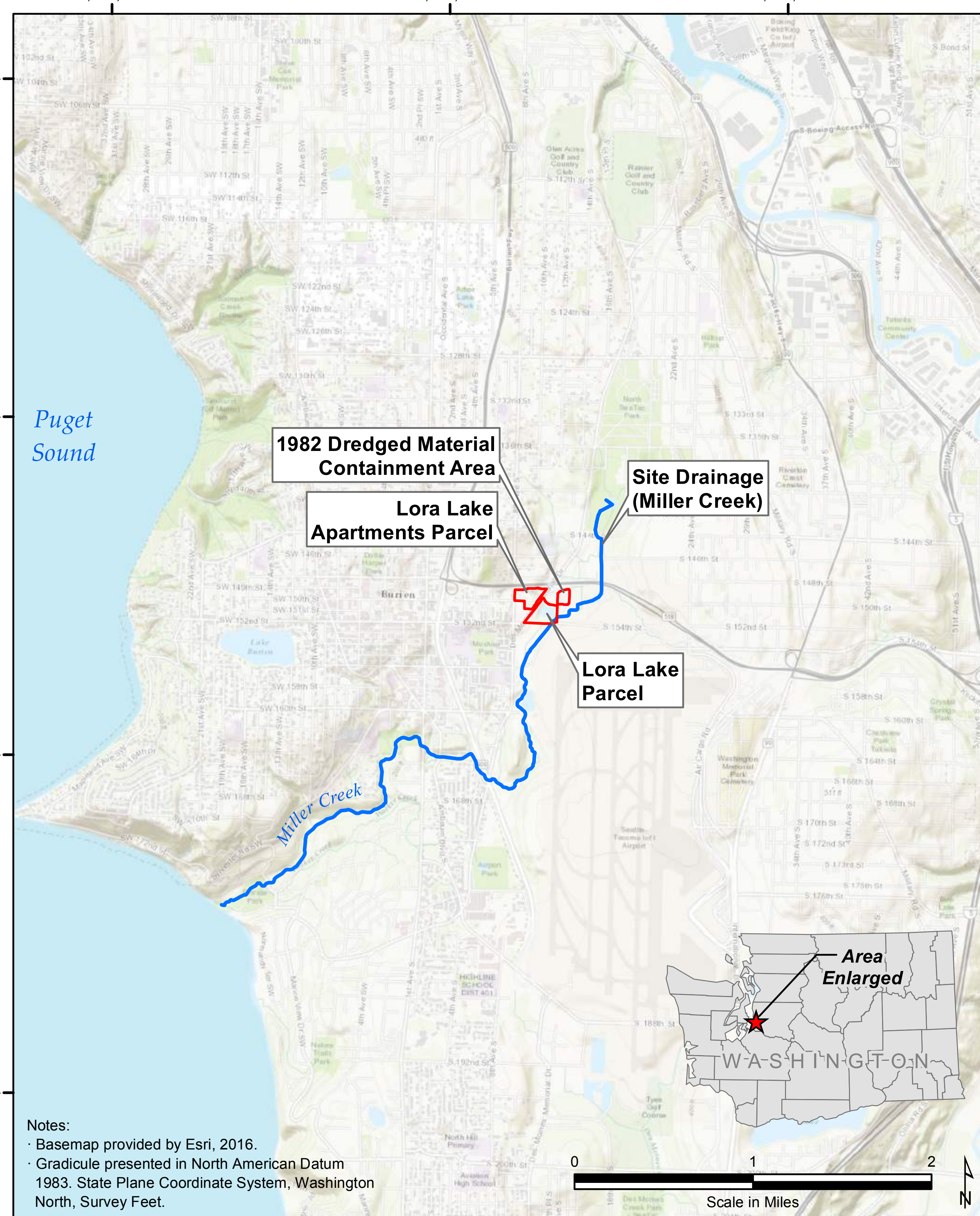
Port of Seattle
Lora Lake Apartments Site

Engineering Design Report

Appendix E
Draft Construction Stormwater Pollution Prevention Plan

Figures



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Port of Seattle
Lora Lake Apartments Site
Burien, Washington

Figure E.1
Vicinity and Drainage Map

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4/1/2016

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Legend

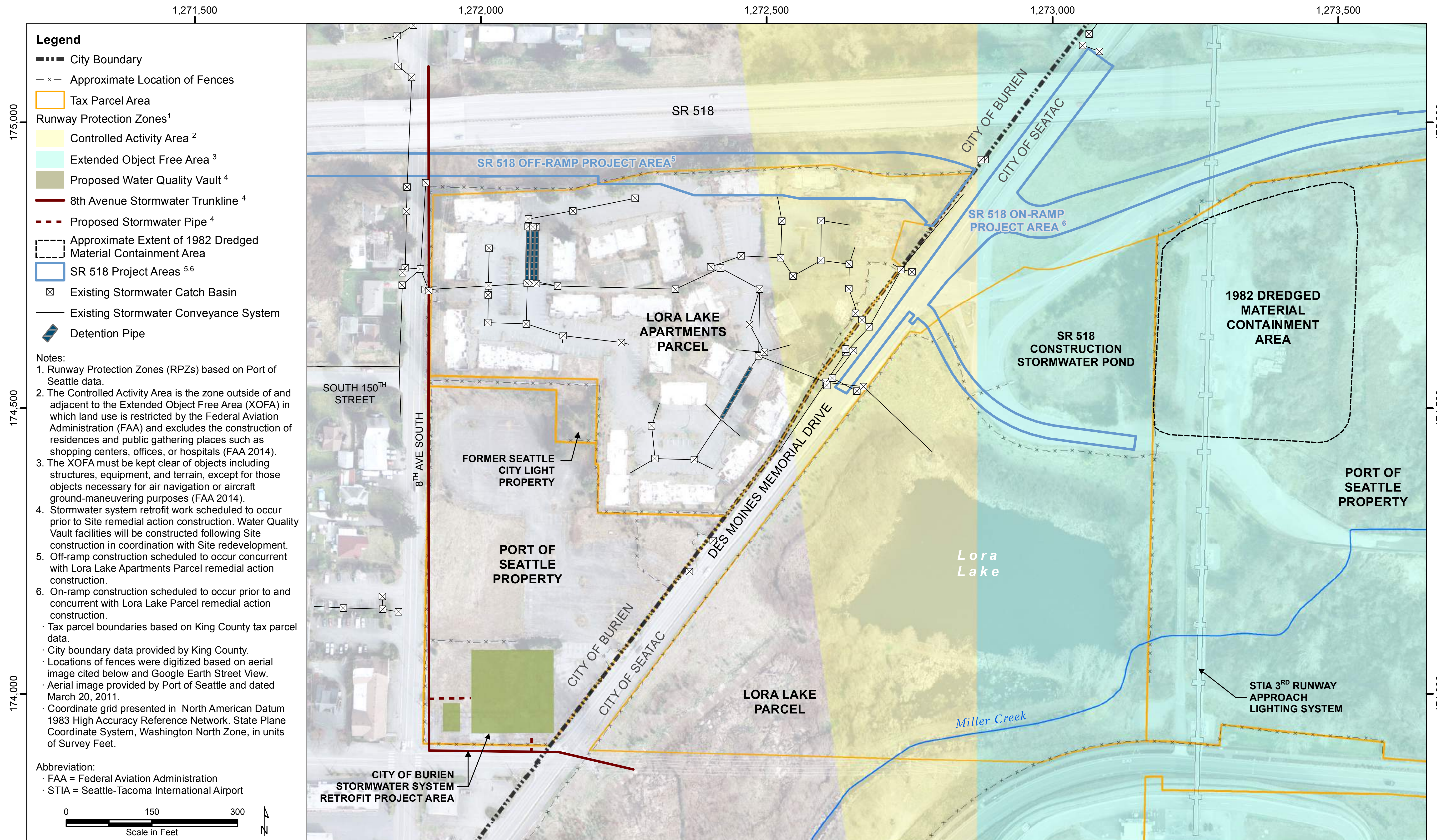
- City Boundary
- Approximate Location of Fences
- Tax Parcel Area
- Runway Protection Zones[1]
  - Controlled Activity Area [2]
  - Extended Object Free Area [3]
- Proposed Water Quality Vault [4]
- 8th Avenue Stormwater Trunkline [4]
- Proposed Stormwater Pipe [4]
- Approximate Extent of 1982 Dredged Material Containment Area
- SR 518 Project Areas [5,6]
- Existing Stormwater Catch Basin
- Existing Stormwater Conveyance System
- Detention Pipe

Notes:
1. Runway Protection Zones (RPZs) based on Port of Seattle data.
2. The Controlled Activity Area is the zone outside of and adjacent to the Extended Object Free Area (XOFA) in which land use is restricted by the Federal Aviation Administration (FAA) and excludes the construction of residences and public gathering places such as shopping centers, offices, or hospitals (FAA 2014).
3. The XOFA must be kept clear of objects including structures, equipment, and terrain, except for those objects necessary for air navigation or aircraft ground-maneuvering purposes (FAA 2014).
4. Stormwater system retrofit work scheduled to occur prior to Site remedial action construction. Water Quality Vault facilities will be constructed following Site construction in coordination with Site redevelopment.
5. Off-ramp construction scheduled to occur concurrent with Lora Lake Apartments Parcel remedial action construction.
6. On-ramp construction scheduled to occur prior to and concurrent with Lora Lake Parcel remedial action construction.

- Tax parcel boundaries based on King County tax parcel data.
- City boundary data provided by King County.
- Locations of fences were digitized based on aerial image cited below and Google Earth Street View.
- Aerial image provided by Port of Seattle and dated March 20, 2011.
- Coordinate grid presented in North American Datum 1983 High Accuracy Reference Network. State Plane Coordinate System, Washington North Zone, in units of Survey Feet.

Abbreviation:
- FAA = Federal Aviation Administration
- STIA = Seattle-Tacoma International Airport

0 150 300
Scale in Feet



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Port of Seattle
Lora Lake Apartments Site
Burien, Washington

Figure E.2
Site Map

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4/1/2016

DRAFT

Port of Seattle
Lora Lake Apartments Site

Engineering Design Report

Appendix E
Draft Construction Stormwater Pollution Prevention Plan

Attachment E.1
Construction Stormwater General Permit
(Reserved)

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Lora Lake Apartments Site

Engineering Design Report

Appendix E
Draft Construction Stormwater Pollution Prevention Plan

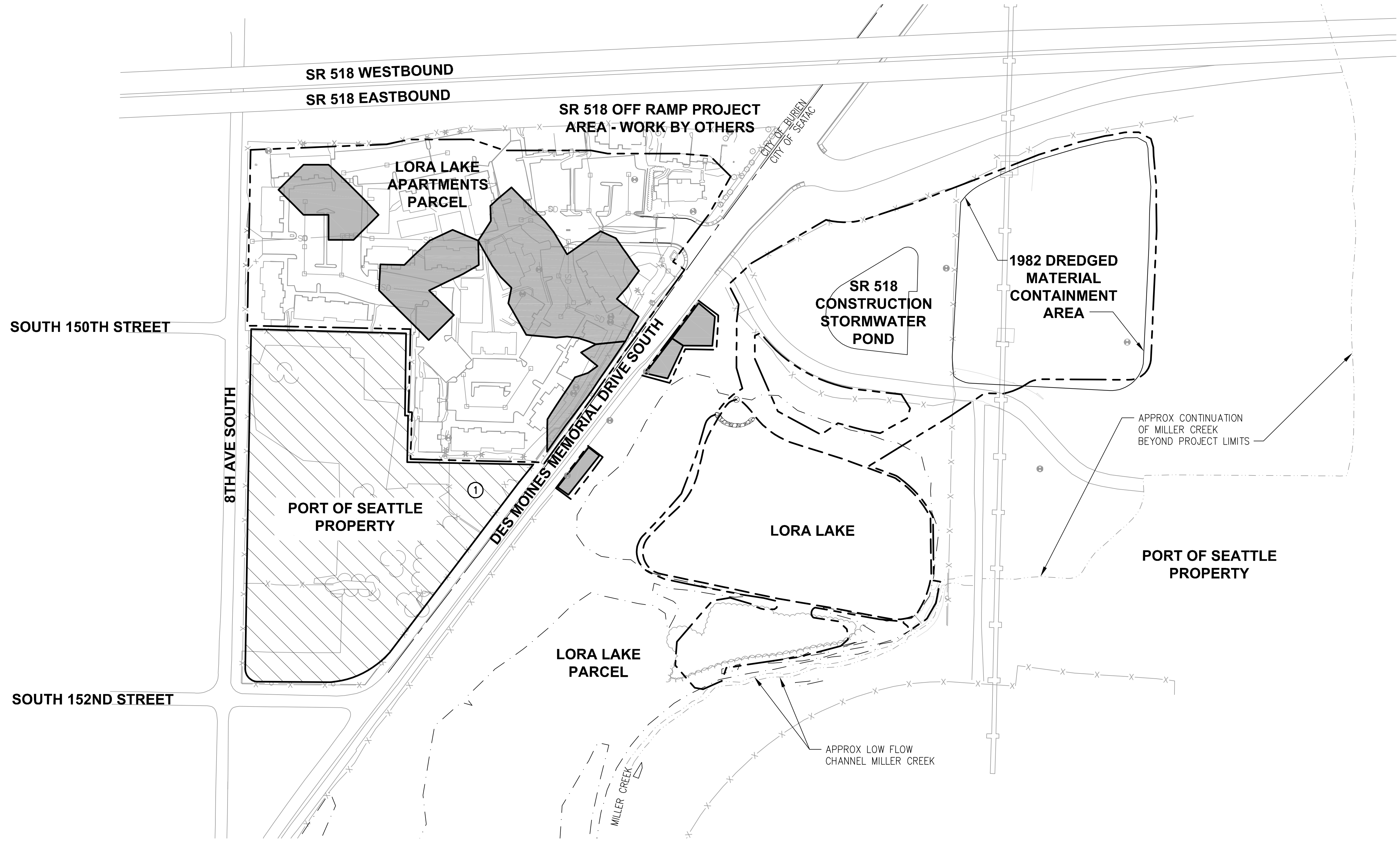
Attachment E.2
Spill Prevention, Control, and Countermeasures Plan
(Reserved)

Port of Seattle
Lora Lake Apartments Site

Engineering Design Report

Appendix E
Draft Construction Stormwater Pollution Prevention Plan

Attachment E.3
100% Design Construction Drawings



NOTES:

1. INSTALLATION OF STORMWATER DRAINAGE CONNECTION TO THE CITY OF BURIEN SYSTEM WILL OCCUR WITHIN THE STAGING AREA. REFER TO SHEET CG05.2.

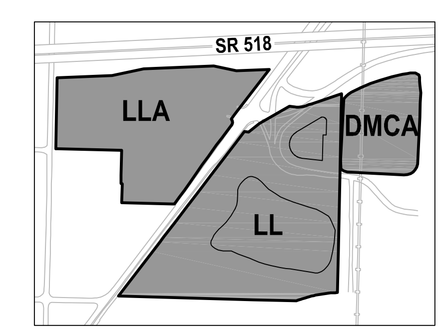
LEGEND:

- PROJECT WORK AREA LIMITS
- SOIL EXCAVATION AREAS
- CITY BOUNDARY
- MILLER CREEK
- EXISTING FENCE
- LORA LAKE CLEANUP AREA
- EXISTING GROUNDWATER MONITORING WELL
- WETLAND BOUNDARY
- STAGING AREA

PLAN
OVERALL SITE PLAN
SCALE: 1" = 100'

1"=100' 100 0 100 200
Scale Feet

N



KEY MAP
NTS

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PROJECT ENGR./ARCH: MEGAN KING
DESIGNER: MMK
DRAWN BY: JKH
SCALE: AS SHOWN
DATE: 8/29/2016
CHECKED BY: JSM
CHECKED/APPROVED BY: MMK

MEGAN MARIE KING, STATE OF WASHINGTON, REGISTERED PROFESSIONAL ENGINEER 3/18/17

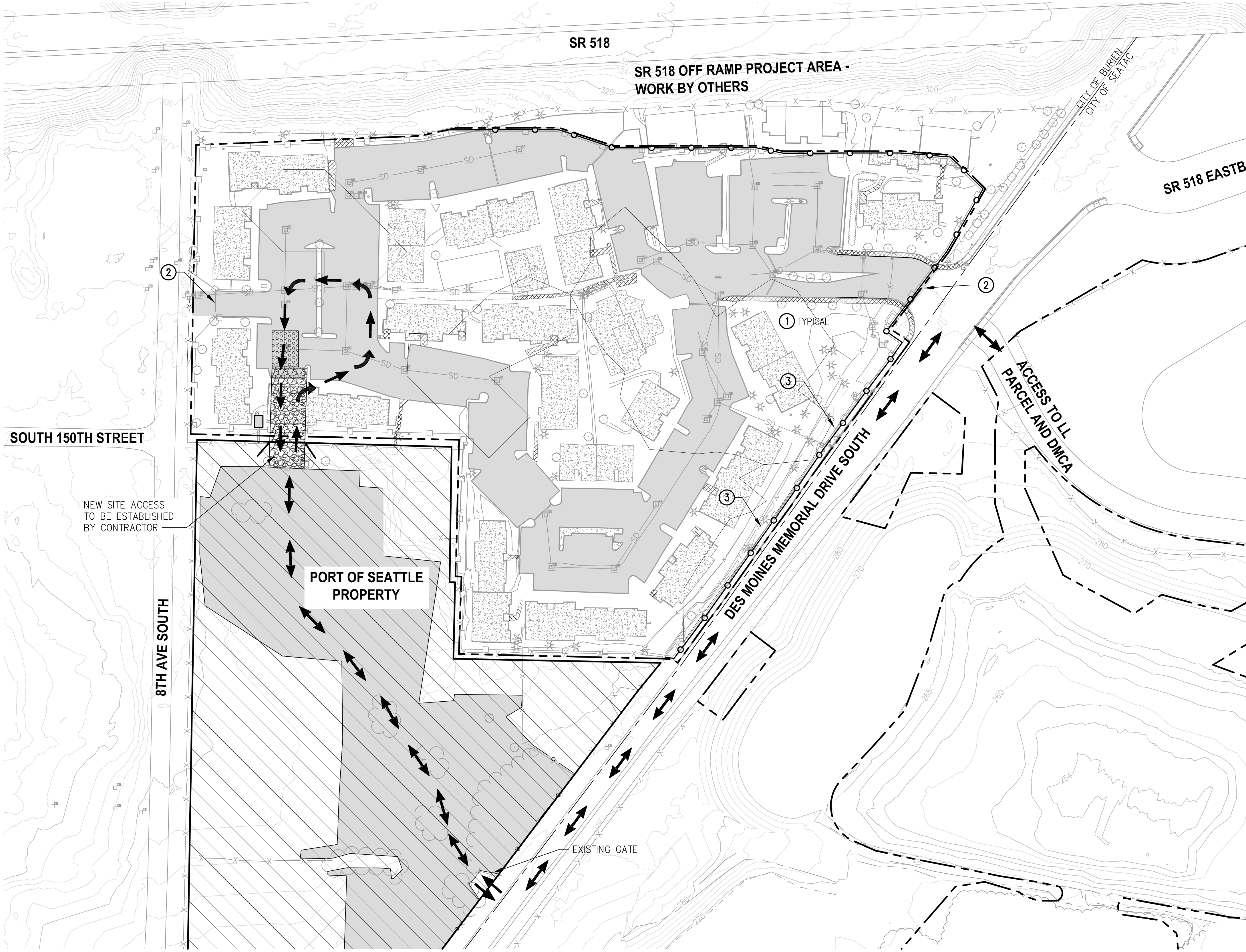
REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

POS PROJECT MANAGER:
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE:
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: 2017 LORA LAKE APARTMENTS MTCA REMEDIATION PROJECTS
SHEET TITLE: OVERALL SITE PLAN

POS WORK PROJECT NUMBER: 104396, 104396
CONSULTANT'S PROJECT NUMBER: POS-LLA/POS-LL
POS PROJECT TRACKING NUMBER: STIA-1701
G03.1



PLAN

LLA ACCESS AND HAUL ROUTES
SCALE: 1" = 40'

1"=40' Scale 40 0 40 80 Feet

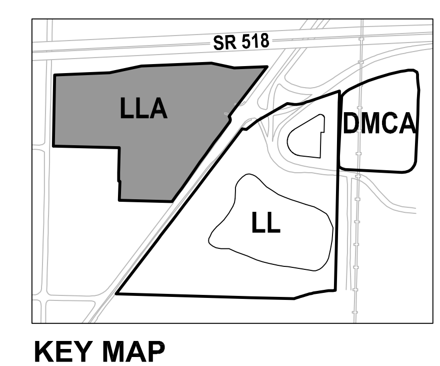
N

NOTES:

1. AREAS WITHIN THE PROJECT WORK AREA LIMITS NOT IDENTIFIED AS EXISTING CONCRETE, ONSITE ASPHALT, OR MISC. CONCRETE SIDEWALKS, PATHS, STAIRS ARE LANDSCAPED AND COVERED IN PLASTIC.
2. ACCESS TO SITE FROM EXISTING GATE IS NOT ALLOWED.
3. IF ACCESSING EXCAVATION AREAS FROM RIGHT OF WAY, TRAFFIC CONTROL REQUIREMENTS APPLY. SEE SHEET G04.3

LEGEND:

- PROJECT WORK AREA LIMITS
- SOIL EXCAVATION AREAS
- WHEEL WASH
- ON-SITE ASPHALT PAVEMENT
- MISC. CONCRETE SIDEWALKS, PATHS STAIRS
- STAGING AREA
- TEMPORARY CONSTRUCTION FENCE
- SILT FENCE
- CONTRACTOR ACCESS ROUTES
- EXISTING FENCE
- CONCRETE BUILDING FOUNDATION
- ELEVATION CONTOUR IN FEET (NAVD 88)
- QUARRY SPALL PAD
- PERMANENT GATE – TO BE INSTALLED



KEY MAP

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POS DATE:
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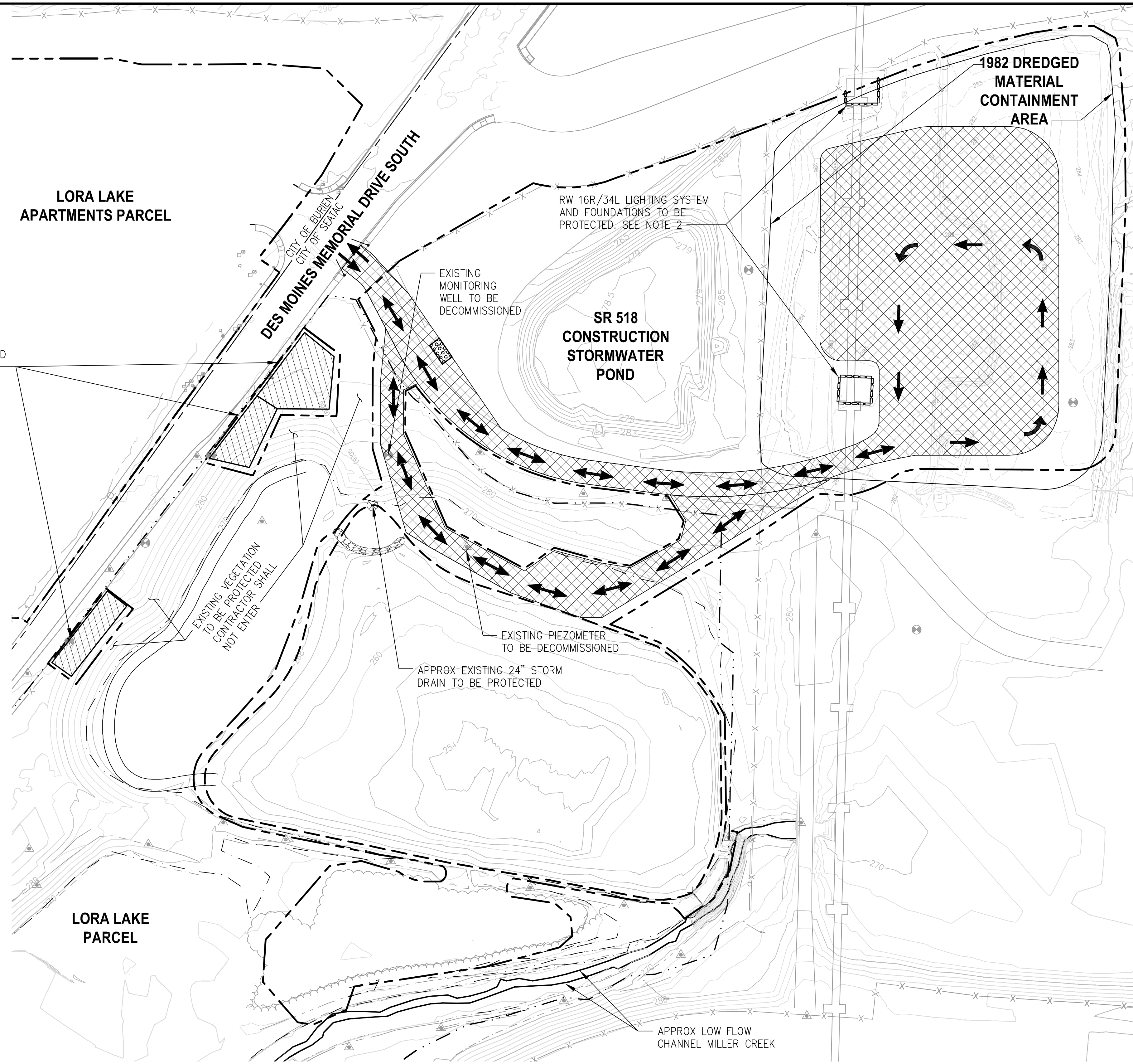
Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: 2017 LORA LAKE APARTMENTS MTCA REMEDIATION PROJECTS
SHEET TITLE: LLA ACCESS AND HAUL ROUTES

POS WORK PROJECT NUMBER: 104396, 104396
CONSULTANT'S PROJECT NUMBER: POS-LLA/POS-LL
POS PROJECT TRACKING NUMBER: STIA-1701
G04.1



PLAN

LL AND DMCA ACCESS AND HAUL ROUTES
SCALE: 1" = 60'

1"=60' Scale 60 0 60 120 Feet

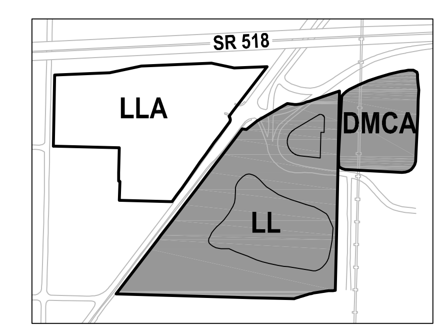
N

NOTES:

1. VEGETATION OUTSIDE OF IDENTIFIED ACCESS AND HAUL ROUTES AND SOIL EXCAVATION AREAS TO BE PROTECTED.
2. PLACE HIGH VISIBILITY FENCE AND ECOLOGY BLOCK TEMPORARY PROTECTION WALL 10 FEET OUTSIDE EXISTING CONCRETE PAD. MAINTAIN DURING ALL USE OF DMCA AS CONSTRUCTION STAGING AREAS.
3. SEE SHEET CG03.1 FOR DMCA CONSTRUCTION SEQUENCING OF CONSTRUCTION ACCESS AND STAGING AREA.

LEGEND:

- PROJECT WORK AREA LIMITS
- WHEEL WASH
- CONSTRUCTION ACCESS AND STAGING AREA
- SOIL EXCAVATION AREAS
- ELEVATION CONTOUR IN FEET (NAVD 88)
- LORA LAKE CLEANUP AREA
- RESTRICTIVE COVENANT BOUNDARY
- WETLAND BOUNDARY
- EXISTING FENCE
- CONTRACTOR ACCESS ROUTE
- HIGH VISIBILITY FENCE AND ECOLOGY BLOCK TEMPORARY PROTECTION
- EXISTING GROUNDWATER MONITORING WELL
- EXISTING GROUNDWATER PIEZOMETER



KEY MAP
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DATE: 8/29/2016
CHECKED BY: MMK
CHECKED/APPROVED BY: JSM

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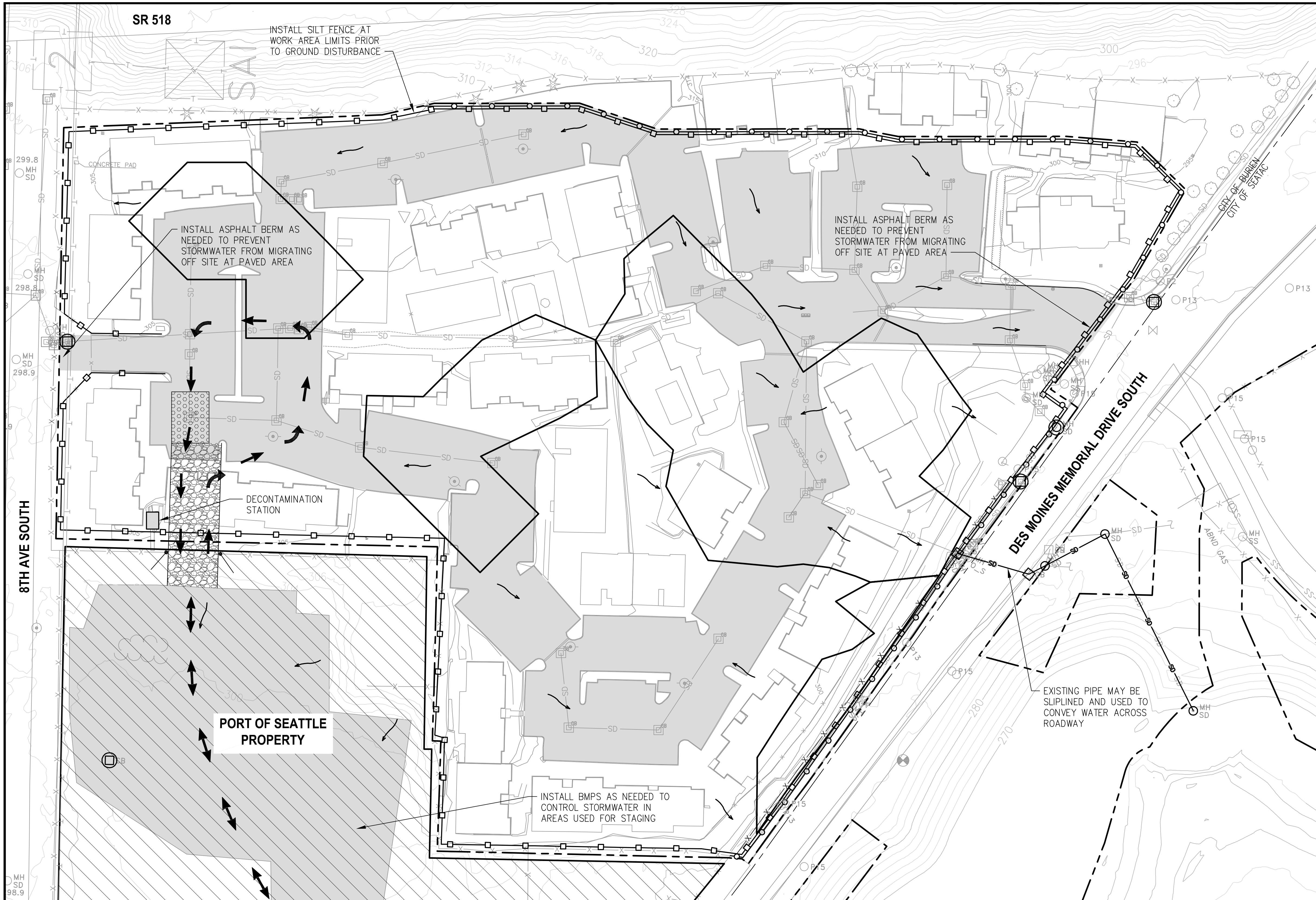
POS DRAFTER:
POS SCALE:
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: 2017 LORA LAKE APARTMENTS MTCA REMEDIATION PROJECTS
SHEET TITLE: LL AND DMCA ACCESS AND HAUL ROUTES

POS WORK PROJECT NUMBER: 104396, 104396
CONSULTANT'S PROJECT NUMBER: POS-LLA/POS-LL
POS PROJECT TRACKING NUMBER: STIA-1701 G05.1



PLAN

LLA TEMPORARY EROSION AND SEDIMENT CONTROL PLAN
SCALE: 1" = 40'

1"=40'-0" Scale 40 0 40 80 Feet

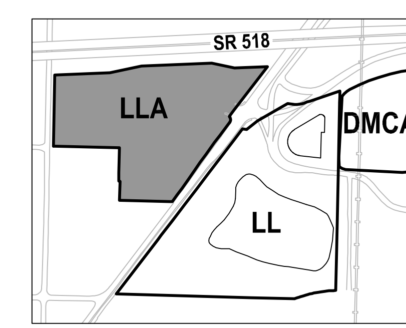
N

NOTES:

1. CONTRACTOR TO UPDATE TESC PLAN AS PART OF SWPPP PRE-CONSTRUCTION SUBMITTAL.
2. BMPS SHOWN ARE MINIMUM REQUIREMENTS. INSTALL ADDITIONAL BMPS AS NECESSARY SO THAT NO UNCONTROLLED STORMWATER OR DEWATERING WATER LEAVES THE SITE.
3. SOIL STOCKPILING AND WATER TREATMENT EQUIPMENT MAY OCCUR IN COMMON EXCAVATION AREAS. STOCKPILE BMPS ARE DETAILED IN THE SPECIFICATIONS.
4. ALL CONSTRUCTION STORMWATER AND EXCAVATION DEWATERING WATER WILL BE CHEMICALLY TREATED AND THEN DISCHARGED TO THE SR 518 CONSTRUCTION STORMWATER POND FOR INFILTRATION WITH CONTINGENCY OVERFLOW DISCHARGE TO MILLER CREEK VIA AN EXISTING VEGETATED SWALE, SEE SHEET CE02.1.

LEGEND:

- PROJECT WORK AREA LIMITS
- SILT FENCE
- TEMPORARY CONSTRUCTION FENCE
- CATCH BASIN INLET PROTECTION
- WHEEL WASH
- SOIL EXCAVATION AREAS
- STAGING AREA
- ON-SITE ASPHALT PAVEMENT
- STORMWATER DRAINAGE LINE
- GENERAL DIRECTION OF SURFACE FLOW
- ELEVATION CONTOUR IN FEET (NAVD 88)
- SUPPORT ZONE
- EXISTING FENCE
- GRAVEL PAD (12" MIN)



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DESIGNER: MMK
DRAWN BY: JKH
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CHECKED BY: JSM
CHECKED/APPROVED BY: MMK

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POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE:
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: 2017 LORA LAKE APARTMENTS MTCA REMEDIATION PROJECTS
SHEET TITLE: LLA TEMPORARY EROSION AND SEDIMENT CONTROL PLAN - MINIMUM REQUIREMENTS

POS WORK PROJECT NUMBER: 104396, 104396
CONSULTANT'S PROJECT NUMBER: POS-LLA/POS-LL
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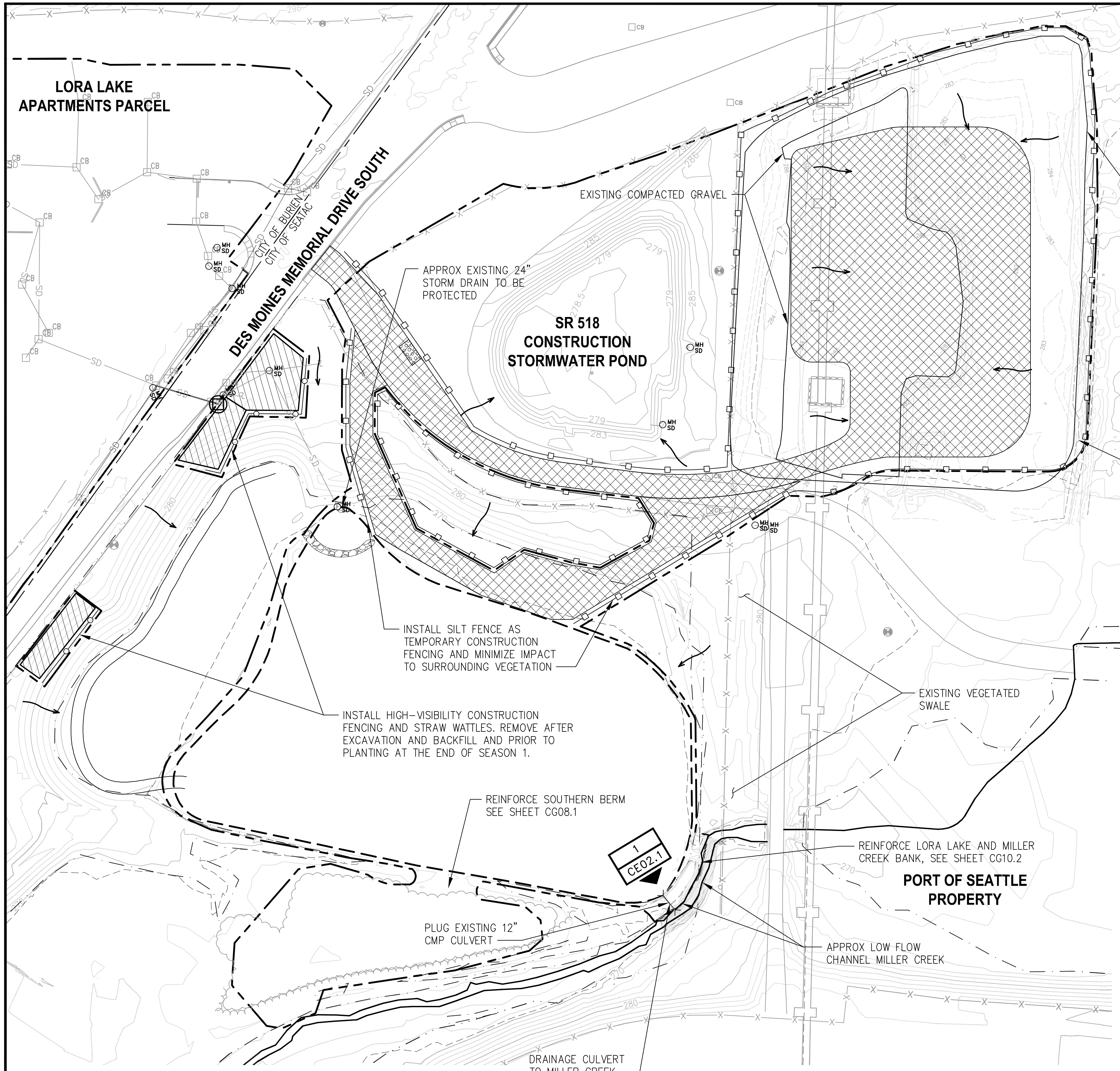
CE01.1



PLAN

LL AND DMCA TEMPORARY EROSION AND SEDIMENT CONTROL PLAN
SCALE: 1" = 60'

1"=60' — Scale 60 0 60 120 Feet

N

PHOTO 1/CE02.1

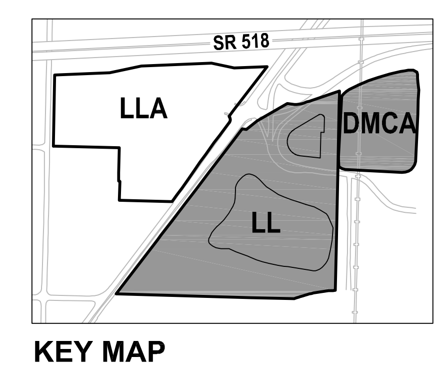
LL AND DMCA TEMPORARY EROSION AND SEDIMENT CONTROL PLAN
CREEK DRAINAGE CULVERT

TESC NOTES:

1. VEGETATION OUTSIDE OF IDENTIFIED ACCESS AND HAUL ROUTES AND SOIL EXCAVATION AREAS TO BE PROTECTED.
2. SURFACE COMPLETION OCCURS FIRST PRIOR TO USE AS CONSTRUCTION ACCESS AND STAGING AREA.
3. SOIL STOCKPILING ALLOWED IN CONSTRUCTION ACCESS AND STAGING AREAS ONLY. STOCKPILE BMP'S ARE DETAILED IN THE PROJECT SPECIFICATIONS.
4. ALL CONSTRUCTION STORMWATER, LAKE DEWATERING AND EXCAVATION DEWATERING WATER WILL BE CHEMICALLY TREATED AND THEN DISCHARGED TO THE SR 518 CONSTRUCTION STORMWATER POND FOR INFILTRATION WITH CONTINGENCY OVERFLOW DISCHARGE TO MILLER CREEK VIA AN EXISTING VEGETATED SWALE. SEE SHEET CE02.1.

LEGEND:

- PROJECT WORK AREA LIMITS
- SILT FENCE
- HIGH VISIBILITY CONSTRUCTION FENCING AND STRAW WATTLES
- WHEEL WASH
- CONSTRUCTION ACCESS AND STAGING AREA
- SOIL EXCAVATION AREAS
- LORA LAKE CLEANUP AREA
- ELEVATION CONTOUR IN FEET (NAVD 88)
- RESTRICTIVE COVENANT BOUNDARY
- WETLAND BOUNDARY
- EXISTING FENCE
- 100-YEAR FLOOD PLAIN BOUNDARY
- SURFACE FLOW
- STORMWATER DRAINAGE LINE
- CATCH BASIN INLET PROTECTION
- HIGH VISIBILITY FENCE AND ECOLOGY BLOCK TEMPORARY PROTECTION



KEY MAP

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PROJECT ENGR./ARCH: JESSI MASSINGALE
DESIGNER: JSM
DRAWN BY: JKH
SCALE: AS SHOWN
DATE: 8/29/2016
CHECKED BY: MMK
CHECKED/APPROVED BY: MMK

JESSICA S. MASSINGALE — STATE OF WASHINGTON — 46140 — REGISTERED PROFESSIONAL ENGINEER
EXP. 10/29/18

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POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE:
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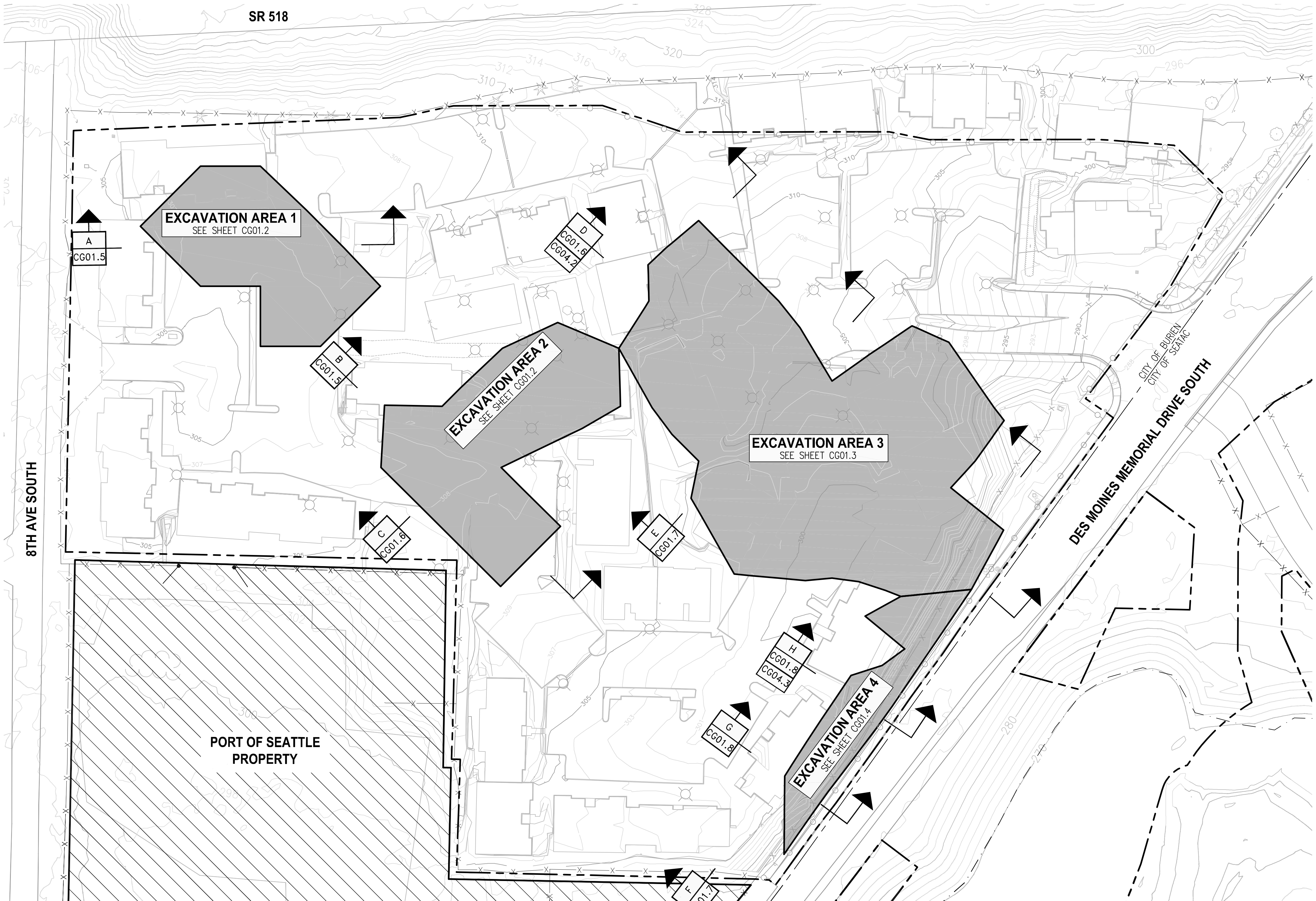
Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: 2017 LORA LAKE APARTMENTS MTCA REMEDIATION PROJECTS
SHEET TITLE: LL AND DMCA TEMPORARY EROSION AND SEDIMENT CONTROL PLAN - MINIMUM REQUIREMENTS

POS WORK PROJECT NUMBER: 104396, 104396
CONSULTANT'S PROJECT NUMBER: POS-LLA/POS-LL
POS PROJECT TRACKING NUMBER: STIA-1701
CE02.1



PLAN

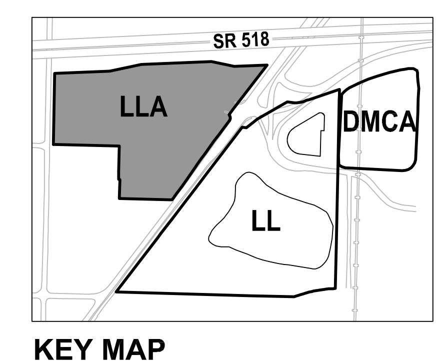
LLA EXCAVATION PLAN
SCALE: 1" = 40'

1"=40' 40 0 40 80
Scale Feet

N

LEGEND:

- PROJECT WORK AREA LIMITS
- CONTAMINATED SOIL EXCAVATION AREA
- ELEVATION CONTOUR IN FEET (NAVD 88)
- EXISTING FENCE
- STAGING AREA
- TEMPORARY CONSTRUCTION FENCE
- PERMANENT GATE – TO BE INSTALLED



KEY MAP

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PROJECT ENGR./ARCH:	MEGAN KING
DESIGNER:	MMK
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CHECKED/APPROVED BY:	MMK

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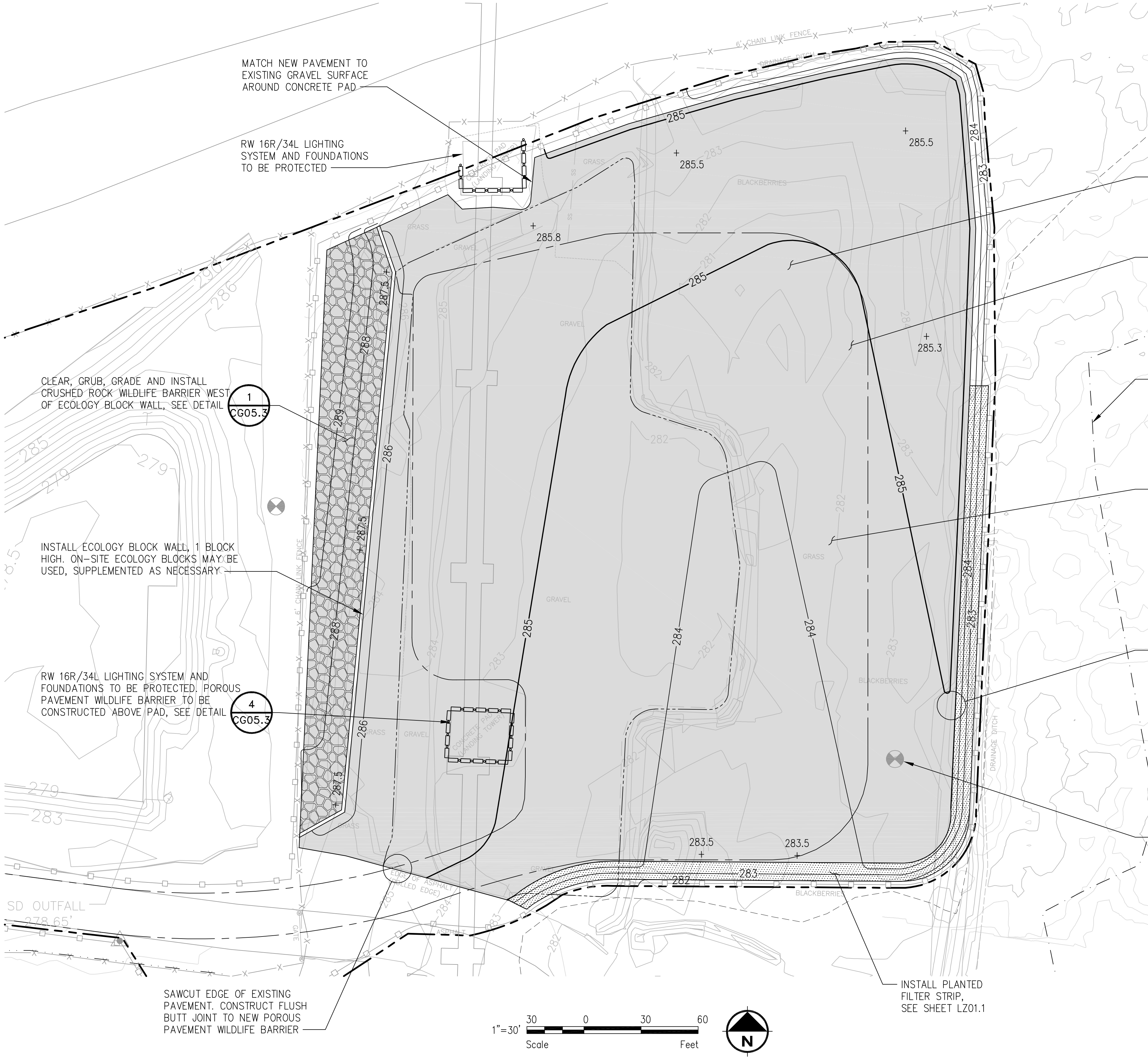
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE:
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: 2017 LORA LAKE APARTMENTS MTCA REMEDIATION PROJECTS
SHEET TITLE: LLA EXCAVATION PLAN

POS WORK PROJECT NUMBER: 104396, 104396
CONSULTANT'S PROJECT NUMBER: POS-LLA/POS-LL
POS PROJECT TRACKING NUMBER: STIA-1701
CG01.1



NOTES:

1. 2013 WETLAND 8 DELINEATION SITE VISIT AND RATING UPDATE FROM MARCH 2016.
2. 100 YEAR FLOOD PLAIN BOUNDARY SHOWN REPRESENTS FEMA 2007 DELINEATION.

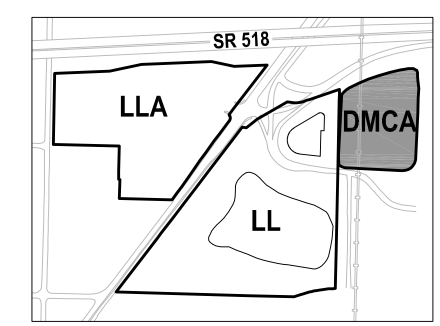
LEGEND:

- PROJECT WORK AREA LIMITS
- SILT FENCE
- PLANTED FILTER STRIP
- LORA LAKE CLEANUP AREA
- 100 YEAR FLOOD PLAIN BOUNDARY
- ELEVATION CONTOUR IN FEET (NAVD 88)
- WETLAND BOUNDARY
- EXISTING MONITORING WELL
- POROUS PAVEMENT WILDLIFE BARRIER
- LIMITS OF EXISTING GRAVEL SURFACE
- CRUSHED ROCK WILDLIFE BARRIER
- CONSTRUCTION ACCESS AND STAGING AREA

CONSTRUCTION SEQUENCE:

THE FOLLOWING CONSTRUCTION SEQUENCE SHALL BE USED IN THE DMCA:

1. INSTALL TESC, AND DECOMMISSION MONITORING WELL. INSTALL RUNWAY LIGHTING PROTECTION.
2. CLEAR AND GRUB VEGETATED AREAS WITHIN DMCA THAT ARE TO BE USED BY CONTRACTOR FOR SOIL STOCKPILE, STAGING, AND ACCESS. ROUGH GRADE AS DESIRED AND PLACE A 9" THICK CRUSHED ROCK WORKING SURFACE. THE EXISTING GRAVEL SURFACED AREAS CAN BE USED FOR CONTRACTOR STAGING IN THEIR CURRENT CONDITION.
3. FOLLOWING COMPLETION OF USE BY CONTRACTOR FOR SOIL STOCKPILE AND SOIL HANDLING, CLEAR AND GRUB REMAINING AREAS GRADE TO FINAL SUBGRADE ELEVATIONS, AND INSTALL POROUS PAVEMENT WILDLIFE BARRIER AND PLANTED FILTER STRIP.
4. AFTER POROUS PAVEMENT WILDLIFE BARRIER IS INSTALLED, USE OF DMCA FOR STOCKPILING OR HANDLING OF SOILS WILL NOT BE ALLOWED.



KEY MAP

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PROJECT ENGR./ARCH: KATHRYN SNIDER
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DRAWN BY: JKH
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KATHRYN H. SNIDER, STATE OF WASHINGTON, REGISTERED PROFESSIONAL ENGINEER

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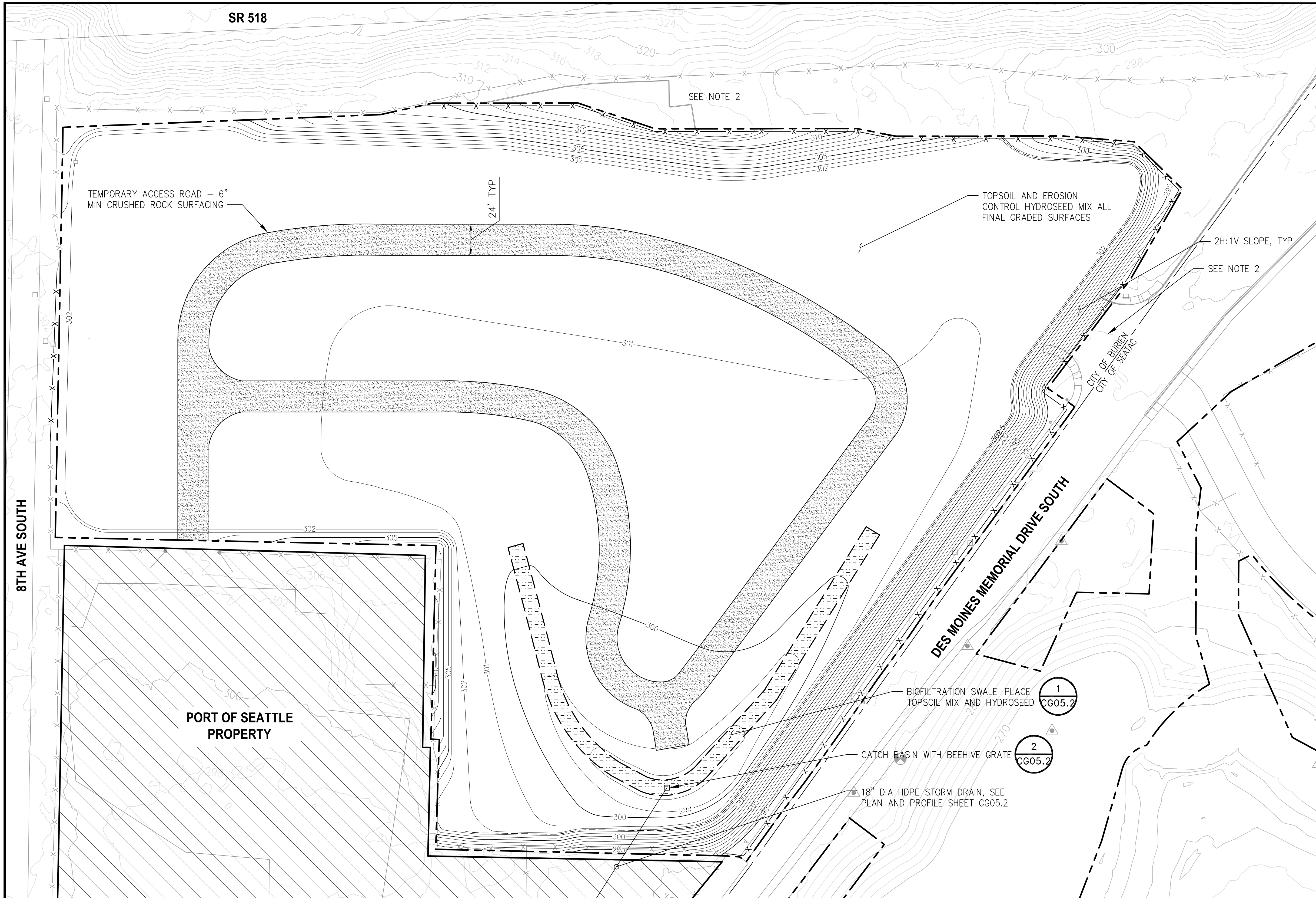
POS DRAFTER:
POS SCALE:
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: 2017 LORA LAKE APARTMENTS MTCA REMEDIATION PROJECTS
SHEET TITLE: DMCA GRADING AND SURFACE COMPLETION PLAN

POS WORK PROJECT NUMBER: 104396, 104396
CONSULTANT'S PROJECT NUMBER: POS-LLA/POS-LL
POS PROJECT TRACKING NUMBER: STIA-1701
CG03.1



PLAN

LLA GRADING AND SURFACE COMPLETION PLAN
SCALE: 1" = 40'

1"=40' 40 0 40 80 Scale Feet

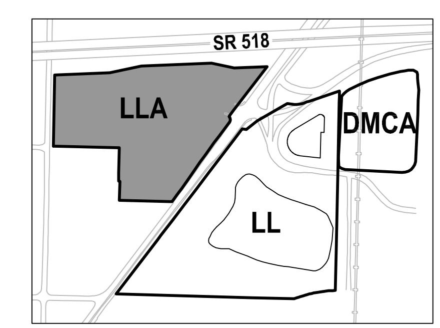
N

NOTES:

1. SITE GRADING, SURFACE COMPLETION, TEMPORARY ACCESS ROAD, FENCE AND DRAINAGE FEATURES TO REMAIN IN PLACE AT CONTRACT COMPLETION. COMMERCIAL SITE REDEVELOPMENT TO BE COMPLETED BY OTHERS IN THE FUTURE.
2. COORDINATE WITH AND MATCH TO WORK CONSTRUCTED BY OTHERS FOR SR 518 OFF-RAMP.

LEGEND:

- EXISTING FENCE
- PROJECT WORK AREA LIMITS
- ELEVATION CONTOUR IN FEET (NAVD 88) (270)
- PROPOSED MAJOR ELEVATION CONTOUR IN FEET (NAVD 88) (310)
- PROPOSED MINOR ELEVATION CONTOUR IN FEET (NAVD 88) (302)
- FENCE TO BE INSTALLED
- TEMPORARY ACCESS ROAD – CRUSHED ROCK SURFACING
- STAGING AREA
- GATE TO BE INSTALLED
- BIOFILTRATION SWALE



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PROJECT ENGR./ARCH:	KATHRYN SNIDER
DESIGNER:	KHS
DRAWN BY:	JKH
SCALE:	AS SHOWN
DATE:	8/29/2016
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CHECKED/APPROVED BY:	MMK

KATHRYN H. SNIDER — STATE OF WASHINGTON — 29336 — REGISTERED PROFESSIONAL ENGINEER

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POS DESIGN ENGINEER:	
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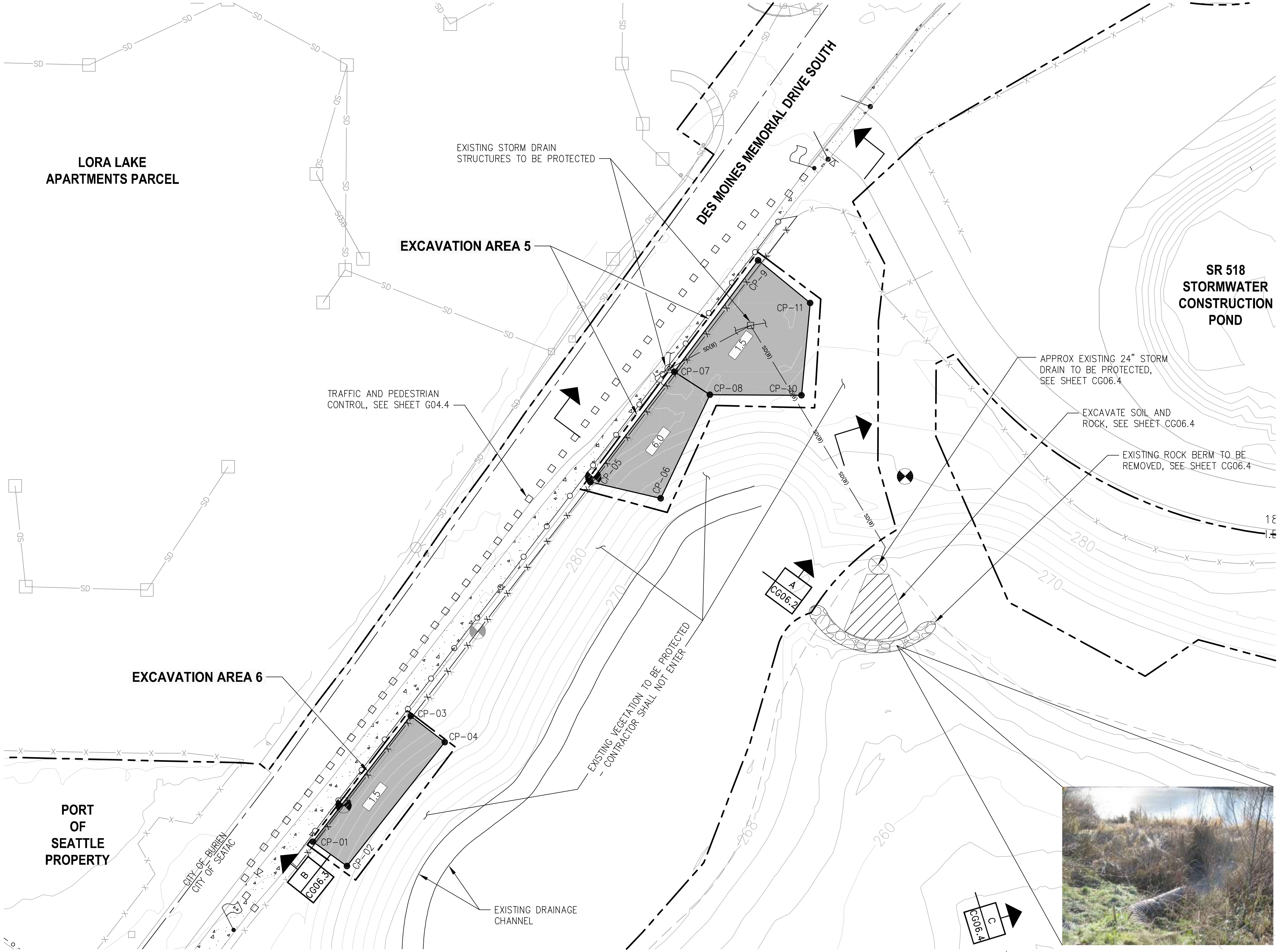
POS SCALE:	
POS DATE:	
POS CHECKED/APPROVED BY:	

Port of Seattle — SEA-TAC INTERNATIONAL AIRPORT

PROJECT NAME: **2017 LORA LAKE APARTMENTS MTCA REMEDIATION PROJECTS**

SHEET TITLE: **LLA GRADING AND SURFACE COMPLETION PLAN**

POS WORK PROJECT NUMBER: 104396, 104396
CONSULTANT'S PROJECT NUMBER: POS-LLA/POS-LL
POS PROJECT TRACKING NUMBER: STIA-1701 CG05.1



PLAN

LL SEASON 1 EXCAVATION PLAN - AREAS 5 AND 6
SCALE: 1" = 30'

1"=30' 30 0 30 60
Scale Feet

N

NOTES:

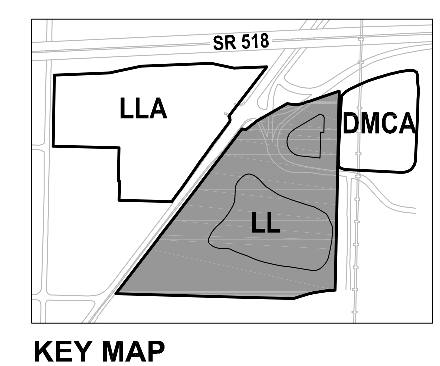
1. VEGETATION OUTSIDE OF IDENTIFIED ACCESS AND HAUL ROUTES AND SOIL EXCAVATION AREAS TO BE PROTECTED.
2. MONITORING WELLS TO BE DECOMISSIONED PRIOR TO START OF EXCAVATION.
3. ALL RIGHT OF WAY UTILITIES ASSUMED ACTIVE.

TABLE 1: SOIL EXCAVATION AREAS 5 AND 6 CONTROL POINTS

CONTROL POINT	NORTHING	EASTING
CP-01	174266.90	1272468.00
CP-02	174253.00	1272487.40
CP-03	174338.40	1272523.60
CP-04	174323.50	1272542.90
CP-05	174471.40	1272625.80
CP-06	174462.10	1272665.70
CP-07	174534.10	1272673.50
CP-08	174521.00	1272693.70
CP-09	174597.40	1272721.10
CP-10	174520.70	1272745.80
CP-11	174573.20	1272750.70

LEGEND:

- PROJECT WORK AREA LIMITS
- CONTAMINATED SOIL EXCAVATION AREA
- 1.5 — EXCAVATION DEPTH BELOW GROUND SURFACE (FEET)
- 270 — ELEVATION CONTOUR IN FEET (NAVD 88)
- LORA LAKE CLEANUP AREA
- EXISTING FENCE – TO BE REMOVED AND REPLACED FOLLOWING WORK COMPLETION
- EXISTING FENCE
- CP-XX — CONTROL POINT
- TEMPORARY CONSTRUCTION FENCE
- EXISTING MONITORING WELLS – TO BE DECOMISSIONED
- PAVED SIDEWALK – TO BE PROTECTED



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PROJECT ENGR./ARCH.: JESSI MASSINGALE
DESIGNER: JSM
DRAWN BY: JKH
SCALE: AS SHOWN
DATE: 8/29/2016
CHECKED BY: MMK
CHECKED/APPROVED BY: JSM

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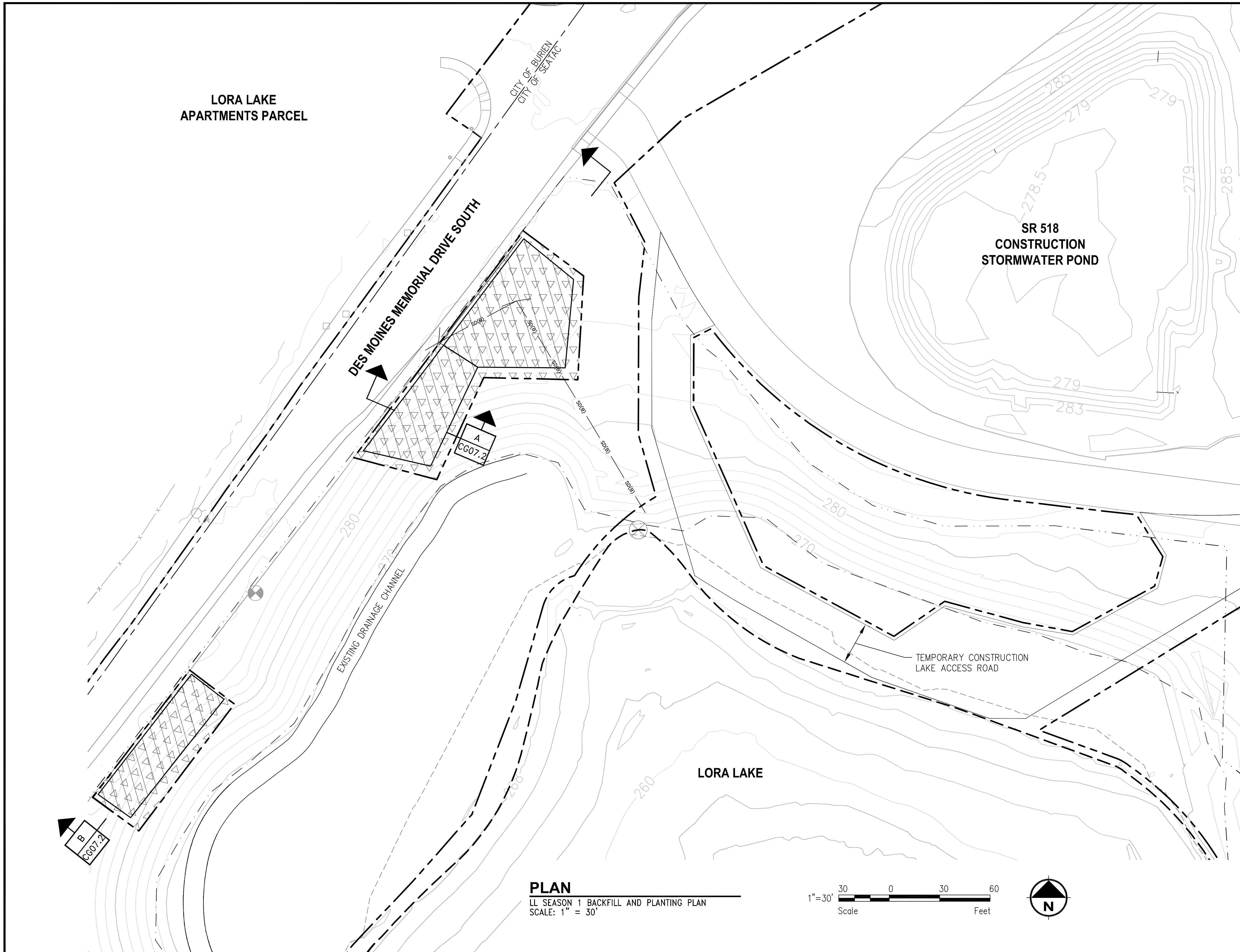
Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: 2017 LORA LAKE APARTMENTS MTCA REMEDIATION PROJECTS
SHEET TITLE: LL SEASON 1 EXCAVATION PLAN - AREAS 5 AND 6

POS WORK PROJECT NUMBER: 104396, 104396
CONSULTANT'S PROJECT NUMBER: POS-LLA/POS-LL
POS PROJECT TRACKING NUMBER: STIA-1701 CG06.1

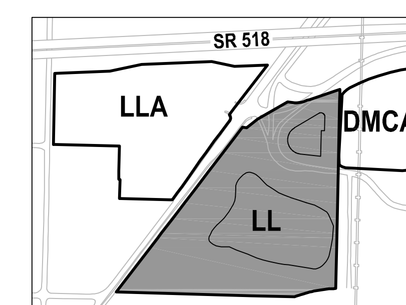


NOTES:

1. SOIL EXCAVATION AREAS WILL BE BACKFILLED AND REPLANTED AT THE END OF SEASON 1. SEE SHEET CG07.2 FOR BACKFILL DETAILS AND SHEET LZ01.1 FOR PLANTING SCHEDULE AND DETAILS.
2. THE TEMPORARY CONSTRUCTION LAKE ACCESS ROAD AND LORA LAKE WILL BE REPLANTED AT THE END OF SEASON 2. SEE SHEET LP01.1 FOR PLANTING EXTENTS AND SHEET LZ01.1 FOR PLANTING SCHEDULE AND DETAILS.

LEGEND:

- PROJECT WORK AREA LIMITS
- UPLAND BUFFER ZONE
- SOIL EXCAVATION AREAS – TO BE BACKFILLED AND REPLANTED
- LORA LAKE CLEANUP AREA
- ELEVATION CONTOUR IN FEET (NAVD 88)
- RESTRICTIVE COVENANT BOUNDARY
- WETLAND BOUNDARY



KEY MAP
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PLAN
LL SEASON 1 BACKFILL AND PLANTING PLAN
SCALE: 1" = 30'

1"=30' 30 0 30 60
Scale Feet

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PROJECT ENGR./ARCH:	JESSI MASSINGALE
DESIGNER:	JSM
DRAWN BY:	JKH
SCALE:	AS SHOWN
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CHECKED/APPROVED BY:	JSM

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Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: 2017 LORA LAKE APARTMENTS MTCA REMEDIATION PROJECTS
SHEET TITLE: LL SEASON 1 BACKFILL AND PLANTING PLAN

POS WORK PROJECT NUMBER: 104396, 104396
CONSULTANT'S PROJECT NUMBER: POS-LLA/POS-LL
POS PROJECT TRACKING NUMBER: STIA-1701
CG07.1

Port of Seattle
Lora Lake Apartments Site

Engineering Design Report

Appendix E
Draft Construction Stormwater Pollution Prevention Plan

Attachment E.4
Construction Best Management Practices

BMP C101: Preserving Natural Vegetation

Purpose

The purpose of preserving natural vegetation is to reduce erosion wherever practicable. Limiting site disturbance is the single most effective method for reducing erosion. For example, conifers can hold up to about 50 percent of all rain that falls during a storm. Up to 20-30 percent of this rain may never reach the ground but is taken up by the tree or evaporates. Another benefit is that the rain held in the tree can be released slowly to the ground after the storm.

Conditions of Use

Natural vegetation should be preserved on steep slopes, near perennial and intermittent watercourses or swales, and on building sites in wooded areas.

- As required by local governments.
- Phase construction to preserve natural vegetation on the project site for as long as possible during the construction period.

Design and Installation Specifications

Natural vegetation can be preserved in natural clumps or as individual trees, shrubs and vines.

The preservation of individual plants is more difficult because heavy equipment is generally used to remove unwanted vegetation. The points to remember when attempting to save individual plants are:

- Is the plant worth saving? Consider the location, species, size, age, vigor, and the work involved. Local governments may also have ordinances to save natural vegetation and trees.
- Fence or clearly mark areas around trees that are to be saved. It is preferable to keep ground disturbance away from the trees at least as far out as the dripline.

  Plants need protection from three kinds of injuries:

- *Construction Equipment* - This injury can be above or below the ground level. Damage results from scarring, cutting of roots, and compaction of the soil. Placing a fenced buffer zone around plants to be saved prior to construction can prevent construction equipment injuries.
- *Grade Changes* - Changing the natural ground level will alter grades, which affects the plant's ability to obtain the necessary air, water, and minerals. Minor fills usually do not cause problems although sensitivity between species does vary and should be checked. Trees can typically tolerate fill of 6 inches or less. For shrubs and other plants, the fill should be less.

  When there are major changes in grade, it may become necessary to supply air to the roots of plants. This can be done by placing a layer of gravel and a tile system over the roots before the fill is made. A tile system protects a tree from a raised grade. The tile system should be laid out on the original grade leading from a dry well around the tree trunk. The system should then be covered with small stones to allow air to circulate over the root area.

Lowering the natural ground level can seriously damage trees and shrubs. The highest percentage of the plant roots are in the upper 12 inches of the soil and cuts of only 2-3 inches can cause serious injury. To protect the roots it may be necessary to terrace the immediate area around the plants to be saved. If roots are exposed, construction of retaining walls may be needed to keep the soil in place. Plants can also be preserved by leaving them on an undisturbed, gently sloping mound. To increase the chances for survival, it is best to limit grade changes and other soil disturbances to areas outside the dripline of the plant.

- *Excavations* **-** Protect trees and other plants when excavating for drainfields, power, water, and sewer lines. Where possible, the trenches should be routed around trees and large shrubs. When this is not possible, it is best to tunnel under them. This can be done with hand tools or with power augers. If it is not possible to route the trench around plants to be saved, then the following should be observed:

  Cut as few roots as possible. When you have to cut, cut clean. Paint cut root ends with a wood dressing like asphalt base paint if roots will be exposed for more than 24-hours.

  Backfill the trench as soon as possible.

  Tunnel beneath root systems as close to the center of the main trunk to preserve most of the important feeder roots.

Some problems that can be encountered with a few specific trees are:

- Maple, Dogwood, Red alder, Western hemlock, Western red cedar, and Douglas fir do not readily adjust to changes in environment and special care should be taken to protect these trees.
- The windthrow hazard of Pacific silver fir and madrona is high, while that of Western hemlock is moderate. The danger of windthrow increases where dense stands have been thinned. Other species (unless they are on shallow, wet soils less than 20 inches deep) have a low windthrow hazard.
- Cottonwoods, maples, and willows have water-seeking roots. These can cause trouble in sewer lines and infiltration fields. On the other hand, they thrive in high moisture conditions that other trees would not.
- Thinning operations in pure or mixed stands of Grand fir, Pacific silver fir, Noble fir, Sitka spruce, Western red cedar, Western hemlock, Pacific dogwood, and Red alder can cause serious disease problems. Disease can become established through damaged limbs, trunks, roots,

and freshly cut stumps. Diseased and weakened trees are also susceptible to insect attack.

Maintenance Standards

Inspect flagged and/or fenced areas regularly to make sure flagging or fencing has not been removed or damaged. If the flagging or fencing has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.

- If tree roots have been exposed or injured, "prune" cleanly with an appropriate pruning saw or lopers directly above the damaged roots and recover with native soils. Treatment of sap flowing trees (fir, hemlock, pine, soft maples) is not advised as sap forms a natural healing barrier.

BMP C102: Buffer Zones

Purpose

Creation of an undisturbed area or strip of natural vegetation or an established suitable planting that will provide a living filter to reduce soil erosion and runoff velocities.

Conditions of Use

Natural buffer zones are used along streams, wetlands and other bodies of water that need protection from erosion and sedimentation. Vegetative buffer zones can be used to protect natural swales and can be incorporated into the natural landscaping of an area.

Critical-areas buffer zones should not be used as sediment treatment areas. These areas shall remain completely undisturbed. The local permitting authority may expand the buffer widths temporarily to allow the use of the expanded area for removal of sediment.

Design and Installation Specifications

- Preserving natural vegetation or plantings in clumps, blocks, or strips is generally the easiest and most successful method.
- Leave all unstable steep slopes in natural vegetation.
- Mark clearing limits and keep all equipment and construction debris out of the natural areas and buffer zones. Steel construction fencing is the most effective method in protecting sensitive areas and buffers. Alternatively, wire-backed silt fence on steel posts is marginally effective. Flagging alone is typically not effective.
- Keep all excavations outside the dripline of trees and shrubs.
- Do not push debris or extra soil into the buffer zone area because it will cause damage from burying and smothering.
- Vegetative buffer zones for streams, lakes or other waterways shall be established by the local permitting authority or other state or federal permits or approvals.

Maintenance Standards

Inspect the area frequently to make sure flagging remains in place and the area remains undisturbed. Replace all damaged flagging immediately.

BMP C103: High Visibility Fence

Purpose

Fencing is intended to:

1. Restrict clearing to approved limits.
2. Prevent disturbance of sensitive areas, their buffers, and other areas required to be left undisturbed.
3. Limit construction traffic to designated construction entrances, exits, or internal roads.
4. Protect areas where marking with survey tape may not provide adequate protection.

Conditions of Use

To establish clearing limits plastic, fabric, or metal fence may be used:

- At the boundary of sensitive areas, their buffers, and other areas required to be left uncleared.
- As necessary to control vehicle access to and on the site.

Design and Installation Specifications

High visibility plastic fence shall be composed of a high-density polyethylene material and shall be at least four feet in height. Posts for the fencing shall be steel or wood and placed every 6 feet on center (maximum) or as needed to ensure rigidity. The fencing shall be fastened to the post every six inches with a polyethylene tie. On long continuous lengths of fencing, a tension wire or rope shall be used as a top stringer to prevent sagging between posts. The fence color shall be high visibility orange. The fence tensile strength shall be 360 lbs./ft. using the ASTM D4595 testing method.

If appropriate install fabric silt fence in accordance with BMP C233 to act as high visibility fence. Silt fence shall be at least 3 feet high and must be highly visible to meet the requirements of this BMP.

Metal fences shall be designed and installed according to the manufacturer's specifications.

Metal fences shall be at least 3 feet high and must be highly visible.

Fences shall not be wired or stapled to trees.

Maintenance Standards

If the fence has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.

BMP C105: Stabili□ed Construction Entrance / Exit

Purpose

Stabilized Construction entrances are established to reduce the amount of sediment transported onto paved roads by vehicles or equipment. This is done by constructing a stabilized pad of quarry spalls at entrances and exits for construction sites.

Conditions of Use

Construction entrances shall be stabilized wherever traffic will be entering or leaving a construction site if paved roads or other paved areas are within 1,000 feet of the site.

For residential construction provide stabilized construction entrances for each residence, rather than only at the main subdivision entrance. Stabilized surfaces shall be of sufficient length/width to provide vehicle access/parking, based on lot size/configuration.

On large commercial, highway, and road projects, the designer should include enough extra materials in the contract to allow for additional stabilized entrances not shown in the initial Construction SWPPP. It is difficult to determine exactly where access to these projects will take place; additional materials will enable the contractor to install them where needed.

Design and Installation Specifications

See Figure 4.1.1 for details. Note: the 100’ minimum length of the entrance shall be reduced to the maximum practicable size when the size or configuration of the site does not allow the full length (100’).

Construct stabilized construction entrances with a 12-inch thick pad of 4-inch to 8-inch quarry spalls, a 4-inch course of asphalt treated base (ATB), or use existing pavement. Do not use crushed concrete, cement, or calcium chloride for construction entrance stabilization because these products raise pH levels in stormwater and concrete discharge to surface waters of the State is prohibited.

A separation geotextile shall be placed under the spalls to prevent fine sediment from pumping up into the rock pad. The geotextile shall meet the following standards:

Grab Tensile Strength (ASTM D4751)	200 psi min.
Grab Tensile Elongation (ASTM D4632)	30% max.
Mullen Burst Strength (ASTM D3786-80a)	400 psi min.
AOS (ASTM D4751)	20-45 (U.S. standard sieve size)

- Consider early installation of the first lift of asphalt in areas that will paved; this can be used as a stabilized entrance. Also consider the installation of excess concrete as a stabilized entrance. During large concrete pours, excess concrete is often available for this purpose.

- Fencing (see BMP C103) shall be installed as necessary to restrict traffic to the construction entrance.
- Whenever possible, the entrance shall be constructed on a firm, compacted subgrade. This can substantially increase the effectiveness of the pad and reduce the need for maintenance.
- Construction entrances should avoid crossing existing sidewalks and back of walk drains if at all possible. If a construction entrance must cross a sidewalk or back of walk drain, the full length of the sidewalk and back of walk drain must be covered and protected from sediment leaving the site.

Maintenance Standards

Quarry spalls shall be added if the pad is no longer in accordance with the specifications.

- If the entrance is not preventing sediment from being tracked onto pavement, then alternative measures to keep the streets free of sediment shall be used. This may include replacement/cleaning of the existing quarry spalls, street sweeping, an increase in the dimensions of the entrance, or the installation of a wheel wash.
- Any sediment that is tracked onto pavement shall be removed by shoveling or street sweeping. The sediment collected by sweeping shall be removed or stabilized on site. The pavement shall not be cleaned by washing down the street, except when high efficiency sweeping is ineffective and there is a threat to public safety. If it is necessary to wash the streets, the construction of a small sump to contain the wash water shall be considered. The sediment would then be washed into the sump where it can be controlled.
- Perform street sweeping by hand or with a high efficiency sweeper. Do not use a non-high efficiency mechanical sweeper because this creates dust and throws soils into storm systems or conveyance ditches.
- Any quarry spalls that are loosened from the pad, which end up on the roadway shall be removed immediately.
- If vehicles are entering or exiting the site at points other than the construction entrance(s), fencing (see BMP C103) shall be installed to control traffic.
- Upon project completion and site stabilization, all construction accesses intended as permanent access for maintenance shall be permanently stabilized.

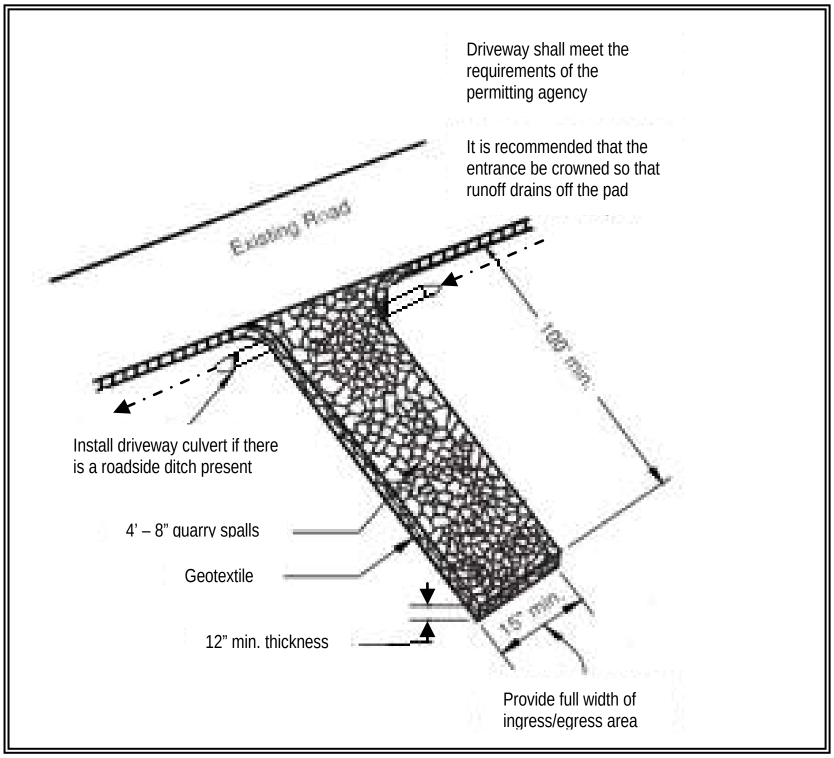


Figure 4.1.1 Stabilized Construction Entrance

Approved as Equivalent

Ecology has approved products as able to meet the requirements of BMP C105. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept this product approved as equivalent, or may require additional testing prior to consideration for local use. The products are available for review on Ecology's website at http://www.ecy.wa.gov/programs/wq/stormwater/newtech/equivalent.html

BMP C106: Wheel Wash

Purpose

Wheel washes reduce the amount of sediment transported onto paved roads by motor vehicles.

Conditions of Use

When a stabilized construction entrance (see BMP C105) is not preventing sediment from being tracked onto pavement.

- Wheel washing is generally an effective BMP when installed with careful attention to topography. For example, a wheel wash can be detrimental if installed at the top of a slope abutting a right-of-way where the water from the dripping truck can run unimpeded into the street.

- Pressure washing combined with an adequately sized and surfaced pad with direct drainage to a large 10-foot x 10-foot sump can be very effective.
- Discharge wheel wash or tire bath wastewater to a separate on-site treatment system that prevents discharge to surface water, such as closed-loop recirculation or upland land application, or to the sanitary sewer with local sewer district approval.
- Wheel wash or tire bath wastewater should not include wastewater from concrete washout areas.

Design and Installation Specifications

Suggested details are shown in Figure 4.1.2. The Local Permitting Authority may allow other designs. A minimum of 6 inches of asphalt treated base (ATB) over crushed base material or 8 inches over a good subgrade is recommended to pave the wheel wash.

Use a low clearance truck to test the wheel wash before paving. Either a belly dump or lowboy will work well to test clearance.

Keep the water level from 12 to 14 inches deep to avoid damage to truck hubs and filling the truck tongues with water.

Midpoint spray nozzles are only needed in extremely muddy conditions.

Wheel wash systems should be designed with a small grade change, 6- to 1-inches for a 10-foot-wide pond, to allow sediment to flow to the low side of pond to help prevent re-suspension of sediment. A drainpipe with a 2- to 3-foot riser should be installed on the low side of the pond to allow for easy cleaning and refilling. Polymers may be used to promote coagulation and flocculation in a closed-loop system. Polyacrylamide (PAM) added to the wheel wash water at a rate of 0.25 - 0.5 pounds per 1,000 gallons of water increases effectiveness and reduces cleanup time. If PAM is already being used for dust or erosion control and is being applied by a water truck, the same truck can be used to change the wash water.

Maintenance Standards

The wheel wash should start out the day with fresh water.

The wash water should be changed a minimum of once per day. On large earthwork jobs where more than 10-20 trucks per hour are expected, the wash water will need to be changed more often.

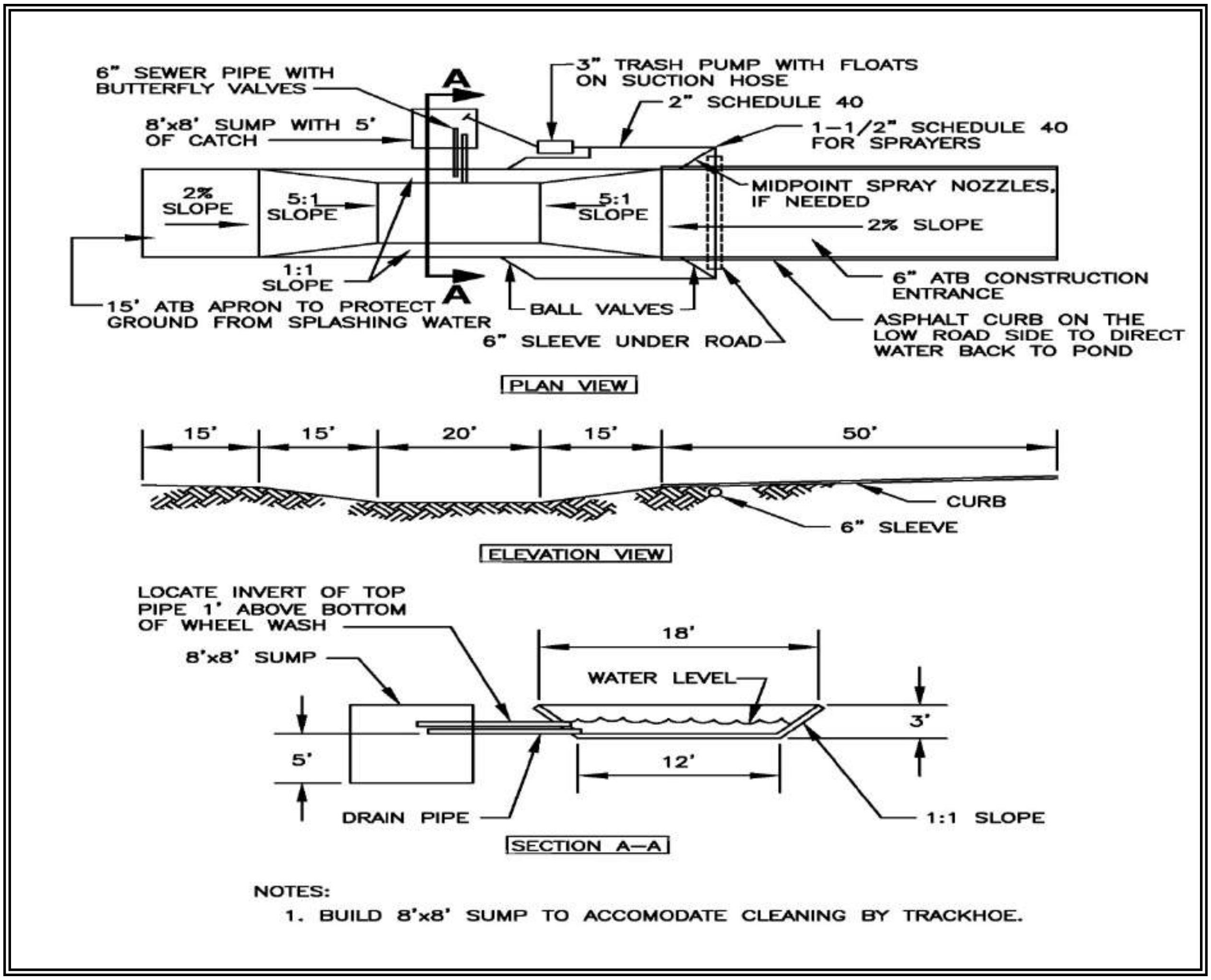


Figure 4.1.2 Wheel Wash

Notes:

1. Asphalt construction entrance 6 in. asphalt treated base (ATB).
2. 3-inch trash pump with floats on the suction hose.
3. Midpoint spray nozzles, if needed.
4. 6-inch sewer pipe with butterfly valves. Bottom one is a drain. Locate top pipe's invert 1 foot above bottom of wheel wash.
5. 8 foot x 8 foot sump with 5 feet of catch. Build so the sump can be cleaned with a trackhoe.
6. Asphalt curb on the low road side to direct water back to pond.
7. 6-inch sleeve under road.
8. Ball valves.
9. 15 foot. ATB apron to protect ground from splashing water.

BMP C107: Construction Road/Parking Area Stabili□ation

Purpose Stabilizing subdivision roads, parking areas, and other on-site vehicle transportation routes immediately after grading reduces erosion caused by construction traffic or runoff.

Conditions of Use Roads or parking areas shall be stabilized wherever they are constructed, whether permanent or temporary, for use by construction traffic.

- High Visibility Fencing (see BMP C103) shall be installed, if necessary, to limit the access of vehicles to only those roads and parking areas that are stabilized.

Design and Installation Specifications

- On areas that will receive asphalt as part of the project, install the first lift as soon as possible.
- A 6-inch depth of 2- to 4-inch crushed rock, gravel base, or crushed surfacing base course shall be applied immediately after grading or utility installation. A 4-inch course of asphalt treated base (ATB) may also be used, or the road/parking area may be paved. It may also be possible to use cement or calcium chloride for soil stabilization. If cement or cement kiln dust is used for roadbase stabilization, pH monitoring and BMPs (BMPs C252 and C253) are necessary to evaluate and minimize the effects on stormwater. If the area will not be used for permanent roads, parking areas, or structures, a 6-inch depth of hog fuel may also be used, but this is likely to require more maintenance. Whenever possible, construction roads and parking areas shall be placed on a firm, compacted subgrade.
- Temporary road gradients shall not exceed 15 percent. Roadways shall be carefully graded to drain. Drainage ditches shall be provided on each side of the roadway in the case of a crowned section, or on one side in the case of a super-elevated section. Drainage ditches shall be directed to a sediment control BMP.
- Rather than relying on ditches, it may also be possible to grade the road so that runoff sheet-flows into a heavily vegetated area with a well-developed topsoil. Landscaped areas are not adequate. If this area has at least 50 feet of vegetation that water can flow through, then it is generally preferable to use the vegetation to treat runoff, rather than a sediment pond or trap. The 50 feet shall not include wetlands or their buffers. If runoff is allowed to sheetflow through adjacent vegetated areas, it is vital to design the roadways and parking areas so that no concentrated runoff is created.
- Storm drain inlets shall be protected to prevent sediment-laden water entering the storm drain system (see BMP C220).

Maintenance Standards Inspect stabilized areas regularly, especially after large storm events.

Crushed rock, gravel base, etc. shall be added as required to maintain a stable driving surface and to stabilize any areas that have eroded.

Following construction, these areas shall be restored to pre-construction condition or better to prevent future erosion.

Perform street cleaning at the end of each day or more often if necessary.

BMP C120: Temporary and Permanent Seeding

Purpose

Seeding reduces erosion by stabilizing exposed soils. A well-established vegetative cover is one of the most effective methods of reducing erosion.

Conditions of Use

Use seeding throughout the project on disturbed areas that have reached final grade or that will remain unworked for more than 30 days.

The optimum seeding windows for western Washington are April 1 through June 30 and September 1 through October 1.

Between July 1 and August 30 seeding requires irrigation until 75 percent grass cover is established.

Between October 1 and March 30 seeding requires a cover of mulch with straw or an erosion control blanket until 75 percent grass cover is established.

Review all disturbed areas in late August to early September and complete all seeding by the end of September. Otherwise, vegetation will not establish itself enough to provide more than average protection.

- Mulch is required at all times for seeding because it protects seeds from heat, moisture loss, and transport due to runoff. Mulch can be applied on top of the seed or simultaneously by hydroseeding. See BMP C121: Mulching for specifications.
- Seed and mulch, all disturbed areas not otherwise vegetated at final site stabilization. Final stabilization means the completion of all soil disturbing activities at the site and the establishment of a permanent vegetative cover, or equivalent permanent stabilization measures (such as pavement, riprap, gabions or geotextiles) which will prevent erosion.

Design and Installation Specifications

Seed retention/detention ponds as required.

Install channels intended for vegetation before starting major earthwork and hydroseed with a Bonded Fiber Matrix. For vegetated channels that will have high flows, install erosion control blankets over hydroseed. Before allowing water to flow in vegetated channels, establish 75 percent vegetation cover. If vegetated channels cannot be established by seed before water flow; install sod in the channel bottom—over hydromulch and erosion control blankets.

- Confirm the installation of all required surface water control measures to prevent seed from washing away.
- Hydroseed applications shall include a minimum of 1,500 pounds per acre of mulch with 3 percent tackifier. See BMP C121: Mulching for specifications.
- Areas that will have seeding only and not landscaping may need compost or meal-based mulch included in the hydroseed in order to establish vegetation. Re-install native topsoil on the disturbed soil surface before application.
- When installing seed via hydroseeding operations, only about 1/3 of the seed actually ends up in contact with the soil surface. This reduces the ability to establish a good stand of grass quickly. To overcome this, consider increasing seed quantities by up to 50 percent.
- Enhance vegetation establishment by dividing the hydromulch operation into two phases:

  1. Phase 1- Install all seed and fertilizer with 25-30 percent mulch and tackifier onto soil in the first lift.
  2. Phase 2- Install the rest of the mulch and tackifier over the first lift.

  Or, enhance vegetation by:

  1. Installing the mulch, seed, fertilizer, and tackifier in one lift.
  2. Spread or blow straw over the top of the hydromulch at a rate of 800-1000 pounds per acre.
  3. Hold straw in place with a standard tackifier.

  Both of these approaches will increase cost moderately but will greatly improve and enhance vegetative establishment. The increased cost may be offset by the reduced need for:

  - Irrigation.
  - Reapplication of mulch.
  - Repair of failed slope surfaces.

  This technique works with standard hydromulch (1,500 pounds per acre minimum) and BFM/MBFMs (3,000 pounds per acre minimum).
- Seed may be installed by hand if:
  - Temporary and covered by straw, mulch, or topsoil.
  - Permanent in small areas (usually less than 1 acre) and covered with mulch, topsoil, or erosion blankets.
- The seed mixes listed in the tables below include recommended mixes for both temporary and permanent seeding.

- Apply these mixes, with the exception of the wetland mix, at a rate of 120 pounds per acre. This rate can be reduced if soil amendments or slow-release fertilizers are used.
- Consult the local suppliers or the local conservation district for their recommendations because the appropriate mix depends on a variety of factors, including location, exposure, soil type, slope, and expected foot traffic. Alternative seed mixes approved by the local authority may be used.
- Other mixes may be appropriate, depending on the soil type and hydrology of the area.

- Table 4.1.2 lists the standard mix for areas requiring a temporary vegetative cover.

Table 4.1.2
Temporary Erosion Control Seed Mix

	% Weight	% Purity	% Germination
Chewings or annual blue grass *Festuca rubra var. commutata* or *Poa anna*	40	98	90
Perennial rye - *Lolium perenne*	50	98	90
Redtop or colonial bentgrass *Agrostis alba* or *Agrostis tenuis*	5	92	85
White dutch clover *Trifolium repens*	5	98	90

- Table 4.1.3 lists a recommended mix for landscaping seed.

Table 4.1.3
Landscaping Seed Mix

	% Weight	% Purity	% Germination
Perennial rye blend *Lolium perenne*	70	98	90
Chewings and red fescue blend *Festuca rubra var. commutata* or *Festuca rubra*	30	98	90

- Table 4.1.4 lists a turf seed mix for dry situations where there is no need for watering. This mix requires very little maintenance.

Table 4.1.4
Low-Growing Turf Seed Mix

	% Weight	% Purity	% Germination
Dwarf tall fescue (several varieties) *Festuca arundinacea var.*	45	98	90
Dwarf perennial rye (Barclay) *Lolium perenne var. barclay*	30	98	90
Red fescue *Festuca rubra*	20	98	90
Colonial bentgrass *Agrostis tenuis*	5	98	90

- Table 4.1.5 lists a mix for bioswales and other intermittently wet areas.

Table 4.1.5
Bioswale Seed Mix*

	% Weight	% Purity	% Germination
Tall or meadow fescue *Festuca arundinacea* or *Festuca elatior*	75-80	98	90
Seaside/Creeping bentgrass *Agrostis palustris*	10-15	92	85
Redtop bentgrass *Agrostis alba* or *Agrostis gigantea*	5-10	90	80

* *Modified Briargreen, Inc. Hydroseeding Guide Wetlands Seed Mix*

- Table 4.1.6 lists a low-growing, relatively non-invasive seed mix appropriate for very wet areas that are not regulated wetlands. Apply this mixture at a rate of 60 pounds per acre. Consult Hydraulic Permit Authority (HPA) for seed mixes if applicable.

Table 4.1.6
Wet Area Seed Mix*

	% Weight	% Purity	% Germination
Tall or meadow fescue *Festuca arundinacea* or *Festuca elatior*	60-70	98	90
Seaside/Creeping bentgrass *Agrostis palustris*	10-15	98	85
Meadow foxtail *Alepocurus pratensis*	10-15	90	80
Alsike clover *Trifolium hybridum*	1-6	98	90
Redtop bentgrass *Agrostis alba*	1-6	92	85

** Modified Briargreen, Inc. Hydroseeding Guide Wetlands Seed Mix*

- Table 4.1.7 lists a recommended meadow seed mix for infrequently maintained areas or non-maintained areas where colonization by native plants is desirable. Likely applications include rural road and utility right-of-way. Seeding should take place in September or very early October in order to obtain adequate establishment prior to the winter months. Consider the appropriateness of clover, a fairly invasive species, in the mix. Amending the soil can reduce the need for clover.

Table 4.1.7
Meadow Seed Mix

	% Weight	% Purity	% Germination
Redtop or Oregon bentgrass *Agrostis alba* or *Agrostis oregonensis*	20	92	85
Red fescue *Festuca rubra*	70	98	90
White dutch clover *Trifolium repens*	10	98	90

- **Roughening and Rototilling:**
  - The seedbed should be firm and rough. Roughen all soil no matter what the slope. Track walk slopes before seeding if engineering purposes require compaction. Backblading or smoothing of slopes greater than 4H:1V is not allowed if they are to be seeded.
  - Restoration-based landscape practices require deeper incorporation than that provided by a simple single-pass rototilling treatment. Wherever practical, initially rip the subgrade to improve long-term permeability, infiltration, and water inflow qualities. At a minimum, permanent areas shall use soil amendments to achieve organic matter and permeability performance defined in engineered soil/landscape systems. For systems that are deeper than 8 inches complete the rototilling process in multiple lifts, or prepare the engineered soil system per specifications and place to achieve the specified depth.
- **Fertilizers:**
  - Conducting soil tests to determine the exact type and quantity of fertilizer is recommended. This will prevent the over-application of fertilizer.
  - Organic matter is the most appropriate form of fertilizer because it provides nutrients (including nitrogen, phosphorus, and potassium) in the least water-soluble form.
  - In general, use 10-4-6 N-P-K (nitrogen-phosphorus-potassium) fertilizer at a rate of 90 pounds per acre. Always use slow-release fertilizers because they are more efficient and have fewer environmental impacts. Do not add fertilizer to the hydromulch machine, or agitate, more than 20 minutes before use. Too much agitation destroys the slow-release coating.
  - There are numerous products available that take the place of chemical fertilizers. These include several with seaweed extracts that are beneficial to soil microbes and organisms. If 100 percent cottonseed meal is used as the mulch in hydroseed, chemical fertilizer may not be necessary. Cottonseed meal provides a good source of long-term, slow-release, available nitrogen.
- **Bonded Fiber Matrix and Mechanically Bonded Fiber Matrix:**
  - On steep slopes use Bonded Fiber Matrix (BFM) or Mechanically Bonded Fiber Matrix (MBFM) products. Apply BFM/MBFM products at a minimum rate of 3,000 pounds per acre of mulch with approximately 10 percent tackifier. Achieve a minimum of 95 percent soil coverage during application. Numerous products are available commercially. Installed products per manufacturer’s instructions. Most products require 24-36 hours to cure before rainfall and cannot be installed on wet or saturated soils.

Generally, products come in 40-50 pound bags and include all necessary ingredients except for seed and fertilizer.

- BFMs and MBFMs provide good alternatives to blankets in most areas requiring vegetation establishment. Advantages over blankets include:
  - BFM and MBFMs do not require surface preparation.
  - Helicopters can assist in installing BFM and MBFMs in remote areas.
  - On slopes steeper than 2.5H:1V, blanket installers may require ropes and harnesses for safety.
  - Installing BFM and MBFMs can save at least $1,000 per acre compared to blankets.

Maintenance Standards

Reseed any seeded areas that fail to establish at least 80 percent cover (100 percent cover for areas that receive sheet or concentrated flows). If reseeding is ineffective, use an alternate method such as sodding, mulching, or nets/blankets. If winter weather prevents adequate grass growth, this time limit may be relaxed at the discretion of the local authority when sensitive areas would otherwise be protected.

- Reseed and protect by mulch any areas that experience erosion after achieving adequate cover. Reseed and protect by mulch any eroded area.
- Supply seeded areas with adequate moisture, but do not water to the extent that it causes runoff.

Approved as Equivalent

Ecology has approved products as able to meet the requirements of BMP C120. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept this product approved as equivalent, or may require additional testing prior to consideration for local use. The products are available for review on Ecology's website at http://www.ecy.wa.gov/programs/wq/stormwater/newtech/equivalent.html

BMP C121: Mulching

Purpose

Mulching soils provides immediate temporary protection from erosion. Mulch also enhances plant establishment by conserving moisture, holding fertilizer, seed, and topsoil in place, and moderating soil temperatures. There is an enormous variety of mulches that can be used. This section discusses only the most common types of mulch.

Conditions of Use

As a temporary cover measure, mulch should be used:

- For less than 30 days on disturbed areas that require cover.
- At all times for seeded areas, especially during the wet season and

during the hot summer months.

- During the wet season on slopes steeper than 3H:1V with more than 10 feet of vertical relief.

Mulch may be applied at any time of the year and must be refreshed periodically.

- For seeded areas mulch may be made up of 100 percent: cottonseed meal; fibers made of wood, recycled cellulose, hemp, kenaf; compost; or blends of these. Tackifier shall be plant-based, such as guar or alpha plantago, or chemical-based such as polyacrylamide or polymers. Any mulch or tackifier product used shall be installed per manufacturer's instructions. Generally, mulches come in 40-50 pound bags. Seed and fertilizer are added at time of application.

Design and Installation Specifications

For mulch materials, application rates, and specifications, see Table 4.1.8. Always use a 2-inch minimum mulch thickness; increase the thickness until the ground is 95% covered (i.e. not visible under the mulch layer). Note: Thickness may be increased for disturbed areas in or near sensitive areas or other areas highly susceptible to erosion.

Mulch used within the ordinary high-water mark of surface waters should be selected to minimize potential flotation of organic matter. Composted organic materials have higher specific gravities (densities) than straw, wood, or chipped material. Consult Hydraulic Permit Authority (HPA) for mulch mixes if applicable.

Maintenance Standards

- The thickness of the cover must be maintained.
- Any areas that experience erosion shall be remulched and/or protected with a net or blanket. If the erosion problem is drainage related, then the problem shall be fixed and the eroded area remulched.

Table 4.1.8
Mulch Standards and Guidelines

Mulch Material	Quality Standards	Application Rates	Remarks
Straw	Air-dried; free from undesirable seed and coarse material.	2"-3" thick; 5 bales per 1,000 sf or 2-3 tons per acre	Cost-effective protection when applied with adequate thickness. Hand-application generally requires greater thickness than blown straw. The thickness of straw may be reduced by half when used in conjunction with seeding. In windy areas straw must be held in place by crimping, using a tackifier, or covering with netting. Blown straw always has to be held in place with a tackifier as even light winds will blow it away. Straw, however, has several deficiencies that should be considered when selecting mulch materials. It often introduces and/or encourages the propagation of weed species and it has no significant long-term benefits. It should also not be used within the ordinary high-water elevation of surface waters (due to flotation).
Hydromulch	No growth inhibiting factors.	Approx. 25-30 lbs per 1,000 sf or 1,500 - 2,000 lbs per acre	Shall be applied with hydromulcher. Shall not be used without seed and tackifier unless the application rate is at least doubled. Fibers longer than about ¾-1 inch clog hydromulch equipment. Fibers should be kept to less than ¾ inch.
Composted Mulch and Compost	No visible water or dust during handling. Must be produced in accordance with WAC 173-350, Solid Waste Handling Standards. .	2" thick min.; approx. 100 tons per acre (approx. 800 lbs per yard)	More effective control can be obtained by increasing thickness to 3". Excellent mulch for protecting final grades until landscaping because it can be directly seeded or tilled into soil as an amendment. Composted mulch has a coarser size gradation than compost. It is more stable and practical to use in wet areas and during rainy weather conditions. Do not use composted mulch near wetlands or near phosphorous impaired water bodies.
Chipped Site Vegetation	Average size shall be several inches. Gradations from fines to 6 inches in length for texture, variation, and interlocking properties.	2" thick min.;	This is a cost-effective way to dispose of debris from clearing and grubbing, and it eliminates the problems associated with burning. Generally, it should not be used on slopes above approx. 10% because of its tendency to be transported by runoff. It is not recommended within 200 feet of surface waters. If seeding is expected shortly after mulch, the decomposition of the chipped vegetation may tie up nutrients important to grass establishment.
Wood-based Mulch or Wood Straw	No visible water or dust during handling. Must be purchased from a supplier with a Solid Waste Handling Permit or one exempt from solid waste regulations.	2" thick min.; approx. 100 tons per acre (approx. 800 lbs. per cubic yard)	This material is often called "hog or hogged fuel." The use of mulch ultimately improves the organic matter in the soil. Special caution is advised regarding the source and composition of wood-based mulches. Its preparation typically does not provide any weed seed control, so evidence of residual vegetation in its composition or known inclusion of weed plants or seeds should be monitored and prevented (or minimized).
Wood Strand Mulch	A blend of loose, long, thin wood pieces derived from native conifer or deciduous trees with high length-to-width ratio.	2" thick min.	Cost-effective protection when applied with adequate thickness. A minimum of 95-percent of the wood strand shall have lengths between 2 and 10-inches, with a width and thickness between 1/16 and ⅜-inches. The mulch shall not contain resin, tannin, or other compounds in quantities that would be detrimental to plant life. Sawdust or wood shavings shall not be used as mulch. (WSDOT specification (9-14.4(4))

BMP C122: Nets and Blankets

Purpose

Erosion control nets and blankets are intended to prevent erosion and hold seed and mulch in place on steep slopes and in channels so that vegetation can become well established. In addition, some nets and blankets can be used to permanently reinforce turf to protect drainage ways during high flows. Nets (commonly called matting) are strands of material woven into an open, but high-tensile strength net (for example, coconut fiber matting). Blankets are strands of material that are not tightly woven, but instead form a layer of interlocking fibers, typically held together by a biodegradable or photodegradable netting (for example, excelsior or straw blankets). They generally have lower tensile strength than nets, but cover the ground more completely. Coir (coconut fiber) fabric comes as both nets and blankets.

Conditions of Use

Erosion control nets and blankets should be used:

- To aid permanent vegetated stabilization of slopes 2H:1V or greater and with more than 10 feet of vertical relief.
- For drainage ditches and swales (highly recommended). The application of appropriate netting or blanket to drainage ditches and swales can protect bare soil from channelized runoff while vegetation is established. Nets and blankets also can capture a great deal of sediment due to their open, porous structure. Nets and blankets can be used to permanently stabilize channels and may provide a cost-effective, environmentally preferable alternative to riprap. 100 percent synthetic blankets manufactured for use in ditches may be easily reused as temporary ditch liners.

Disadvantages of blankets include:

- Surface preparation required.
- On slopes steeper than 2.5H:1V, blanket installers may need to be roped and harnessed for safety.
- They cost at least $4,000-6,000 per acre installed.

Advantages of blankets include:

- Installation without mobilizing special equipment.
- Installation by anyone with minimal training
- Installation in stages or phases as the project progresses.
- Installers can hand place seed and fertilizer as they progress down the slope.
- Installation in any weather.
- There are numerous types of blankets that can be designed with various parameters in mind. Those parameters include: fiber blend, mesh strength, longevity, biodegradability, cost, and availability.

Design and Installation Specifications

- See Figure 4.1.3 and Figure 4.1.4 for typical orientation and installation of blankets used in channels and as slope protection. Note: these are typical only; all blankets must be installed per manufacturer's installation instructions.
- Installation is critical to the effectiveness of these products. If good ground contact is not achieved, runoff can concentrate under the product, resulting in significant erosion.
- Installation of Blankets on Slopes:
  1. Complete final grade and track walk up and down the slope.
  2. Install hydromulch with seed and fertilizer.
  3. Dig a small trench, approximately 12 inches wide by 6 inches deep along the top of the slope.
  4. Install the leading edge of the blanket into the small trench and staple approximately every 18 inches. NOTE: Staples are metal, "U"-shaped, and a minimum of 6 inches long. Longer staples are used in sandy soils. Biodegradable stakes are also available.
  5. Roll the blanket slowly down the slope as installer walks backwards. NOTE: The blanket rests against the installer's legs. Staples are installed as the blanket is unrolled. It is critical that the proper staple pattern is used for the blanket being installed. The blanket is not to be allowed to roll down the slope on its own as this stretches the blanket making it impossible to maintain soil contact. In addition, no one is allowed to walk on the blanket after it is in place.
  6. If the blanket is not long enough to cover the entire slope length, the trailing edge of the upper blanket should overlap the leading edge of the lower blanket and be stapled. On steeper slopes, this overlap should be installed in a small trench, stapled, and covered with soil.
- With the variety of products available, it is impossible to cover all the details of appropriate use and installation. Therefore, it is critical that the design engineer consult the manufacturer's information and that a site visit takes place in order to ensure that the product specified is appropriate. Information is also available at the following web sites:
  1. WSDOT (Section 3.2.4):

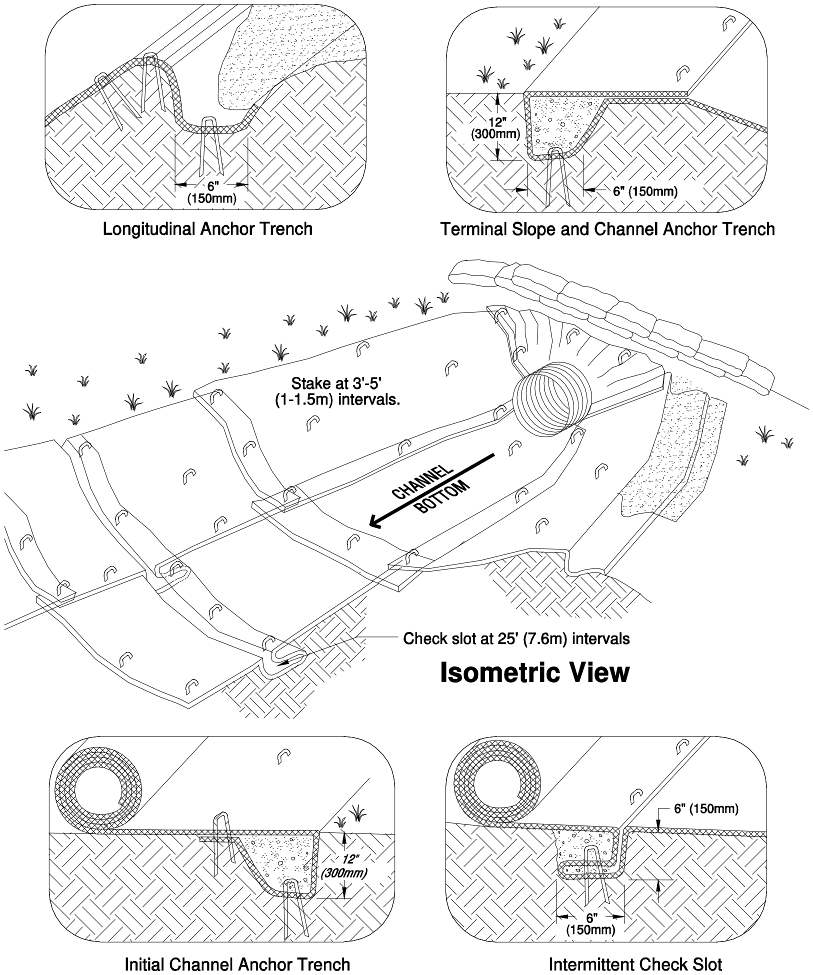
     http://www.wsdot.wa.gov/NR/rdonlyres/3B41E087-FA86-4717-932D-D7A8556CCD57/0/ErosionTrainingManual.pdf
  2. Texas Transportation Institute:

     http://www.txdot.gov/business/doing_business/product_evaluation/erosion_control.htm

- Use jute matting in conjunction with mulch (BMP C121). Excelsior, woven straw blankets and coir (coconut fiber) blankets may be installed without mulch. There are many other types of erosion control nets and blankets on the market that may be appropriate in certain circumstances.
- In general, most nets (e.g., jute matting) require mulch in order to prevent erosion because they have a fairly open structure. Blankets typically do not require mulch because they usually provide complete protection of the surface.
- Extremely steep, unstable, wet, or rocky slopes are often appropriate candidates for use of synthetic blankets, as are riverbanks, beaches and other high-energy environments. If synthetic blankets are used, the soil should be hydromulched first.
- 100-percent biodegradable blankets are available for use in sensitive areas. These organic blankets are usually held together with a paper or fiber mesh and stitching which may last up to a year.
- Most netting used with blankets is photodegradable, meaning they break down under sunlight (not UV stabilized). However, this process can take months or years even under bright sun. Once vegetation is established, sunlight does not reach the mesh. It is not uncommon to find non-degraded netting still in place several years after installation. This can be a problem if maintenance requires the use of mowers or ditch cleaning equipment. In addition, birds and small animals can become trapped in the netting.

Maintenance Standards

- Maintain good contact with the ground. Erosion must not occur beneath the net or blanket.
- Repair and staple any areas of the net or blanket that are damaged or not in close contact with the ground.
- Fix and protect eroded areas if erosion occurs due to poorly controlled drainage.



NOTES:
1. Check slots to be constructed per manufacturers specifications.
2. Staking or stapling layout per manufacturers specifications.

Figure 4.1.3 – Channel Installation

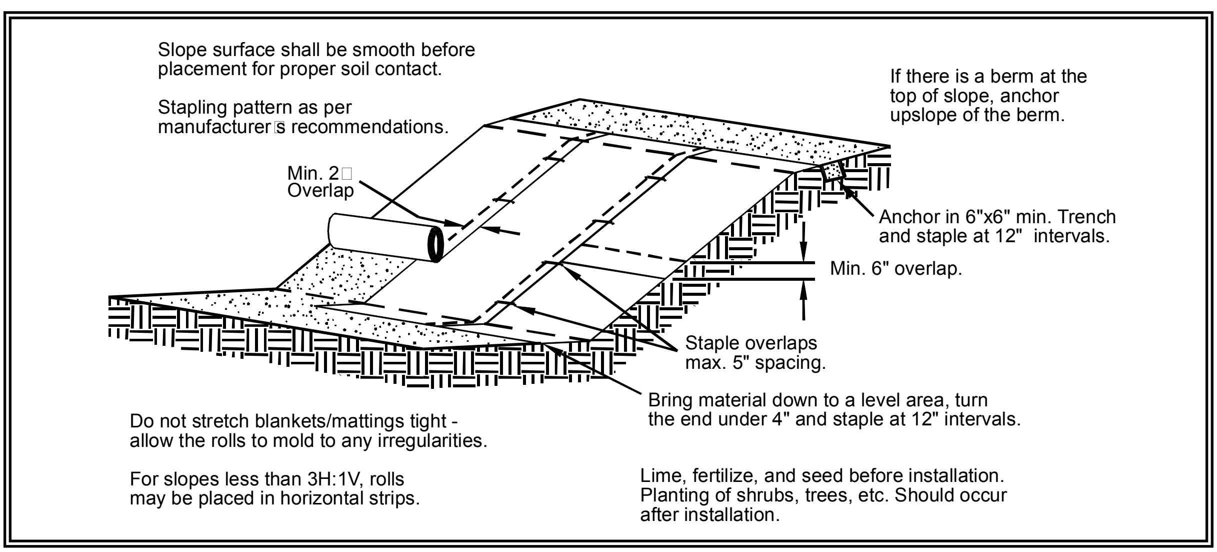


Figure 4.1.4 – Slope Installation

BMP C123: Plastic Covering

Purpose

Plastic covering provides immediate, short-term erosion protection to slopes and disturbed areas.

Conditions of Use

Plastic covering may be used on disturbed areas that require cover measures for less than 30 days, except as stated below.

- Plastic is particularly useful for protecting cut and fill slopes and stockpiles. Note: The relatively rapid breakdown of most polyethylene sheeting makes it unsuitable for long-term (greater than six months) applications.
- Due to rapid runoff caused by plastic covering, do not use this method upslope of areas that might be adversely impacted by concentrated runoff. Such areas include steep and/or unstable slopes.
- Plastic sheeting may result in increased runoff volumes and velocities, requiring additional on-site measures to counteract the increases. Creating a trough with wattles or other material can convey clean water away from these areas.
- To prevent undercutting, trench and backfill rolled plastic covering products.
- While plastic is inexpensive to purchase, the added cost of installation, maintenance, removal, and disposal make this an expensive material, up to $1.50-2.00 per square yard.
- Whenever plastic is used to protect slopes install water collection measures at the base of the slope. These measures include plastic-covered berms, channels, and pipes used to covey clean rainwater away from bare soil and disturbed areas. Do not mix clean runoff from a plastic covered slope with dirty runoff from a project.
- Other uses for plastic include:
  1. Temporary ditch liner.
  2. Pond liner in temporary sediment pond.
  3. Liner for bermed temporary fuel storage area if plastic is not reactive to the type of fuel being stored.
  4. Emergency slope protection during heavy rains.
  5. Temporary drainpipe (“elephant trunk”) used to direct water.

Design and Installation Specifications

- Plastic slope cover must be installed as follows:
  1. Run plastic up and down slope, not across slope.
  2. Plastic may be installed perpendicular to a slope if the slope length is less than 10 feet.
  3. Minimum of 8-inch overlap at seams.

4. On long or wide slopes, or slopes subject to wind, tape all seams.
5. Place plastic into a small (12-inch wide by 6-inch deep) slot trench at the top of the slope and backfill with soil to keep water from flowing underneath.
6. Place sand filled burlap or geotextile bags every 3 to 6 feet along seams and tie them together with twine to hold them in place.
7. Inspect plastic for rips, tears, and open seams regularly and repair immediately. This prevents high velocity runoff from contacting bare soil which causes extreme erosion.
8. Sandbags may be lowered into place tied to ropes. However, all sandbags must be staked in place.

- Plastic sheeting shall have a minimum thickness of 0.06 millimeters.
- If erosion at the toe of a slope is likely, a gravel berm, riprap, or other suitable protection shall be installed at the toe of the slope in order to reduce the velocity of runoff.

Maintenance Standards

- Torn sheets must be replaced and open seams repaired.
- Completely remove and replace the plastic if it begins to deteriorate due to ultraviolet radiation.
- Completely remove plastic when no longer needed.
- Dispose of old tires used to weight down plastic sheeting appropriately.

Approved as Equivalent

Ecology has approved products as able to meet the requirements of BMP C123. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept this product approved as equivalent, or may require additional testing prior to consideration for local use. The products are available for review on Ecology's website at http://www.ecy.wa.gov/programs/wq/stormwater/newtech/equivalent.html

BMP C124: Sodding

Purpose

The purpose of sodding is to establish permanent turf for immediate erosion protection and to stabilize drainage ways where concentrated overland flow will occur.

Conditions of Use

Sodding may be used in the following areas:

- Disturbed areas that require short-term or long-term cover.
- Disturbed areas that require immediate vegetative cover.
- All waterways that require vegetative lining. Waterways may also be seeded rather than sodded, and protected with a net or blanket.

Design and Installation Specifications

Sod shall be free of weeds, of uniform thickness (approximately 1-inch thick), and shall have a dense root mat for mechanical strength.

The following steps are recommended for sod installation:

- Shape and smooth the surface to final grade in accordance with the approved grading plan. The swale needs to be overexcavated 4 to 6 inches below design elevation to allow room for placing soil amendment and sod.
- Amend 4 inches (minimum) of compost into the top 8 inches of the soil if the organic content of the soil is less than ten percent or the permeability is less than 0.6 inches per hour. See http://www.ecy.wa.gov/programs/swfa/organics/soil.html for further information.
- Fertilize according to the supplier's recommendations.
- Work lime and fertilizer 1 to 2 inches into the soil, and smooth the surface.
- Lay strips of sod beginning at the lowest area to be sodded and perpendicular to the direction of water flow. Wedge strips securely into place. Square the ends of each strip to provide for a close, tight fit. Stagger joints at least 12 inches. Staple on slopes steeper than 3H:1V. Staple the upstream edge of each sod strip.
- Roll the sodded area and irrigate.
- When sodding is carried out in alternating strips or other patterns, seed the areas between the sod immediately after sodding.

Maintenance Standards

If the grass is unhealthy, the cause shall be determined and appropriate action taken to reestablish a healthy groundcover. If it is impossible to establish a healthy groundcover due to frequent saturation, instability, or some other cause, the sod shall be removed, the area seeded with an appropriate mix, and protected with a net or blanket.

BMP C125: Topsoiling / Composting

Purpose

Topsoiling and composting provide a suitable growth medium for final site stabilization with vegetation. While not a permanent cover practice in itself, topsoiling and composting are an integral component of providing permanent cover in those areas where there is an unsuitable soil surface for plant growth. Use this BMP in conjunction with other BMPs such as seeding, mulching, or sodding.

Native soils and disturbed soils that have been organically amended not only retain much more stormwater, but they also serve as effective biofilters for urban pollutants and, by supporting more vigorous plant growth, reduce the water, fertilizer and pesticides needed to support installed landscapes. Topsoil does not include any subsoils but only the material from the top several inches including organic debris.

Conditions of Use

- Permanent landscaped areas shall contain healthy topsoil that reduces the need for fertilizers, improves overall topsoil quality, provides for better vegetal health and vitality, improves hydrologic characteristics, and reduces the need for irrigation.
- Leave native soils and the duff layer undisturbed to the maximum extent practicable. Stripping of existing, properly functioning soil system and vegetation for the purpose of topsoiling during construction is not acceptable. Preserve existing soil systems in undisturbed and uncompacted conditions if functioning properly.
- Areas that already have good topsoil, such as undisturbed areas, do not require soil amendments.
- Restore, to the maximum extent practical, native soils disturbed during clearing and grading to a condition equal to or better than the original site condition's moisture-holding capacity. Use on-site native topsoil, incorporate amendments into on-site soil, or import blended topsoil to meet this requirement.
- Topsoiling is a required procedure when establishing vegetation on shallow soils, and soils of critically low pH (high acid) levels.
- Beware of where the topsoil comes from, and what vegetation was on site before disturbance, invasive plant seeds may be included and could cause problems for establishing native plants, landscaped areas, or grasses.
- Topsoil from the site will contain mycorrhizal bacteria that are necessary for healthy root growth and nutrient transfer. These native mycorrhiza are acclimated to the site and will provide optimum conditions for establishing grasses. Use commercially available mycorrhiza products when using off-site topsoil.

Design and Installation Specifications

Meet the following requirements for areas requiring disruption and topsoiling:

- Maximize the depth of the topsoil wherever possible to provide the maximum possible infiltration capacity and beneficial growth medium. Topsoil shall have:
    - A minimum depth of 8-inches. Scarify subsoils below the topsoil layer at least 4-inches with some incorporation of the upper material to avoid stratified layers, where feasible. Ripping or re-structuring the subgrade may also provide additional benefits regarding the overall infiltration and interflow dynamics of the soil system.

- A minimum organic content of 10% dry weight, and 5% organic matter content in turf areas. Incorporate organic amendments to a minimum 8-inch depth except where tree roots or other natural features limit the depth of incorporation.
- A pH between 6.0 and 8.0 or matching the pH of the undisturbed soil.
- If blended topsoil is imported, then fines should be limited to 25 percent passing through a 200 sieve.

- Accomplish the required organic content and pH by either returning native topsoil to the site and/or incorporating organic amendments.
  - To meet the organic content use compost that meets the definition of "composted materials" in WAC 173-350-220. This code is available online at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-350-220.

    The compost must also have an organic matter content of 35% to 65%, and a carbon to nitrogen ratio below 25H:1V.

    The carbon to nitrogen ratio may be as high as 35H:1V for plantings composed entirely of plants native to the Puget Sound Lowlands region.
  - For till soils use a mixture of approximately two parts soil to one part compost. This equates to 4 inches of compost mixed to a depth of 12 inches in till soils. Increasing the concentration of compost beyond this level can have negative effects on vegetal health, while decreasing the concentrations can reduce the benefits of amended soils.
  - Gravel or cobble outwash soils, may require different approaches. Organics and fines easily migrate through the loose structure of these soils. Therefore, the importation of at least 6 inches of quality topsoil, underlain by some type of filter fabric to prevent the migration of fines, may be more appropriate for these soils.
- The final composition and construction of the soil system will result in a natural selection or favoring of certain plant species over time. For example, incorporation of topsoil may favor grasses, while layering with mildly acidic, high-carbon amendments may favor more woody vegetation.
- Allow sufficient time in scheduling for topsoil spreading prior to seeding, sodding, or planting.
- Take care when applying top soil to subsoils with contrasting textures. Sandy topsoil over clayey subsoil is a particularly poor combination, as water creeps along the junction between the soil layers and causes the topsoil to slough. If topsoil and subsoil are not properly bonded, water will not infiltrate the soil profile evenly and it will be difficult to

establish vegetation. The best method to prevent a lack of bonding is to actually work the topsoil into the layer below for a depth of at least 6 inches.

- Field exploration of the site shall be made to determine if there is surface soil of sufficient quantity and quality to justify stripping. Topsoil shall be friable and loamy (loam, sandy loam, silt loam, sandy clay loam, and clay loam). Avoid areas of natural ground water recharge.
- Stripping shall be confined to the immediate construction area. A 4-inch to 6-inch stripping depth is common, but depth may vary depending on the particular soil. All surface runoff control structures shall be in place prior to stripping.
- Do not place topsoil while in a frozen or muddy condition, when the subgrade is excessively wet, or when conditions exist that may otherwise be detrimental to proper grading or proposed sodding or seeding.
- In any areas requiring grading remove and stockpile the duff layer and topsoil on site in a designated, controlled area, not adjacent to public resources and critical areas. Stockpiled topsoil is to be reapplied to other portions of the site where feasible.
- Locate the topsoil stockpile so that it meets specifications and does not interfere with work on the site. It may be possible to locate more than one pile in proximity to areas where topsoil will be used.

Stockpiling of topsoil shall occur in the following manner:

- Side slopes of the stockpile shall not exceed 2H:1V.
- Between October 1 and April 30:
    - An interceptor dike with gravel outlet and silt fence shall surround all topsoil.
    - Within 2 days complete erosion control seeding, or covering stockpiles with clear plastic, or other mulching materials.
- Between May 1 and September 30:
    - An interceptor dike with gravel outlet and silt fence shall surround all topsoil if the stockpile will remain in place for a longer period of time than active construction grading.
    - Within 7 days complete erosion control seeding, or covering stockpiles with clear plastic, or other mulching materials.

- When native topsoil is to be stockpiled and reused the following should apply to ensure that the mycorrhizal bacterial, earthworms, and other beneficial organisms will not be destroyed:

    1. Re-install topsoil within 4 to 6 weeks.

2. Do not allow the saturation of topsoil with water.
3. Do not use plastic covering.

Maintenance Standards

- Inspect stockpiles regularly, especially after large storm events. Stabilize any areas that have eroded.
- Establish soil quality and depth toward the end of construction and once established, protect from compaction, such as from large machinery use, and from erosion.
- Plant and mulch soil after installation.
- Leave plant debris or its equivalent on the soil surface to replenish organic matter.
- Reduce and adjust, where possible, the use of irrigation, fertilizers, herbicides and pesticides, rather than continuing to implement formerly established practices.

BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection

Purpose

Polyacrylamide (PAM) is used on construction sites to prevent soil erosion.

Applying PAM to bare soil in advance of a rain event significantly reduces erosion and controls sediment in two ways. First, PAM increases the soil's available pore volume, thus increasing infiltration through flocculation and reducing the quantity of stormwater runoff. Second, it increases flocculation of suspended particles and aids in their deposition, thus reducing stormwater runoff turbidity and improving water quality.

Conditions of Use

PAM shall not be directly applied to water or allowed to enter a water body.

In areas that drain to a sediment pond, PAM can be applied to bare soil under the following conditions:

- During rough grading operations.
- In Staging areas.
- Balanced cut and fill earthwork.
- Haul roads prior to placement of crushed rock surfacing.
- Compacted soil roadbase.
- Stockpiles.
- After final grade and before paving or final seeding and planting.
- Pit sites.

- Sites having a winter shut down. In the case of winter shut down, or where soil will remain unworked for several months, PAM should be used together with mulch.

Design and Installation Specifications

PAM may be applied with water in dissolved form. The preferred application method is the dissolved form.

PAM is to be applied at a maximum rate of 2/3 pound PAM per 1,000 gallons water (80 mg/L) per 1 acre of bare soil. Table 4.1.9 can be used to determine the PAM and water application rate for a disturbed soil area. Higher concentrations of PAM **do not** provide any additional effectiveness.

Table 4.1.9
PAM and Water Application Rates

Disturbed Area (ac)	PAM (lbs)	Water (gal)
0.50	0.33	500
1.00	0.66	1,000
1.50	1.00	1,500
2.00	1.32	2,000
2.50	1.65	2,500
3.00	2.00	3,000
3.50	2.33	3,500
4.00	2.65	4,000
4.50	3.00	4,500
5.00	3.33	5,000

The Preferred Method:

- Pre-measure the area where PAM is to be applied and calculate the amount of product and water necessary to provide coverage at the specified application rate (2/3 pound PAM/1000 gallons/acre).
- PAM has infinite solubility in water, but dissolves very slowly. Dissolve pre-measured dry granular PAM with a known quantity of clean water in a bucket several hours or overnight. Mechanical mixing will help dissolve the PAM. Always add PAM to water - not water to PAM.
- Pre-fill the water truck about 1/8 full with water. The water does not have to be potable, but it must have relatively low turbidity – in the range of 20 NTU or less.
- Add PAM /Water mixture to the truck
- Completely fill the water truck to specified volume.
- Spray PAM/Water mixture onto dry soil until the soil surface is uniformly and completely wetted.

An Alternate Method:

PAM may also be applied as a powder at the rate of 5 lbs. per acre. This must be applied on a day that is dry. For areas less than 5-10 acres, a hand-held “organ grinder” fertilizer spreader set to the smallest setting will work. Tractor-mounted spreaders will work for larger areas.

The following shall be used for application of powdered PAM:

- Powered PAM shall be used in conjunction with other BMPs and not in place of other BMPs.
- Do not use PAM on a slope that flows directly into a stream or wetland. The stormwater runoff shall pass through a sediment control BMP prior to discharging to surface waters.
- Do not add PAM to water discharging from site.
- When the total drainage area is greater than or equal to 5 acres, PAM treated areas shall drain to a sediment pond.
- Areas less than 5 acres shall drain to sediment control BMPs, such as a minimum of 3 check dams per acre. The total number of check dams used shall be maximized to achieve the greatest amount of settlement of sediment prior to discharging from the site. Each check dam shall be spaced evenly in the drainage channel through which stormwater flows are discharged off-site.
- On all sites, the use of silt fence shall be maximized to limit the discharges of sediment from the site.
- All areas not being actively worked shall be covered and protected from rainfall. PAM shall not be the only cover BMP used.
- PAM can be applied to wet soil, but dry soil is preferred due to less sediment loss.
- PAM will work when applied to saturated soil but is not as effective as applications to dry or damp soil.
- Keep the granular PAM supply out of the sun. Granular PAM loses its effectiveness in three months after exposure to sunlight and air.
- Proper application and re-application plans are necessary to ensure total effectiveness of PAM usage.
- PAM, combined with water, is very slippery and can be a safety hazard. Care must be taken to prevent spills of PAM powder onto paved surfaces. During an application of PAM, prevent over-spray from reaching pavement as pavement will become slippery. If PAM powder gets on skin or clothing, wipe it off with a rough towel rather than washing with water-this only makes cleanup messier and take longer.
- Some PAMs are more toxic and carcinogenic than others. Only the most environmentally safe PAM products should be used.

The specific PAM copolymer formulation must be anionic. **Cationic PAM shall not be used in any application because of known aquatic toxicity problems.** Only the highest drinking water grade PAM, certified for compliance with ANSI/NSF Standard 60 for drinking water treatment, will be used for soil applications. Recent media attention and high interest in PAM has resulted in some entrepreneurial exploitation of the term "polymer." All PAM are polymers, but not all polymers are PAM, and not all PAM products comply with ANSI/NSF Standard 60. PAM use shall be reviewed and approved by the local permitting authority.

- PAM designated for these uses should be "water soluble" or "linear" or "non-crosslinked". Cross-linked or water absorbent PAM, polymerized in highly acidic (pH<2) conditions, are used to maintain soil moisture content.
- The PAM anionic charge density may vary from 2-30 percent; a value of 18 percent is typical. Studies conducted by the United States Department of Agriculture (USDA)/ARS demonstrated that soil stabilization was optimized by using very high molecular weight (12-15 mg/mole), highly anionic (>20% hydrolysis) PAM.

- PAM tackifiers are available and being used in place of guar and alpha plantago. Typically, PAM tackifiers should be used at a rate of no more than 0.5-1 lb. per 1000 gallons of water in a hydromulch machine. Some tackifier product instructions say to use at a rate of 3 –5 lbs. per acre, which can be too much. In addition, pump problems can occur at higher rates due to increased viscosity.

Maintenance Standards

- PAM may be reapplied on actively worked areas after a 48-hour period.
- Reapplication is not required unless PAM treated soil is disturbed or unless turbidity levels show the need for an additional application. If PAM treated soil is left undisturbed a reapplication may be necessary after two months. More PAM applications may be required for steep slopes, silty and clayey soils (USDA Classification Type "C" and "D" soils), long grades, and high precipitation areas. When PAM is applied first to bare soil and then covered with straw, a reapplication may not be necessary for several months.
- Loss of sediment and PAM may be a basis for penalties per RCW 90.48.080.

BMP C130: Surface Roughening

Purpose

Surface roughening aids in the establishment of vegetative cover, reduces runoff velocity, increases infiltration, and provides for sediment trapping through the provision of a rough soil surface. Horizontal depressions are created by operating a tiller or other suitable equipment on the contour or by leaving slopes in a roughened condition by not fine grading them.

Use this BMP in conjunction with other BMPs such as seeding, mulching, or sodding.

Conditions for Use

- All slopes steeper than 3H:1V and greater than 5 vertical feet require surface roughening to a depth of 2 to 4 inches prior to seeding..
- Areas that will not be stabilized immediately may be roughened to reduce runoff velocity until seeding takes place.
- Slopes with a stable rock face do not require roughening.
- Slopes where mowing is planned should not be excessively roughened.

Design and Installation Specifications

There are different methods for achieving a roughened soil surface on a slope, and the selection of an appropriate method depends upon the type of slope. Roughening methods include stair-step grading, grooving, contour furrows, and tracking. See Figure 4.1.5 for tracking and contour furrows. Factors to be considered in choosing a method are slope steepness, mowing requirements, and whether the slope is formed by cutting or filling.

- Disturbed areas that will not require mowing may be stair-step graded, grooved, or left rough after filling.
- Stair-step grading is particularly appropriate in soils containing large amounts of soft rock. Each "step" catches material that sloughs from above, and provides a level site where vegetation can become established. Stairs should be wide enough to work with standard earth moving equipment. Stair steps must be on contour or gullies will form on the slope.
- Areas that will be mowed (these areas should have slopes less steep than 3H:1V) may have small furrows left by disking, harrowing, raking, or seed-planting machinery operated on the contour.
- Graded areas with slopes steeper than 3H:1V but less than 2H:1V should be roughened before seeding. This can be accomplished in a variety of ways, including "track walking," or driving a crawler tractor up and down the slope, leaving a pattern of cleat imprints parallel to slope contours.
- Tracking is done by operating equipment up and down the slope to leave horizontal depressions in the soil.

Maintenance Standards

- Areas that are graded in this manner should be seeded as quickly as possible.
- Regular inspections should be made of the area. If rills appear, they should be re-graded and re-seeded immediately.

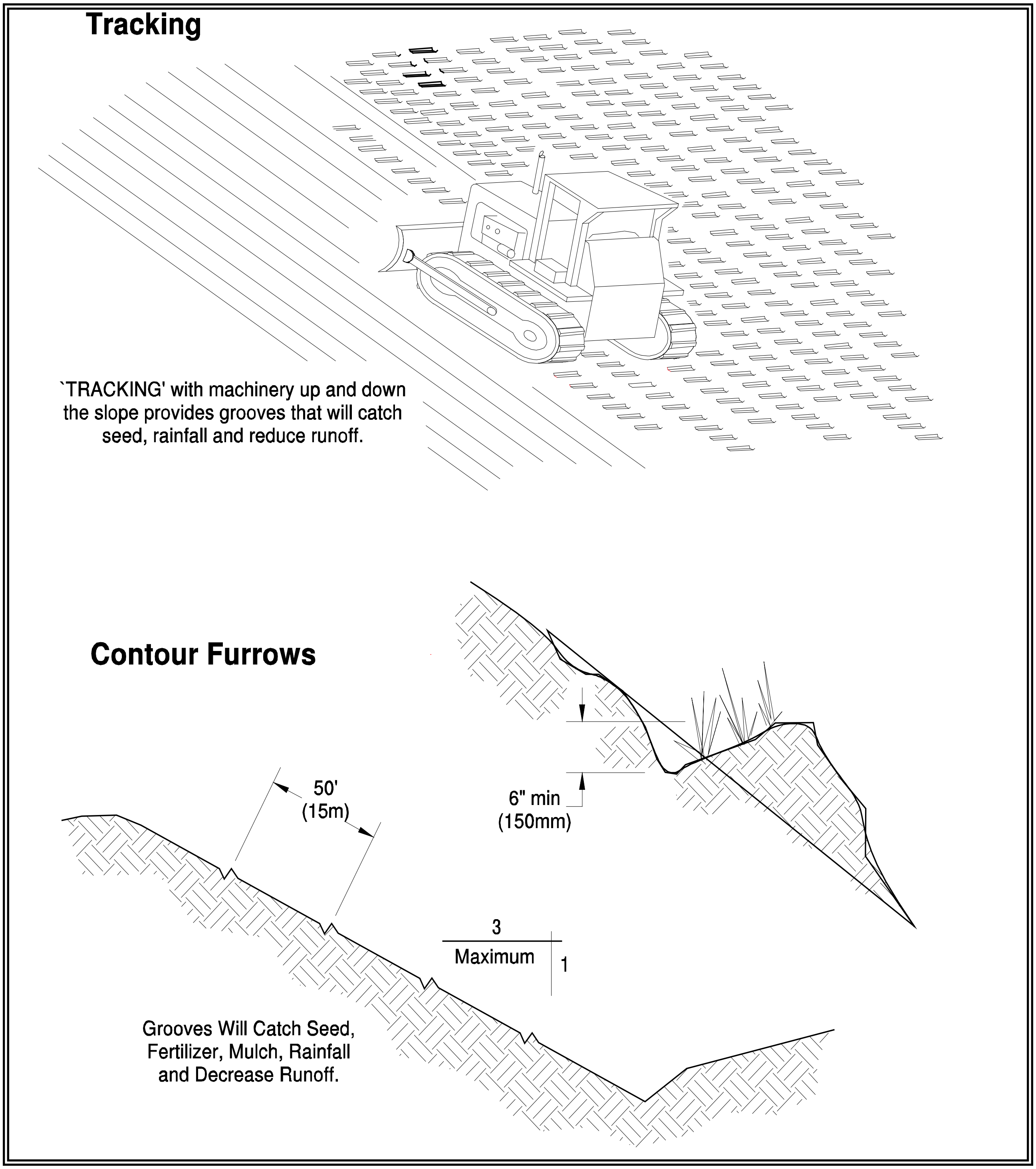


Figure 4.1.5 Surface Roughening by Tracking and Contour Furrows

BMP C131: Gradient Terraces

Purpose

Gradient terraces reduce erosion damage by intercepting surface runoff and conducting it to a stable outlet at a non-erosive velocity.

Conditions of Use

- Gradient terraces normally are limited to denuded land having a water erosion problem. They should not be constructed on deep sands or on soils that are too stony, steep, or shallow to permit practical and economical installation and maintenance. Gradient terraces may be used only where suitable outlets are or will be made available. See Figure 4.1.6 for gradient terraces.

Design and Installation Specifications

- The maximum vertical spacing of gradient terraces should be determined by the following method:

  $$VI = (0.8)s + y$$

  Where:
  - VI = vertical interval in feet
  - s = land rise per 100 feet, expressed in feet
  - y = a soil and cover variable with values from 1.0 to 4.0

  Values of "y" are influenced by soil erodibility and cover practices. The lower values are applicable to erosive soils where little to no residue is left on the surface. The higher value is applicable only to erosion-resistant soils where a large amount of residue (1½ tons of straw/acre equivalent) is on the surface.

- The minimum constructed cross-section should meet the design dimensions.
- The top of the constructed ridge should not be lower at any point than the design elevation plus the specified overfill for settlement. The opening at the outlet end of the terrace should have a cross section equal to that specified for the terrace channel.
- Channel grades may be either uniform or variable with a maximum grade of 0.6 feet per 100 feet length (0.6%). For short distances, terrace grades may be increased to improve alignment. The channel velocity should not exceed that which is nonerosive for the soil type.
- All gradient terraces should have adequate outlets. Such an outlet may be a grassed waterway, vegetated area, or tile outlet. In all cases the outlet must convey runoff from the terrace or terrace system to a point where the outflow will not cause damage. Vegetative cover should be used in the outlet channel.
- The design elevation of the water surface of the terrace should not be lower than the design elevation of the water surface in the outlet at their junction, when both are operating at design flow.

- Vertical spacing determined by the above methods may be increased as much as 0.5 feet or 10 percent, whichever is greater, to provide better alignment or location, to avoid obstacles, to adjust for equipment size, or to reach a satisfactory outlet. The drainage area above the terrace should not exceed the area that would be drained by a terrace with normal spacing.
- The terrace should have enough capacity to handle the peak runoff expected from a 2-year, 24-hour design storm without overtopping.
- The terrace cross-section should be proportioned to fit the land slope. The ridge height should include a reasonable settlement factor. The ridge should have a minimum top width of 3 feet at the design height. The minimum cross-sectional area of the terrace channel should be 8 square feet for land slopes of 5 percent or less, 7 square feet for slopes from 5 to 8 percent, and 6 square feet for slopes steeper than 8 percent. The terrace can be constructed wide enough to be maintained using a small vehicle.

Maintenance Standards

- Maintenance should be performed as needed. Terraces should be inspected regularly; at least once a year, and after large storm events.

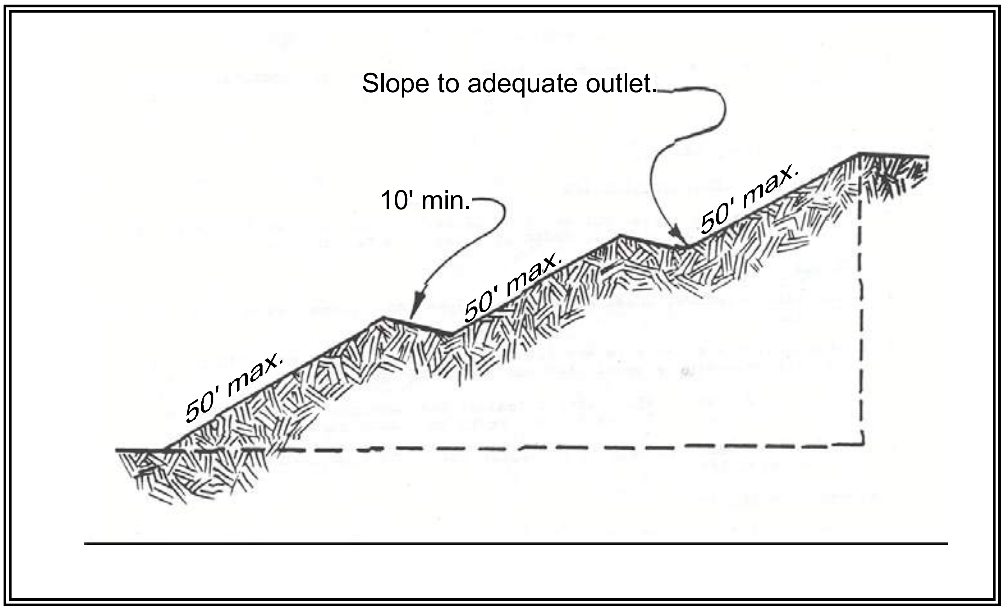


Figure 4.1.6 Gradient Terraces

BMP C140: Dust Control

Purpose

Dust control prevents wind transport of dust from disturbed soil surfaces onto roadways, drainage ways, and surface waters.

Conditions of Use

- In areas (including roadways) subject to surface and air movement of dust where on-site and off-site impacts to roadways, drainage ways, or surface waters are likely.

Design and Installation Specifications

- Vegetate or mulch areas that will not receive vehicle traffic. In areas where planting, mulching, or paving is impractical, apply gravel or landscaping rock.
- Limit dust generation by clearing only those areas where immediate activity will take place, leaving the remaining area(s) in the original condition. Maintain the original ground cover as long as practical.
- Construct natural or artificial windbreaks or windscreens. These may be designed as enclosures for small dust sources.
- Sprinkle the site with water until surface is wet. Repeat as needed. To prevent carryout of mud onto street, refer to Stabilized Construction Entrance (BMP C105).
- Irrigation water can be used for dust control. Irrigation systems should be installed as a first step on sites where dust control is a concern.
- Spray exposed soil areas with a dust palliative, following the manufacturer's instructions and cautions regarding handling and application. Used oil is prohibited from use as a dust suppressant. Local governments may approve other dust palliatives such as calcium chloride or PAM.
- PAM (BMP C126) added to water at a rate of 0.5 lbs. per 1,000 gallons of water per acre and applied from a water truck is more effective than water alone. This is due to increased infiltration of water into the soil and reduced evaporation. In addition, small soil particles are bonded together and are not as easily transported by wind. Adding PAM may actually reduce the quantity of water needed for dust control. Use of PAM could be a cost-effective dust control method.

Techniques that can be used for unpaved roads and lots include:

- Lower speed limits. High vehicle speed increases the amount of dust stirred up from unpaved roads and lots.
- Upgrade the road surface strength by improving particle size, shape, and mineral types that make up the surface and base materials.
- Add surface gravel to reduce the source of dust emission. Limit the amount of fine particles (those smaller than .075 mm) to 10 to 20 percent.

- Use geotextile fabrics to increase the strength of new roads or roads undergoing reconstruction.
- Encourage the use of alternate, paved routes, if available.
- Restrict use of paved roadways by tracked vehicles and heavy trucks to prevent damage to road surface and base.
- Apply chemical dust suppressants using the admix method, blending the product with the top few inches of surface material. Suppressants may also be applied as surface treatments.
- Pave unpaved permanent roads and other trafficked areas.
- Use vacuum street sweepers.
- Remove mud and other dirt promptly so it does not dry and then turn into dust.
- Limit dust-causing work on windy days.
- Contact your local Air Pollution Control Authority for guidance and training on other dust control measures. Compliance with the local Air Pollution Control Authority constitutes compliance with this BMP.

Maintenance Standards Respray area as necessary to keep dust to a minimum.

BMP C150: Materials on Hand

Purpose Keep quantities of erosion prevention and sediment control materials on the project site at all times to be used for regular maintenance and emergency situations such as unexpected heavy summer rains. Having these materials on-site reduces the time needed to implement BMPs when inspections indicate that existing BMPs are not meeting the Construction SWPPP requirements. In addition, contractors can save money by buying some materials in bulk and storing them at their office or yard.

Conditions of Use

- Construction projects of any size or type can benefit from having materials on hand. A small commercial development project could have a roll of plastic and some gravel available for immediate protection of bare soil and temporary berm construction. A large earthwork project, such as highway construction, might have several tons of straw, several rolls of plastic, flexible pipe, sandbags, geotextile fabric and steel “T” posts.
- Materials are stockpiled and readily available before any site clearing, grubbing, or earthwork begins. A large contractor or developer could keep a stockpile of materials that are available for use on several projects.
- If storage space at the project site is at a premium, the contractor could maintain the materials at their office or yard. The office or yard must be less than an hour from the project site.

Design and Installation Specifications

Depending on project type, size, complexity, and length, materials and quantities will vary. A good minimum list of items that will cover numerous situations includes:

Material
Clear Plastic, 6 mil
Drainpipe, 6 or 8 inch diameter
Sandbags, filled
Straw Bales for mulching,
Quarry Spalls
Washed Gravel
Geotextile Fabric
Catch Basin Inserts
Steel “T” Posts
Silt fence material
Straw Wattles

Maintenance Standards

- All materials with the exception of the quarry spalls, steel “T” posts, and gravel should be kept covered and out of both sun and rain.
- Re-stock materials used as needed.

BMP C151: Concrete Handling

Purpose

Concrete work can generate process water and slurry that contain fine particles and high pH, both of which can violate water quality standards in the receiving water. Concrete spillage or concrete discharge to surface waters of the State is prohibited. Use this BMP to minimize and eliminate concrete, concrete process water, and concrete slurry from entering waters of the state.

Conditions of Use

Any time concrete is used, utilize these management practices. Concrete construction projects include, but are not limited to, the following:

- Curbs
- Sidewalks
- Roads
- Bridges
- Foundations
- Floors
- Runways

Design and Installation

- Wash out concrete truck chutes, pumps, and internals into formed areas only. Assure that washout of concrete trucks is performed off-

BMP C160: Certified Erosion and Sediment Control Lead

Purpose

The project proponent designates at least one person as the responsible representative in charge of erosion and sediment control (ESC), and water quality protection. The designated person shall be the Certified Erosion and Sediment Control Lead (CESCL) who is responsible for ensuring compliance with all local, state, and federal erosion and sediment control and water quality requirements.

Conditions of Use

A CESCL shall be made available on projects one acre or larger that discharge stormwater to surface waters of the state. Sites less than one acre may have a person without CESCL certification conduct inspections; sampling is not required on sites that disturb less than an acre.

- The CESCL shall:
  - Have a current certificate proving attendance in an erosion and sediment control training course that meets the minimum ESC training and certification requirements established by Ecology (see details below).

    Ecology will maintain a list of ESC training and certification providers at: http://www.ecy.wa.gov/programs/wq/stormwater/cescl.html

    OR
  - Be a Certified Professional in Erosion and Sediment Control (CPESC); for additional information go to: www.cpesc.net

Specifications

- Certification shall remain valid for three years.
- The CESCL shall have authority to act on behalf of the contractor or developer and shall be available, or on-call, 24 hours per day throughout the period of construction.
- The Construction SWPPP shall include the name, telephone number, fax number, and address of the designated CESCL.
- A CESCL may provide inspection and compliance services for multiple construction projects in the same geographic region.

Duties and responsibilities of the CESCL shall include, but are not limited to the following:

- Maintaining permit file on site at all times which includes the Construction SWPPP and any associated permits and plans.
- Directing BMP installation, inspection, maintenance, modification, and removal.

- Updating all project drawings and the Construction SWPPP with changes made.
- Completing any sampling requirements including reporting results using WebDMR.
- Keeping daily logs, and inspection reports. Inspection reports should include:
    - Inspection date/time.
    - Weather information; general conditions during inspection and approximate amount of precipitation since the last inspection.
    - A summary or list of all BMPs implemented, including observations of all erosion/sediment control structures or practices. The following shall be noted:
        1. Locations of BMPs inspected.
        2. Locations of BMPs that need maintenance.
        3. Locations of BMPs that failed to operate as designed or intended.
        4. Locations of where additional or different BMPs are required.
        - Visual monitoring results, including a description of discharged stormwater. The presence of suspended sediment, turbid water, discoloration, and oil sheen shall be noted, as applicable.
        - Any water quality monitoring performed during inspection.
        - General comments and notes, including a brief description of any BMP repairs, maintenance or installations made as a result of the inspection.
- Facilitate, participate in, and take corrective actions resulting from inspections performed by outside agencies or the owner.

BMP C162: Scheduling

Purpose Sequencing a construction project reduces the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking.

Conditions of Use The construction sequence schedule is an orderly listing of all major land-disturbing activities together with the necessary erosion and sedimentation control measures planned for the project. This type of schedule guides the contractor on work to be done before other work is started so that serious erosion and sedimentation problems can be avoided.

Following a specified work schedule that coordinates the timing of land-disturbing activities and the installation of control measures is perhaps the most cost-effective way of controlling erosion during construction. The removal of surface ground cover leaves a site vulnerable to accelerated erosion. Construction procedures that limit land clearing provide timely installation of erosion and sedimentation controls, and restore protective cover quickly can significantly reduce the erosion potential of a site.

Design Considerations

- Minimize construction during rainy periods.
- Schedule projects to disturb only small portions of the site at any one time. Complete grading as soon as possible. Immediately stabilize the disturbed portion before grading the next portion. Practice staged seeding in order to revegetate cut and fill slopes as the work progresses.

BMP C200: Interceptor Dike and Swale

Purpose

Provide a ridge of compacted soil, or a ridge with an upslope swale, at the top or base of a disturbed slope or along the perimeter of a disturbed construction area to convey stormwater. Use the dike and/or swale to intercept the runoff from unprotected areas and direct it to areas where erosion can be controlled. This can prevent storm runoff from entering the work area or sediment-laden runoff from leaving the construction site.

Conditions of Use

Where the runoff from an exposed site or disturbed slope must be conveyed to an erosion control facility which can safely convey the stormwater.

- Locate upslope of a construction site to prevent runoff from entering disturbed area.
- When placed horizontally across a disturbed slope, it reduces the amount and velocity of runoff flowing down the slope.
- Locate downslope to collect runoff from a disturbed area and direct water to a sediment basin.

Design and Installation Specifications

- Dike and/or swale and channel must be stabilized with temporary or permanent vegetation or other channel protection during construction.
- Channel requires a positive grade for drainage; steeper grades require channel protection and check dams.
- Review construction for areas where overtopping may occur.
- Can be used at top of new fill before vegetation is established.
- May be used as a permanent diversion channel to carry the runoff.
- Sub-basin tributary area should be one acre or less.
- Design capacity for the peak flow from a 10-year, 24-hour storm, assuming a Type 1A rainfall distribution, for temporary facilities. Alternatively, use 1.6 times the 10-year, 1-hour flow indicated by an approved continuous runoff model. For facilities that will also serve on a permanent basis, consult the local government's drainage requirements.

Interceptor dikes shall meet the following criteria:

Top Width	2 feet minimum.
Height	1.5 feet minimum on berm.
Side Slope	2H:1V or flatter.
Grade	Depends on topography, however, dike system minimum is 0.5%, and maximum is 1%.
Compaction	Minimum of 90 percent ASTM D698 standard proctor.

Horizontal Spacing of Interceptor Dikes:

Average Slope	Slope Percent	Flowpath Length
20H:1V or less	3-5%	300 feet
(10 to 20)H:1V	5-10%	200 feet
(4 to 10)H:1V	10-25%	100 feet
(2 to 4)H:1V	25-50%	50 feet

Stabilization depends on velocity and reach

Slopes <5%	Seed and mulch applied within 5 days of dike construction (see BMP C121, Mulching).
Slopes 5 - 40%	Dependent on runoff velocities and dike materials. Stabilization should be done immediately using either sod or riprap or other measures to avoid erosion.

- The upslope side of the dike shall provide positive drainage to the dike outlet. No erosion shall occur at the outlet. Provide energy dissipation measures as necessary. Sediment-laden runoff must be released through a sediment trapping facility.
- Minimize construction traffic over temporary dikes. Use temporary cross culverts for channel crossing.

Interceptor swales shall meet the following criteria:

Bottom Width	2 feet minimum; the cross-section bottom shall be level.
Depth	1-foot minimum.
Side Slope	2H:1V or flatter.
Grade	Maximum 5 percent, with positive drainage to a suitable outlet (such as a sediment pond).
Stabilization	Seed as per BMP C120, *Temporary and Permanent Seeding*, or *BMP C202*, *Channel Lining*, 12 inches thick riprap pressed into the bank and extending at least 8 inches vertical from the bottom.

- Inspect diversion dikes and interceptor swales once a week and after every rainfall. Immediately remove sediment from the flow area.
- Damage caused by construction traffic or other activity must be repaired before the end of each working day.

Check outlets and make timely repairs as needed to avoid gully formation. When the area below the temporary diversion dike is permanently stabilized, remove the dike and fill and stabilize the channel to blend with the natural surface.

BMP C204: Pipe Slope Drains

Purpose To use a pipe to convey stormwater anytime water needs to be diverted away from or over bare soil to prevent gullies, channel erosion, and saturation of slide-prone soils.

Conditions of Use Pipe slope drains should be used when a temporary or permanent stormwater conveyance is needed to move the water down a steep slope to avoid erosion (Figure 4.2.4).

On highway projects, pipe slope drains should be used at bridge ends to collect runoff and pipe it to the base of the fill slopes along bridge approaches. These can be designed into a project and included as bid items. Another use on road projects is to collect runoff from pavement and pipe it away from side slopes. These are useful because there is generally a time lag between having the first lift of asphalt installed and the curbs, gutters, and permanent drainage installed. Used in conjunction with sand bags, or other temporary diversion devices, these will prevent massive amounts of sediment from leaving a project.

Water can be collected, channeled with sand bags, Triangular Silt Dikes, berms, or other material, and piped to temporary sediment ponds.

Pipe slope drains can be:

- Connected to new catch basins and used temporarily until all permanent piping is installed;
- Used to drain water collected from aquifers exposed on cut slopes and take it to the base of the slope;
- Used to collect clean runoff from plastic sheeting and direct it away from exposed soil;
- Installed in conjunction with silt fence to drain collected water to a controlled area;
- Used to divert small seasonal streams away from construction. They have been used successfully on culvert replacement and extension jobs. Large flex pipe can be used on larger streams during culvert removal, repair, or replacement; and,
- Connected to existing down spouts and roof drains and used to divert water away from work areas during building renovation, demolition, and construction projects.

There are now several commercially available collectors that are attached to the pipe inlet and help prevent erosion at the inlet.

Design and Installation Specifications

Size the pipe to convey the flow. The capacity for temporary drains shall be sufficient to handle the peak flow from a 10-year, 24-hour storm event, assuming a Type 1A rainfall distribution. Alternatively, use 1.6 times the 10-year, 1-hour flow indicated by an approved continuous runoff model.

Consult local drainage requirements for sizing permanent pipe slope drains.

- Use care in clearing vegetated slopes for installation.
- Re-establish cover immediately on areas disturbed by installation.
- Use temporary drains on new cut or fill slopes.
- Use diversion dikes or swales to collect water at the top of the slope.
- Ensure that the entrance area is stable and large enough to direct flow into the pipe.
- Piping of water through the berm at the entrance area is a common failure mode.
- The entrance shall consist of a standard flared end section for culverts 12 inches and larger with a minimum 6-inch metal toe plate to prevent runoff from undercutting the pipe inlet. The slope of the entrance shall be at least 3 percent. Sand bags may also be used at pipe entrances as a temporary measure.
- The soil around and under the pipe and entrance section shall be thoroughly compacted to prevent undercutting.
- The flared inlet section shall be securely connected to the slope drain and have watertight connecting bands.
- Slope drain sections shall be securely fastened together, fused or have gasketed watertight fittings, and shall be securely anchored into the soil.
- Thrust blocks should be installed anytime 90 degree bends are utilized. Depending on size of pipe and flow, these can be constructed with sand bags, straw bales staked in place, “t” posts and wire, or ecology blocks.
- Pipe needs to be secured along its full length to prevent movement. This can be done with steel “t” posts and wire. A post is installed on each side of the pipe and the pipe is wired to them. This should be done every 10-20 feet of pipe length or so, depending on the size of the pipe and quantity of water to divert.
- Interceptor dikes shall be used to direct runoff into a slope drain. The height of the dike shall be at least 1 foot higher at all points than the top of the inlet pipe.
- The area below the outlet must be stabilized with a riprap apron (see BMP C209 Outlet Protection, for the appropriate outlet material).

- If the pipe slope drain is conveying sediment-laden water, direct all flows into the sediment trapping facility.
- Materials specifications for any permanent piped system shall be set by the local government.

Maintenance Standards

Check inlet and outlet points regularly, especially after storms.

The inlet should be free of undercutting, and no water should be going around the point of entry. If there are problems, the headwall should be reinforced with compacted earth or sand bags.

- The outlet point should be free of erosion and installed with appropriate outlet protection.
- For permanent installations, inspect pipe periodically for vandalism and physical distress such as slides and wind-throw.
- Normally the pipe slope is so steep that clogging is not a problem with smooth wall pipe, however, debris may become lodged in the pipe.

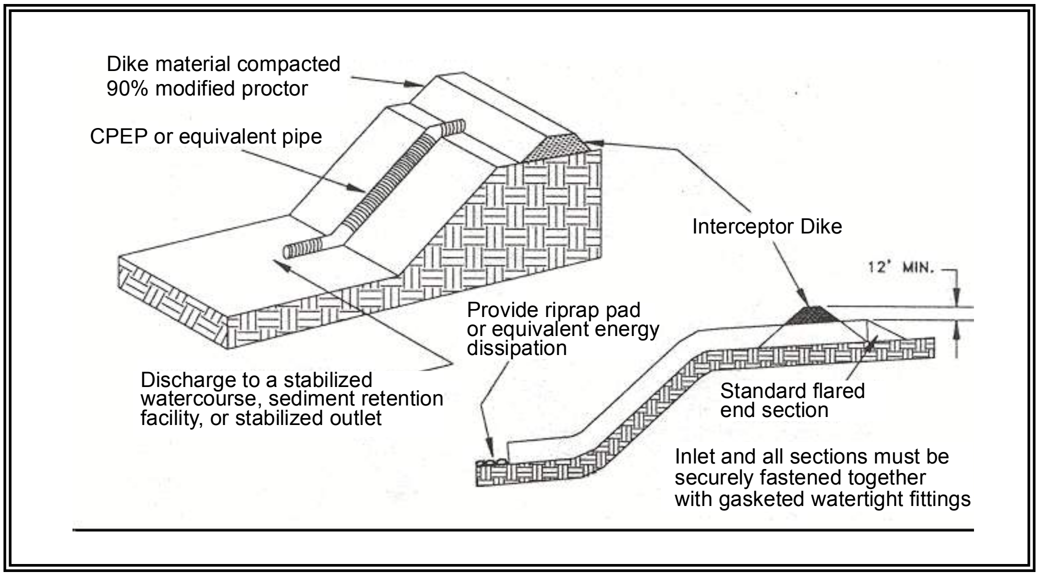


Figure 4.2.4 Pipe Slope Drain

BMP C208: Triangular Silt Dike (TSD) (Geotextile-Encased Check Dam)

Purpose

Triangular silt dikes may be used as check dams, for perimeter protection, for temporary soil stockpile protection, for drop inlet protection, or as a temporary interceptor dike.

Conditions of use

- May be used on soil or pavement with adhesive or staples.
- TSDs have been used to build temporary:
    1. sediment ponds;
    2. diversion ditches;
    3. concrete wash out facilities;
    4. curbing;
    5. water bars;
    6. level spreaders; and,
    7. berms.

Design and Installation Specifications

Made of urethane foam sewn into a woven geosynthetic fabric.

It is triangular, 10 inches to 14 inches high in the center, with a 20-inch to 28-inch base. A 2–foot apron extends beyond both sides of the triangle along its standard section of 7 feet. A sleeve at one end allows attachment of additional sections as needed.

- Install with ends curved up to prevent water from flowing around the ends.
- The fabric flaps and check dam units are attached to the ground with wire staples. Wire staples should be No. 11 gauge wire and should be 200 mm to 300 mm in length.
- When multiple units are installed, the sleeve of fabric at the end of the unit shall overlap the abutting unit and be stapled.
- Check dams should be located and installed as soon as construction will allow.
- Check dams should be placed perpendicular to the flow of water.
- When used as check dams, the leading edge must be secured with rocks, sandbags, or a small key slot and staples.
- In the case of grass-lined ditches and swales, check dams and accumulated sediment shall be removed when the grass has matured sufficiently to protect the ditch or swale unless the slope of the swale is greater than 4 percent. The area beneath the check dams shall be seeded and mulched immediately after dam removal.

Maintenance

- Triangular silt dams shall be inspected for performance and sediment

Standards

accumulation during and after each runoff producing rainfall. Sediment shall be removed when it reaches one half the height of the dam.

- Anticipate submergence and deposition above the triangular silt dam and erosion from high flows around the edges of the dam. Immediately repair any damage or any undercutting of the dam.

BMP C209: Outlet Protection

Purpose

Outlet protection prevents scour at conveyance outlets and minimizes the potential for downstream erosion by reducing the velocity of concentrated stormwater flows.

Conditions of use

Outlet protection is required at the outlets of all ponds, pipes, ditches, or other conveyances, and where runoff is conveyed to a natural or manmade drainage feature such as a stream, wetland, lake, or ditch.

Design and Installation Specifications

The receiving channel at the outlet of a culvert shall be protected from erosion by rock lining a minimum of 6 feet downstream and extending up the channel sides a minimum of 1–foot above the maximum tailwater elevation or 1-foot above the crown, whichever is higher. For large pipes (more than 18 inches in diameter), the outlet protection lining of the channel is lengthened to four times the diameter of the culvert.

- Standard wingwalls, and tapered outlets and paved channels should also be considered when appropriate for permanent culvert outlet protection. (See WSDOT Hydraulic Manual, available through WSDOT Engineering Publications).
- Organic or synthetic erosion blankets, with or without vegetation, are usually more effective than rock, cheaper, and easier to install. Materials can be chosen using manufacturer product specifications. ASTM test results are available for most products and the designer can choose the correct material for the expected flow.
- With low flows, vegetation (including sod) can be effective.
- The following guidelines shall be used for riprap outlet protection:
  1. If the discharge velocity at the outlet is less than 5 fps (pipe slope less than 1 percent), use 2-inch to 8-inch riprap. Minimum thickness is 1-foot.
  2. For 5 to 10 fps discharge velocity at the outlet (pipe slope less than 3 percent), use 24-inch to 48-inch riprap. Minimum thickness is 2 feet.
  3. For outlets at the base of steep slope pipes (pipe slope greater than 10 percent), an engineered energy dissipater shall be used.
- Filter fabric or erosion control blankets should always be used under riprap to prevent scour and channel erosion.

- New pipe outfalls can provide an opportunity for low-cost fish habitat improvements. For example, an alcove of low-velocity water can be created by constructing the pipe outfall and associated energy dissipater back from the stream edge and digging a channel, over-widened to the upstream side, from the outfall. Overwintering juvenile and migrating adult salmonids may use the alcove as shelter during high flows. Bank stabilization, bioengineering, and habitat features may be required for disturbed areas. This work may require a HPA. See Volume V for more information on outfall system design.

Maintenance Standards

- Inspect and repair as needed.
- Add rock as needed to maintain the intended function.
- Clean energy dissipater if sediment builds up.

BMP C220: Storm Drain Inlet Protection

Purpose

Storm drain inlet protection prevents coarse sediment from entering drainage systems prior to permanent stabilization of the disturbed area.

Conditions of Use

Use storm drain inlet protection at inlets that are operational before permanent stabilization of the disturbed drainage area. Provide protection for all storm drain inlets downslope and within 500 feet of a disturbed or construction area, unless conveying runoff entering catch basins to a sediment pond or trap.

Also consider inlet protection for lawn and yard drains on new home construction. These small and numerous drains coupled with lack of gutters in new home construction can add significant amounts of sediment into the roof drain system. If possible delay installing lawn and yard drains until just before landscaping or cap these drains to prevent sediment from entering the system until completion of landscaping. Provide 18-inches of sod around each finished lawn and yard drain.

Table 4.2.2 lists several options for inlet protection. All of the methods for storm drain inlet protection tend to plug and require a high frequency of maintenance. Limit drainage areas to one acre or less. Possibly provide emergency overflows with additional end-of-pipe treatment where stormwater ponding would cause a hazard.

Type of Inlet Protection	Emergency Overflow	Applicable for Paved/ Earthen Surfaces	Conditions of Use
Table 4.2.2 **Storm Drain Inlet Protection**			
Drop Inlet Protection			
Excavated drop inlet protection	Yes, temporary flooding will occur	Earthen	Applicable for heavy flows. Easy to maintain. Large area Requirement: 30' X 30'/acre
Block and gravel drop inlet protection	Yes	Paved or Earthen	Applicable for heavy concentrated flows. Will not pond.
Gravel and wire drop inlet protection	No		Applicable for heavy concentrated flows. Will pond. Can withstand traffic.
Catch basin filters	Yes	Paved or Earthen	Frequent maintenance required.
Curb Inlet Protection			
Curb inlet protection with a wooden weir	Small capacity overflow	Paved	Used for sturdy, more compact installation.
Block and gravel curb inlet protection	Yes	Paved	Sturdy, but limited filtration.
Culvert Inlet Protection			
Culvert inlet sediment trap			18 month expected life.

Design and Installation Specifications

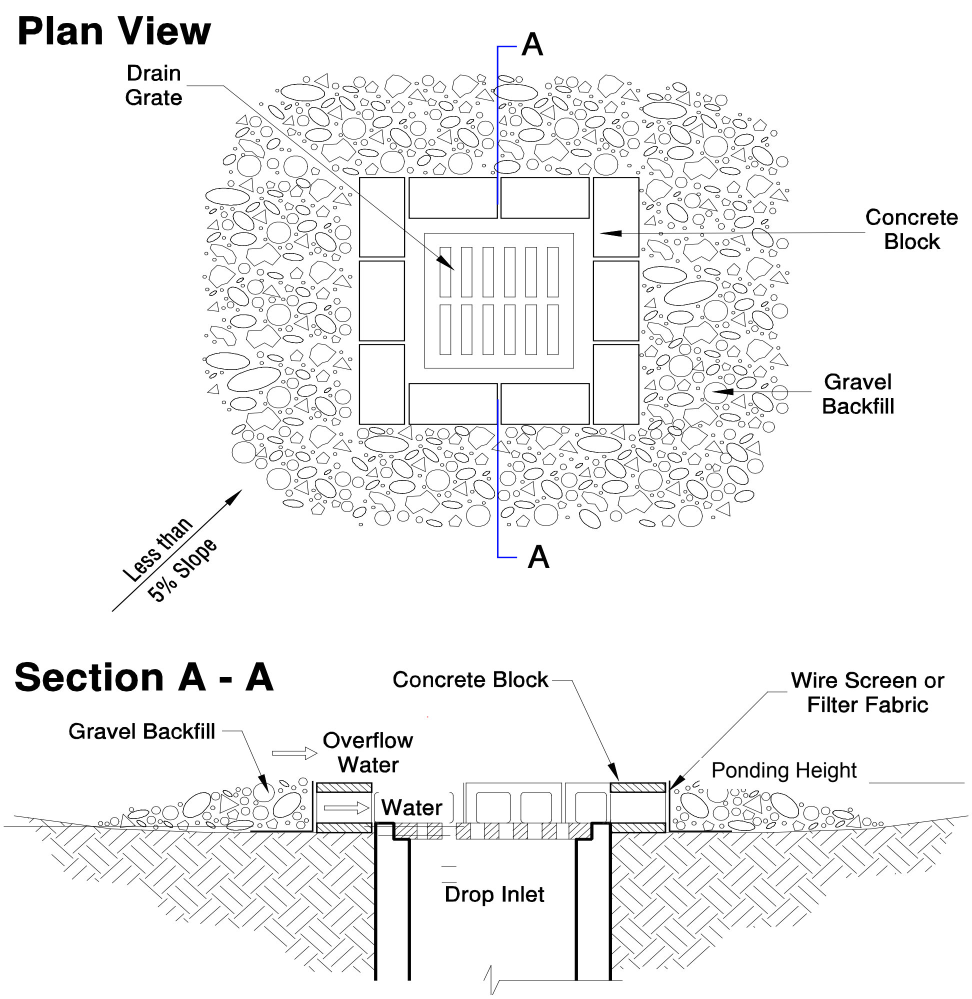
Excavated Drop Inlet Protection - An excavated impoundment around the storm drain. Sediment settles out of the stormwater prior to entering the storm drain.

- Provide a depth of 1-2 ft as measured from the crest of the inlet structure.
- Slope sides of excavation no steeper than 2H:1V.
- Minimum volume of excavation 35 cubic yards.
- Shape basin to fit site with longest dimension oriented toward the longest inflow area.
- Install provisions for draining to prevent standing water problems.
- Clear the area of all debris.
- Grade the approach to the inlet uniformly.
- Drill weep holes into the side of the inlet.
- Protect weep holes with screen wire and washed aggregate.
- Seal weep holes when removing structure and stabilizing area.

- Build a temporary dike, if necessary, to the down slope side of the structure to prevent bypass flow.

Block and Gravel Filter - A barrier formed around the storm drain inlet with standard concrete blocks and gravel. See Figure 4.2.8.

- Provide a height of 1 to 2 feet above inlet.
- Recess the first row 2-inches into the ground for stability.
- Support subsequent courses by placing a 2x4 through the block opening.
- Do not use mortar.
- Lay some blocks in the bottom row on their side for dewatering the pool.
- Place hardware cloth or comparable wire mesh with ½-inch openings over all block openings.
- Place gravel just below the top of blocks on slopes of 2H:1V or flatter.
- An alternative design is a gravel donut.
- Provide an inlet slope of 3H:1V.
- Provide an outlet slope of 2H:1V.
- Provide a1-foot wide level stone area between the structure and the inlet.
- Use inlet slope stones 3 inches in diameter or larger.
- Use gravel ½- to ¾-inch at a minimum thickness of 1-foot for the outlet slope.



Notes:
1. Drop inlet sediment barriers are to be used for small, nearly level drainage areas. (less than 5%)
2. Excavate a basin of sufficient size adjacent to the drop inlet.
3. The top of the structure (ponding height) must be well below the ground elevation downslope to prevent runoff from bypassing the inlet. A temporary dike may be necessary on the downslope side of the structure.

Figure 4.2.8 Block and Gravel Filter

Gravel and Wire Mesh Filter - A gravel barrier placed over the top of the inlet. This structure does not provide an overflow.

- Use a hardware cloth or comparable wire mesh with ½-inch openings.
- Use coarse aggregate.
- Provide a height 1-foot or more, 18-inches wider than inlet on all sides.
- Place wire mesh over the drop inlet so that the wire extends a minimum of 1-foot beyond each side of the inlet structure.
- Overlap the strips if more than one strip of mesh is necessary.

- Place coarse aggregate over the wire mesh.
- Provide at least a 12-inch depth of gravel over the entire inlet opening and extend at least 18-inches on all sides.

Catchbasin Filters – Use inserts designed by manufacturers for construction sites. The limited sediment storage capacity increases the amount of inspection and maintenance required, which may be daily for heavy sediment loads. To reduce maintenance requirements combine a catchbasin filter with another type of inlet protection. This type of inlet protection provides flow bypass without overflow and therefore may be a better method for inlets located along active rights-of-way.

- Provides 5 cubic feet of storage.
- Requires dewatering provisions.
- Provides a high-flow bypass that will not clog under normal use at a construction site.
- Insert the catchbasin filter in the catchbasin just below the grating.

Curb Inlet Protection with Wooden Weir – Barrier formed around a curb inlet with a wooden frame and gravel.

- Use wire mesh with ½-inch openings.
- Use extra strength filter cloth.
- Construct a frame.
- Attach the wire and filter fabric to the frame.
- Pile coarse washed aggregate against wire/fabric.
- Place weight on frame anchors.

Block and Gravel Curb Inlet Protection – Barrier formed around a curb inlet with concrete blocks and gravel. See Figure 4.2.9.

- Use wire mesh with ½-inch openings.
- Place two concrete blocks on their sides abutting the curb at either side of the inlet opening. These are spacer blocks.
- Place a 2x4 stud through the outer holes of each spacer block to align the front blocks.
- Place blocks on their sides across the front of the inlet and abutting the spacer blocks.
- Place wire mesh over the outside vertical face.
- Pile coarse aggregate against the wire to the top of the barrier.

Curb and Gutter Sediment Barrier – Sandbag or rock berm (riprap and aggregate) 3 feet high and 3 feet wide in a horseshoe shape. See Figure 4.2.10.

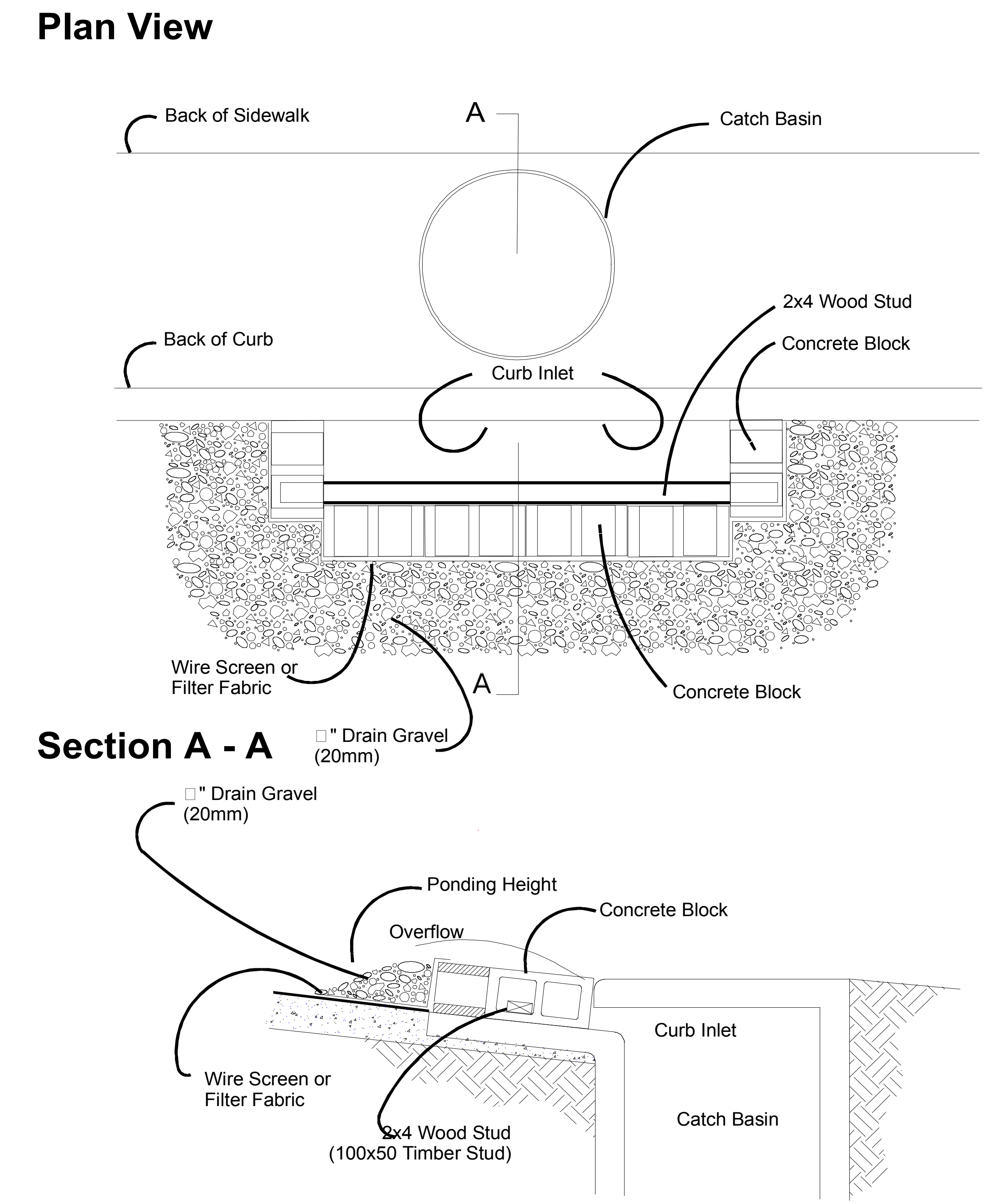
- Construct a horseshoe shaped berm, faced with coarse aggregate if using riprap, 3 feet high and 3 feet wide, at least 2 feet from the inlet.
- Construct a horseshoe shaped sedimentation trap on the outside of the berm sized to sediment trap standards for protecting a culvert inlet.

Maintenance Standards

- Inspect catch basin filters frequently, especially after storm events. Clean and replace clogged inserts. For systems with clogged stone filters: pull away the stones from the inlet and clean or replace. An alternative approach would be to use the clogged stone as fill and put fresh stone around the inlet.
- Do not wash sediment into storm drains while cleaning. Spread all excavated material evenly over the surrounding land area or stockpile and stabilize as appropriate.

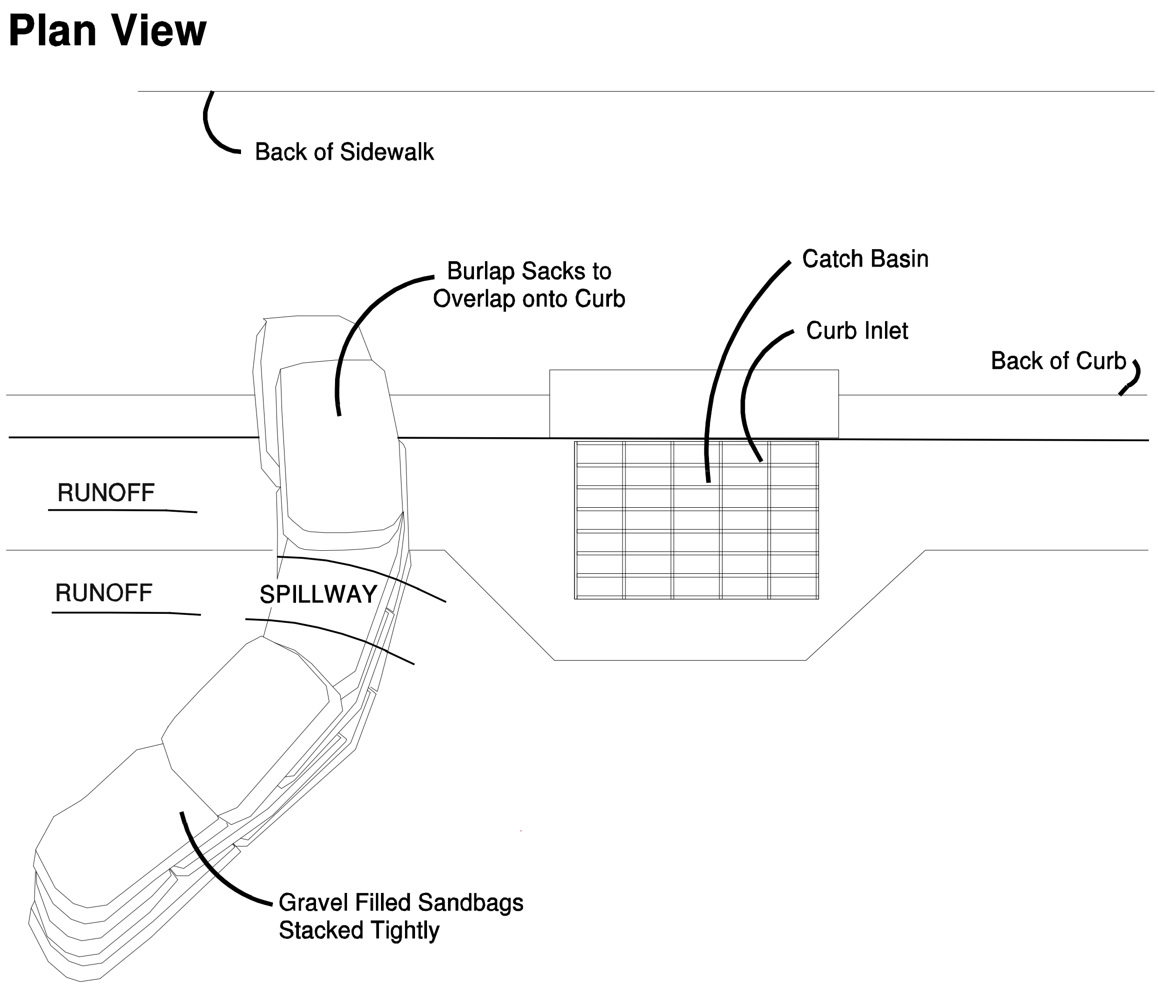
Approved as Equivalent

Ecology has approved products as able to meet the requirements of BMP C220. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept this product approved as equivalent, or may require additional testing prior to consideration for local use. The products are available for review on Ecology's website at http://www.ecy.wa.gov/programs/wq/stormwater/newtech/equivalent.html



NOTES:
1. Use block and gravel type sediment barrier when curb inlet is located in gently sloping street segment, where water can pond and allow sediment to separate from runoff.
2. Barrier shall allow for overflow from severe storm event.
3. Inspect barriers and remove sediment after each storm event. Sediment and gravel must be removed from the traveled way immediately.

Figure 4.2.9 □Block and Gravel Curb Inlet Protection



NOTES:
1. Place curb type sediment barriers on gently sloping street segments, where water can pond and allow sediment to separate from runoff.
2. Sandbags of either burlap or woven `geotextile' fabric, are filled with gravel, layered and packed tightly.
3. Leave a one sandbag gap in the top row to provide a spillway for overflow.
4. Inspect barriers and remove sediment after each storm event. Sediment and gravel must be removed from the traveled way immediately.

Figure 4.2.10 Curb and Gutter Barrier

BMP C231: Brush Barrier

Purpose

The purpose of brush barriers is to reduce the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

Conditions of Use

- Brush barriers may be used downslope of all disturbed areas of less than one-quarter acre.
- Brush barriers are not intended to treat concentrated flows, nor are they intended to treat substantial amounts of overland flow. Any concentrated flows must be conveyed through the drainage system to a sediment pond. The only circumstance in which overland flow can be treated solely by a brush barrier, rather than by a sediment pond, is when the area draining to the barrier is small.
- Brush barriers should only be installed on contours.

Design and Installation Specifications

- Height 2 feet (minimum) to 5 feet (maximum).
- Width 5 feet at base (minimum) to 15 feet (maximum).
- Filter fabric (geotextile) may be anchored over the brush berm to enhance the filtration ability of the barrier. Ten-ounce burlap is an adequate alternative to filter fabric.
- Chipped site vegetation, composted mulch, or wood-based mulch (hog fuel) can be used to construct brush barriers.
- A 100 percent biodegradable installation can be constructed using 10-ounce burlap held in place by wooden stakes. Figure 4.2.11 depicts a typical brush barrier.

Maintenance Standards

- There shall be no signs of erosion or concentrated runoff under or around the barrier. If concentrated flows are bypassing the barrier, it must be expanded or augmented by toed-in filter fabric.
- The dimensions of the barrier must be maintained.

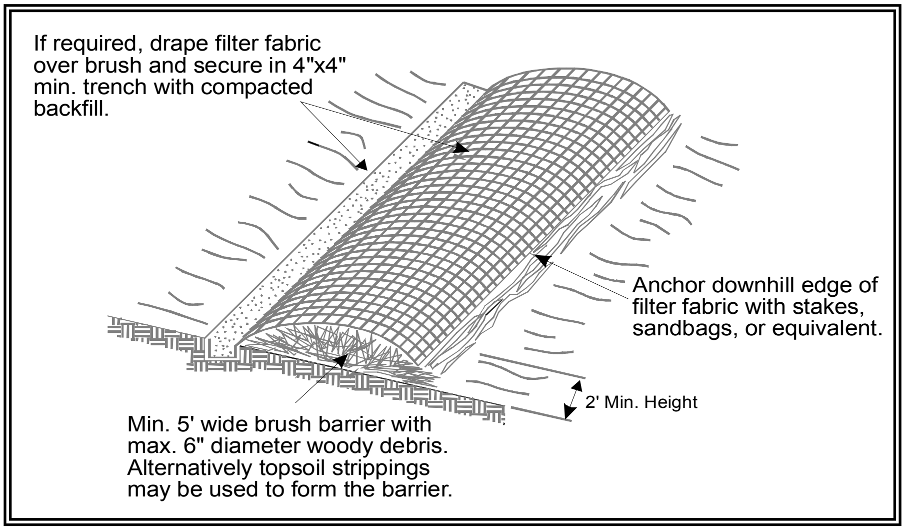


Figure 4.2.11 Brush Barrier

BMP C232: Gravel Filter Berm

Purpose

A gravel filter berm is constructed on rights-of-way or traffic areas within a construction site to retain sediment by using a filter berm of gravel or crushed rock.

Conditions of Use

Where a temporary measure is needed to retain sediment from rights-of-way or in traffic areas on construction sites.

Design and Installation Specifications

- Berm material shall be ¾ to 3 inches in size, washed well-grade gravel or crushed rock with less than 5 percent fines.
- Spacing of berms:
  - Every 300 feet on slopes less than 5 percent
  - Every 200 feet on slopes between 5 percent and 10 percent
  - Every 100 feet on slopes greater than 10 percent
- Berm dimensions:
  - 1 foot high with 3H:1V side slopes
  - 8 linear feet per 1 cfs runoff based on the 10-year, 24-hour design storm

Maintenance Standards

- Regular inspection is required. Sediment shall be removed and filter material replaced as needed.

BMP C233: Silt Fence

Purpose

Use of a silt fence reduces the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow. See Figure 4.2.12 for details on silt fence construction.

Conditions of Use

Silt fence may be used downslope of all disturbed areas.

- Silt fence shall prevent soil carried by runoff water from going beneath, through, or over the top of the silt fence, but shall allow the water to pass through the fence.
- Silt fence is not intended to treat concentrated flows, nor is it intended to treat substantial amounts of overland flow. Convey any concentrated flows through the drainage system to a sediment pond.
- Do not construct silt fences in streams or use in V-shaped ditches. Silt fences do not provide an adequate method of silt control for anything deeper than sheet or overland flow.

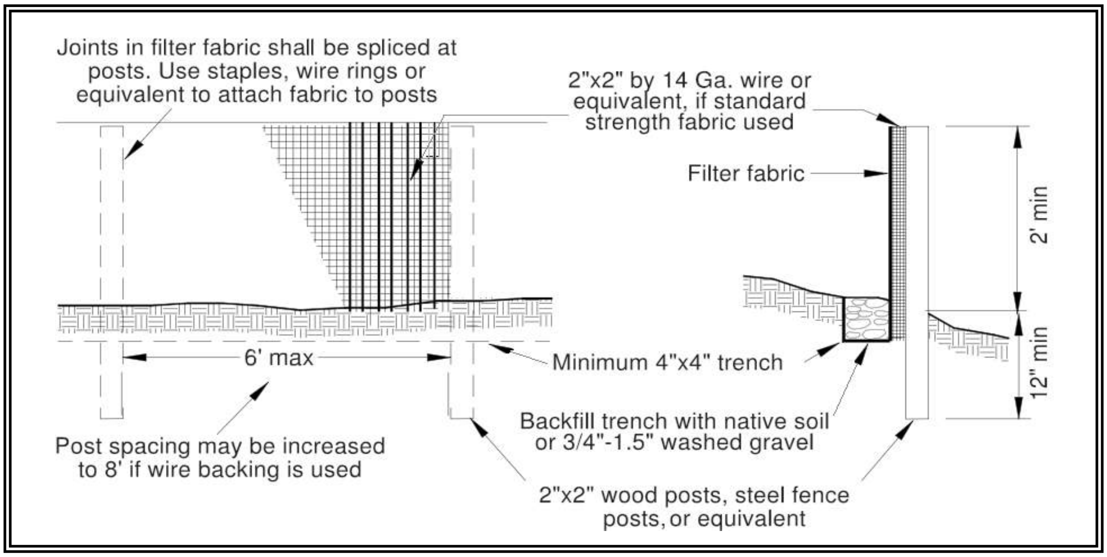


Figure 4.2.12 Silt Fence

Design and Installation Specifications

- Use in combination with sediment basins or other BMPs.
- Maximum slope steepness (normal (perpendicular) to fence line) 1H:1V.
- Maximum sheet or overland flow path length to the fence of 100 feet.
- Do not allow flows greater than 0.5 cfs.
- The geotextile used shall meet the following standards. All geotextile properties listed below are minimum average roll values (i.e., the test result for any sampled roll in a lot shall meet or exceed the values shown in Table 4.2.3):

Table 4.2.3
Geotextile Standards

Polymeric Mesh AOS (ASTM D4751)	0.60 mm maximum for slit film woven (#30 sieve). 0.30 mm maximum for all other geotextile types (#50 sieve). 0.15 mm minimum for all fabric types (#100 sieve).
Water Permittivity (ASTM D4491)	0.02 sec^{-1} minimum
Grab Tensile Strength (ASTM D4632)	180 lbs. Minimum for extra strength fabric. 100 lbs minimum for standard strength fabric.
Grab Tensile Strength (ASTM D4632)	30% maximum
Ultraviolet Resistance (ASTM D4355)	70% minimum

- Support standard strength fabrics with wire mesh, chicken wire, 2-inch x 2-inch wire, safety fence, or jute mesh to increase the strength of the fabric. Silt fence materials are available that have synthetic mesh backing attached.

- Filter fabric material shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0°F. to 120°F.
- One-hundred percent biodegradable silt fence is available that is strong, long lasting, and can be left in place after the project is completed, if permitted by local regulations.
- Refer to Figure 4.2.12 for standard silt fence details. Include the following standard Notes for silt fence on construction plans and specifications:
  1. The contractor shall install and maintain temporary silt fences at the locations shown in the Plans.
  2. Construct silt fences in areas of clearing, grading, or drainage prior to starting those activities.
  3. The silt fence shall have a 2-feet min. and a 2½-feet max. height above the original ground surface.
  4. The filter fabric shall be sewn together at the point of manufacture to form filter fabric lengths as required. Locate all sewn seams at support posts. Alternatively, two sections of silt fence can be overlapped, provided the Contractor can demonstrate, to the satisfaction of the Engineer, that the overlap is long enough and that the adjacent fence sections are close enough together to prevent silt laden water from escaping through the fence at the overlap.
  5. Attach the filter fabric on the up-slope side of the posts and secure with staples, wire, or in accordance with the manufacturer's recommendations. Attach the filter fabric to the posts in a manner that reduces the potential for tearing.
  6. Support the filter fabric with wire or plastic mesh, dependent on the properties of the geotextile selected for use. If wire or plastic mesh is used, fasten the mesh securely to the up-slope side of the posts with the filter fabric up-slope of the mesh.
  7. Mesh support, if used, shall consist of steel wire with a maximum mesh spacing of 2-inches, or a prefabricated polymeric mesh. The strength of the wire or polymeric mesh shall be equivalent to or greater than 180 lbs. grab tensile strength. The polymeric mesh must be as resistant to the same level of ultraviolet radiation as the filter fabric it supports.
  8. Bury the bottom of the filter fabric 4-inches min. below the ground surface. Backfill and tamp soil in place over the buried portion of the filter fabric, so that no flow can pass beneath the fence and

scouring cannot occur. When wire or polymeric back-up support mesh is used, the wire or polymeric mesh shall extend into the ground 3-inches min.

9. Drive or place the fence posts into the ground 18-inches min. A 12–inch min. depth is allowed if topsoil or other soft subgrade soil is not present and 18-inches cannot be reached. Increase fence post min. depths by 6 inches if the fence is located on slopes of 3H:1V or steeper and the slope is perpendicular to the fence. If required post depths cannot be obtained, the posts shall be adequately secured by bracing or guying to prevent overturning of the fence due to sediment loading.

10. Use wood, steel or equivalent posts. The spacing of the support posts shall be a maximum of 6-feet. Posts shall consist of either:

    - Wood with dimensions of 2-inches by 2-inches wide min. and a 3-feet min. length. Wood posts shall be free of defects such as knots, splits, or gouges.
    - No. 6 steel rebar or larger.
    - ASTM A 120 steel pipe with a minimum diameter of 1-inch.
    - U, T, L, or C shape steel posts with a minimum weight of 1.35 lbs./ft.
    - Other steel posts having equivalent strength and bending resistance to the post sizes listed above.

11. Locate silt fences on contour as much as possible, except at the ends of the fence, where the fence shall be turned uphill such that the silt fence captures the runoff water and prevents water from flowing around the end of the fence.

12. If the fence must cross contours, with the exception of the ends of the fence, place gravel check dams perpendicular to the back of the fence to minimize concentrated flow and erosion. The slope of the fence line where contours must be crossed shall not be steeper than 3H:1V.

    - Gravel check dams shall be approximately 1-foot deep at the back of the fence. Gravel check dams shall be continued perpendicular to the fence at the same elevation until the top of the check dam intercepts the ground surface behind the fence.
    - Gravel check dams shall consist of crushed surfacing base course, gravel backfill for walls, or shoulder ballast. Gravel check dams shall be located every 10 feet along the fence where the fence must cross contours.

- Refer to Figure 4.2.13 for slicing method details. Silt fence installation using the slicing method specifications:

1. The base of both end posts must be at least 2- to 4-inches above the top of the filter fabric on the middle posts for ditch checks to drain properly. Use a hand level or string level, if necessary, to mark base points before installation.
2. Install posts 3- to 4-feet apart in critical retention areas and 6- to 7-feet apart in standard applications.
3. Install posts 24-inches deep on the downstream side of the silt fence, and as close as possible to the filter fabric, enabling posts to support the filter fabric from upstream water pressure.
4. Install posts with the nipples facing away from the filter fabric.
5. Attach the filter fabric to each post with three ties, all spaced within the top 8-inches of the filter fabric. Attach each tie diagonally 45 degrees through the filter fabric, with each puncture at least 1-inch vertically apart. Each tie should be positioned to hang on a post nipple when tightening to prevent sagging.
6. Wrap approximately 6-inches of fabric around the end posts and secure with 3 ties.
7. No more than 24-inches of a 36-inch filter fabric is allowed above ground level.

   Compact the soil immediately next to the filter fabric with the front wheel of the tractor, skid steer, or roller exerting at least 60 pounds per square inch. Compact the upstream side first and then each side twice for a total of four trips. Check and correct the silt fence installation for any deviation before compaction. Use a flat-bladed shovel to tuck fabric deeper into the ground if necessary.

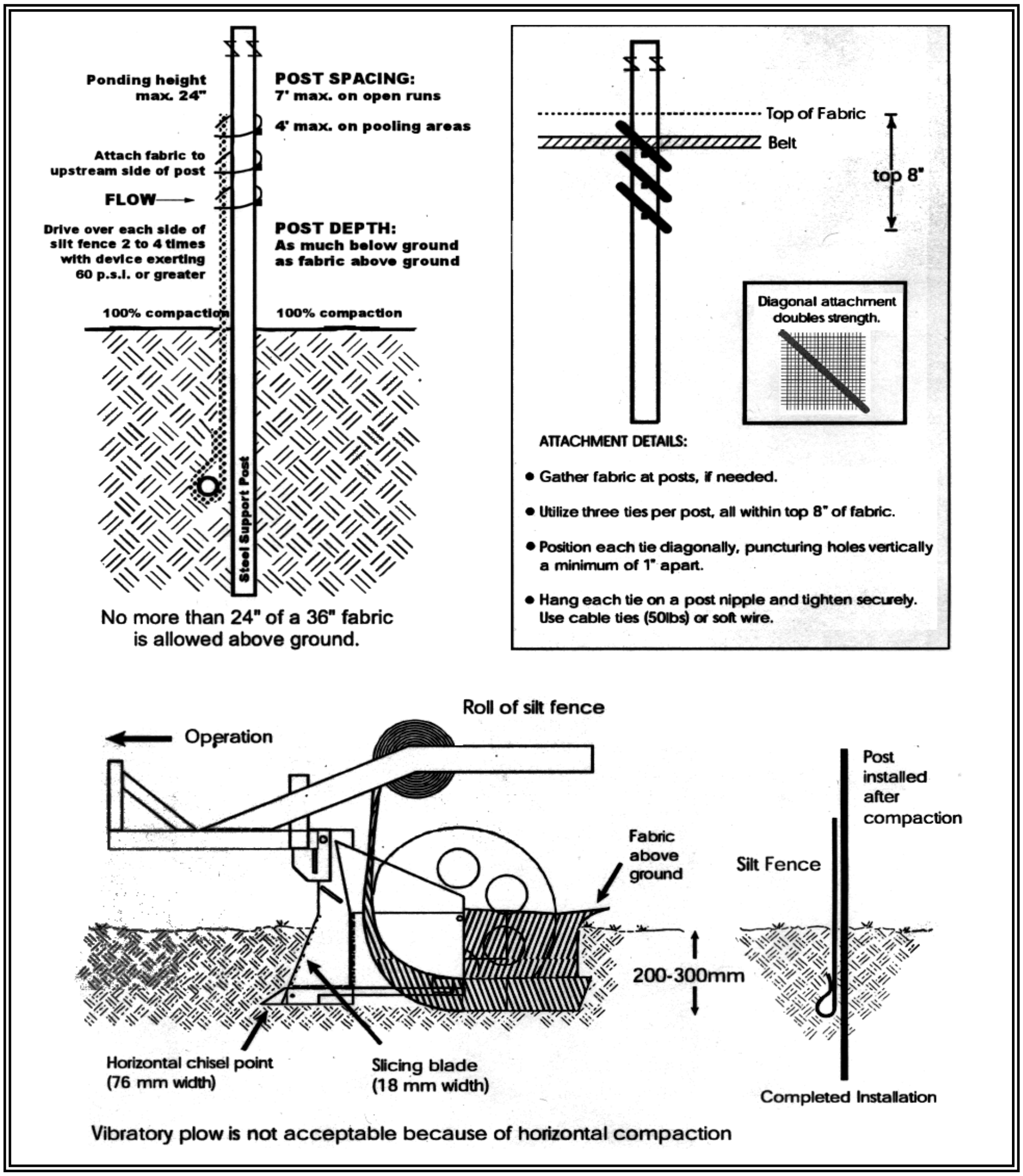


Figure 4.2.13 Silt Fence Installation by Slicing Method

Maintenance Standards

- Repair any damage immediately.
- Intercept and convey all evident concentrated flows uphill of the silt fence to a sediment pond.
- Check the uphill side of the fence for signs of the fence clogging and acting as a barrier to flow and then causing channelization of flows parallel to the fence. If this occurs, replace the fence or remove the trapped sediment.

- Remove sediment deposits when the deposit reaches approximately one-third the height of the silt fence, or install a second silt fence.
- Replace filter fabric that has deteriorated due to ultraviolet breakdown.

BMP C234: Vegetated Strip

Purpose

Vegetated strips reduce the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

Conditions of Use

- Vegetated strips may be used downslope of all disturbed areas.
- Vegetated strips are not intended to treat concentrated flows, nor are they intended to treat substantial amounts of overland flow. Any concentrated flows must be conveyed through the drainage system to a sediment pond. The only circumstance in which overland flow can be treated solely by a strip, rather than by a sediment pond, is when the following criteria are met (see Table 4.2.4):

Table 4.2.4
Contributing Drainage Area for Vegetated Strips

Average Contributing area Slope	Average Contributing area Percent Slope	Max Contributing area Flowpath Length
1.5H:1V or flatter	67% or flatter	100 feet
2H:1V or flatter	50% or flatter	115 feet
4H:1V or flatter	25% or flatter	150 feet
6H:1V or flatter	16.7% or flatter	200 feet
10H:1V or flatter	10% or flatter	250 feet

Design and Installation Specifications

- The vegetated strip shall consist of a minimum of a 25-foot flowpath length continuous strip of dense vegetation with topsoil. Grass-covered, landscaped areas are generally not adequate because the volume of sediment overwhelms the grass. Ideally, vegetated strips shall consist of undisturbed native growth with a well-developed soil that allows for infiltration of runoff.
- The slope within the strip shall not exceed 4H:1V.
- The uphill boundary of the vegetated strip shall be delineated with clearing limits.

Maintenance Standards

- Any areas damaged by erosion or construction activity shall be seeded immediately and protected by mulch.
- If more than 5 feet of the original vegetated strip width has had vegetation removed or is being eroded, sod must be installed.
- If there are indications that concentrated flows are traveling across the buffer, surface water controls must be installed to reduce the flows

entering the buffer, or additional perimeter protection must be installed.

BMP C235: Wattles

Purpose

Wattles are temporary erosion and sediment control barriers consisting of straw, compost, or other material that is wrapped in biodegradable tubular plastic or similar encasing material. They reduce the velocity and can spread the flow of rill and sheet runoff, and can capture and retain sediment. Wattles are typically 8 to 10 inches in diameter and 25 to 30 feet in length. Wattles are placed in shallow trenches and staked along the contour of disturbed or newly constructed slopes. See Figure 4.2.14 for typical construction details. WSDOT Standard Plan I-30.30-00 also provides information on Wattles (http://www.wsdot.wa.gov/Design/Standards/Plans.htm#SectionI)

Conditions of Use

- Use wattles:
  - In disturbed areas that require immediate erosion protection.
  - On exposed soils during the period of short construction delays, or over winter months.
  - On slopes requiring stabilization until permanent vegetation can be established.
- The material used dictates the effectiveness period of the wattle. Generally, Wattles are typically effective for one to two seasons.
- Prevent rilling beneath wattles by properly entrenching and abutting wattles together to prevent water from passing between them.

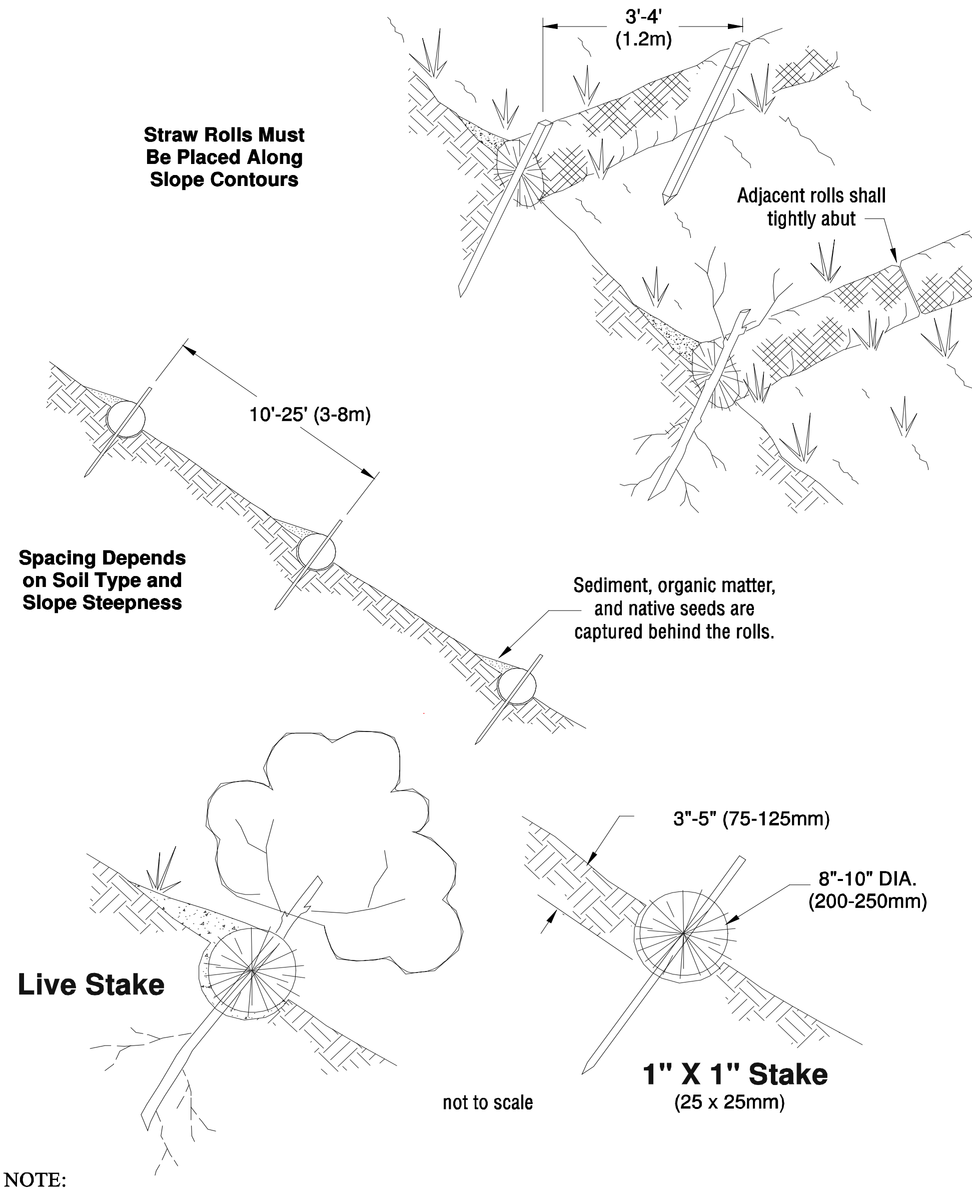
Design Criteria

- Install wattles perpendicular to the flow direction and parallel to the slope contour.
- Narrow trenches should be dug across the slope on contour to a depth of 3- to 5-inches on clay soils and soils with gradual slopes. On loose soils, steep slopes, and areas with high rainfall, the trenches should be dug to a depth of 5- to 7- inches, or 1/2 to 2/3 of the thickness of the wattle.
- Start building trenches and installing wattles from the base of the slope and work up. Spread excavated material evenly along the uphill slope and compacted using hand tamping or other methods.
- Construct trenches at intervals of 10- to 25-feet depending on the steepness of the slope, soil type, and rainfall. The steeper the slope the closer together the trenches.
- Install the wattles snugly into the trenches and abut tightly end to end. Do not overlap the ends.
- Install stakes at each end of the wattle, and at 4-foot centers along entire length of wattle.

- If required, install pilot holes for the stakes using a straight bar to drive holes through the wattle and into the soil.
- Wooden stakes should be approximately 3/4 x 3/4 x 24 inches min. Willow cuttings or 3/8-inch rebar can also be used for stakes.
- Stakes should be driven through the middle of the wattle, leaving 2 to 3 inches of the stake protruding above the wattle.

Maintenance Standards

- Wattles may require maintenance to ensure they are in contact with soil and thoroughly entrenched, especially after significant rainfall on steep sandy soils.



NOTE:
1. Straw roll installation requires the placement and secure staking of the roll in a trench, 3"-5" (75-125mm) deep, dug on contour. runoff must not be allowed to run under or around roll.

Figure 4.2.14 Wattles

- Inspect the slope after significant storms and repair any areas where wattles are not tightly abutted or water has scoured beneath the wattles.

Approved as Equivalent

Ecology has approved products as able to meet the requirements of BMP C235. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept this product approved as equivalent, or may require additional testing prior to consideration for local use. The products are available for review on Ecology's website at http://www.ecy.wa.gov/programs/wq/stormwater/newtech/equivalent.html

BMP C236: Vegetative Filtration

Purpose

Vegetative Filtration may be used in conjunction with BMP C241 Temporary Sediment Ponds, BMP C206 Level Spreader and a pumping system with surface intake to improve turbidity levels of stormwater discharges by filtering through existing vegetation where undisturbed forest floor duff layer or established lawn with thatch layer are present. Vegetative Filtration can also be used to infiltrate dewatering waste from foundations, vaults, and trenches as long as runoff does not occur.

Conditions of Use

- For every five acre of disturbed soil use one acre of grass field, farm pasture, or wooded area. Reduce or increase this area depending on project size, ground water table height, and other site conditions.
- Wetlands shall not be used for filtration.
- Do not use this BMP in areas with a high ground water table, or in areas that will have a high seasonal ground water table during the use of this BMP.
- This BMP may be less effective on soils that prevent the infiltration of the water, such as hard till.
- Using other effective source control measures throughout a construction site will prevent the generation of additional highly turbid water and may reduce the time period or area need for this BMP.
- Stop distributing water into the vegetated area if standing water or erosion results.

Design Criteria

- Find land adjacent to the project that has a vegetated field, preferably a farm field, or wooded area.
- If the project site does not contain enough vegetated field area consider obtaining permission from adjacent landowners (especially for farm fields).
- Install a pump and downstream distribution manifold depending on the project size. Generally, the main distribution line should reach 100 to 200-feet long (many large projects, or projects on tight soil, will

Port of Seattle
Lora Lake Apartments Site

Engineering Design Report

Appendix E
Draft Construction Stormwater Pollution Prevention Plan

Attachment E.5
Site Inspection Form

Construction Stormwater Pollution Prevention Plan
Site Inspection Form

The site inspection form shall be completely filled out and attached to the Site logbook. The Construction Stormwater Pollution Prevention Plan (SWPPP) and the site inspection forms shall be kept on-site at all times during construction, and inspections will be performed and documented as outlined below.

At a minimum, each site inspection form shall include the following:

a. Inspection date/times

b. Weather information: general conditions during inspection, approximate amount of precipitation since the last inspection, and approximate amount of precipitation within the last 24 hours

c. A summary or list of all the best management practices (BMPs) that have been implemented, including observations of all erosion/sediment control structures or practices

d. Notations of the following:

   i. Locations of BMPs inspected

   ii. Locations of BMPs that need maintenance

   iii. The reason maintenance is needed

   iv. Locations of BMPs that failed to operate as designed or intended

   v. Locations where additional or different BMPs are needed and the reason(s) why.

e. Description of any stormwater discharged from the site and notations of the presence of suspended sediment, turbid water, discoloration, and/or oil sheen, as applicable

f. Summary of any samples collected and/or stormwater tests conducted, including location, date, time, sampler, sampling and testing equipment, number and type of containers, parameter or constituent tested, analyses, and results, if available

g. General comments and notes, including a brief description of any BMP repairs, maintenance, or installations made as a result of the inspection

When the site inspection indicates that the BMPs are insufficient to maintain unauthorized discharge from the work area, the inspector shall take immediate action(s) to stop, contain, and clean up the discharges; correct the problem(s); implement appropriate BMPs, and/or conduct maintenance of existing BMPs; and achieve zero discharge. In addition, if the discharge poses a threat to human health or the environment, the inspector shall comply with the Notification of Discharge requirements in the SWPPP.

General Information					
Project Name:	Lora Lake Apartments Site Remedial Action				
Inspector Name:			**Title:** **CESCL #:**		
Date:			**Time:**		
Inspection Type:		Implementation			
		Weekly			
		After a rain event			
		Other			
Weather:					
Precipitation:	Since last inspection:			In last 24 hours:	

Description of General Site Conditions		**Yes**	**No**	**Comments**
	Stormwater Discharge from Site?			
	Photo Taken?			
	Ecology Notified?			
	Date, Time, and Ecology Contact Name	--	--	

Inspection of BMPs						
BMP	**Inspected**		**Functioning**			**Problem/Corrective Action**
	Yes	**No**	**Yes**	**No**	**NIP**	
1. Preserve Natural Vegetation						
2. High-Visibility Fencing						
3. Entrance and Construction Road Stabilization						
4. Wheel Wash						
5. Soils - Plastic Covering						
6. Storm Drain Inlet Protection						
7. Silt Fence						
8. Straw Wattles						

Inspection of BMPs						
BMP Element	Inspected		Functioning			Problem/Corrective Action
	Yes	No	Yes	No	NIP	
6. Dust Control						
7. Interceptor Dike and Swale and Pipe Slope Drains						
8. Outlet Protection						
9. Materials on Hand						
10. Material Delivery, Storage, and Containment						

Port of Seattle
Lora Lake Apartments Site

Engineering Design Report

Appendix F
Lora Lake Apartments Parcel Excavation Volume and Extent Analysis

Appendix F
Lora Lake Apartments Parcel Excavation Volume and Extent Analysis

The horizontal and vertical extent of excavation for the Lora Lake Apartments Parcel (LL Apartments Parcel) was evaluated on the basis of the remedial investigation (RI) and compliance monitoring data (Appendix C of the Engineering Design Report [EDR]). Although ultimately the extent of excavation was driven by dioxins/furans contamination, the data for the other Site contaminants of concern (COCs) were evaluated to ensure that the excavation extent encompassed all Site COC exceedances of cleanup levels (with the exception of gasoline range total petroleum hydrocarbons [TPH-G] discussed in the EDR).

The horizontal extent of excavation was drawn by plotting all of the sample points on a map. The locations from which a sample with a dioxins/furans toxicity equivalent (TEQ) concentration greater than 100 picograms per gram (pg/g) was collected at any depth were shown in red, and the locations from which the dioxins/furans TEQ concentration was less than 100 pg/g at all depths were shown in black. The excavation extent was drawn by connecting the black sample locations surrounding the red sample locations (Figure F.1), ensuring that all red sample locations were within the excavation extent. The horizontal extent was then modified slightly in some locations to square-off the shape for constructability. These changes moved excavation extents by no more than a few feet in any direction, and allowed for application of a grid as discussed later.

The vertical excavation extent was determined using a series of data analysis tools in ArcGIS and in the programming language R. Because samples were collected at and stored in the Floyd|Snider database as elevations below ground surface (bgs), the data used to determine the vertical extent of excavation were also completed in bgs. Once the vertical extent was determined, the depth bgs values associated with the base of the excavation were converted to actual elevations relative to the North American Vertical Datum of 1988 (NAVD 88). The following bullets describe the steps that were taken to determine the depth of excavation:

- **Step 1**: For all data points within the horizontal excavation extent, the depth (in bgs) where the first clean sample in that boring was encountered was determined. These points were determined to be below the extent of contamination at that point and were the used to build a triangulated irregular network (TIN; refer to Step 2). This meant that for each boring location, a depth was determined where there were shallower contaminated samples but no deeper samples that were contaminated. Each boring had a sample that bounded the vertical contamination at that location. Historical borings that did not have a clean vertical bounding sample were eliminated from the evaluation and replaced by a compliance monitoring location with a clean sample in the vicinity.
- **Step 2**: A TIN was created by connecting all of the clean points within the horizontal excavation extent that represented the vertical extent of contamination (Figure F.1). Sloped, straight lines were drawn from each point to the adjacent points, generating a sloped surface across the extent of the excavation. The TIN was set to ground surface (0 feet bgs) at the clean sample locations used to set the horizontal extent of excavation.

- **Step 3**: Because excavation of a bottom surface with varying slopes is infeasible, the excavation plan was simplified by creating flat bases for the excavation, on a square grid. Grids with six different cell sizes were generated for analysis and comparison to identify the grid size that optimized contaminated soil removal while limiting the volume of over-excavation of soil with dioxins/furans concentrations less than the remediation level. The grid sizes evaluated for determination of the optimal grid size were 45, 40, 35, 30, 25, and 20 square feet. Figures F.2 and F.3) show the 40- and 20-square-foot grids, respectively. Each grid cell would then be excavated to a consistent depth within that grid cell. The generated grids used a single origin and pitched around a single anchor point, essentially, meaning that the TIN was being flatted within each grid cell. The depth of the new excavation surface in the grid cell was the deepest elevation from the TIN within each grid cell. For example, if the TIN surface in a grid varied from elevation 295 to 290 feet NAVD 88, the grid cell would be assigned an excavation depth of 290 feet for the entire grid cell.
- **Step 4**: The different grid cell sizes were analyzed to determine the size of the grid cell that should be used. The larger the grid cell, the larger the volume of soil that would have to be removed to flatten the slope. Over the entire excavation area (Excavation Areas 1 through 4), the difference in total excavation volume varied by approximately 5,000 cubic yards based on the grid cell size used. This is because with a large grid cell size in areas where the slopes of the TIN are steep, an additional "extra" volume would have to be removed to flatten that area to the deepest elevation of the TIN within that grid cell. The larger the grid cells, the greater the variation in TIN surface depth across the grid cell. In excavation areas where the TIN was relatively flat or the depth of contamination did not vary much (e.g., Excavation Areas 1 and 2), a larger grid cell could be used. In these areas, the large grid cell size did not result in over-excavation of soil with dioxins/furans TEQ concentrations less than 100 pg/g. However, in excavation areas where the TIN has steep slopes or where the bottom depth of contamination varies greatly (e.g., Excavation Area 3 and 4) smaller grid cell sizes could be used. These smaller grid cell sizes were able to better match the TIN surface and minimize over-excavation of clean soil.
- **Step 5:** The size of the grid cells and layout of the grid cells were optimized for each of the four excavation areas to develop an excavation plan that was constructible but minimized the removal of extra clean soil. Larger grid cells are easier to excavate but smaller grid cells better mirror the TIN surface. The optimized grids designed for the LL Apartments Parcel are shown in Figure F.4, and are consistent with the design drawings that will be used by the Contractor for determination of excavation extent. A grid with 40-square-foot cells was designed for Excavation Area 1 because the TIN in this area is relatively flat and was favorable for the use of a large grid cell. This same logic was used to design the grid for Excavation Area 2, except the grid cell size was adjusted to 43 square feet to eliminate the need for small "slivers" of grid cells on the edges of the excavation. This adjustment reduced the number of very small non-square cells that would require excavation. A smaller grid cell (20 square feet) was used in Excavation Areas 3 and 4 because the TIN had steeper slopes in these areas and smaller grid cells better mirrored the base of contamination and minimized the volume of extra clean soil that would be excavated. In addition to optimizing the grid cell size, the grids were shifted,

as appropriate, to minimize small cells at the edges of the excavation. An elevation was assigned to each grid cell to denote the bottom elevation.

- **Step 6:** After the grids were optimized, the final step was to join small grid cells (less than 20 square feet in size) with the adjacent cells to eliminate small non-square grids from the edges of the excavation. This was done by connecting these small fragments of grid cells at the edges of the excavations to the adjoining grid cell that had the nearest base elevation to the fragmented grid cell. Fragmented grid cells were always joined to grid cells with a deeper base elevation to ensure full removal of soil exceeding the remediation level.

- **Step 7:** Once the grid cells and excavation plan were designed, the excavation volume was estimated. The volume was calculated by taking the surface elevation (available as a topographical map from a survey) and subtracting the excavation bottom surface elevation. The bottom surface is the modeled grid cell surface with an excavation depth, relative to NAVD 88, applied to each grid cell. The difference between these two surfaces yielded the volume of contaminated soil that would require excavation. The excavation volume calculated for the LL Apartments Parcel via the above method is 24,000 cubic yards.

- **Step 8:** After the excavation volume was estimated, KPFF and Floyd|Snider performed a cut and fill analysis for a quality assurance/quality control check of the excavation volume estimate, and to determine the quantity of common excavation fill material and non-yellow painted concrete available for use as backfill on-site. The cut and fill analysis also developed quantities for asphalt and clear and grub material to be removed from the site. The quantity available for common excavation fill material was calculated by subtracting the proposed subgrade from the excavation surface and clear and grub surface. Quantities for concrete, asphalt, and clear and grub material were calculated by estimating the surface area for each material and then multiplying by a 6-inch depth for concrete, 4-inch depth for asphalt, and 12-inch depth for clear and grub material. Quantities are provided in Table F.1 and additional details of the cut and fill analysis are provided in Attachment F.1. These evaluations were conducted prior to finalization of the excavation extent for constructability, but adjustments made after this step did not result in measurable changes. If variation exists between the excavation extent and depths shown in the project plans and this EDR, the excavation as shown in the project plans supersede.

- **Step 9:** A side slope layback and shoring analysis was also conducted to assess excavation constructability and potential for additional material to be hauled off-site. It was assumed that excavation walls greater than 8 feet high will be shored while excavation walls less than 8 feet high will be allowed to slough or layback. Sidewall slough and over-excavation volumes are presented in Table F.1 and excavation sidewalls assumed to be shored are presented in Figure F.5. This step was conducted for project costing to make estimates of degree of over-excavation and shoring expected for completion of the excavation.

List of Tables

List of Figures

List of Attachments

Port of Seattle
Lora Lake Apartments Site

Engineering Design Report

Appendix F
Lora Lake Apartments Parcel Excavation Volume and Extent Analysis

Table

Table F.1
Lora Lake Apartments Excavation Extent and Cut and Fill Volume Calculations Summary

Calculation Method	Contaminated Soil Excavation	Total Asphalt Removed	Total Concrete Removed and Reused	Concrete Swell Factor (in place to crushed and placed)	Post Crushing Concrete Volume	Total Concrete Removed and Disposed (yellow concrete)	Total Clearing and Grubbing Volume	Total Non-Contaminated Soil Volume	Total Fill for Reuse	Total Fill Required	Balance (assuming no over excavation or sloughing)	Sidewall Sloughing and Over-excavation Volume - Off-Site Disposal	Geotechnical Unsuitable Soil - Disposed Off Site (2% of Common Excavation Soil)	Balance (assuming sloughing sidewalls and removal of geotechnically unsuitable)
Units	BCY	BCY	BCY	-	CY	LF	BCY	BCY	BCY	BCY	BCY	BCY	BCY	BCY
GIS and R (Floyd|Snider)	24,048	-	-	-	-	-	-	-	-	-	-	3,136	-	-
Civil 3D CAD (KPFF)	24,039	1,600	1,500	150 lb/cf / 135 lb/cf	1,667	Not Calculated	4,450	36,500	38,167	30,600	7,567	-	-	-
Hand Calculation	-	1,566	1,364	150 lb/cf / 135 lb/cf	1,516	2,340	4,749	-	-	-	-	-	730	3,701

Sideslope layback and shoring Assumptions

For purposes of the design and engineer's estimate, an assumption was made on what part of the excavation will be shored and what portion of the excavation will be over-excavated. Over-excavated soil is assumed to be sent to the landfill.

It is assumed that shoring will be used at excavation wall heights of 8 feet and higher. Excavation wall heights less than 8 feet at assumed to slough at a 2H:1V slope. The sloughed material would be hauled off-site. Refer to the figure showing wall heights that are taller than 8 feet and taller than 13 feet.

For grid cells where the wall was less than 8 feet high, it was assumed that a 2:1 slope would be used to lay back the excavation. This is called "sloughing" in the volume calculation. Both the interior and perimeter walls were considered.

Assuming shoring is used for walls taller than 8 feet, the total sloughing volume is 3,136 BCY.

If no shoring was used a total sloughing volume is 6,475 BCY.

Key Points and Assumptions

1. Will use a conversion factor of 1.6 tons/BCY for soil, 1.9 tons/CY for asphalt
2. The excavation boxes in Civil 3D cannot share points on top of one another so they are all angled slightly. This does not affect the total volume.
3. Hand calculations performed by Floyd|Snider using CAD DWG TrueView.
4. It is assumed that a BCY of soil that comes out of the excavation goes back into the excavation as backfill as an equivalent BCY and there is no swell factor. Swell factors are provided in the geotechnical report for use by the Contractor for stockpiling and hauling soil.
5. There may or may not be an excess of soil based on how the Contractor does the excavation. If the Contractor lays back the excavation sidewalls or otherwise over-excavates, this balance will be reduced.
6. Any excess of material would be spread out over the site along the north wall.
7. Floyd|Snider calculated the same contaminated soil excavation volume when they used the surfaces provided by KPFF.
8. The total fill required assumes no excavation sidewall layback and assumes a 6-inch surface soil lift (i.e., the surface in this analysis is 6 inches lower than the final grade).
9. The concrete volume calculation does not include the foundation walls if they are thicker than 6 inches.
10. The total clearing and grubbing volume represents the entire site.
11. The grub thickness (12 inches) is based on the geotech borings where the duff layer was observed to be between 6 and 12 inches thick.

Abbreviations

BYC Bulk cubic yards
CY Cubic yards
lb/cf Pounds per cubic foot
LF Linear foot

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Lora Lake Apartments Site

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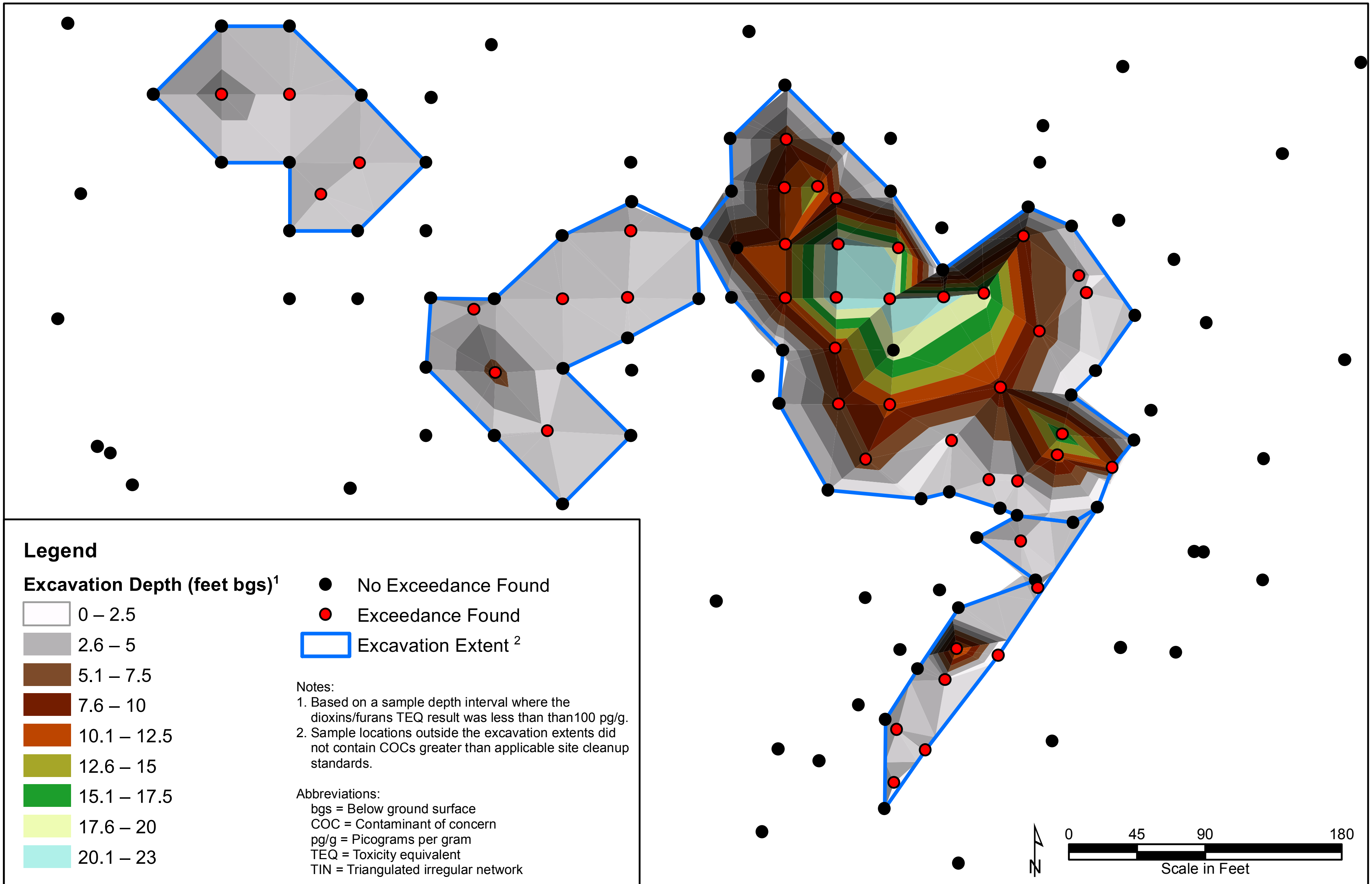
Appendix F
Lora Lake Apartments Parcel Excavation Volume and Extent Analysis

Figures



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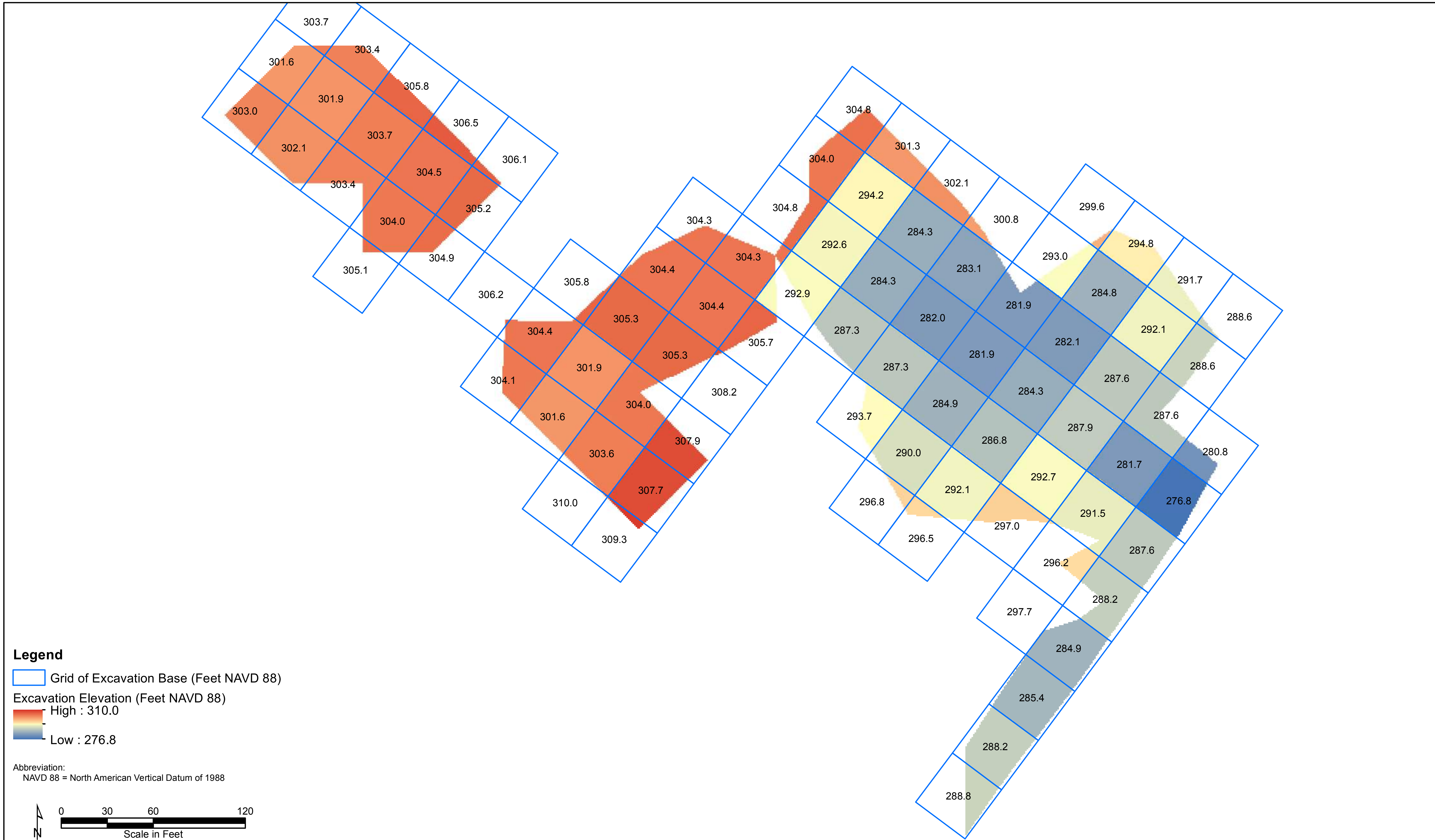
Lora Lake Apartments Site
Burien, Washington

Figure F.1
TIN Surface Generated from Clean Bottom Samples

I:\GIS\Projects\POS_LL\MXD\EDR\Figure F.1 TIN Surface Generated from Clean Bottom Samples.mxd
9/1/2016



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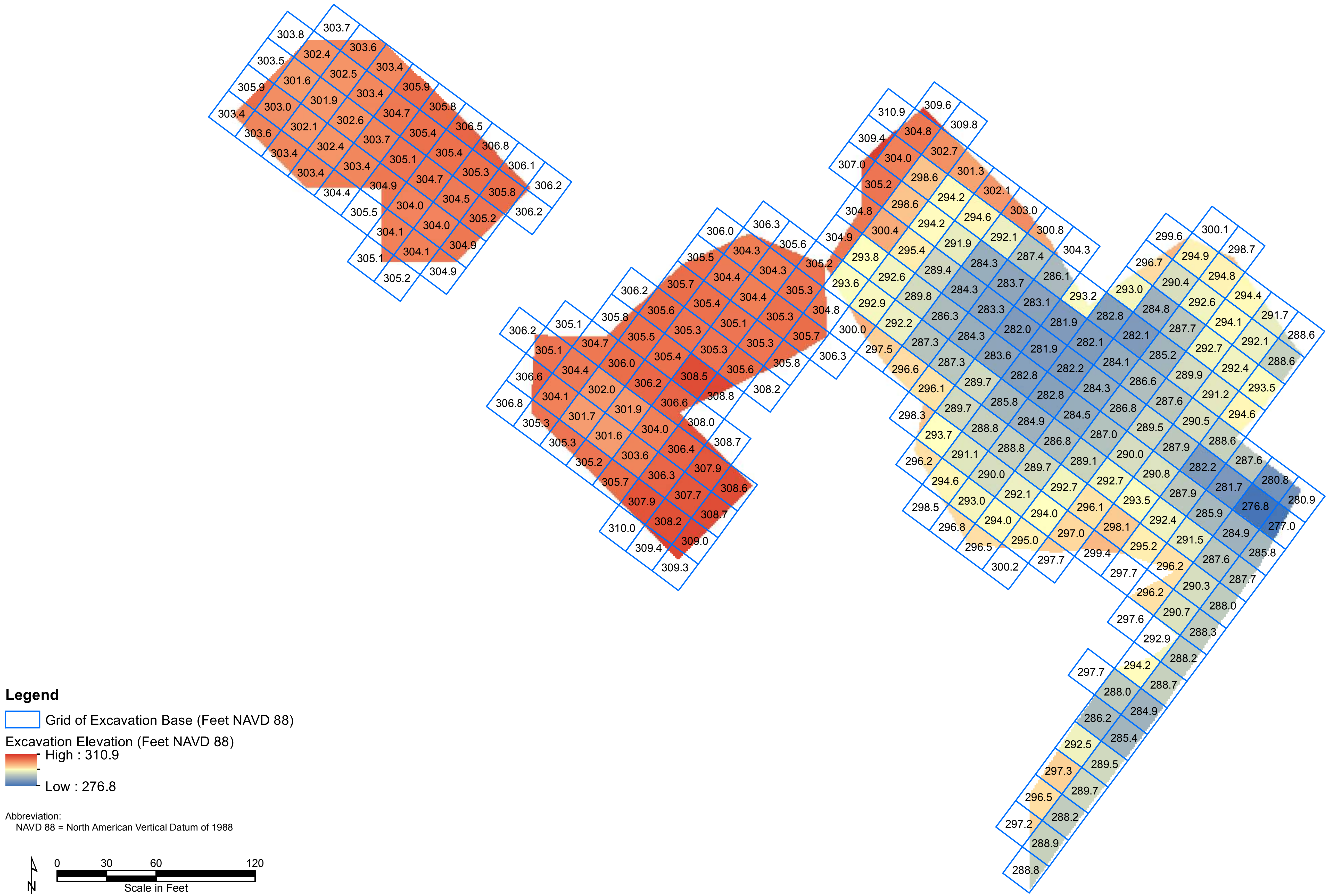
Lora Lake Apartments Site
Burien, Washington

Figure F.2
Excavation Grid with 40-Square-Foot Cells

I:\GIS\Projects\POS_LL\MXD\EDR\Figure F.2 40-Foot Excavation Grid.mxd
9/1/2016



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Lora Lake Apartments Site
Burien, Washington

Figure F.3
Excavation Grid with 20-Square-Foot Cells

I:\GIS\Projects\POS_LL\MXD\EDR\Figure F.3 20-Foot Excavation Grid.mxd
9/1/2016

Legend

Note:
· Topography from 2015 Port of Seattle survey, North American Vertical Datum 1988.

N

0 30 60 120

Scale in Feet

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Lora Lake Apartments Site
Burien, Washington

Figure F.4
Optimized Excavation Grids for the
Lora Lake Apartments Parcel

I:\GIS\Projects\POS_LL\MXD\EDR\Figure F.4 Optimized Excavation.mxd
9/1/2016

Legend

Wall Height in Feet

- 0–8
- 8.1–13
- >13

Summary Statistics:

Interior Sloughing Volume with Shoring
1,963.19 cy

Exterior Sloughing Volume with Shoring
1,224.10 cy

Total Sloughing with Shoring
3,187.29 cy

Total Sloughing without Shoring
6,131.47 cy

Total Wall Length ≥ 8 ft and < 13 ft
450.96 ft

Total Wall Length ≥ 13 ft
153.05 ft

Max Wall Height
16.64 ft

Mean Wall Height ≥ 8 ft and < 13 ft
9.77 ft

Mean Wall Height ≥ 13 ft
15.28 ft

Notes:
- Sloughing was calculated at as 2:1 slope.
- Only edges less than 8 feet difference were used to calculate sloughing.
- Orthophoto provided by nearmap.

Abbreviations:
cy = Cubic yards
ft = Feet

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Lora Lake Apartments Site
Burien, Washington

Figure F.5
Excavation Sidewall Sloughing and Shoring Analysis

I:\GIS\Projects\POS_LL\MXD\EDR\Figure F.5 Excavation Sidewall Sloughing and Shoring Analysis.mxd
9/1/2016

Port of Seattle
Lora Lake Apartments Site

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Appendix F
Lora Lake Apartments Parcel Excavation Volume and Extent Analysis

Attachment F.1
Lora Lake Appt. Cut/Fill Civil 3D Analysis Memorandum

MEMORANDUM

1601 5th Avenue, Suite 1300
Seattle, WA 98101

To:	**Megan King, Tucker Stevens**	Date:	**7/19/16**
From:	**Scott Stainer**	Job No.	**115132**
Subject:	**Lora Lake Appt. Cut/Fill Civil 3D Analysis**	File No.	

Lora Lake Apartments Cut/Fill Analysis

As a part of the larger project, the Lora Lake Apartments area includes some contaminated areas. These areas are to be excavated to specific elevations based on an area grid provided in Plan. The site is then to be re-graded using on-site material in such a way as to provide a zero net import/export excavation quantity. This narrative is to provide explanation for the results of the Civil3D analysis performed to determine the cut and fill volumes for this portion of the project.

Area boundaries and proposed contours are based on the 90% version of the plans. Proposed grades of the interior of the site were assumed to generally slope from elevation 302 to elevation 298 with straight grades assumed between contours. It was assumed that in general the top of subgrade was 6" below the finish grade contours shown in plan.

The existing conditions surface was provided on 11-12-2015 by Floyd Snider in a file named "150120-1_Lora Lake Appt_NAD83.dwg". We used this file because we understand it represents the most recent survey for the apartment area. The following table summarizes the findings from the Civil3D model. Results include values taken directly from the program as well as calculated values, see backup calculations for details.

Cut/Fill Quantities Assuming Neat line Excavation	
Total Contaminated Volume from Pits #1 - #4 to be Exported	24,000 CY
Total Asphalt Removed Assumed to be Exported	1,600 CY
Total Clear & Grub Assumed to be Exported	4,450 CY
Total Fill Available on Site above Finish Subgrade Plus Crushed Concrete (NIC Contaminated Material)	38,200 CY
Total Fill Required to Achieve Top of Subgrade Grade	30,600 CY
Volume of Extra Fill Available	7,600 CY

Existing concrete, asphalt and clear & grub were excluded from the balance analysis done for the cut and fill volumes. For analysis, all asphalt was assumed to be 4” thick, all concrete was assumed to be 6” thick and clear & grub that could not be reused as fill was assumed to be 12” thick (note: for simplicity of the model, clear & grub was analyzed as 6” thick, and an additional 6” was later removed based on hand calculations of that additional area).

No expansion factor was applied to excavated subgrade reused as fill. Existing concrete was then assumed to be crushed and then reused as fill on site. An expansion factor of 150/135 was used to determine a post crushing volume for concrete (150lb/CY placed concrete, vs 135lb/CY for crushed concrete). Existing asphalt and clear & grub material were assumed to be exported off site.

Additional fill could be required depending on any over-excavation the contractor may do in order to ensure that he successfully reaches the minimum depths required for contaminate removal. The following table summarizes the additional volume potentially required if over-excavation occurs. Note that additional volume was not included to account for any side slopes required for excavation.

Additional Fill Potentially Required if Over-Excavation is Assumed	
0.5 foot Over-Excavation in Pits #1- #4	1,600 CY
1 foot Over-Excavation in Pits #1- #4	3,300 CY

If over-excavation is assumed to occur, the total volume of extra fill available decreases from 7,600 to 6,000 CY if 0.5 feet of over-excavation is assumed and 4,300 if 1 foot of over-excavation is assumed. This value will decrease further depending on any side slope assumptions that could be made around the perimeter of the excavation pits.

Project: Lora Lake
Location: Appartment Area Cut/Fill
Client: FLOYD | SNIDER
Backup Calculations

EXPORTED VALUES FROM CIVIL3D

Column	Base Surface	Comparison Surface	Cut Vol (CY)	Fill Vol (CY)	Net Vol (CY)
1	Existing Subgrade	Proposed Subgrade	43,912	11,172	(32,740)
2	Existing Subgrade	Excavation #1	988	2	(986)
3	Existing Subgrade	Excavation #2	2,048	3	(2,045)
4	Existing Subgrade	Excavation #3	19,864	-	(19,864)
5	Existing Subgrade	Excavation #4	1,145	2	(1,144)
6	Excavation #1	Proposed Subgrade	1,134	0	(1,134)
7	Excavation #2	Proposed Subgrade	3,132	0	(3,132)
8	Excavation #3	Proposed Subgrade	318	17,694	17,376
9	Excavation #4	Proposed Subgrade	-	1,686	1,686

Calculations based on Civil3D volumes:

- **Total Excavated Contaminated Volume (to be exported)** **24,000 CY**
  col 2 cut + col 3 cut + col 4 cut + col 5 cut

- Total Excavated Non-Contaminated Volume 36,500 CY
  (Measured from below ACP/Conc/Clearing & Grubbing)
  col 1 cut - [(col 2 cut-col 6 fill)+(col 3 cut - col 7 fill)+(col 4 cut - col 8 fill)]-total Clear & Grub/2
  **note: area over excavation #4 not included, because area is a fill area*
  **note: half total clear & grub included because model accounts for 6 inches of clear and grub only*

- Total ACP, Conc and Clearing & Grubbing based on area calculations, included here for additional calculations

  - Total ACP Removed (4" assumed) 1,600 CY
    (To be exported)
  - Total Conc Removed (6" thick assumed) 1,500 CY
    (To be reused as fill - assumed 150lb/cf to 135lb/cf conversion)
  - Total Clearing & Grubbing (12" thick assumed) 4,450 CY
    (To be exported)

- **Total Available Fill for Reuse** **38,200 CY**
  Total Excavated Non - Contaminated Volume + total conc removed x (150/135)
  **note: expansion factor only applied to concrete value for this calculation*

- **Total Fill Required** **30,600 CY**
  col 1 fill + col 6 fill + col 7 fill + col 8 fill + col 9 fill

- **Volume of Extra Fill (beyond current proposed grading)** **7,600 CY**

Possible over-excavation in Pits #1 - #4 will decrease the volume of extra fill

Surface Area for each Excavation Pit		
Excavation Pit #1	13,300	SF
Excavation Pit #2	20,100	SF
Excavation Pit #3	47,300	SF
Excavation Pit #4	7,100	SF
Total for all Excavation Pits	87,800	SF

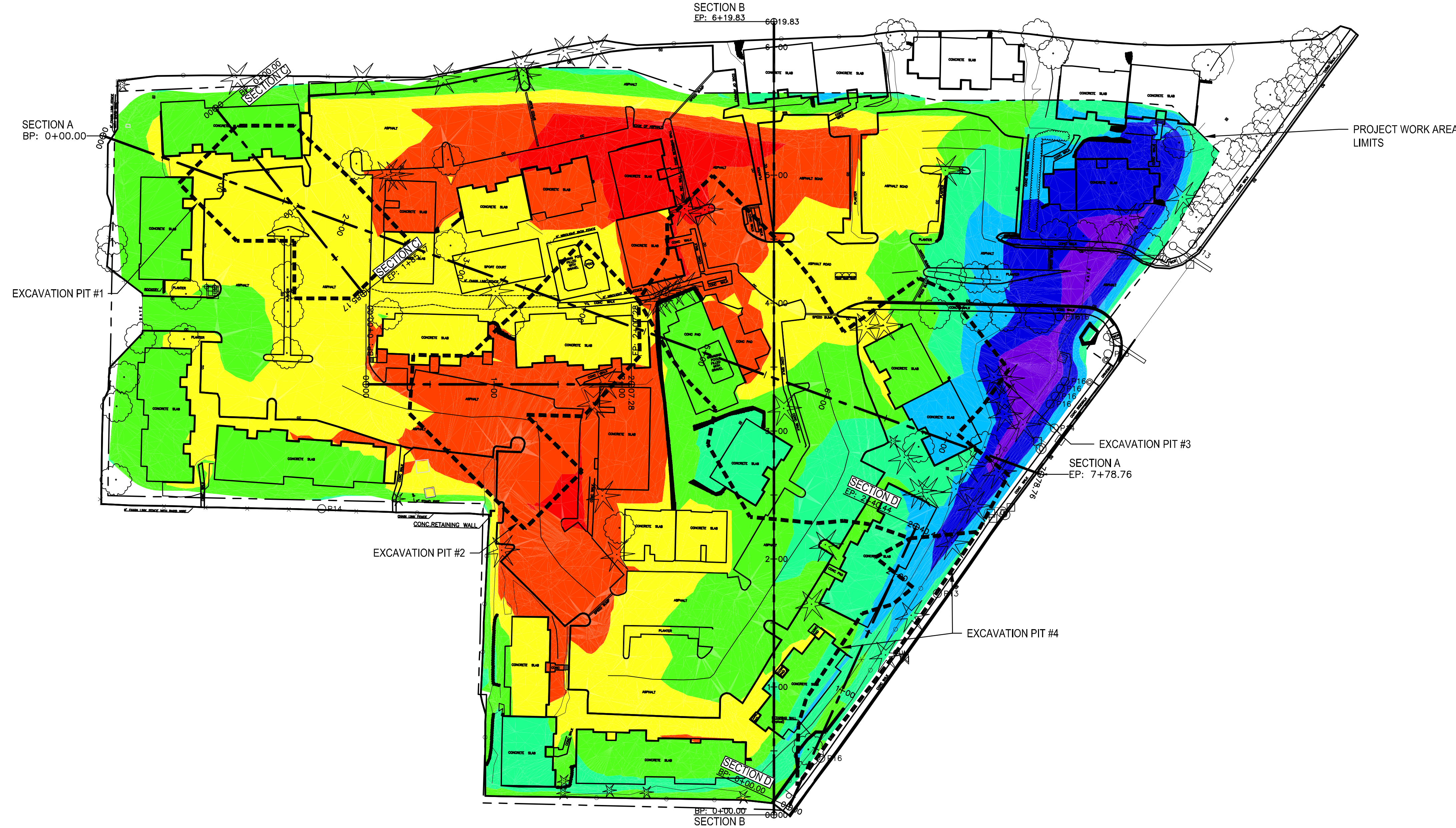
Additional fill required assuming over-ex, w/o side slopes in all excavation pits		
0.5 foot of over excavation	1,600	CY
1 foot of over excavation	3,300	CY

Volume of Extra Fill with 0.5' Over-Ex and 1:1 Side Slopes	**6,000**	**CY**
Volume of Fill Short with 1.0' Over-Ex and 1:1 Side Slopes	**4,300**	**CY**

ID	Minimum Elevation	Maximum Elevation	Color Scheme
1	-13.17'	-9.00'	
2	-9.00'	-6.00'	
3	-6.00'	-3.00'	
4	-3.00'	0.00'	
5	0.00'	3.00'	
6	3.00'	6.00'	
7	6.00'	11.00'	
8	11.00'	17.00'	

NEGATIVE = NET CUT
POSITIVE = NET FILL

NOTE
COLOR BANDING REPRESENTS NET CUT OR FILL FROM EXISTING GRADE TO PROPOSED GRADE
- NEGATIVE VALUES REPRESENT CUT DEPTHS
- POSITIVE VALUES REPRESENT FILL DEPTHS



N

50' 0 50' 100'
25' 75'
SCALE: 1"=100'

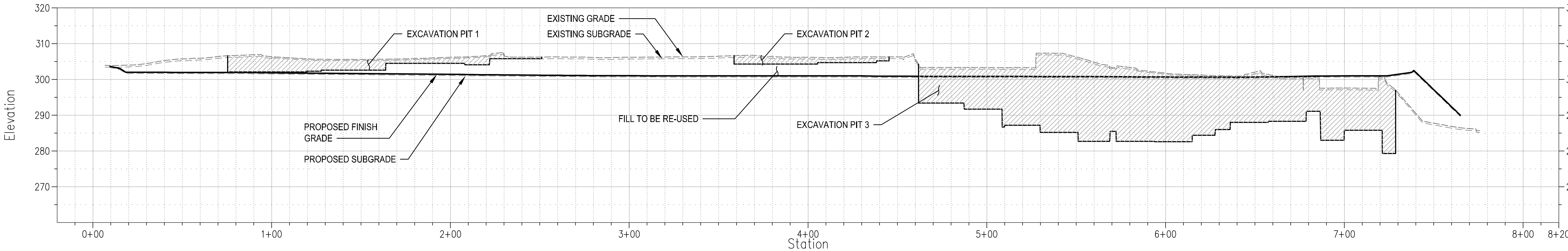
CUT/FILL COMPARISON EXISTING GRADE TO FINISH GRADE

LAURA LAKE APARTMENTS SITE
MTCA REMEDIAL ACTION
LLA EXCAVATION/FILL QUANTITIES EXHIBIT

DATE: 6-01-2016
SCALE: 1:100
DRAWN BY: SJS
SHT 1 OF 2

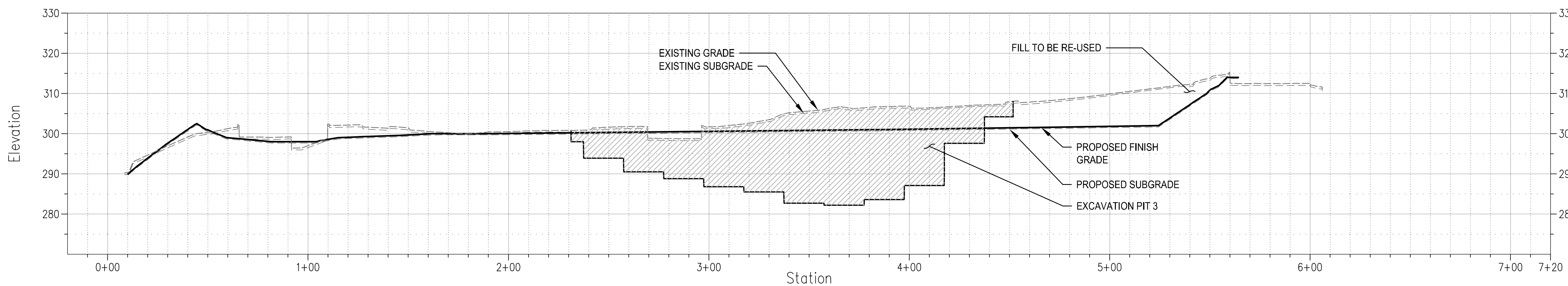
kpff
1601 5th Avenue, Suite 1300
Seattle, Washington 98101
(206) 382-0600 Fax (206) 382-0500

Plotted: Jun 01, 2016 – 10:59am sstainer Layout: CUT FILL COLOR
M:\2015\115132 Lora Lake Apartment Clean-Up (Floyd_Snider)\Drawings\C3D\LLA Apartment Area Cut Fill Check.dwg



SECTION A (WEST TO EAST ACROSS SITE)

SCALE: H=1:60, V=1:30



SECTION B (SOUTH TO NORTH ACROSS SITE)

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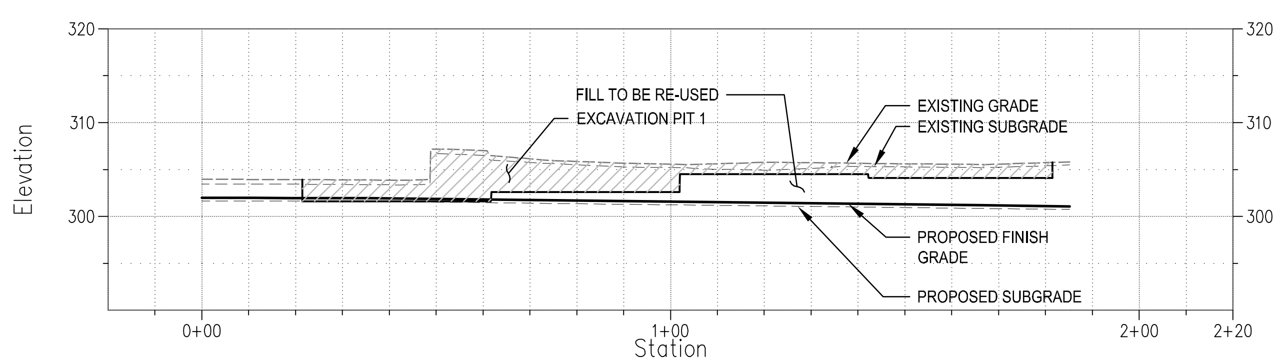
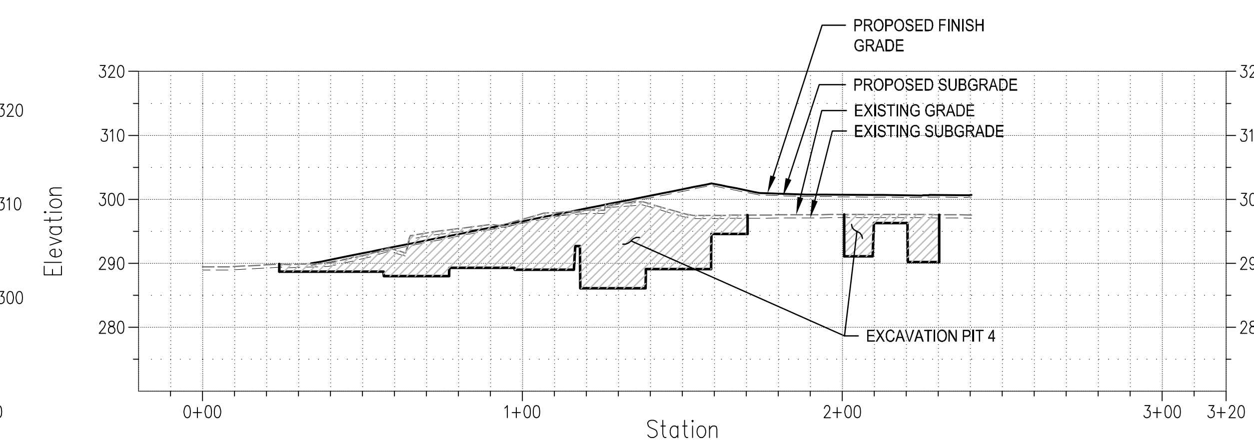


SECTION C (EXCAVATION PIT #1)

SCALE: H=1:60, V=1:30



SECTION D (EXCAVATION PIT #4)

SCALE: H=1:60, V=1:30

15' 0 15' 30'
7.5' 22.5'
SCALE: 1"=30'

30' 0 30' 60'
15' 45'
SCALE: 1"=60'

LAURA LAKE APARTMENTS SITE
MTCA REMEDIAL ACTION
LLA EXCAVATION/FILL QUANTITIES EXHIBIT

DATE: 6-01-2016
DRAWN BY: SJS
SCALE: AS NOTED
SHT 2 OF 2

kpff
1601 5th Avenue, Suite 1300
Seattle, Washington 98101
(206) 382-0600 Fax (206) 382-0500

Plotted: Jun 01, 2016 – 11:08am sstainer Layout: SECTIONS A&B
M:\2015\115132 Lora Lake Apartment Clean-Up (Floyd_Snider)\Drawings\C3D\LLA Apartment Area Cut Fill Check.dwg

Port of Seattle
Lora Lake Apartments Site

Engineering Design Report

Appendix G
Lora Lake Apartments Site Geotechnical Report

MEMORANDUM

Project No.: 110125-003-07

August 1, 2016

To: Megan King, Floyd|Snider
Jessi Massingale, Floyd|Snider

From:

Tyson Carlson, LHG
Associate Hydrogeologist
tcarlson@aspectconsulting.com

Henry Haselton, PE, PMP
Principal Geotechnical Engineer
hhaselton@aspectconsulting.com

Re: **Geotechnical Support for Lora Lake Apartments Parcel Remedial Action—90-Percent Design Phase**

Introduction

This report contains geotechnical recommendations by Aspect Consulting, LLC (Aspect) in support of the Remedial Action 90-percent design phases for the Lora Lake Apartments parcel (Site). Remediation for the Site will consist of excavation of contaminated soil in exceedance of the remedial action level (dioxin/furan toxic equivalent quantity [TEQ] concentrations >100 pg/g), and post-cleanup restoration of the parcel to construction-ready conditions as specified by the Port of Seattle (Port). More information on the remedial design objectives and approach are included in the Cleanup Action Plan (CAP) and Remedial Investigation/Feasibility Study (RI/FS) (Floyd|Snider, 2015) and the 90-percent design plans (Port of Seattle, 2016).

Geotechnical recommendations supporting Site remediation include considerations related to grading and temporary slopes, shoring, suitability for reuse of onsite soils, backfill, conceptual dewatering approach, and temporary and permanent erosion control. In general, onsite soils and concrete below the remedial action level may be reused on site. Final design plans detailing these elements will be created by the design team, then implemented by the remediation contractor selected by the Port.

Subsurface Explorations

Multiple previous phases of subsurface investigation have been conducted at the Site. These have included several hollow stem auger borings conducted by AECOM, which provide geotechnical density/consistency data (MW-1 through MW-6, and MW-12 through MW-14; AECOM 2009). Additional phases of environmental subsurface investigation have also been completed, including recent remedial investigations to identify excavation extents for this project (Floyd|Snider, 2015).

We reviewed logs for numerous borings conducted for the remedial investigation between September 15 and 28, 2015, which were provided for our review by Floyd|Snider. Seven of those borings (PM-71, PM-72, PM-73, PM-84, PM-86, PM-94, and PM-95) were conducted by hollow stem auger methods; the remaining borings were conducted by geoprobe methods. We also reviewed draft field logs for 19 additional geoprobe borings supervised by Floyd|Snider on February 1, 2016.

In order to determine suitability for reuse and identify backfill recommendations for onsite soils, Aspect also observed and collected samples from six test pit excavations (PM-35, PM-38, PM-44, PM-45, PM-47, and PM-49) coordinated by Floyd|Snider on September 29, 2015 (Figure 1). One additional test pit (PM-31) was logged by Floyd|Snider at that time.

Because preliminary environmental testing indicated that temporary shoring may be needed to support the required excavation depths, Aspect completed two project-specific geotechnical explorations on February 23, 2016 to augment existing data and inform the development of shoring recommendations. These explorations were completed by Gregory Drilling, a licensed drilling contractor in the state of Washington under subcontract to Aspect, using hollow-stem auger techniques to depths of 51.5 feet below ground surface (bgs). Samples were collected at 5 foot intervals using Standard Penetration Test (SPT) methods per American Society for Testing and Materials (ASTM) Method D1586, *Standard Test Method for Standard Penetration Test and Split-Barrel Sampling of Soils*, which provided undisturbed samples and representative density/consistency data. Soils were classified per Unified Soil Classification System (USCS) ASTM D2488, *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*. A Site and Exploration Plan is included as Figure 1. Selected logs for geotechnical borings, test pits, and other deep borings used in our geologic analysis are included in Attachment A.

Laboratory Testing

Aspect and Floyd|Snider conducted geotechnical laboratory testing on select soil samples from borings and test pits. Laboratory testing included natural moisture content testing, grain size distribution testing, and Modified Proctor testing (ASTM D1557 Method C), a laboratory method of determining the optimal moisture content at which the representative soil sample will achieve its maximum density. Implications of laboratory test results are discussed in later sections of this memorandum in regards to suitability for reuse of onsite soils. Laboratory test results are included as Attachment B.

Subsurface Conditions

Our understanding of subsurface conditions is based on the subsurface exploration program described above, and review of various documents relating to previous work conducted at and near the Site. The data we reviewed included boring and test pit logs, laboratory testing, topographic surveys, and well monitoring data. Documents included the RI/FS (Floyd|Snider, 2015) and various consultant subsurface and groundwater investigations (Aspect, 2010; AECOM, 2009).

Regional geology from the *Geologic Map or the Des Moines 7.5' quadrangle, King County,* Washington, (Booth and Waldron, 2004) in the Site vicinity consists of several hundred feet of glacially overridden sediments from the Vashon Stade of the Fraser glaciation (which ended approximately 13,000 years ago) and nonglacial soils overlying sedimentary and volcanic bedrock. Observations from explorations by Aspect encountered fill over undifferentiated water-borne fluvial and lacustrine deposits (Figure 2). Geologic units are described below in order from youngest to oldest.

Recent (Postglacial) and Glacial Geologic Units

Fill – Fill typically comprises moist to very moist, brown, occasionally gravelly, silty SAND (SM) with rare asphalt fragments, cobbles, and organic fragments. Occasional clean SAND (SP), sand with less than 5 percent silt content, or SILT (ML) occur in the fill. Fill is present within the vicinity of the Site up to approximately 15 feet thick with variable composition and is most common in low-lying areas around drainage bottoms. Based on observations by Aspect and Floyd|Snider, as well as limited laboratory testing on selected samples, fill is typically loose to medium dense.

Fluvial Deposits – Fluvial deposits typically comprise wet, gray, occasionally gravelly to very gravelly, fine to coarse clean SAND (SP) to silty SAND (SM) with occasional organic fragments. Gravel content decreases with depth and becomes trace to nonexistent below 20 feet to 25 feet bgs. Fluvial deposits are present underlying the fill across the Site and are greater than 28-feet-thick. Occasional SILT (ML) lenses are present in the fluvial deposits. Site fluvial deposits are typically medium dense to very dense with low compressibility and moderate to high permeability. Lenses of concentrated compressible organic matter and/or peat may be present within the fluvial deposits. Based on our lithologic observations and recorded densities, we interpret Site fluvial deposits as either nonglacial or glacial-recessional in nature.

Lacustrine Deposits – Lacustrine deposits typically consist of wet, gray, occasionally sandy or clayey SILT (ML) with scattered fine organic fragments. Lacustrine deposits occur beneath fluvial deposits across the Site; the transition from fluvial deposits to lacustrine deposits is gradational with silt content increasing with depth and sand size decreasing with depth. Silt and sand are commonly interbedded near the fluvial/lacustrine contact. Lacustrine deposits were typically very dense where non-cohesive, and very stiff where cohesive, and therefore have probably been glacially overridden. Lacustrine deposits typically exhibit low permeability and form an aquitard beneath the Site.

Groundwater Conditions

Monitoring Wells

AECOM installed one onsite monitoring well (MW-1) in October 2007 and five onsite monitoring wells (MW-2 through MW-6) in March 2008 in order to determine soil lithology and contamination extent (AECOM, 2009). Additional wells were installed by Floyd|Snider and Aspect in 2010, including two deeper wells (MW-15 and MW-16) which penetrated through the recessional outwash at the Site into what was interpreted as Vashon till (Aspect, 2010; Floyd|Snider, 2015). A network of multiple monitoring wells has also been installed downgradient and east of the Site, on the Lora Lake Parcel.

Groundwater Occurrence

The regional groundwater table at the Site flows generally to the south and southwest (AECOM, 2009; Aspect, 2010); however, shallow groundwater found locally at the Site within the fill and fluvial deposits generally flows to the southeast (Aspect, 2010; Figure 2). Potentiometric surface contour maps generated from monitoring well water levels indicate that wet season water levels range from approximately 294 feet elevation (NAVD88) in the western portion of the Site to approximately 280 feet elevation in the eastern portion of the Site. Dry season water levels range from approximately 294 to 278 feet elevation. Additional information regarding groundwater conditions can be found in the RI/FS (Floyd|Snider, 2015) and in the *Lora Lake 2013-2014 Surface Water—Groundwater Baseline Monitoring, Data Summary Memorandum* (Aspect, 2015).

Slug Testing

Slug testing analysis was performed on select wells to estimate hydraulic conductivity subsurface conditions at the Site. The slug test method generally involves quickly displacing a volume of water within the standpipe and monitoring the rate of water recovery back to baseline level. The water-level recovery data was then reduced to yield an estimate of hydraulic conductivity of the surrounding soil. This method is generally considered to provide a lower bound, order-of-magnitude estimate of hydraulic conductivity.

Slug testing was conducted previously for well MW-2. Aspect reviewed project well logs and identified six select slug test datasets for additional analysis (MW-4, MW-5, MW-14, MW-9, MW-10, and MW-12). Selection criteria were based on completion intervals within saturated units (primarily fluvial deposit) in close proximity to the deeper portions of the excavation (at about 282 feet elevation).

Select datasets were then analyzed with the Bouwer and Rice method (1976) in general accordance with ASTM Method D4104-96. The resulting hydraulic conductivity estimates are relatively well constrained, ranging from $1x10^{-3}$ to $5x10^{-3}$ centimeters per second (cm/sec), as summarized in Attachment C.

Recommendations

Site Grading and Excavation

Based on the 90-percent design grading plan, we understand that the final Site grade will generally vary from approximately elevation 302 to elevation 300 across the northern upland portion of the Site (Figure 1). The northern perimeter and southwestern corner of the Site will grade steeply upwards toward the property boundary, and the southeastern perimeter will grade steeply down towards Des Moines Memorial Drive.

In general, excavations can be completed with standard earthwork equipment. Although not encountered in our explorations, our experience suggests that boulders and oversized materials may be present within either the fill or fluvial deposits. Organic or other debris may also be present.

Therefore, the contractor should be prepared to encounter and handle such materials if encountered. Excavated soils should be expected to increase in volume when loaded into trucks as compared to *in situ* volumes. For planning purposes, a "swell factor" of an additional 10 to 15 percent beyond *in situ* Site soil densities can be assumed.

Vertical cuts anticipated to be greater than approximately 6 feet in height should either be shored or temporarily sloped for safety reasons. Recommendations and guidelines for driven steel-sheet piling, temporary slopes greater than 6 feet in height, and dewatering are discussed in the sections below. The contractor will be ultimately responsible for determining which excavation locations will be shored versus sloped, and for planning and implementing an effective dewatering program.

Temporary and Permanent Slopes

Based on our slope evaluations and previous experience with similar soil types, we recommend laying back temporary slopes that are less than 20 feet in height to an angle of 2 horizontal to 1 vertical (2H:1V) or flatter, assuming the presence of 5 feet of groundwater or less at the base. Slopes taller than 20 feet should be assessed on a case-by-case basis by a competent person. Alternatively, soils may be benched in order to reduce the overall vertical cut height. Excavations that will be entered by personnel may be benched to a maximum height of 4 feet within a horizontal distance of 8 feet (averaging a 2H:1V slope). Excavations that will be entered only by personnel-operated heavy machinery may be benched to a maximum height of 6 feet with in a horizontal distance of 12 feet (averaging a 2H:1V slope).

With time and the presence of seepage and/or precipitation, the stability of temporary unsupported cut slopes can be significantly reduced. Therefore, all temporary slopes should be protected from erosion by installing a surface water diversion ditch or berm at the top of the slope. In addition, the contractor should monitor the stability of the temporary cut slopes and adjust the construction schedule and slope inclination accordingly. Vibrations created by traffic and construction equipment may cause caving and raveling of the cut slope.

Permanent slopes should be laid back to a maximum grade of 2H:1V. Following completion of the Project, permanent slopes should be revegetated in accordance with erosion control recommendations below.

Shoring

We expect that, given the anticipated excavation depths, sheet pile will need to be driven to a depth of approximately 15 to 25 feet below pre-excavation grade. Tieback anchors may be required to support excavations greater than approximately 12 feet in depth. Yielding walls, such as cantilever or tieback sheet pile retaining walls, should be designed using a lateral earth pressure based on an equivalent fluid having a density of 38 pounds per cubic foot (pcf) for active conditions. An ultimate passive equivalent fluid density of 190 pcf should be used to determine resistance of the portion of the shoring wall that will be below the base of the excavation. The upper 2 feet of passive resistance should be neglected. The recommended passive pressure value is an ultimate value that does not include a safety factor. We recommend applying a factor of safety of at least 1.5 in design for determining an allowable value passive pressure.

According to the 90-percent design plans, excavations adjacent to Des Moines Memorial Drive will be less than 6 vertical feet in depth; from a cut slope safety perspective, no shoring or temporary slopes are strictly required. However, the potential for encountering underground utilities adjacent to the roadway, the effects of traffic loading on vertical cuts within the excavation (in terms of road stability), and other special considerations must be taken into account in this vicinity.

Backfill

Based on subsurface exploration logs used to characterize the Site, and selected laboratory test results, reuse of onsite soil with contaminant concentrations below the remedial action level appears to be feasible, provided they are carefully managed to avoid excessive moisture. Natural moisture content and Modified Proctor testing results for selected soil samples indicate that soil moisture contents are similar to the optimum moisture content needed for compaction; thus, any required moisture conditioning should be minimal, provided the earthwork is performed in dry weather. Soil moisture content will vary with location, depth, and weather conditions during earthwork. Onsite soil that classify as silty SAND (SM) and SILT (ML) are considered moisture-sensitive and will therefore be difficult to work with during wet weather. To maximize the ability to use onsite soils, earthwork activities should take place during the dry season, and handling of onsite soil should be minimized during wet weather.

Deleterious materials including organic soils or debris, wet soils with significant fines contents, or particles larger than 6 inches in diameter are not acceptable for reuse as structural backfill as required in the project specifications. Soils with significant fines content are not suitable for reuse in wet weather conditions. The suitability of various fill soils for reuse should be determined by the field geotechnical engineer on a case-by-case basis. In general, suitable structural fill material for the project should be placed within 3 percent of its optimum moisture content per ASTM test method D1557 (Modified Proctor). The following backfill recommendations assume that the remedial excavation will be completely dewatered prior to placement of onsite fill.

If material is imported for use as structural fill, it should be granular material with less than 10 percent fines such as Select Borrow as specified in Section 9-03.14(2) of the Washington State Department of Transportation (WSDOT) *Standard Specifications* (WSDOT, 2014), similar to well-graded pit run. In wet weather conditions or situations requiring free-draining backfill, material meeting the criteria for Gravel Borrow as specified in Section 9-03.14(1) of the WSDOT Standard Specifications should be imported for use as fill.

Suitable onsite soils may be used as structural fill, provided it is compacted to a minimum of 90 percent of the maximum dry density (MDD) based on ASTM D1557, to a maximum elevation corresponding to a depth of 2 feet below finished grade. Suitable onsite soils may be used as structural fill in the top 2 feet below finished grade, provided it is compacted to a minimum of 95 percent of the MDD. A lower compaction rate can be used for the top 2 feet of structural fill beneath landscaped areas, as specified in the contract documents. A volume decrease of approximately 5 to 20 percent (or average 10 percent) should be expected during compaction of reused onsite soils to 90 percent of MDD. A volume decrease of 10 to 25 percent (or average 15 percent) should be expected if reused onsite soils are compacted to 95 percent of MDD.

Recycled concrete, crushed to meet WSDOT Select Borrow (Section 9.03,14(1)) or an equivalent Port standard gradation may be used for structural fill at depths at least 3 feet above typical groundwater level and 2 feet below proposed finished grade. Modified Proctor tests should be conducted as a baseline for compaction on at least one representative sample of crushed concrete prior to construction. Recycled concrete should be moisture-conditioned to within 2 percent of optimum moisture content and compacted to a minimum of 95 percent of the MDD based on Modified Proctor testing (ASTM D1557).

We anticipate that the compaction requirements described above can be met by compacting 12-inch lifts of structural fill with a vibratory drum roller. The contractor may choose to use another means of compaction as long as the required compaction standards are met. Thinner lifts of structural fill or heavier equipment may help the contractor to meet compaction requirements if the required level of compaction is not being achieved.

Compaction requirements should be verified by conducting at least one nuclear gauge test for every 500 cubic yards of loose-lift backfill, material change, or work-day shift (whichever comes first). At least one laboratory Modified Proctor test should be performed for every 5,000 cubic yards of backfill material or material change (whichever comes first).

Earthwork is typically most economical when performed under dry weather conditions. Appropriate erosion control measures should be implemented prior to beginning earthwork activities in accordance with the local regulations. If earthwork is to be performed in wet weather or under wet conditions when soil moisture content is difficult to control, the following recommendations apply:

- Earthwork should be performed in small areas to minimize exposure to wet weather.
- Excavation or the removal of unsuitable soils should be followed promptly by the placement and compaction of clean structural fill. The size and type of construction equipment used may have to be limited to prevent soil disturbance.
- The ground surface within the construction area should be graded to promote runoff of surface water and to prevent the ponding of water.
- Onsite soils with significant fines contents are not suitable for reuse.
- Material used as structural fill should consist of clean, granular soil containing less than 5 percent fines, for example Gravel Backfill for Walls in accordance with Section 9-03.12(2) of the WSDOT Standard Specifications (WSDOT, 2014).
- The ground surface within the construction area should be sealed by a smooth drum vibratory roller, or equivalent, and under no circumstances should be left uncompacted and exposed to moisture. Soils that become too wet for compaction should be removed and replaced with clean granular materials.
- Excavation and placement of fill should be observed by the geotechnical engineer to verify that all unsuitable materials are removed and suitable compaction and Site drainage is achieved.
- Appropriate erosion and sedimentation best management practices (BMPs) should be strategically implemented in accordance with Port standards and permitting jurisdiction requirements.

Excavation Dewatering

It is anticipated that active dewatering will be required to stabilize sidewalls and excavation bottoms in some locations during construction and to achieve relatively dry conditions to accommodate placement of fill. We assume that construction will occur during seasonal low groundwater conditions, and dewatering must be able to reduce the hydrostatic pressure by 7 feet (reducing the groundwater elevation to 2 feet below excavation bottom, or to a minimum elevation of about 280 feet). Based on the 90-percent excavation grid developed by Floyd|Snider, and assuming dry season groundwater levels, we anticipate that dewatering will be required in an approximately 11,200 square-foot area, as shown on Figures 1 and 2.

Dewatering considerations, including methods, flowrates, and cost are presented in the sections below.

Potentially Feasible Dewatering Technologies

There are various potential dewatering techniques available, each suited for a unique set of hydrogeologic conditions, with its own set of limitations and relative costs. The dewatering technologies that we consider as feasible for the project are summarized below:

- **Well Points –** Typically jetted or mechanically driven into the ground, well points are particularly suited for dewatering fine- to medium-grained soils. Water is extracted simultaneously from multiple well points by a central vacuum system via a header and individual flow controls.
- **Pumping Wells –** Pumping wells have the ability to effectively dewater large areas in permeable sediments and may produce large amounts of water. Dewatering pumping wells typically consist of 6- to 12-inch casing installed in 8- to 36-inch boreholes. Screen designs and filter packs are specified based on the texture of the water-bearing zone. Submersible pumps are generally used.
- **Sumps –** In addition, sumps with submersible pumps are often used inside of the excavation to control residual seepage and stormwater. The placement of sumps is usually determined on an as needed basis by the contractor, and the location and number of sumps are often moved as the excavation is advanced.

A necessary input to the design of a dewatering system is the permeability and heterogeneity of the geologic conditions, including the consideration of any significant hydraulic boundaries.

Conceptual Dewatering Approach

Based on our understanding of the Site's hydrogeologic conditions, we anticipate the installation of regularly spaced well points around the perimeter of the excavation. In addition, several deeper pumping wells may be required to ensure excavation bottom stability. The pumping wells may be placed on the perimeter, or in the center of the excavation. It is feasible that with proper placement and completion, pumping wells may reduce the number of well points required. The dewatering system would be most effective if installed after the removal of unsaturated overburden.

Optimization of the dewatering system will be completed as part of final design. Design of the dewatering system will be the responsibility of the selected contractor. Project specifications will require the contractor to prepare and submit a Construction Dewatering Plan for approval. The plan will include details regarding method, installation, and construction of the dewatering system, indicating number and type of equipment, depth and locations, conveyance and capacity(ies), water discharge locations, an estimate of advance time to dewater the excavation prior to work in the excavation when necessary, and such other information to verify acceptable control and performance. The Construction Dewatering Plan shall be prepared by a licensed professional hydrogeologist or an experienced professional engineer.

Potential Flow Rates

The total volume of water required to effectively dewater the proposed excavation is directly proportional to the bulk hydraulic conductivity of each major water-bearing unit. Preliminary dewatering volumes for the excavation can be estimated by assuming an equivalent well radius equal to that of the excavation footprint. Assuming the hydraulic conductivities and excavation heads presented above, we estimate that the pumping well dewatering system will need to produce a total flow rate of 50 to 100 gallons per minute (gpm). Initial flow rates may be higher before decreasing to steady state flow.

It should be emphasized that these estimates are preliminary and design flow rates are dependent on verification of field conditions. Depending on extent and depth, placement of sheet piling may also help reduce required excavation dewatering flow rates.

It is our understanding that drawdown due to dewatering is not expected to cause negative impacts to the distribution of subsurface contaminants. In addition, we understand that water generated from dewatering will be treated and discharged to infiltration or surface water.

Cost of Dewatering

The costs of dewatering a deep excavation can vary significantly depending on the complexity of the subsurface conditions, flow rates, and length of construction. However, recent bids by local dewatering contractors on projects with similar conditions were approximately $35,000 per pumping well and $1,500 per well point.

Costs associated with operations and maintenance (O&M) of a well point system is approximately $15,000, whereas the O&M cost for a pumping well is typically $1,000 per month. Based on these assumptions, the total cost for construction and O&M of a dewatering system of this magnitude for a 2-month period is on the order $250,000.

Additional costs include electrical power for the vacuum and submersible pumps and fees associated with discharge to the sanitary or stormwater sewers. Discharge fees vary, but are typically a fraction of a cent per gallon.

Temporary and Permanent Erosion Control

We recommend that all permanent slopes be revegetated with grass or dense native vegetation as quickly as possible following the completion of construction.

References

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Aspect Consulting LLC (Aspect), 2015, Lora Lake 2013-2014 Surface Water—Groundwater Baseline Monitoring, Data Summary Memorandum, prepared for Floyd|Snider, February 20, 2015.

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Limitations

Work for this project was performed for Floyd|Snider and the Port of Seattle (Clients), and this report was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This report does not represent a legal opinion. No other warranty, expressed or implied, is made.

Experience has shown that subsurface soil and groundwater conditions can vary significantly over small distances. Inconsistent conditions can occur between explorations and may not be detected by a geotechnical study. Our recommendations and analysis are based on some degree of reliance on pre-existing and third party-provided data. If, during future Site operations, subsurface conditions are encountered which vary appreciably from those described herein, Aspect Consulting should be notified for review of the recommendations of this report, and revision of such if necessary. If there is a substantial lapse of time between the submission of this report and the start of construction, or if conditions have changed due to construction operations at or near the Site, it is recommended that this report be reviewed to determine the applicability of the conclusions and recommendations considering the changed conditions and time lapse.

This report is issued with the understanding that the information and recommendations contained herein will be incorporated into the 90-percent project plans and specifications, and the necessary steps will be taken to verify that the contractor and subcontractors carry out such recommendations in the field. This report will be revised as necessary as the design progresses through final design.

This firm does not practice or consult in the field of safety engineering. We do not direct the contractor's operations, and we cannot be responsible for the safety of personnel other than our own on the Site; the safety of others is the responsibility of the contractor. The contractor should notify the owner if they consider any of the recommended actions presented herein unsafe.

All reports prepared by Aspect Consulting for the Clients apply only to the services described in the Agreement(s) with the Clients. Any use or reuse by any party other than the Clients is at the sole risk of that party, and without liability to Aspect Consulting. Aspect Consulting's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

Attachments

Figure 1 – Site and Exploration Plan
Figure 2 – Geologic Cross Sections
Attachment A – Geotechnical Exploration Logs
Attachment B – Laboratory Testing
Attachment C – Aquifer Hydraulic Conductivity Estimates from Slug Tests

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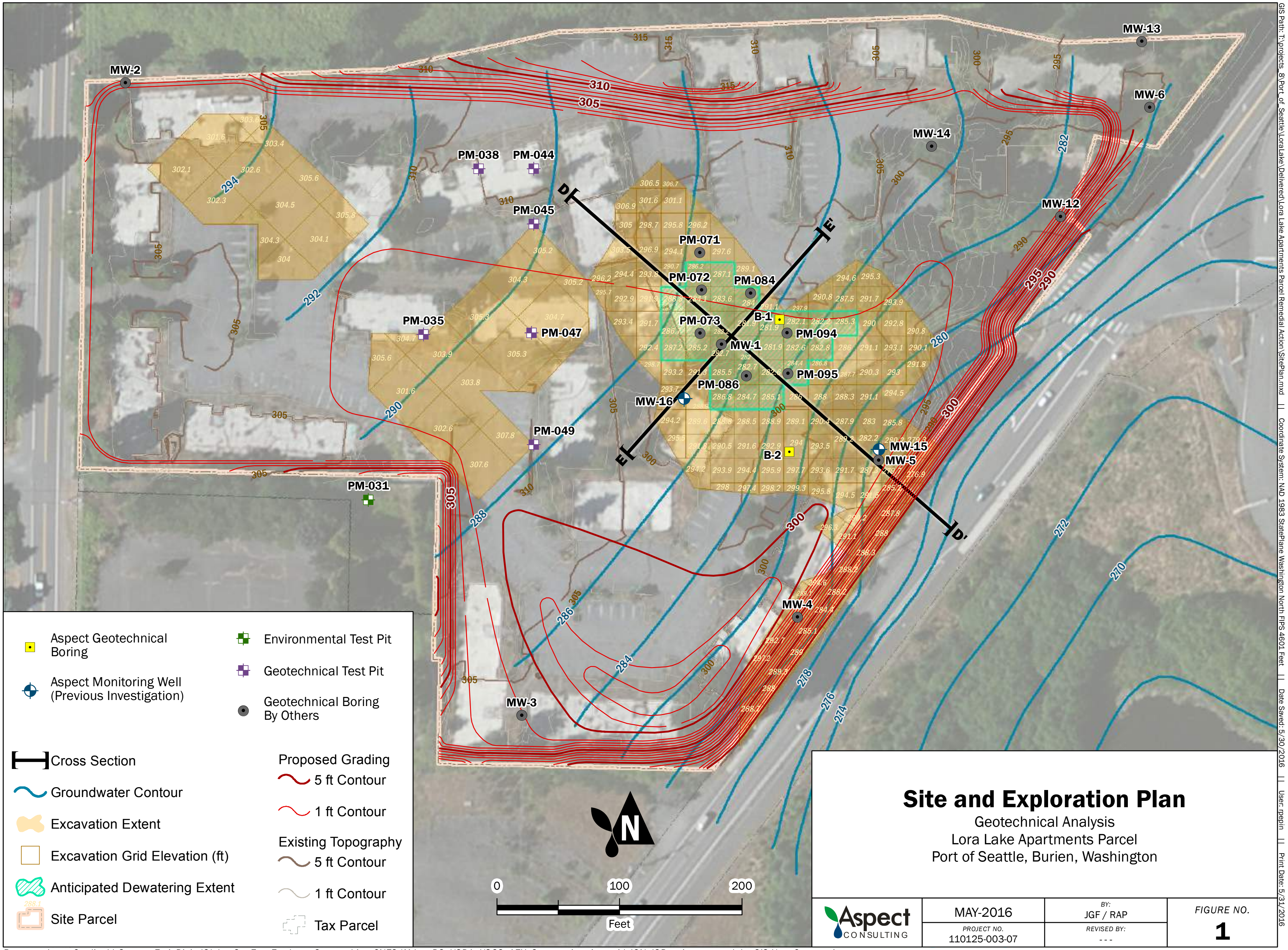
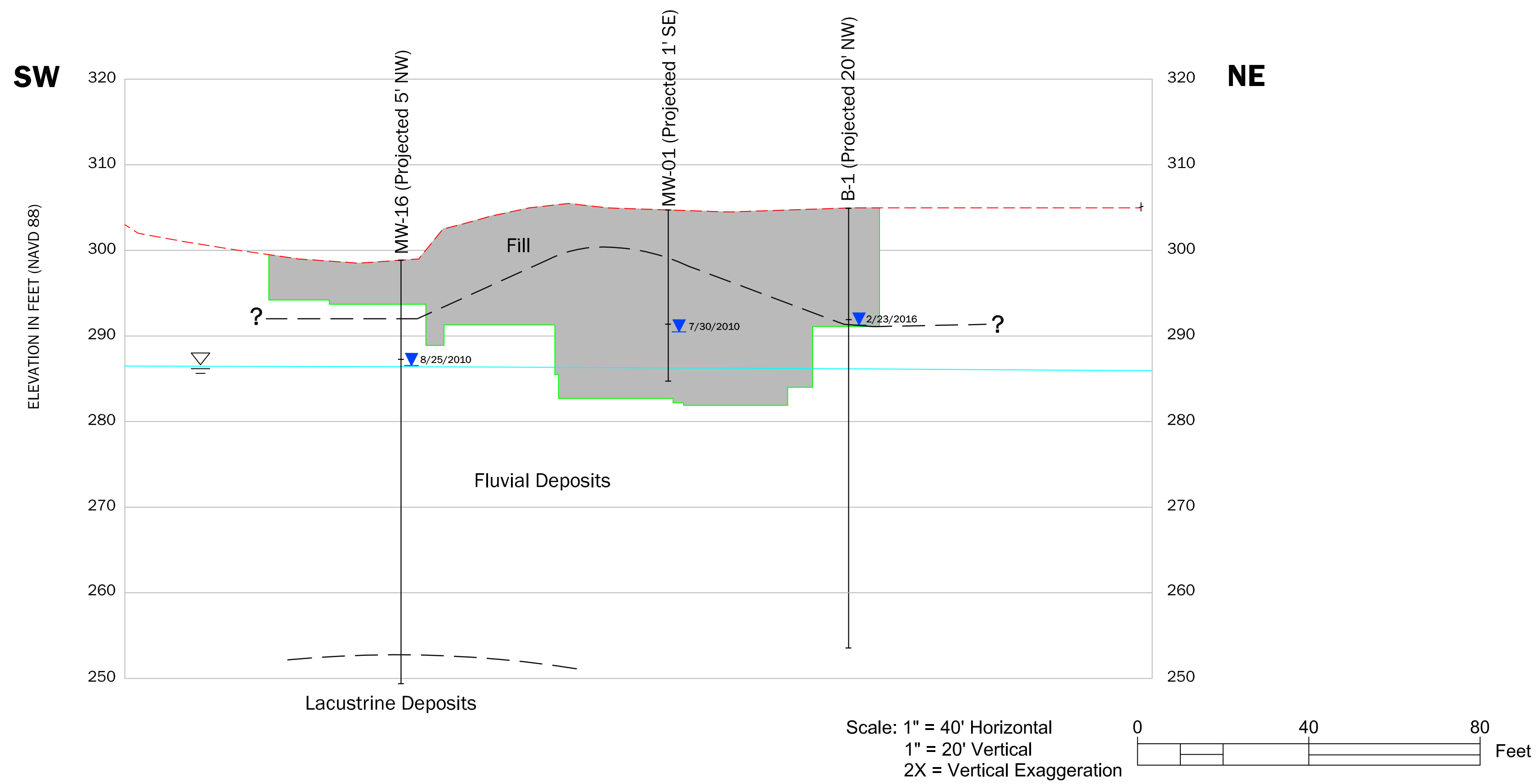
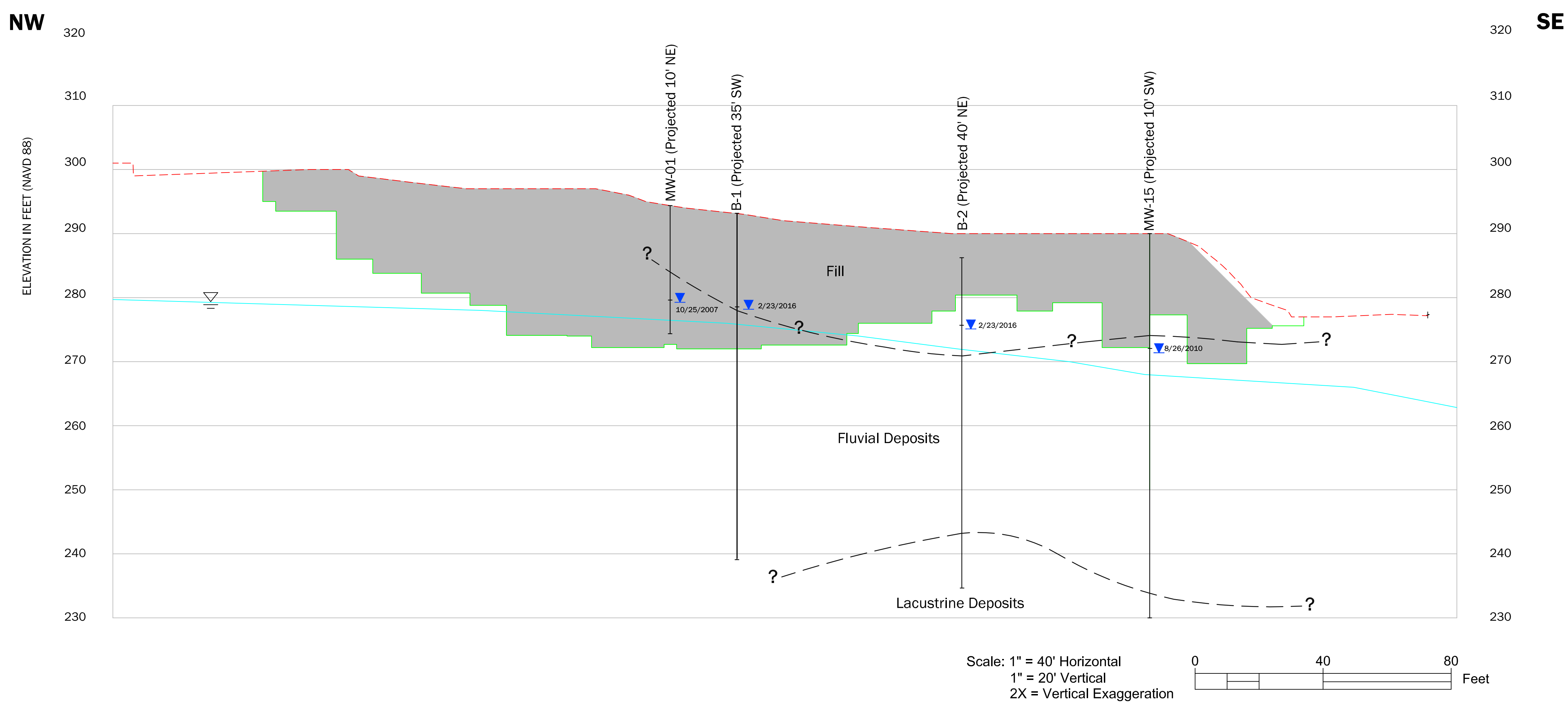
FIGURES



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

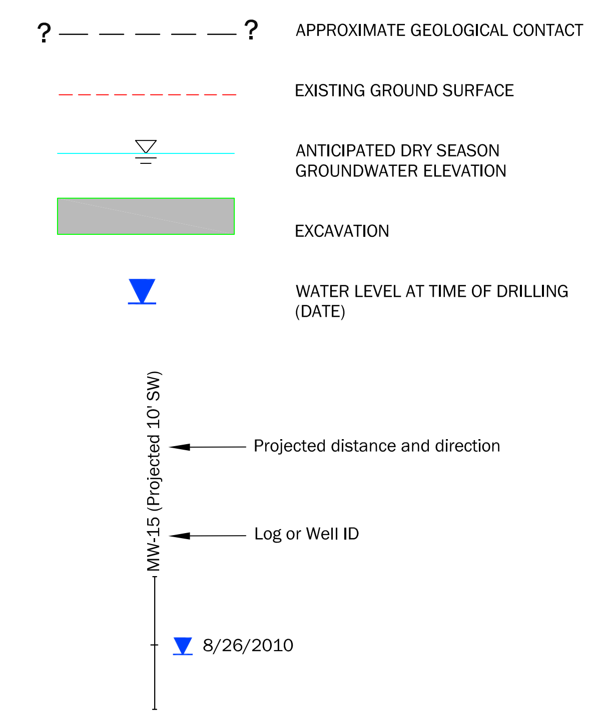




NOTES:

1. GROUNDWATER ELEVATIONS VARY SEASONALLY. GROUNDWATER ELEVATION SHOWN IS THE APPROXIMATE DRY SEASON ELEVATION.
2. EXCAVATION SECTIONS SHOWN ARE POST CLEARING, GRUBBING, AND SUBSURFACE DEMOLITION.
3. SEE MAIN REPORT TEXT FOR COMPLETE SOIL UNIT DESCRIPTIONS.

LEGEND:



Geologic Cross Sections

Geotechnical Report
Lora Lake Apartments Parcel Remedial Action
Port of Seattle, Burien, WA

Aspect CONSULTING	Jun-2016	BY: JGF / RMB	FIGURE NO.
	PROJECT NO. 110125	REVISED BY: RMB	2

ATTACHMENT A

Geotechnical Exploration Logs

Major Divisions			Symbol	Description
Coarse-Grained Soils - More than 50% [1] Retained on No. 200 Sieve	Gravels - More than 50% [1] of Coarse Fraction Retained on No. 4 Sieve	≤5% Fines [5]	GW	Well-graded gravel and gravel with sand, little to no fines
			GP	Poorly-graded gravel and gravel with sand, little to no fines
		≥15% Fines [5]	GM	Silty gravel and silty gravel with sand
			GC	Clayey gravel and clayey gravel with sand
	Sands - 50% [1] or More of Coarse Fraction Passes No. 4 Sieve	≤5% Fines [5]	SW	Well-graded sand and sand with gravel, little to no fines
			SP	Poorly-graded sand and sand with gravel, little to no fines
		≥15% Fines [5]	SM	Silty sand and silty sand with gravel
			SC	Clayey sand and clayey sand with gravel
Fine-Grained Soils - 50% [1] or More Passes No. 200 Sieve	Silts and Clays Liquid Limit Less than 50		ML	Silt, sandy silt, gravelly silt, silt with sand or gravel
			CL	Clay of low to medium plasticity; silty, sandy, or gravelly clay, lean clay
			OL	Organic clay or silt of low plasticity
	Silts and Clays Liquid Limit 50 or More		MH	Elastic silt, clayey silt, silt with micaceous or diatomaceous fine sand or silt
			CH	Clay of high plasticity, sandy or gravelly clay, fat clay with sand or gravel
			OH	Organic clay or silt of medium to high plasticity
Highly Organic Soils			PT	Peat, muck and other highly organic soils

Terms Describing Relative Density and Consistency

	Density	SPT [2] blows/foot
Coarse-Grained Soils	Very Loose	0 to 4
	Loose	4 to 10
	Medium Dense	10 to 30
	Dense	30 to 50
	Very Dense	>50

	Consistency	SPT [2] blows/foot
Fine-Grained Soils	Very Soft	0 to 2
	Soft	2 to 4
	Medium Stiff	4 to 8
	Stiff	8 to 15
	Very Stiff	15 to 30
	Hard	>30

Test Symbols

FC = Fines Content
G = Grain Size
M = Moisture Content
A = Atterberg Limits
C = Consolidation
DD = Dry Density
K = Permeability
Str = Shear Strength
Env = Environmental
PiD = Photoionization Detector

Component Definitions

Descriptive Term	Size Range and Sieve Number
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

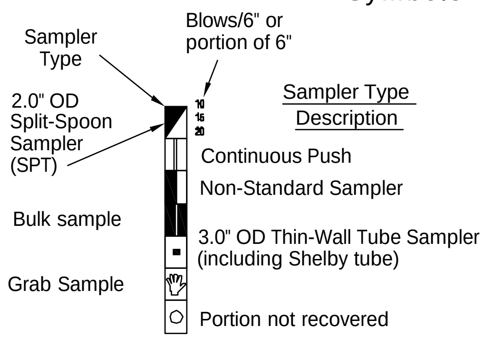
[3] Estimated Percentage

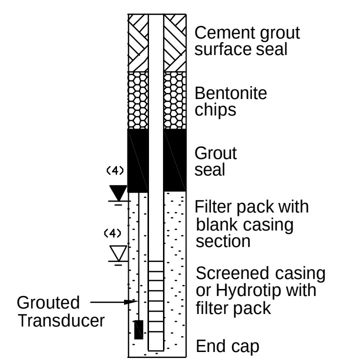
Percentage by Weight	Modifier
<5	Trace
5 to 15	Slightly (sandy, silty, clayey, gravelly)
15 to 30	Sandy, silty, clayey, gravelly)
30 to 49	Very (sandy, silty, clayey, gravelly)

Moisture Content

Dry - Absence of moisture, dusty, dry to the touch
Slightly Moist - Perceptible moisture
Moist - Damp but no visible water
Very Moist - Water visible but not free draining
Wet - Visible free water, usually from below water table

Symbols





(1) Percentage by dry weight
(2) (SPT) Standard Penetration Test (ASTM D-1586)
(3) In General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)
(4) Depth of groundwater
▽ ATD = At time of drilling
▼ Static water level (date)
(5) Combined USCS symbols used for fines between 5% and 15% as estimated in General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)

BGS = below ground surface

Classifications of soils in this report are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D-2487 and D-2488 were used as an identification guide for the Unified Soil Classification System.

Aspect CONSULTING

Exploration Log Key

DATE:
DESIGNED BY:
DRAWN BY:
REVISED BY:
PROJECT NO.
FIGURE NO.
A-1

Q:_ACAD Standards\Standard Details\Exploration Log Key A1.dwg

Aspect Consulting	Lora Lake Apartments - 110125		Geotechnical Exploration Log	
	Project Address & Site Specific Location		*Coordinates (Lat,Lon WGS84)*	*Exploration Number*
	15001 Des Moines Memorial Drive, Burien, Washington.		,	**B-1**

Contractor	*Equipment*	*Sampling Method*	*Ground Surface (GS) Elev. (NAVD88)*
Gregory Drilling	Trackmounted CME-55	Autohammer; 140 lb hammer; 30" drop	305'

Operator	*Exploration Method(s)*	*Work Start/Completion Dates*	*Top of Casing Elev. (NAVD88)*	*Depth to Water (Below GS)*
Josh	Hollow-stem auger	2/23/2016	NA	13.5' (ATD)

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Blows/6"	Tests	Description
0	305					**FILL** 1" Asphalt Medium dense, moist, gray, gravelly, very silty SAND (SM); fine to medium sand, fine subangular gravel.
5	300		S1	9 8 9		
8						Medium dense, moist to very moist, brown with orange mottles, slightly gravelly, silty SAND (SM); fine to coarse sand, fine subrounded gravel.
10	295		S2	4 7 11		
13.5		∇ 2/23/2016				**FLUVIAL DEPOSITS** Medium dense, wet, gray, very gravelly SAND (SP); trace silt, fine to medium sand, fine rounded to subrounded gravel, faint organic odor from 20' to 21.5' bgs.
15	290		S3	6 14 9	G	
20	285		S4	6 8 8		Heave in drill rods.
			S4a	1 0 0 5	G	
24						Dense, wet, light brownish gray, slightly silty SAND (SP-SM); fine sand.
25	280		S5	13 17 20		Becomes gray.

Blows/foot ▲ Water Content (%) ● 0 10 20 30 40 50

Plastic Limit |——| Liquid Limit

Legend

Sample Method: ○ No Soil Sample Recovery; ◩ SPLIT BARREL 2" X 1.375" (SPT) (ASTM 1586)

Water Level: ∇ Water Level (ATD)

See Exploration Log Key for explanation of symbols

Logged by: JGF
Approved by: AAE

Exploration log B-1

Sheet 1 of 2

Aspect CONSULTING	Lora Lake Apartments - 110125		Geotechnical Exploration Log	
	Project Address & Site Specific Location: 15001 Des Moines Memorial Drive, Burien, Washington.		Coordinates (Lat,Lon WGS84): ,	Exploration Number: B-1
Contractor: Gregory Drilling	Equipment: Trackmounted CME-55	Sampling Method: Autohammer; 140 lb hammer; 30" drop	Ground Surface (GS) Elev. (NAVD88): 305'	
Operator: Josh	Exploration Method(s): Hollow-stem auger	Work Start/Completion Dates: 2/23/2016	Top of Casing Elev. (NAVD88): NA	Depth to Water (Below GS): 13.5' (ATD)

Depth (feet)	Elev. (feet)	Sample Type/ID	Blows/foot ▲ / Water Content (%) ●	Blows/6"	Tests	Description	Depth (ft)
		S6	▲ ●	11 21 27			
						Becomes gray.	
35	270	S7	▲	3 12 23			35
						Very dense, wet, brown, very silty SAND (SM); fine sand laminated with silt layers.	
40	265	S8	▲	12 31 50/6			40
45	260	S9	▲	10 20 28			45
						With 10 -15 % light mica.	
50	255	S10	▲	12 24 31			50
						Bottom of exploration at 51.5 ft. BGS.	
55	250						55

Legend

Sample Method: No Soil Sample Recovery; SPLIT BARREL 2" X 1.375" (SPT) (ASTM 1586)

Plastic Limit ├─┤ Liquid Limit

Water Level: ▽ Water Level (ATD)

See Exploration Log Key for explanation of symbols

Logged by: JGF
Approved by: AAE

Exploration log B-1

Lora Lake Apartments - 110125

Geotechnical Exploration Log

Aspect CONSULTING

Project Address & Site Specific Location	Coordinates (Lat,Lon WGS84)	Exploration Number
15001 Des Moines Memorial Drive, Burien, Washington.	,	B-2

Contractor	Equipment	Sampling Method	Ground Surface (GS) Elev. (NAVD88)
Gregory Drilling	Trackmounted CME-55	Autohammer; 140 lb hammer; 30" drop	295'

Operator	Exploration Method(s)	Work Start/Completion Dates	Top of Casing Elev. (NAVD88)	Depth to Water (Below GS)
Josh	Hollow-stem auger	2/23/2016	NA	13.5' (ATD)

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Blows/6"	Tests	Description
0	295					**FILL** 1" Asphalt. Loose, moist, brown, slightly silty SAND (SP-SM); fine to medium sand, trace subrounded to subangular gravel, rare asphalt fragments.
5	290		S1	4 3 3		
						Medium dense, very moist, brown, gravelly, silty SAND (SM); fine to medium sand, subrounded to subangular gravel.
10	285		S2	7 9 11		
		▽ 2/23/2016				**FLUVIAL DEPOSITS** Medium dense, wet, gray, very gravelly, slightly silty SAND (SP-SM); well-graded fine to coarse sand, fine subrounded to subangular gravel, occasional organic fragments.
15	280		S3	7 11 9	G	
						Very dense, wet, brown, silty SAND (SM); fine to medium sand.
20	275		S4	29 42 16		
						Becomes dense.
25	270		S5	8 14 18	G	

Blows/foot ▲ Water Content (%) ● 0 10 20 30 40 50

Plastic Limit ├──┤ Liquid Limit

Legend

Sample Method: ○ No Soil Sample Recovery; ◩ SPLIT BARREL 2" X 1.375" (SPT) (ASTM 1586)

Water Level: ▽ Water Level (ATD)

See Exploration Log Key for explanation of symbols

Logged by: JGF
Approved by: AAE

Exploration log B-2

Lora Lake Apartments - 110125

Geotechnical Exploration Log

Aspect CONSULTING

Project Address & Site Specific Location	Coordinates (Lat,Lon WGS84)	Exploration Number
15001 Des Moines Memorial Drive, Burien, Washington.	,	B-2

Contractor	Equipment	Sampling Method	Ground Surface (GS) Elev. (NAVD88)
Gregory Drilling	Trackmounted CME-55	Autohammer; 140 lb hammer; 30" drop	295'

Operator	Exploration Method(s)	Work Start/Completion Dates	Top of Casing Elev. (NAVD88)	Depth to Water (Below GS)
Josh	Hollow-stem auger	2/23/2016	NA	13.5' (ATD)

Depth (feet)	Elev. (feet)	Sample Type/ID	Blows/6"	Description
~31		S6	3, 13, 21	
~34				Becomes grayish brown.
35	260	S7	7, 17, 23	
40	255	S8	11, 23, 39	Becomes very dense.
~43				**LACUSTRINE DEPOSITS** Dense, wet, gray, sandy SILT (ML); low-plasticity, non-cohesive silt, fine sand, micaceous and thinly laminated with occassional sandier laminae, scattered organics.
45	250	S9	9, 18, 23	
~47.5				Very stiff, wet, gray, SILT (ML); low-plasticity cohesive silt, scattered organics.
50	245	S10	9, 11, 18	
51.5				Bottom of exploration at 51.5 ft. BGS.
55	240			

Column headers also include: Exploration Completion and Notes; Blows/foot ▲ Water Content (%) ● (0 10 20 30 40 50); Tests; Material Type.

Legend

Sample Method: ◯ No Soil Sample Recovery; ◪ SPLIT BARREL 2" X 1.375" (SPT) (ASTM 1586)

Plastic Limit ├──┤ Liquid Limit

Water Level: ▽ Water Level (ATD)

See Exploration Log Key for explanation of symbols

Logged by: JGF
Approved by: AAE

Exploration log B-2

FLOYD | SNIDER strategy ▪ science ▪ engineering	PROJECT: POS-LLA	LOCATION:	BORING ID: PM-071
	LOGGED BY: K. Anderson	BORING LOCATION: Area A1	
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade		NORTHING: 174732.488	EASTING: 1272417.054
DRILLING EQUIPMENT: CME 75 Auger Truck rig		SURFACE ELEVATION:	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA		TOTAL DEPTH (ft bgs): 26	DEPTH TO WATER (ft bgs): 22.1
SAMPLING METHOD: 2" x 18" split spoon, 140 lb. auto hammer		BORING DIAMETER: 8"	DRILL DATE: 9/15/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
0	Asphalt	Asphalt ground surface.			
0.5	SW	Moist, brown well-graded fine to coarse **SAND** with small rounded gravel and trace silt. No odor.			
1					
2					
3					
4					
5			Drive 5–6.5	6	
			Recovery 5.7–6.5	5	
6				5	
7					
8					
9					
10					

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Moved ~5.5 feet due to storm sewer lines-to re-survey

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-071**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174732.488	**EASTING:** 1272417.054	
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:**	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 22.1	
SAMPLING METHOD: 2" x 18" split spoon, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/15/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
10					
11					
12					
13					
14					
15					
16					
17					
18					
		Moist, brown poorly graded fine SAND.			
19					

ABBREVIATIONS:
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NOTES:
Moved ~5.5 feet due to storm sewer lines-to re-survey

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-071**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174732.488	**EASTING:** 1272417.054	
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:**	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 22.1	
SAMPLING METHOD: 2" x 18" split spoon, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/15/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	# of Blows	Sample ID
20	SP		10	
	SP		13	
21	SP		14	PM-071-21.0-22.0@0935
	SP	At 21.5 feet, 0.4-foot lense of brown sandy silt, then same as above.	12	
22	SP	At 22.1 feet, becomes wet. Thin bands of red oxidized sand present. No odor.	14	
	SP		15	
23	SP		9	PM-071-23.0-24.0@0945
	SP		17	
24	SP		20	
	SP		7	
25	SP		5	PM-071-25.0-26.0@1000
	SP	Bottom of boring = 26 feet. Assume recovered intervals compressed for sample collection.	21	
26				

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Moved ~5.5 feet due to storm sewer lines-to re-survey

FLOYD | SNIDER strategy ▪ science ▪ engineering	PROJECT: POS-LLA	LOCATION:	BORING ID: PM-072
	LOGGED BY: K. Anderson	BORING LOCATION: Area A1	

DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	NORTHING:	EASTING:
DRILLING EQUIPMENT: CME 75 Auger Truck rig	SURFACE ELEVATION: 307.09	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA	TOTAL DEPTH (ft bgs): 21.5	DEPTH TO WATER (ft bgs): 18.5
SAMPLING METHOD: 2" x 18" split spoon, 140 lb. auto hammer	BORING DIAMETER: 8"	DRILL DATE: 9/15/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
0	Concrete	Concrete ground surface.			
0.5–10		Moist, gray brown well-graded fine to coarse **SAND** with rounded gravel and trace silt.			
5–6.5			Drive 5–6.5; Recovery 5.75–6.5	4, 5, 9	
5.8		At 5.8 feet, becomes brown.			
6.4		At 6.4 feet, nail (anthropogenic debris) present.			
10					

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

FLOYD | SNIDER strategy ▪ science ▪ engineering	PROJECT: POS-LLA	LOCATION:	BORING ID: **PM-072**
	LOGGED BY: K. Anderson	BORING LOCATION: Area A1	
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade		NORTHING:	EASTING:
DRILLING EQUIPMENT: CME 75 Auger Truck rig		SURFACE ELEVATION: 307.09	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA		TOTAL DEPTH (ft bgs): 21.5	DEPTH TO WATER (ft bgs): 18.5
SAMPLING METHOD: 2" x 18" split spoon, 140 lb. auto hammer		BORING DIAMETER: 8"	DRILL DATE: 9/15/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
10	SW			3	
				2	
11				2	
12					
13					
14					
15					
16					
17					
18		At 18 feet, becomes loose and wet. Poor sample recovery 18.5 to 20 feet.		7	
19				5	
				5	

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-072**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:**	**EASTING:**	
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:** 307.09	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 21.5	**DEPTH TO WATER (ft bgs):** 18.5	
SAMPLING METHOD: 2" x 18" split spoon, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/15/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
20		At 20 feet, large rounded cobbles blocking sampler. Abandoned boring and re-drilled using larger diameter sampler.		7	
				9	
21				10	

ABBREVIATIONS:
ft bgs = feet below ground surface ▼ = denotes groundwater table
USCS = Unified Soil Classification System

NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-072 rep 2**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:**	**EASTING:**	
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:**	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 18" D&M sampler, 300 lb. hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/15/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
0		No samples 0 to 18.5 feet. See PM-072 for lithology.			
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Location moved 2.5 feet south of original PM-072 location, needs re-survey

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-072 rep 2**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:**	**EASTING:**	
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:**	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 18" D&M sampler, 300 lb. hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/15/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
10					
11					
12					
13					
14					
15					
16					
17					
18					
19		Wet, brown poorly graded silty fine **SAND** with abundant well rounded gravel. Driller reports cobbles in overlying material, likely causing poor recovery.		5	
				5	PM-072-19.0-20.0@1215
				9	

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Location moved 2.5 feet south of original PM-072 location, needs re-survey

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-072 rep 2**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:**	**EASTING:**	
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:**	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: 18" D&M sampler, 300 lb. hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/15/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	# of Blows	Sample ID
20	SM	At 20 feet, slight hydrocarbon odor present.	3	PM-072-20.0-21.0@1225
			4	
21	SM		7	PM-072-21.0-22.0@1232
		At 21.5 feet, becomes gray with increased silt.	7	
22	ML	Moist, brown firm sandy **SILT**. No odor.	15	
	SP	Wet, gray poorly graded fine **SAND**. Slight hydrocarbon odor that dissipates quickly when sample is homogenized.	20	
23	SP		12	PM-072-23.0-24.0@1250 PM-072-23.0-24.0-D@1258
			20	
24	SP		24	
		At 24.5 feet, grain size becomes smaller.	13	
25	SP		17	PM-072-25.0-26.0@1305
		Bottom of boring = 26 feet. Assume recovered intervals compressed for sample collection.	22	
26				

ABBREVIATIONS:
ft bgs = feet below ground surface
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▼ = denotes groundwater table

NOTES:
Location moved 2.5 feet south of original PM-072 location, needs re-survey

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-073
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1	
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174667.047	**EASTING:** 1272417.292
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:**	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 23
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/15/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
0	Concrete	Concrete ground surface.			
0.5	SW	Moist, brown well-graded fine to coarse **SAND** with rounded gravel and trace silt.			
5			Drive 5–6.5	12	
5.5			Recovery 5.75–6.5	16	
5.8		At 5.8 feet, geotextile fabric present.			
6				15	
10					

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
1' west of target location due to vegetation

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PROJECT:	LOCATION:	BORING ID:
POS-LLA		PM-073

LOGGED BY: K. Anderson	BORING LOCATION: Area A1
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	NORTHING: 174667.047 / EASTING: 1272417.292
DRILLING EQUIPMENT: CME 75 Auger Truck rig	SURFACE ELEVATION: / COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA	TOTAL DEPTH (ft bgs): 26 / DEPTH TO WATER (ft bgs): 23
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	BORING DIAMETER: 8" / DRILL DATE: 9/15/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
10				16	
				25	
11		At 11 feet, abundant large gravel blocking sampler.		24	
12					
13					
14					
15					
16					
17					
18					
		Moist, brown poorly graded fine SAND.		15	
19		At 19.2 feet, becomes gray with hydrocarbon odor.		40	PM-073-19.0-20.0@1438 PM-073-19.0-20.0-D@1440
				42	

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
1' west of target location due to vegetation

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-073
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1	
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174667.047	**EASTING:** 1272417.292
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:**	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 23
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/15/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
20	SP			15	
				32	
21				30	PM-073-21.0-22.0@1445
				25	
22				40	
		At 22.5 feet, becomes reddish brown. Slight musty odor, no hydrocarbon odor.		35	
23 ▼		At 23 feet, becomes wet and gray with slight musty odor.		12	PM-073-23.0-24.0@1500
		At 23.5 feet, becomes reddish brown.		32	
24				30	
				12	
25				31	PM-073-25.0-26.0@1510
		Bottom of boring = 26 feet. Assume recovered intervals compressed for sample collection.		8	
26					

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
1' west of target location due to vegetation

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-084
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1	
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174699.689	**EASTING:** 1272458.251
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:**	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 17
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/16/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
0	Asphalt	Asphalt ground surface.			
0.5–10	SW	Moist, brown well-graded fine to coarse **SAND** with well-graded sub-angular to angular gravel and trace silt. No odor.			
5–5.5			Drive 5–6.5; Recovery 5.75–6.5	14	
5.5–6				24	
6–6.5				43	

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Moved location approximately 5.5' east to avoid trees and thick concrete slab

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-084	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174699.689	**EASTING:** 1272458.251	
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:**	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 17	
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/16/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
10				6	
				6	
11				7	
12					
13					
14					
15					
16					
17 (groundwater)					
18					
	SM	Wet, brown well-graded fine to coarse silty **SAND** with few fine gravel. No odor.		12	
19				35	PM-084-19.0-20.0@0850
				30	

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Moved location approximately 5.5' east to avoid trees and thick concrete slab

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-084**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade		**NORTHING:** 174699.689	**EASTING:** 1272458.251
DRILLING EQUIPMENT: CME 75 Auger Truck rig		**SURFACE ELEVATION:**	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA		**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 17
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer		**BORING DIAMETER:** 8"	**DRILL DATE:** 9/16/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
20				30	
				34	
21	SP	Wet, gray poorly graded fine **SAND** with few rounded gravel. No odor.		41	PM-084-21.0-22.0@0905
				13	
22				22	
				38	
23				30	PM-084-23.0-24.0@0925
				35	
24				40	
				32	
25		At 25.2 feet, becomes slightly reddish-brown.		41	PM-084-25.0-26.0@0935
		Bottom of boring = 26 feet. Assume recovered intervals compressed for sample collection.		39	
26					

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
Moved location approximately 5.5' east to avoid trees and thick concrete slab

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-086**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174632.383	**EASTING:** 1272454.995	
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:**	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 18.75	
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/16/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
0	Asphalt	Asphalt ground surface.			
0.5–10	SW	Slightly moist, dark black brown well-graded **SAND** with gravel and grace silt. Wood fragments present in shoe of sampler.			
5–5.5				8	PM-086-05.0-06.0@1035
5.5–6				8	
6–6.5				6	

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
~1-foot east of target location due to vegetation

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-086
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1	
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174632.383	**EASTING:** 1272454.995
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:**	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 18.75
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/16/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
10	SP	Moist, brown poorly graded fine **SAND** with abundant wood fragments. Wood fragments have slight sweet odor.		8	PM-086-10.0-11.0@1040
		At 10.5 feet, wood fragments disappear.		10	
11		From 11 to 11.25 feet, color grades to gray.		12	
12					
13					
14					
15					
16					
17					
18				14	
19		At 18.75 feet, becomes wet. No odor.		22	PM-086-19.0-20.0@1055 PM-086-19.0-20.0-D@1040
				30	

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
~1-foot east of target location due to vegetation

FLOYD | SNIDER strategy ▪ science ▪ engineering	PROJECT: POS-LLA	LOCATION:	BORING ID: PM-086
	LOGGED BY: K. Anderson	BORING LOCATION: Area A1	

DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	NORTHING: 174632.383	EASTING: 1272454.995
DRILLING EQUIPMENT: CME 75 Auger Truck rig	SURFACE ELEVATION:	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA	TOTAL DEPTH (ft bgs): 26	DEPTH TO WATER (ft bgs): 18.75
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	BORING DIAMETER: 8"	DRILL DATE: 9/16/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
20		At 20 feet, slight sweet odor.		11	
				22	
21		At 21.25 feet, 3-inch lense of wet, brown silty fine sand.		27	PM-086-21.0-22.0@1110
				27	
22		At 22.25 feet, 0.5-foot lense of reddish brown sand. Slight sweet odor.		39	
				44	
23				27	PM-086-23.0-24.0@1125
				31	
24				39	
				18	
25		At 25.4 feet, becomes gray with no odor. At 25.75 feet, becomes gray brown. Bottom of boring = 26 feet. Assume recovered intervals compressed for sample collection.		27	PM-086-25.0-26.0@1135
				30	
26					

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:
~1-foot east of target location due to vegetation

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PROJECT: POS-LLA		**LOCATION:**	**BORING ID:** PM-094
LOGGED BY: K. Anderson		**BORING LOCATION:** Area A1	
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade		**NORTHING:** 174667.316	**EASTING:** 1272487.994
DRILLING EQUIPMENT: CME 75 Auger Truck rig		**SURFACE ELEVATION:** 303.54	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA		**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 18.5
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer		**BORING DIAMETER:** 8"	**DRILL DATE:** 9/16/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
0	Asphalt	Asphalt ground surface.			
0.5–10	SW	Moist, dark brown well-graded fine to coarse **SAND** with small gravel and trace silt. No odor.			
5–5.5			Drive	8	PM-094-05.0-06.0@1310
5.5–6			Drive/Recovery	12	
6–6.5			Drive/Recovery	11	

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-094**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174667.316	**EASTING:** 1272487.994	
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:** 303.54	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 18.5	
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/16/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
10				5	PM-094-10.0-11.0@1317
				8	
11	SP	Moist, brown poorly graded fine **SAND**. No odor.		11	
12					
13					
14					
15					
16					
17					
18					
18.5 (groundwater)	SP-SM	Wet, brown well-graded fine to coarse **SAND** with silt and gravel.		12	
19				14	PM-094-19.0-20.0@1335
		Wet, gray poorly graded fine **SAND**. Slight hydrocarbon odor.		17	

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** PM-094
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174667.316	**EASTING:** 1272487.994	
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:** 303.54	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 26	**DEPTH TO WATER (ft bgs):** 18.5	
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/16/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
20	SP	At 20 feet, small to medium gravel and little silt present.		17	
				21	
21				23	PM-094-21.0-22.0@1345
				18	
22		At 22.3 feet, 3-inch lense of red sand. Hydrocarbon odor present.		24	
				31	
23				16	PM-094-23.0-24.0@1400
				22	
24				23	
		At 24.5 feet, some pockets of brown silty sand and slight hydrocarbon odor present. At 24.75 feet, becomes gray brown.		14	
25				19	PM-094-25.0-26.0@1405
		Bottom of boring = 26 feet. Assume recovered intervals compressed for sample collection.		28	
26					

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-095**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174634.239	**EASTING:** 1272488.894	
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:** 301.52	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** 18.5	
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/16/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
0	Asphalt	Asphalt ground surface.			
0.5	SW	Slightly moist, brown well-graded fine to coarse **SAND** with small rounded gravel and trace silt. Asphalt fragments present in shallow soil. No odor.			
1				12	PM-095-01.0-02.0@1505
1.5				13	
2				14	
3					
4					
5					
6					
7					
8					
9					
9.5		At 9.5 feet, gravel becomes larger.		15	
10					

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-095
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1	

DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174634.239	**EASTING:** 1272488.894
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:** 301.52	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** 18.5
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/16/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
10				17	PM-095-10.0-11.0@1515
				20	
11		From 11 to 20 feet, driller reports rig feedback indicating more dense material than that encountered in nearby borings.			
12					
13					
14					
15					
16					
17					
18					
18.5 ▼	SP	Wet, gray and brown poorly graded fine **SAND** with large gravel. No odor.		14	
19				21	PM-095-19.0-20.0@1525
		Bottom of boring = 20 feet. Assume recovered intervals compressed for sample collection.		29	

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-095**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area A1		
DRILLED BY: Curtis Askew/Kyle Ceruti, Cascade	**NORTHING:** 174634.239	**EASTING:** 1272488.894	
DRILLING EQUIPMENT: CME 75 Auger Truck rig	**SURFACE ELEVATION:** 301.52	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 8" x 5" HSA	**TOTAL DEPTH (ft bgs):** 20	**DEPTH TO WATER (ft bgs):** 18.5	
SAMPLING METHOD: 18" D&M sampler, 140 lb. auto hammer	**BORING DIAMETER:** 8"	**DRILL DATE:** 9/16/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Drive/ Recovery	# of Blows	Sample ID
20					

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** PM-031	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B2		
DRILLED BY: Mark Jaymeson, Port of Seattle	**NORTHING:** 174531.089159	**EASTING:** 1272146.44324	
DRILLING EQUIPMENT: Excavator	**SURFACE ELEVATION:**	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 1-foot bucket	**TOTAL DEPTH (ft bgs):** 3	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: Hand grab	**BORING DIAMETER:** Test pit	**DRILL DATE:** 9/29/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Sample ID
0	SW/OL/OH	Moist, dark brown well-graded **SAND** and **ORGANIC SOIL** with little silt.	
1	SW	Moist, brown well-graded **SAND** with little silt.	
		At 1.5 feet, becomes dark brown.	
2		Bottom of test pit = 3 feet.	PM-031-02.0-03.0@0915
3			

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:

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PROJECT: POS-LLA		**LOCATION:**	**BORING ID:** **PM-035**
LOGGED BY: K. Anderson		**BORING LOCATION:** Area B1	
DRILLED BY: Mark Jaymeson, Port of Seattle		**NORTHING:** 174666.089159	**EASTING:** 1272191.44324
DRILLING EQUIPMENT: Excavator		**SURFACE ELEVATION:**	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 1-foot bucket		**TOTAL DEPTH (ft bgs):** 3	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: Hand grab		**BORING DIAMETER:** Test pit	**DRILL DATE:** 9/29/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Sample ID
0	SW	Moist, brown well-graded **SAND** with gravel and little silt. Abundant rootlets.	PM-035-00.0-01.0@1000 PM-035-00.0-01.0-D@1006
1			PM-035-01.0-02.0@1002
2		At 2 feet, abandoned electrical wire present. At 3 feet, perforated PVC pipe (possible foundation drain) present. Bottom of test pit = 3 feet.	PM-035-02.0-03.0@1004
3			

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:
Drove second core for sample volume

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-038**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1		
DRILLED BY: Mark Jaymeson, Port of Seattle		**NORTHING:** 174801.089159	**EASTING:** 1272236.44324
DRILLING EQUIPMENT: Excavator		**SURFACE ELEVATION:**	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 1-foot bucket		**TOTAL DEPTH (ft bgs):** 3	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: Hand grab		**BORING DIAMETER:** Test pit	**DRILL DATE:** 9/29/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Sample ID
0	Concrete	Concrete ground surface underlain by plastic. Concrete broken by operator with air-powered breaker and removed with bucket.	PM-038-00.0-01.0@1121
1	SW	Dry, brown well-graded **SAND** with abundant rounded gravel and little silt.	
2		At 1.5 feet, becomes moist.	
3		Bottom of test pit = 3 feet.	

ABBREVIATIONS:
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NOTES:
Moved because target location was on a foundation wall

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PROJECT: POS-LLA	**LOCATION:**	**BORING ID:** **PM-044**	
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1		
DRILLED BY: Mark Jaymeson, Port of Seattle		**NORTHING:** 174801.089159	**EASTING:** 1272281.44324
DRILLING EQUIPMENT: Excavator		**SURFACE ELEVATION:**	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 1-foot bucket		**TOTAL DEPTH (ft bgs):** 2	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: Hand grab		**BORING DIAMETER:** Test pit	**DRILL DATE:** 9/29/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Sample ID
0	Concrete	Concrete ground surface surrounding location; broken concrete at sample location (appears to be potholed to locate buried utility).	PM-044-00.0-01.0@1206
	SW	Dry, brown well-graded **SAND** with gravel and little silt.	
1		At 1 foot, becomes moist.	PM-044-01.0-02.0@1208
		At 1.5 feet, PVC conduit containing decommissioned electrical wires encountered. Bottom of test pit = 2 feet.	
2			

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-045**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1		
DRILLED BY: Mark Jaymeson, Port of Seattle	**NORTHING:** 174756.089159	**EASTING:** 1272281.44324	
DRILLING EQUIPMENT: Excavator	**SURFACE ELEVATION:**	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT	
DRILLING METHOD: 1-foot bucket	**TOTAL DEPTH (ft bgs):** 3	**DEPTH TO WATER (ft bgs):** NA	
SAMPLING METHOD: Hand grab	**BORING DIAMETER:** Test pit	**DRILL DATE:** 9/29/2015	

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Sample ID
0	Concrete	Concrete ground surface. Concrete broken by operator using air-powered breaker and removed with bucket.	PM-045-00.0-01.0@1314
	SW	Dry, brown well-graded **SAND** with gravel.	
1			PM-045-01.0-02.0@1316
		At 1.5 feet, becomes moist.	
2			PM-045-02.0-03.0@1318
		Bottom of test pit = 3 feet.	
3			

ABBREVIATIONS:
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NOTES:

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PROJECT: POS-LLA	**LOCATION:**		**BORING ID:** **PM-047**
LOGGED BY: K. Anderson	**BORING LOCATION:** Area B1		
DRILLED BY: Mark Jaymeson, Port of Seattle		**NORTHING:** 174667.179	**EASTING:** 1272279.558
DRILLING EQUIPMENT: Excavator		**SURFACE ELEVATION:** 306.401	**COORDINATE SYSTEM:** SPCS WA N NAD83 FT
DRILLING METHOD: 1-foot bucket		**TOTAL DEPTH (ft bgs):** 2	**DEPTH TO WATER (ft bgs):** NA
SAMPLING METHOD: Hand grab		**BORING DIAMETER:** Test pit	**DRILL DATE:** 9/29/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**, minor constituent, odor, staining, sheen, debris, etc.)	Sample ID
0	Concrete	Concrete ground surface. Concrete broken by operator using air-powered breaker and removed with bucket.	PM-047-00.0-01.0@1453
1	SW	Slightly moist, brown well-graded **SAND** with gravel and little silt.	PM-047-01.0-02.0@1455
2	SW	Bottom of test pit = 2 feet.	

ABBREVIATIONS:
ft bgs = feet below ground surface
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NOTES:

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PROJECT:	LOCATION:	BORING ID:
POS-LLA		PM-049
LOGGED BY: K. Anderson	BORING LOCATION: Area B2	

DRILLED BY:	NORTHING:	EASTING:
Mark Jaymeson, Port of Seattle	174576.089159	1272281.44324
DRILLING EQUIPMENT: Excavator	SURFACE ELEVATION:	COORDINATE SYSTEM: SPCS WA N NAD83 FT
DRILLING METHOD: 1-foot bucket	TOTAL DEPTH (ft bgs): 3	DEPTH TO WATER (ft bgs): NA
SAMPLING METHOD: Hand grab	BORING DIAMETER: Test pit	DRILL DATE: 9/29/2015

Depth (feet)	USCS Symbol	Soil Description and Observations (Moisture, color, consistency, **MAJOR CONSTITUENT**,minor constituent, odor, staining, sheen, debris, etc.)	Sample ID
0	SW	Dry, brown well-graded **SAND** with gravel and little silt.	
1		At 1 foot, geotextile membrane present	
2		Bottom of test pit = 3 feet.	PM-049-02.0-03.0@1518 PM-049-02.0-03.0-D@1520
3			

ABBREVIATIONS:
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NOTES:

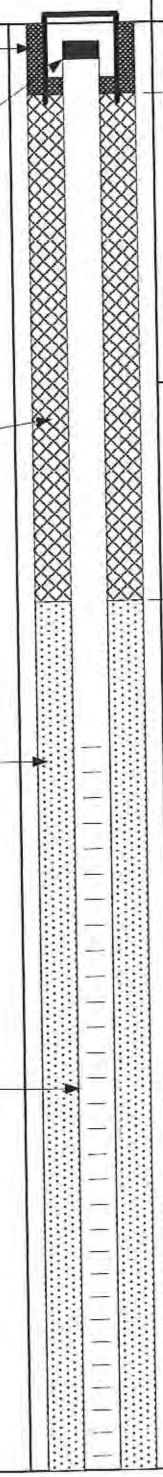
Boring & Well Construction Log

Well MW-1 (Boring LLP-4 Location)

GeoScience Management, Inc.
Environmental Consulting Services
809 156th Street NE
Arlington, WA 98223

PROJECT Lora Lake Apartments
CLIENT Port of Seattle
DRILLING COMPANY Hollow-stem Auger
GEOLOGIST H. W. Small, L.HG.
START DATE 10/25/2007 **END DATE** 10/25/2007

DRILLING METHOD Hollow-stem Auger (4.25 ID x 9 OD)
SAMPLING METHOD 3-in. O.D. Split-Spoon Sampler
SURFACE COMPLETION Flush-mount steel monument
Elevation Ground: Not Measured
Elevation TOC: Not Measured
Total Boring Depth: 20 Feet
Depth to Water ATD: 14 Feet



DEPTH (FEET)	SAMPLE ID	BLOW COUNT (PER 6 INCHES)	PID READINGS (PPM)	USCS	DESCRIPTION
0				FILL	Planter soil over: Gray, brown and black, damp, slightly silty, gravelly, medium to fine SAND (Fill). Occasional fragments of wood, debris, roots and organic matter to approximately 6 feet bgs.
5.5 to 6.0	MW-1-5.5'	50/6"	10		Drove sample at 5.5 feet, but did not encounter target zone of substantial organics, as observed in boring LLP-4.
6.0 to 6.5	MW-1-6'	50/6"	10		Drove sample at 6.0 feet, but did not encounter target zone of substantial organics. Gravel in shoe.
7.0 to 8.0	MW-1-7'	10, 20, 22	5	SP	Drilled to 7 feet and drove sample again, but did not encounter target zone of substantial organics. Brown, damp, trace to slightly silty, gravelly, medium to fine SAND (Native soil).
14.0					Water level approximately 14.0 feet below ground surface at time of drilling.
14.0 to 15.0	MW-1-14'	40, 36, 50	80	GP	Gray, wet, sandy gravel zone approximately 3-inch thick. Strong hydrocarbon-like odor, sheen on gravel.
				SP	Gray, wet, trace to slightly silty, gravelly, medium to fine SAND.
20					Total depth = 20 feet.

Construction Notes: Installed 2-inch diameter PVC well screen from 20 to 10 feet (see as-built diagram this page). Completed at the ground surface in concrete pad with steel, traffic-rated well monument. No water added during drilling except to hydrate bentonite seal.

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Boring/Well Log

Well #: MW-2
Sheet 1 of 2

Project: Lora Lake Apartments	Monument: Flush Mount	Stick Up: -
Project #: 05482-025-210	Northing: - Easting: -	Ground Elevation: -
Location: Burien, WA	Drill Rig Type: HSA Limited Access	MP Elevation: -
Client: Port of Seattle	Method: HSA	Total Depth: 15.5'
Start Date & Time: 3/18/08 0800	Casing ID: 2"	Filter Pack: 10/20 Silica Sand
Finish Date & Time: 3/18/08 0850	Boring ID: 8.25"	Seal: Bentonite chips
Contractor: Cascade Drilling Inc.	Bit Type: 4.25" HSA	Grout: -
Operator: Curtis Askew	Logged By: R. Knecht/ C. Smith	Screen: 0.010" slot Sch. 40 PVC 5-15 ft-bgs

Sample: Type & Number	Sample: Depth Range	Sample: % Rec	Sample: Blows per 6"	Sample: PID (ppm)	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft.)	Comments & Samples
					0	(0.0-0.3) MULCH	0	Flush Mount Monument 2-inch Sch. 40 PVC riser from 0-5 ft-bgs
SS-1	0.0-1.5	66	4 5 9	0.7 (Amb. 0.3)		(0.3-1.5) SP: POORLY GRADED SAND, dark yellowish brown, fine, medium dense, moist. Trace rootlets, and fine, rounded, gravel. No odor or visible contamination.		0.0-0.5' Sampled for analytical
SS-2	1.5-3.0	72	11 13 14	1.2 (Amb. 0.3)		(1.5-3.0) SP: POORLY GRADED SAND, light yellowish gray, fine, medium dense, moist. One large, long root, 1/8" in diameter. Trace coarse sand, and rounded, fine gravel, up to 0.5" in diameter. No odor or visible contamination.		1.5-2.0' Sampled for analytical
						(3.0-4.0) Not Sampled.		Bentonite seal from 2 to 4 ft-bgs
SS-3	4.0-5.5	66	13 23 25	1.1 (Amb. 0.3)	5	(4.0-5.5) SW: WELL GRADED SAND, yellowish gray grading to dark yellowish gray, fine to medium, dense, moist to wet. Trace fine gravel, up to 3/4" in diameter. No odor or visible contamination.	-5	
						(5.5-6.5) Not Sampled.		
SS-4	6.5-8.0	75	20 50/6"	1.4 (Amb. 0.6)		(6.5-8.0) SW: WELL GRADED SAND, yellowish brown, fine to coarse, very dense, wet. Trace rounded, fine gravel, up to 3/4" in diameter. No odor or visible contamination.		6.5-8.0' Sampled for analytical
						(8.0-9.0) Not Sampled.		

Remarks and Datum Used:
ft-bgs - feet below ground surface
HSA - Hollow Stem Auger
Sch. - Schedule
Amb. - ambient air

ENSR
1011 SW Klickitat Way, Suite 207
Seattle, WA 98134-1162
Phone: (206) 624-9349
Fax: (206) 624-2839

Sample Type
N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater

Date	Time	Depth (ft.)
03/18/08	0944	6.46'

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Boring/Well Log

Well #: MW-3
Sheet 1 of 3

Project: Lora Lake Apartments	Monument: Flush Mount	Stick Up: -
Project #: 05482-025-210	Northing: - Easting: -	Ground Elevation: -
Location: Burien, WA	Drill Rig Type: HSA Limited Access	MP Elevation: -
Client: Port of Seattle	Method: HSA	Total Depth: 25.5'
Start Date & Time: 3/18/08 1015	Casing ID: 2"	Filter Pack: 10/20 Silica Sand
Finish Date & Time: 3/18/08 1115	Boring ID: 8.25"	Seal: Bentonite chips
Contractor: Cascade Drilling Inc.	Bit Type: 4.25" HSA	Grout: -
Operator: Curtis Askew	Logged By: R. Knecht/ C. Smith	Screen: 0.010" slot Sch. 40 PVC 13-23 ft-bgs

Sample: Type & Number	Depth Range	% Rec	Blows per 6"	PID (ppm)	Well Completion Log	Graphic	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft.)	Comments & Samples
							0	(0.0-0.3) MULCH	0	Flush Mount Monument 2-inch diameter, Sch. 40 PVC riser from 0-13 ft-bgs
SS-1	0.0-1.5	66	5 / 8 / 23	0.7 (Amb. 0.5)				(0.3-1.5) SP: POORLY GRADED SAND, dark yellowish brown to yellowish brown, fine, dense, moist. 10% medium to coarse sand and rounded, fine to coarse gravel, up to 1.5" long. Trace rootlets. No odor or visible contamination.		
SS-2	1.5-3.0	72	13 / 17 / 20	1.2 (Amb. 0.5)				(1.5-3.0) SP: POORLY GRADED SAND, brown to slightly dark brown, fine, dense, moist. 10% medium to coarse sand. Trace, elongated, fine to coarse gravel, up to 1.5" long. No odor or visible contamination.		0.0-0.5' Sampled for analytical; mulch not included in sample 1.5-2.0' Sampled for analytical
								(3.0-4.0) Not Sampled.		
SS-3	4.0-5.5	66	13 / 17 / 16	1.1 (Amb. 0.6)				(4.0-4.6) SP: POORLY GRADED SAND, brown to dark brown, fine, dense, moist. 10% rounded to sub rounded, elongate, coarse sand and fine gravel, up to 0.5" long. No odor or visible contamination.		
							5	(4.6-5.5) SW: WELL GRADED SAND, yellowish brown, fine to medium, dense, moist. Trace rounded, coarse sand and fine gravel, up to 0.5" in diameter. No odor or visible contamination.	-5	Bentonite seal from 2 to 11 ft-bgs
								(5.5-6.5) Not Sampled.		
SS-4	6.5-8.0	75	20 / 23 / 27	1.4 (Amb. 0.6)				(6.5-7.5) SP: POORLY GRADED SAND, brown to dark brown, fine, very dense, moist. 20% medium to coarse sand. 10% rounded, fine gravel, up to 1/4" in diameter. No odor or visible contamination.		6.5-8.0' Sampled for analytical
								(7.5-8.0) SW: WELL GRADED SAND, yellowish brown, fine to medium. Trace rounded coarse sand and fine gravel, up to 1/2" long. No odor or visible contamination.		
SS-	9.0-	66	14	1.3						

Remarks and Datum Used:
ft-bgs - feet below ground surface
HSA - Hollow Stem Auger
Sch. - Schedule
Amb. - ambient air

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Sample Type
N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater: Date	Time	Depth (ft.)
03/18/08	1220	17.46'

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Boring/Well Log

Project: Lora Lake Apartments	Monument: Flush Mount	Stick Up: -
Project #: 05482-025-210	Northing: - Easting: -	Ground Elevation: -
Location: Burien, WA	Drill Rig Type: HSA Limited Access	MP Elevation: -
Client: Port of Seattle	Method: HSA	Total Depth: 25.5'
Start Date & Time: 3/18/08 1015	Casing ID: 2"	Filter Pack: 10/20 Silica Sand
Finish Date & Time: 3/18/08 1115	Boring ID: 8.25"	Seal: Bentonite chips
Contractor: Cascade Drilling Inc.	Bit Type: 4.25" HSA	Grout: -
Operator: Curtis Askew	Logged By: R. Knecht/ C. Smith	Screen: 0.010" slot Sch. 40 PVC 13-23 ft-bgs

Sample Type & Number	Depth Range	% Rec	Blows per 6"	PID (ppm)	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft.)	Comments & Samples
5	10.5		50/6"	(Amb. 0.7)		(8.0-9.0) Not Sampled.		
					10	(9.0-10.5) SP: POORLY GRADED SAND, light yellowish gray, fine, very dense. 20% medium to coarse sand. Trace rounded, fine gravel, up to 3/4" long. No odor or visible contamination.	-10	2-inch diameter, 0.010-inch slot, Sch. 40 PVC screen from 13 to 23 ft-bgs
						(10.5-11.5) Not Sampled.		
SS-6	11.5-13.0	83	50/6"	1.7 (Amb. 0.7)		(11.5-13.0) SW: WELL GRADED SAND, light grayish brown to brown, fine to medium, very dense. 15% coarse sand. 10-15% sub rounded to rounded, fine to coarse gravel, up to 1" in diameter. Trace silt and iron staining. No odor or visible contamination.		
						(13.0-14.0) Not Sampled.		
SS-7	14.0-15.5	-	23 50/6"	0.5 (Amb. 0.5)	15	(14.0-15.5) SP: POORLY GRADED SAND, yellowish brown, fine, very dense, moist to wet. Trace medium sand and silt. No odor or visible contamination.	-15	14-15.5' Sampled for analytical 10/20 silica sand pack from 11 to 23.5 ft-bgs
						(15.5-16.5) Not Sampled.		
SS-8	16.5-18	94	50/6"	2.2 (Amb. 0.9)		(16.5-18.0) SP: POORLY GRADED SAND, brownish gray, medium, very dense, moist to wet. 10-15% fine sand. Trace silt. No odor or visible contamination.		
						(18.0-19.0) Not Sampled.		

Remarks and Datum Used:
ft-bgs - feet below ground surface
HSA - Hollow Stem Auger
Sch. - Schedule
Amb. - ambient air

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Sample Type
N = SPT
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C = Core

Groundwater Date	Time	Depth (ft.)
03/18/08	1220	17.46'

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Boring/Well Log

Well #: MW-3
Sheet 3 of 3

Project: Lora Lake Apartments	Monument: Flush Mount	Stick Up: -
Project #: 05482-025-210	Northing: - Easting: -	Ground Elevation: -
Location: Burien, WA	Drill Rig Type: HSA Limited Access	MP Elevation: -
Client: Port of Seattle	Method: HSA	Total Depth: 25.5'
Start Date & Time: 3/18/08 1015	Casing ID: 2"	Filter Pack: 10/20 Silica Sand
Finish Date & Time: 3/18/08 1115	Boring ID: 8.25"	Seal: Bentonite chips
Contractor: Cascade Drilling Inc.	Bit Type: 4.25" HSA	Grout: -
Operator: Curtis Askew	Logged By: R. Knecht/ C. Smith	Screen: 0.010" slot Sch. 40 PVC 13-23 ft-bgs

Sample: Type & Number	Sample: Depth Range	Sample: % Rec	Sample: Blows per 6"	Sample: PID (ppm)	Well Completion Log	Graphic	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft.)	Comments & Samples
SS-9	19.0-20.5	77	50/6"	2.2 (Amb. 2.2)			20	(19.0-20.5) SW: WELL GRADED SAND, grayish brown to brown, fine to medium, very dense, wet. Trace silt and mica flakes. 10% winnowing. No odor or visible contamination.	-20	
								(20.5-21.5) Not Sampled.		
SS-10	21.5-23.0	92	36 50/6"	1.0 (Amb. 0.9)				(21.5-23.0) SP: POORLY GRADED SAND, gray to bluish gray, fine, very dense, wet. Abundant wood pieces. Trace large, mica flakes. 2mm thick lamination in soil layer. Very slight H2S-like odor. No visible contamination.		
								(23.0-24.0) Not Sampled.		
SS-11	24.0-25.5	100	50/6"	-			25	(24.0-25.5) SW: WELL GRADED SAND, slightly yellowish brown ro gray, medium to fine, very dense, wet. Iron stained beds, up to 1/4" thick at top of interval. No odor or visible contamination.	-25	heaving sand, filled top foot of SS-11 with slough

Remarks and Datum Used:

ft-bgs - feet below ground surface
HSA - Hollow Stem Auger
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Sample Type
N = SPT
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Groundwater: Date	Time	Depth (ft.)
03/18/08	1220	17.46'

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Boring/Well Log

Well #: MW-4
Sheet 1 of 3

Project: Lora Lake Apartments	Monument: Flush Mount	Stick Up: -
Project #: 05482-025-210	Northing: - Easting: -	Ground Elevation: -
Location: Burien, WA	Drill Rig Type: HSA Limited Access	MP Elevation: -
Client: Port of Seattle	Method: HSA	Total Depth: 26'
Start Date & Time: 3/17/08 1400	Casing ID: 2"	Filter Pack: 10/20 Silica Sand
Finish Date & Time: 3/17/08 1515	Boring ID: 8.25"	Seal: Bentonite chips
Contractor: Cascade Drilling Inc.	Bit Type: 4.25" HSA	Grout: -
Operator: Curtis Askew	Logged By: R. Knecht/ C. Smith	Screen: 0.010" slot Sch. 40 PVC 11-25.75 ft-bgs

Sample: Type & Number	Depth Range	% Rec	Blows per 6"	PID (ppm)	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft.)	Comments & Samples
SS-1	0.0-1.5	66	11, 10, 10	0.0	0	(0.0-1.5) SW: SAND, brown, fine to medium, medium dense, moist. 20% rounded, coarse sand to fine gravel. Trace silt and rounded, coarse gravel, up to 1" long. Abundant grass and rootlets from 0.0-0.2'. Moderate organic-like odor, no visible contamination.	0	Flush Mount Monument 2-inch diameter, Sch. 40 PVC riser from 0 to 11 ft-bgs
SS-2	1.5-3.0	72	17, 10, 10	0.0		(1.5-2.0) SP: POORLY GRADED SAND, brown, fine, medium dense, moist. 15% silt. Trace rounded, fine, gravel. Organic-like odor, no visible contamination.		
						(2.0-3.0) SP: POORLY GRADED SAND, yellowish brown with pockets of gray from 2.5-3', fine, medium dense, moist. 20% medium sand from 2-2.5'. Trace rounded, fine gravel. No odor or visible contamination.		0.0-0.5' Sampled for analytical
						(3.0-4.0) Not Sampled.		1.5-2.0' Sampled for analytical
SS-3	4.0-5.5	66	12, 10, 10	0.0	5	(4.0-5.5) SP: POORLY GRADED SAND, yellowish brown grading to light yellowish brown at 5.0', fine, medium dense, moist. 20% medium sand from 4-5'. Trace rounded, fine gravel, content decreases downhole. Trace rootlets at 4.5'. No odor or visible contamination.	-5	Bentonite seal from 2 to 9 ft-bgs
						(5.5-6.5) Not Sampled.		
SS-4	6.5-8.0	75	10, 50/6"	0.0		(6.5-8.0) SP: POORLY GRADED SAND, yellowish brown, medium, very dense, moist. 20% rounded, fine to coarse gravel. Trace rootlets. No odor or visible contamination.		
						(8.0-9.0) Not Sampled.		

Remarks and Datum Used:		Sample Type	Groundwater		
	ft-bgs - feet below ground surface	N = SPT	Date	Time	Depth (ft.)
	HSA - Hollow Stem Auger	DP = Direct Push	03/17/08	1644	15.70'
	Sch. - Schedule	SS = Split Spoon			
	-	C = Core			

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Boring/Well Log

Project: **Lora Lake Apartments**	Monument: **Flush Mount**	Stick Up: **-**
Project #: **05482-025-210**	Northing: **-** Easting: **-**	Ground Elevation: **-**
Location: **Burien, WA**	Drill Rig Type: **HSA Limited Access**	MP Elevation: **-**
Client: **Port of Seattle**	Method: **HSA**	Total Depth: **26'**
Start Date & Time: **3/17/08 1400**	Casing ID: **2"**	Filter Pack: **10/20 Silica Sand**
Finish Date & Time: **3/17/08 1515**	Boring ID: **8.25"**	Seal: **Bentonite chips**
Contractor: **Cascade Drilling Inc.**	Bit Type: **4.25" HSA**	Grout: **-**
Operator: **Curtis Askew**	Logged By: **R. Knecht/ C. Smith**	Screen: **0.010" slot Sch. 40 PVC 11-25.75 ft-bgs**

Depth (ft.): 10, 15; Elevation (ft.): -10, -15

Type & Number	Depth Range	% Rec	Blows per 6"	PID (ppm)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Comments & Samples
SS-5	9.0-10.5	66	19 50/6"	0.0	(9.0-10.5) SW: WELL GRADED SAND WITH GRAVEL, brown to yellowish brown, fine to coarse, very dense, moist. 30% rounded to sub rounded, flat, elongate, fine to coarse gravel, up to 1" long. Slight sweet odor, no visible contamination.	9.5-10.5' Sampled for analytical
					(10.5-11.5) Not Sampled.	2-inch diameter, 0.010-inch slot, Sch. 40 PVC screen from 11 to 25.75 ft-bgs
SS-6	11.5-13.0	83	19 21 24	0.0	(11.5-13.0) SP: POORLY GRADED SAND, slightly yellowish brown grading to yellowish gray, fine, dense, moist. Few 0.5" thick lenses of very fine sand. Trace coarse sand. No odor or visible contamination.	
					(13.0-14.0) Not Sampled.	
SS-7	14.0-15.5	-	23 50/6"	0.0	(14.0-15.5) SP: POORLY GRADED SAND, brownish gray, fine, very dense, moist. 10-15% silt. Trace mica. No odor or visible contamination.	14-15.5' Sampled for analytical 10/20 silica sand pack from 9 to 26 ft-bgs
					(15.5-16.5) Not Sampled.	
SS-8	16.5-18	94	19 50/6"	0.0	(16.5-18.0) SP: POORLY GRADED SAND, gray to grayish brown, fine, very dense, moist. 20% medium sand at 16.75-17'. Little iron staining at 17.5-18'. At 17.9', 4mm thick black and iron stained bed. No odor or visible contamination.	

Remarks and Datum Used:
ft-bgs - feet below ground surface
HSA - Hollow Stem Auger
Sch. - Schedule
-

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Sample Type
N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater		
Date	Time	Depth (ft.)
03/17/08	1644	15.70'

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Boring/Well Log

Well #: MW-4
Sheet 3 of 3

Project: **Lora Lake Apartments**	Monument: **Flush Mount**	Stick Up: -
Project #: **05482-025-210**	Northing: - Easting: -	Ground Elevation: -
Location: **Burien, WA**	Drill Rig Type: **HSA Limited Access**	MP Elevation: -
Client: **Port of Seattle**	Method: **HSA**	Total Depth: **26'**
Start Date & Time: **3/17/08 1400**	Casing ID: **2"**	Filter Pack: **10/20 Silica Sand**
Finish Date & Time: **3/17/08 1515**	Boring ID: **8.25"**	Seal: **Bentonite chips**
Contractor: **Cascade Drilling Inc.**	Bit Type: **4.25" HSA**	Grout: -
Operator: **Curtis Askew**	Logged By: **R. Knecht/ C. Smith**	Screen: **0.010" slot Sch. 40 PVC 11-25.75 ft-bgs**

Sample: Type & Number	Depth Range	% Rec	Blows per 6"	PID (ppm)	Well Completion Log	Graphic	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft.)	Comments & Samples
								(18.0-19.0) Not Sampled.		
SS-9	19.0-20.5	77	22 50/6"	0.0				(19.0-20.0) SP: POORLY GRADED SAND, gray, fine, very dense, wet. 2.5" long, gray, friable, clay pocket with one white rock at 19.75'. No odor or visible contamination.		
							20	(20.0-20.5) SP: POORLY GRADED SAND, brown, fine, very dense, wet. Trace rounded, coarse sand. No odor or visible contamination.	-20	
								(20.5-21.5) Not Sampled.		
SS-10	21.5-23.0	92	19 50/6"	0.0				(21.5-23.0) SP: POORLY GRADED SAND, brown to slightly yellowish brown, fine, very dense, wet. Wood pieces and gray sand at top of interval. No odor or visible contamination.		
								(23.0-24.0) Not Sampled.		Slight heaving sand at bottom of borehole
SS-11	24.0-25.5	100	50/5"	0.0				(24.0-25.5) SP: POORLY GRADED SAND, yellowish brown to brown, medium, very dense, wet. 25% winnowing. No odor or visible contamination.		
							25		-25	
								(25.5-26.0) Not Sampled.		

Remarks and Datum Used:

ft-bgs - feet below ground surface

HSA - Hollow Stem Auger

Sch. - Schedule

-

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Sample Type
N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater		
Date	Time	Depth (ft.)
03/17/08	1644	15.70'

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Boring/Well Log

Well #: MW-5
Sheet 1 of 3

Project: Lora Lake Apartments	Monument: Flush Mount	Stick Up: -
Project #: 05482-025-210	Northing: - Easting: -	Ground Elevation: -
Location: Burien, WA	Drill Rig Type: HSA Limited Access	MP Elevation: -
Client: Port of Seattle	Method: HSA	Total Depth: 28'
Start Date & Time: 3/17/08 1025	Casing ID: 2"	Filter Pack: 10/20 Silica Sand
Finish Date & Time: 3/17/08 1210	Boring ID: 8.25"	Seal: Bentonite chips
Contractor: Cascade Drilling Inc.	Bit Type: 4.25" HSA	Grout: -
Operator: Curtis Askew	Logged By: R. Knecht/ C. Smith	Screen: 0.010" slot Sch. 40 PVC 13-28 ft-bgs

Sample: Type & Number	Sample: Depth Range	Sample: % Rec	Sample: Blows per 6"	Sample: PID (ppm)	Well Completion Log	Graphic	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft.)	Comments & Samples
SS-1	0.0-1.5	66	15 14 20	0.0			0	(0.0-1.5) SP: POORLY GRADED SAND, brown to dark brown, fine, loose, moist. 15% rounded, fine gravel, 0.25-0.5" long. One rounded gravel, 3" in diameter. Trace straw. No odor or visible contamination.	0	Flush Mount Monument 2-inch diameter Sch. 40 PVC riser from 0 to 13 ft-bgs
SS-2	1.5-3.0	100	50/5"	0.0				(1.5-3.0) SP: POORLY GRADED SAND, yellowish brown, fine, dense, moist. Trace coarse sand to fine gravel, rounded, up to 0.5" long. No odor or visible contamination.		0.0-0.5' Sampled for analytical
								(3.0-4.0) Not Sampled.		1.5-2.0' Sampled for analytical
SS-3	4.0-5.5	91	24 50/6"	0.0			5	(4.0-5.5) SW: WELL GRADED SAND, yellowish brown, fine to medium, very dense, moist. 20% sub rounded, gravel, up to 1/2" in diameter. Gravel content increases to 30% with depth. No odor or visible contamination.	-5	Bentonite seal from 2 to 11 ft-bgs
								(5.5-6.5) Not Sampled.		
SS-4	6.5-8.0	100	50/6"	0.0				(6.5-8.0) SM: SILTY SAND, gray to slightly brownish gray, fine, very dense, moist. 20% silt. 10% rounded, sand and fine gravel. One gravel up to 2" long. No odor or visible contamination.		6.5-8.0' Sampled for analytical
								(8.0-9.0) Not Sampled.		
SS-5	9.0-10.5	75	30 50/6"	0.0			10	(9.0-10.5) SW: WELL GRADED SAND, gray to brownish gray, fine to medium, very dense, moist to wet. Trace coarse sand, fine gravel, and 1" thick pockets of silt and very fine sand. Trace hydrocarbon-like odor in 0.5" thick silt lense at 10.5'. No visible contamination.	-10	

Remarks and Datum Used:

ft-bgs - feet below ground surface
HSA - Hollow Stem Auger
Sch. - Schedule
-

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Sample Type

N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater: Date	Time	Depth (ft.)
03/17/08	1332	20.27'

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Boring/Well Log

Well #: MW-5
Sheet 3 of 3

Project: Lora Lake Apartments	Monument: Flush Mount	Stick Up: -
Project #: 05482-025-210	Northing: - Easting: -	Ground Elevation: -
Location: Burien, WA	Drill Rig Type: HSA Limited Access	MP Elevation: -
Client: Port of Seattle	Method: HSA	Total Depth: 28'
Start Date & Time: 3/17/08 1025	Casing ID: 2"	Filter Pack: 10/20 Silica Sand
Finish Date & Time: 3/17/08 1210	Boring ID: 8.25"	Seal: Bentonite chips
Contractor: Cascade Drilling Inc.	Bit Type: 4.25" HSA	Grout: -
Operator: Curtis Askew	Logged By: R. Knecht/ C. Smith	Screen: 0.010" slot Sch. 40 PVC 13-28 ft-bgs

Sample: Type & Number	Depth Range	% Rec	Blows per 6"	PID (ppm)	Well Completion Log	Graphic	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft.)	Comments & Samples
SS-10	21.5-23.0	66	32 50/6"	0.0				(21.5-23.0) SW: WELL GRADED SAND, grayish brown grading to yellowish brown, sub angular to sub rounded, very dense, wet. 20% sub angular to rounded, elongated, fine to coarse, gravel. No odor or visible contamination.		
								(23.0-24.0) Not Sampled.		
SS-11	24.0-25.5	100	25 50/6"	0.0			25	(24.0-25.5) SP: POORLY GRADED SAND, grayish brown, fine, very dense, wet. Trace medium sand and rounded, fine gravel. No odor or visible contamination.	-25	
								(25.5-26.5) Not Sampled.		
SS-12	26.5-28	100	50/6"	0.0				(26.5-28.0) SP: POORLY GRADED SAND, gray from 26.5-27.0', sharp contact to yellowish brown at 27.0', fine, very dense, wet. 15% gray, medium to coarse sand. Trace, soft, silt. 50% winnowing. No odor or visible contamination.		Slight heaving sand at bottom of borehole

Remarks and Datum Used:

ft-bgs - feet below ground surface

HSA - Hollow Stem Auger

Sch. - Schedule

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Sample Type
N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater		
Date	Time	Depth (ft.)
03/17/08	1332	20.27'

ENSR | AECOM

Boring/Well Log

Project: Lora Lake Apartments	Monument: Flush Mount	Stick Up: -
Project #: 05482-025-210	Northing: - Easting: -	Ground Elevation: -
Location: Burien, WA	Drill Rig Type: HSA Limited Access	MP Elevation: -
Client: Port of Seattle	Method: HSA	Total Depth: 20.5'
Start Date & Time: 3/18/08 1344	Casing ID: 2"	Filter Pack: 10/20 Silica Sand
Finish Date & Time: 3/18/08 1445	Boring ID: 8.25"	Seal: Bentonite chips
Contractor: Cascade Drilling Inc.	Bit Type: 4.25" HSA	Grout: -
Operator: Curtis Askew	Logged By: R. Knecht/ C. Smith	Screen: 0.010" slot Sch. 40 PVC 5-15 ft-bgs

Sample Type & Number	Depth Range	% Rec	Blows per 6"	PID (ppm)	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft.)	Comments & Samples
SS-1	0.0-1.5	83	3, 5, 14	0.9 (Amb. 0.3)	0	(0.0-1.5) SP: POORLY GRADED SAND, brown, fine, medium dense, moist. 20-25% silt. 10% medium to coarse sand. Trace fine gravel, up to 1/4" in diameter. Abundant rootlets throughout, grass on top. Moderate organic odor, no visible contamination.	0	Flush Mount Monument 2-inch diameter Sch. 40 PVC riser from 0 to 5 ft-bgs
SS-2	1.5-3.0	66	20, 25, 25	1.2 (Amb. 0.3)		(1.5-3.0) SP: POORLY GRADED SAND, brown to slightly dark brown, fine, very dense, moist. 20% silt. Trace rounded, coarse sand to fine gravel. Little rootlets. Friable. Moderate organic odor, no visible contamination.		0.0-0.5' Sampled for analytical
						(3.0-4.0) Not Sampled.		
SS-3	4.0-5.5	66	3, 4, 5	1.3 (Amb. 0.4)	5	(4.0-5.5) SP: POORLY GRADED SAND, slightly reddish brown, fine, loose, moist. 10-15% medium to coarse sand. Trace rounded, fine gravel, up to 3/4" in diameter. Trace rootlets in catcher. No odor or visible contamination.	-5	1.5-2.0' Sampled for analytical
						(5.5-6.5) Not Sampled.		6.5-8.0' Sampled for analytical
SS-4	6.5-8.0	72	11, 9, 13	1.4 (Amb. 0.6)		(6.5-8.0) SP: POORLY GRADED SAND, reddish brown grading to light reddish brown, fine, medium dense, moist. Trace fine gravel, up to 1/2" in diameter. No odor or visible contamination.		
						(8.0-9.0) Not Sampled.		
SS-5	9.0-10.5	94	20, 20, 20	1.5 (Amb. 0.6)	10	(9.0-10.5) SP: POORLY GRADED SAND, gray with iron staining, fine, dense, moist. Trace organic matter and silt. No odor or visible contamination.	-10	Bentonite seal from 2 to 4 ft-bgs
						(10.5-11.5) Not Sampled.		

Remarks and Datum Used:

ft-bgs - feet below ground surface
HSA - Hollow Stem Auger
Sch. - Schedule
Amb. - ambient air

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Sample Type

N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater		
Date	Time	Depth (ft.)
03/18/08	1553	12.51'

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Boring/Well Log

Well #: MW-6
Sheet 2 of 2

Project: Lora Lake Apartments	Monument: Flush Mount	Stick Up: -
Project #: 05482-025-210	Northing: - Easting: -	Ground Elevation: -
Location: Burien, WA	Drill Rig Type: HSA Limited Access	MP Elevation: -
Client: Port of Seattle	Method: HSA	Total Depth: 20.5'
Start Date & Time: 3/18/08 1344	Casing ID: 2"	Filter Pack: 10/20 Silica Sand
Finish Date & Time: 3/18/08 1445	Boring ID: 8.25"	Seal: Bentonite chips
Contractor: Cascade Drilling Inc.	Bit Type: 4.25" HSA	Grout: -
Operator: Curtis Askew	Logged By: R. Knecht/ C. Smith	Screen: 0.010" slot Sch. 40 PVC 5-15 ft-bgs

Sample: Type & Number	Depth Range	% Rec	Blows per 6"	PID (ppm)	Well Completion Log	Graphic	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft.)	Comments & Samples
SS-6	11.5-13.0	92	25 50/6"	1.4 (Amb. 0.6)				(11.5-13.0) SP: POORLY GRADED SAND, gray, fine, very dense, wet. 25% sub angular, fine to coarse gravel. 10% coarse sand. Slight to moderate soapy-like to hydrocarbon-like odor, no visible contamination.		11.5-13.0' Sampled for analytical
								(13.0-14.0) Not Sampled.		2-inch diameter, 0.010-inch slot, Sch. 40 PVC screen from 5 to 15 ft-bgs
SS-7	14.0-15.5	100	50/6"	2.4 (Amb. 0.7)			15	(14.0-15.5) SW: WELL SORTED SAND, gray to brownish gray, fine to coarse, very dense, wet. 10-15% rounded, fine to coarse gravel, up to 2" in diameter. Trace to little iron mottles. Slight soapy-like to hydrocarbon-like odor, no visible contamination.	-15	
								(15.5-16.5) Not Sampled.		10/20 silica sand pack from 4 to 16 ft-bgs
SS-8	16.5-18	61	19 50/6"	2.1 (Amb. 0.8)				(16.5-17.25) ML: SILT, gray to brownish gray, high plasticity, hard, wet. 15% clay. Slight soap-like odor, no visible contamination.		
								(17.25-18.0) SW: WELL GRADED SAND, gray, fine to coarse, very dense, wet. 25% rounded, fine gravel, up to 1/2" in diameter. Slight soap-like odor, no visible contamination.		Bentonite from 16 to 20.5 ft-bgs
								(18.0-19.0) Not Sampled.		
SS-9	19.0-20.5	55	21 36 50/4"	2.2 (Amb. 1.0)			20	(19.0-20.3) SW: WELL GRADED SAND, gray, fine to medium, very dense, wet. 10% silt and rounded, fine gravel, up to 1/4" in diameter. No odor or visible contamination.	-20	19.0-20.5' Sampled for analytical
								(20.3-20.5) SP: POORLY GRADED SAND, black, fine, wet. No odor or visible contamination.		

Remarks and Datum Used:
ft-bgs - feet below ground surface
HSA - Hollow Stem Auger
Sch. - Schedule
Amb. - ambient air

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Sample Type
N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater		
Date	Time	Depth (ft.)
03/18/08	1553	12.51'

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Boring/Well Log

Well #: MW-8
Sheet 1 of 2

Project: **Lora Lake Apartments**	Monument: **Flush Mount**	Stick Up: **-**
Project #: **05482-025-3000**	Northing: **174627.2741** Easting: **1272775.8574'**	Ground Elevation: **282.534'**
Location: **Seattle, WA**	Drill Rig Type: **Limited Access Track Rig**	MP Elevation: **287.907'**
Client: **Port of Seattle**	Method: **HSA**	Total Depth: **20.5'**
Start Date & Time: **08/12/08 1357**	Casing ID: **2"**	Filter Pack: **10/20 Silica Sand**
Finish Date & Time: **08/12/08 1429**	Boring ID: **4.25"**	Seal: **Bentonite Chips**
Contractor: **Cascade Drilling Inc.**	Bit Type: **4.25" HSA**	Grout: **-**
Operator: **Curtis Askew**	Logged By: **C. Smith**	Screen: **0.010-inch slot, Sch. 40 PVC**

Classification Scheme: **USCS/ASTM**

Type & No.	Depth Range	% Rec	Blows per 6"	PID (ppm)	Depth (ft.)	Soil and Rock Description	Elevation (ft.)	Comments
					0	(0.0-5.0) Not sampled.	280	Flush mount monument. Bentonite chip plug from 1.5-8 ft-bgs.
SS-1	5-6.5	80	7 8 17	0.4 aa= 0.4	5	(5.0-6.5) SW: WELL GRADED SAND, brown, fine to coarse, sub angular to sub rounded, medium dense, dry. Trace rootlets. No odor or visible contamination.		2-inch schedule 40 riser pipe from 0-10 ft-bgs.
						(6.5-10.0) Not sampled.	275	10/20 silica sand pack from 8-20.5 ft-bgs.
SS-2	10-11.5	46	50/6"	0.3 aa= 0.3	10	(10.0-10.4) SM: SILTY SAND, gray and brown, fine to medium, very dense, moist. 40% silt. Trace, angular, coarse sand. Trace rootlets. No odor or visible contamination.		
						(10.4-11.5) SP: POORLY GRADED SAND, brown, fine, very dense, moist. Trace coarse sand. One rounded peice of large gravel. No odor or visible contamination.		0.010-inch slot, 2-inch schedule 40 PVC screen from 10-20 ft-bgs.
						(11.5-12.5) Not sampled.	270	

Remarks and Datum Used:

aa = ambient air
ft-bgs = feet below ground suface
Sch. = schedule
HSA = Hollow Stem Auger

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Sample Type
N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater

Date	Time	Depth (ft.)
8/12/08	1415	12'

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Boring/Well Log

Well #: MW-8
Sheet 2 of 2

Project: **Lora Lake Apartments**	Monument: **Flush Mount**	Stick Up: **-**
Project #: **05482-025-3000**	Northing: **174627.2741** Easting: **1272775.8574'**	Ground Elevation: **282.534'**
Location: **Seattle, WA**	Drill Rig Type: **Limited Access Track Rig**	MP Elevation: **287.907'**
Client: **Port of Seattle**	Method: **HSA**	Total Depth: **20.5'**
Start Date & Time: **08/12/08 1357**	Casing ID: **2"**	Filter Pack: **10/20 Silica Sand**
Finish Date & Time: **08/12/08 1429**	Boring ID: **4.25"**	Seal: **Bentonite Chips**
Contractor: **Cascade Drilling Inc.**	Bit Type: **4.25" HSA**	Grout: **-**
Operator: **Curtis Askew**	Logged By: **C. Smith**	Screen: **0.010-inch slot, Sch. 40 PVC**

Soil and Rock Description — Classification Scheme: **USCS/ASTM**

Sample Type & No.	Depth Range	% Rec	Blows per 6"	PID (ppm)	Well Completion Log	Graphic	Depth (ft.)	Soil and Rock Description	Elevation (ft.)	Comments
									270	
SS-3	12.5-14	80	50/6"	0.3 aa= 0.3				(12.5-14.0) SP: POORLY GRADED SAND, white, black, orange, and yellow grains, medium, sub rounded, very dense, wet. Trace coarse sand to large gravel. Trace, orange, iron oxide staining. One cobble, 3" in diameter. No odor or visible contamination.		12.5-14': Sampled for analytical.
							15	(14.0-19.0) Not sampled.		
									265	Threaded end cap from 20-20.35 ft-bgs.
SS-4	19-20.5	26	50/4"	0.3 aa= 0.3			20	(19.0-20.5) SW: WELL GRADED SAND, brown with white, black, and yellow grains, fine to medium, very dense, wet. Trace coarse sand. 10% winnowing. No odor or visible contamination.		

Remarks and Datum Used:

aa = ambient air
ft-bgs = feet below ground suface
Sch. = schedule
HSA = Hollow Stem Auger

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Sample Type
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DP = Direct Push
SS = Split Spoon
C = Core

Groundwater

Date	Time	Depth (ft.)
8/12/08	1415	12'

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Boring/Well Log

Well #: MW-9
Sheet 1 of 2

Project: **Lora Lake Apartments**	Monument: **Flush Mount**	Stick Up: **-**
Project #: **05482-025-3000**	Northing: **174474.2134** Easting: **1272627.3356'**	Ground Elevation: **283.698'**
Location: **Seattle, WA**	Drill Rig Type: **Limited Access Track Rig**	MP Elevation: **283.335'**
Client: **Port of Seattle**	Method: **HSA**	Total Depth: **20.5'**
Start Date & Time: **08/12/08 1217**	Casing ID: **2"**	Filter Pack: **10/20 Silica Sand**
Finish Date & Time: **08/12/08 1240**	Boring ID: **4.25"**	Seal: **Bentonite Chips**
Contractor: **Cascade Drilling Inc.**	Bit Type: **4.25" HSA**	Grout: **-**
Operator: **Curtis Askew**	Logged By: **C. Smith**	Screen: **0.010-inch slot, Sch. 40 PVC**

Type &	Depth Range	% Rec	Blows per 6"	PID (ppm)	Well Completion Log	Graphic	Depth (ft.)	Soil and Rock Description (Classification Scheme: **USCS/ASTM**)	Elevation (ft.)	Comments
							0	(0.0-5.0) Not sampled.	280	Flush mount monument. Bentonite chip plug from 1.5-8 ft-bgs.
SS -1	5-6.5	53	24 50/6"	0.4 aa= 0.4			5	(5.0-6.5) SM: SILTY SAND, brown, fine to medium, very dense, moist. At 5-5.3', trace coarse sand and rootlets, large 3", rounded, cobble. At 5.3-5.6', color grades to gray. No odor or visible contamination.		2-inch schedule 40 riser pipe from 0-10 ft-bgs.
								(6.5-10.0) Not sampled.	275	10/20 silica sand pack from 8-20.5 ft-bgs.
SS -2	10-11.5	-	21 25 30	0.3 aa= 0.3			10	(10.0-10.7) SW: WELL GRADED SAND, brown, fine to coarse, sub rounded, very dense, moist. Angular, crushed, dark gray boulder at 10.5'. No odor or visible contamination.		0.010-inch slot, 2-inch schedule 40 PVC screen from 10-20 ft-bgs.
								(10.7-11.5) SP: POORLY GRADED SAND, brown, fine, very dense, moist. Few 1/4" thick gray lenses at 11.1' and 11.3'. No odor or visible contamination.		
								(11.5-15.0) Not sampled.		

Remarks and Datum Used:

aa = ambient air
ft-bgs = feet below ground suface
Sch. = schedule
HSA = Hollow Stem Auger

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Sample Type
N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater		
Date	Time	Depth (ft.)
8/12/08	1230	14'

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Boring/Well Log

Well #: **MW-9**

Project: **Lora Lake Apartments**	Monument: **Flush Mount**	Stick Up: **-**
Project #: **05482-025-3000**	Northing: **174474.2134'** Easting: **1272627.3356'**	Ground Elevation: **283.698'**
Location: **Seattle, WA**	Drill Rig Type: **Limited Access Track Rig**	MP Elevation: **283.335'**
Client: **Port of Seattle**	Method: **HSA**	Total Depth: **20.5'**
Start Date & Time: **08/12/08 1217**	Casing ID: **2"**	Filter Pack: **10/20 Silica Sand**
Finish Date & Time: **08/12/08 1240**	Boring ID: **4.25"**	Seal: **Bentonite Chips**
Contractor: **Cascade Drilling Inc.**	Bit Type: **4.25" HSA**	Grout: **-**
Operator: **Curtis Askew**	Logged By: **C. Smith**	Screen: **0.010-inch slot, Sch. 40 PVC**

Sample: Type &	Sample: Depth Range	Sample: % Rec	Sample: Blows per 6"	Sample: PID (ppm)	Well Completion Log	Graphic	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft.)	Comments
									270	
SS -3	15-16.5	66	50/6"	0.3 aa= 0.3			15	(15.0-16.5) SP: POORLY GRADED SAND, brown with white, black and yellow grains, fine, very dense, wet. Trace silt. 15% winnowing. No odor or visible contamination.		15-16.5 ft-bgs: Sampled for analytical.
								(16.5-19) Not sampled.		
									265	Threaded end cap from 20-20.35 ft-bgs.
SS -4	19-20.5	-	50/6"	0.3 aa= 0.3			20	(19.0-20.5) SP: POORLY GRADED SAND, brown with white, black and yellow grains, fine, very dense, wet. Trace silt. 15% winnowing. No odor or visible contamination.		

Remarks and Datum Used:

aa = ambient air

ft-bgs = feet below ground suface

Sch. = schedule

HSA = Hollow Stem Auger

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Sample Type

N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater: Date	Time	Depth (ft.)
8/12/08	1230	14'

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Boring/Well Log

Well #: MW-10
Sheet 1 of 2

Project: **Lora Lake Apartments**	Monument: **Flush Mount**	Stick Up: **-**
Project #: **05482-025-3000**	Northing: **174386.6154'** Easting: **1272561.6472'**	Ground Elevation: **284.397'**
Location: **Seattle, WA**	Drill Rig Type: **Limited Access Track Rig**	MP Elevation: **284.149'**
Client: **Port of Seattle**	Method: **HSA**	Total Depth: **20.5'**
Start Date & Time: **08/12/08 1041**	Casing ID: **2"**	Filter Pack: **10/20 Silica Sand**
Finish Date & Time: **08/12/08 1115**	Boring ID: **4.25"**	Seal: **Bentonite Chips**
Contractor: **Cascade Drilling Inc.**	Bit Type: **4.25" HSA**	Grout: **-**
Operator: **Curtis Askew**	Logged By: **C. Smith**	Screen: **0.010-inch slot, Sch. 40 PVC**

Sample: Type &	Depth Range	% Rec	Blows per 6"	PID (ppm)	Well Completion Log	Graphic	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft.)	Comments
							0	(0.0-5.0) Not sampled.		Flush mount monument. Bentonite chip plug from 1.5-8 ft-bgs.
									280	
SS -1	5-6.5	46	24 50/6"	0.3 aa= 0.3			5	(5.0-6.5) SP: POORLY GRADED SAND, orangish brown, medium, very dense, dry. Trace, angular, coarse sand to small gravel. Some fine sand and silt. No odor or visible contamination.		2-inch schedule 40 riser pipe from 0-10 ft-bgs.
								(6.5-10.0) Not sampled.	275	10/20 silica sand pack from 8-20.5 ft-bgs.
SS -2	10-11.5	44	21 25 30	0.3 aa= 0.3			10	(10.0-11.5) SW: WELL GRADED SAND, brown, fine to medium, very dense, moist. Some silt and coarse sand. No odor or visible contamination.		0.010-inch slot, 2-inch schedule 40 PVC screen from 10-20 ft-bgs.
								(11.5-12.5) Not sampled.		

Remarks and Datum Used:
- **aa = ambient air**
- **ft-bgs = feet below ground suface**
- **Sch. = schedule**
- **HSA = Hollow Stem Auger**

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Sample Type
N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater Date	Time	Depth (ft.)
8/12/08	1115	13'

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Boring/Well Log

Well #: MW-10

Project: **Lora Lake Apartments**	Monument: **Flush Mount**	Stick Up: **-**
Project #: **05482-025-3000**	Northing: **174386.6154** Easting: **1272561.6472'**	Ground Elevation: **284.397'**
Location: **Seattle, WA**	Drill Rig Type: **Limited Access Track Rig**	MP Elevation: **284.149'**
Client: **Port of Seattle**	Method: **HSA**	Total Depth: **20.5'**
Start Date & Time: **08/12/08 1041**	Casing ID: **2"**	Filter Pack: **10/20 Silica Sand**
Finish Date & Time: **08/12/08 1115**	Boring ID: **4.25"**	Seal: **Bentonite Chips**
Contractor: **Cascade Drilling Inc.**	Bit Type: **4.25" HSA**	Grout: **-**
Operator: **Curtis Askew**	Logged By: **C. Smith**	Screen: **0.010-inch slot, Sch. 40 PVC**

Sample: Type &	Depth Range	% Rec	Blows per 6"	PID (ppm)	Well Completion Log	Graphic	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft.)	Comments
SS -3	12.5-14	60	50/6"	0.3 aa= 0.3				(12.5-14.0) SP: POORLY GRADED SAND, brown, medium, sub rounded, very dense, moist to wet at 13'. Trace, fine sand and silt. No odor or visible contamination.		
								(14.0-18.5) Not sampled.	270	
							15			12.5-14 ft-bgs: Sampled for analytical.
										Threaded end cap from 20-20.35 ft-bgs.
SS -4	19-20.5	80	50/6"	0.3 aa= 0.3				(19.0-20.5) SP: POORLY GRADED SAND, brown with black, white, yellow, and orange grains, medium, sub rounded, very dense, wet. Trace silt. No odor or visible contamination.	265	
							20			

Remarks and Datum Used:

- **aa = ambient air**
- **ft-bgs = feet below ground suface**
- **Sch. = schedule**
- **HSA = Hollow Stem Auger**

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Sample Type
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DP = Direct Push
SS = Split Spoon
C = Core

Groundwater		
Date	Time	Depth (ft.)
8/12/08	1115	13'

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Boring/Well Log

Well #: MW-11
Sheet 1 of 2

Project: **Lora Lake Apartments**	Monument: **Flush Mount**	Stick Up: **-**
Project #: **05482-025-3000**	Northing: **174287.7124** Easting: **1272485.4391'**	Ground Elevation: **284.948'**
Location: **Seattle, WA**	Drill Rig Type: **Limited Access Track Rig**	MP Elevation: **284.36'**
Client: **Port of Seattle**	Method: **HSA**	Total Depth: **20.5'**
Start Date & Time: **08/12/08 0930**	Casing ID: **2"**	Filter Pack: **10/20 Silica Sand**
Finish Date & Time: **08/12/08 1005**	Boring ID: **4.25"**	Seal: **Bentonite Chips**
Contractor: **Cascade Drilling Inc.**	Bit Type: **4.25" HSA**	Grout: **-**
Operator: **Curtis Askew**	Logged By: **C. Smith**	Screen: **0.010-inch slot, Sch. 40 PVC**

Sample: Type &	Depth Range	% Rec	Blows per 6"	PID (ppm)	Well Completion Log	Graphic	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft.)	Comments
							0	(0.0-5.0) Not sampled.		Flush mount monument. Bentonite chip plug from 1.5-8 ft-bgs.
SS-1	5-6.5	100	50/2"	0.0			5	(5.0-6.5) SW: WELL GRADED SAND, dark brown, fine to medium, very dense, moist. Trace coarse sand. Few, angular gravel up to 1" in diameter. Few grass and rootlets. No odor or visible contamination.	280	2-inch schedule 40 riser pipe from 0-10 ft-bgs.
								(6.5-7.5) Not sampled.		
SS-2	7.5-9	100	50/6"	0.0				(7.5-9.0) SW: WELL GRADED SAND, dark brown, fine to medium, very dense, moist. Trace, angular, coarse sand and small gravel. Some rootlets. No odor or visible contamination.		10/20 silica sand pack from 8-20.5 ft-bgs.
								(9.0-10.0) Not sampled.		
SS-3	10-11.5	100	50/6"	0.0			10	(10.0-10.3) SW: WELL GRADED SAND, brown, fine to medium, very dense, moist. Trace coarse sand. No odor or visible contamination.	275	0.010-inch slot, 2-inch schedule 40 PVC screen from 10-20 ft-bgs.
								(10.3-11.5) SP: POORLY GRADED SAND, brown, medium, very dense, moist. No odor or visible contamination.		
								(11.5-12.5) Not sampled.		

Remarks and Datum Used:
ft-bgs = feet below ground suface
Sch. = schedule
HSA = Hollow Stem Auger

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Sample Type
N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater Date	Time	Depth (ft.)
8/12/08	0950	12.8'

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Boring/Well Log

Project: **Lora Lake Apartments**	Monument: **Flush Mount**	Stick Up: **-**
Project #: **05482-025-3000**	Northing: **174287.7124'** Easting: **1272485.4391'**	Ground Elevation: **284.948'**
Location: **Seattle, WA**	Drill Rig Type: **Limited Access Track Rig**	MP Elevation: **284.36'**
Client: **Port of Seattle**	Method: **HSA**	Total Depth: **20.5'**
Start Date & Time: **08/12/08 0930**	Casing ID: **2"**	Filter Pack: **10/20 Silica Sand**
Finish Date & Time: **08/12/08 1005**	Boring ID: **4.25"**	Seal: **Bentonite Chips**
Contractor: **Cascade Drilling Inc.**	Bit Type: **4.25" HSA**	Grout: **-**
Operator: **Curtis Askew**	Logged By: **C. Smith**	Screen: **0.010-inch slot, Sch. 40 PVC**

Sample: Type & #	Sample: Depth Range	Sample: % Rec	Sample: Blows per 6"	Sample: PID (ppm)	Well Completion Log	Graphic	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS/ASTM)	Elevation (ft.)	Comments
SS -4	12.5-14	100	60/5"	0.0				(12.5-14.0) SP: POORLY GRADED SAND, brown, medium, moist to wet at 12.8'. Trace coarse sand. No odor or visible contamination.		
								(14.0-15.0) Not sampled.		
SS -5	15-16.5	100	50/5"	0.0			15	(15.0-16.5) SP: POORLY GRADED SAND, brown, medium, very dense, wet. Trace silt at 16'. No odor or visible contamination.	270	12.5-13 ft-bgs: Sampled for analytical.
								(16.5-19.0) Not sampled.		
SS -6	19-20.5	100	50/6"	0.0			20	(19.0-20.5) SP: POORLY GRADED SAND, brown with white, black, orange and yellow grains, medium, sub angular, very dense, wet. Trace silt. 10% winnowing. No odor or visible contamination.	265	Threaded end cap from 20-20.35 ft-bgs.

Remarks and Datum Used:

ft-bgs = feet below ground suface

Sch. = schedule

HSA = Hollow Stem Auger

The RETEC Group, Inc.
1011 SW Klickitat Way, Suite 207
Seattle, WA 98134-1162
Phone: (206) 624-9349
Fax: (206) 624-2839

Sample Type

N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater

Date	Time	Depth (ft.)
8/12/08	0950	12.8'

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Monitoring Well ID: MW-12

Drill Date: August 2, 2010
Logged By: Megan McCullough
Drilled By: Cascade Drilling
Drill Type: Hollow Stem Auger
Sample Method: 18" split spoon
Boring Diameter: 8 inches
Boring Depth (ft bgs): 19 ft
Groundwater ATD (ft bgs): 10 ft

Ground Surf Elev. □ Datum: 287.13 ft
Coordinate System: NGVD29/NAD83
Latitude/Northing: 174762.0372 ft
Longitude/Easting: 1272711.531 ft
Casing Elevation: 286.53 ft

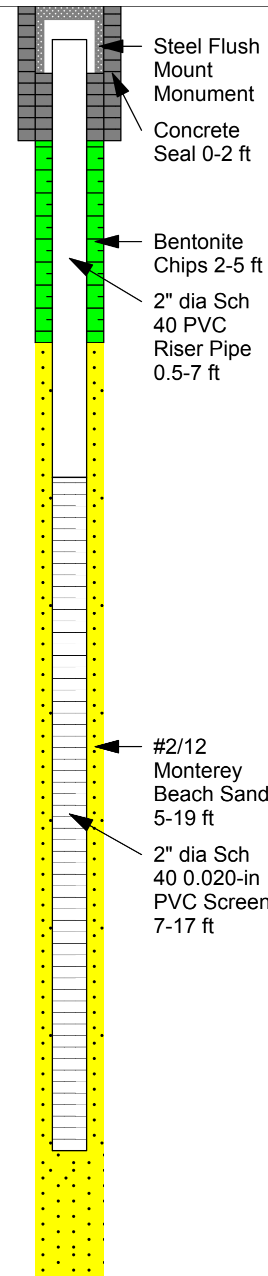
Client: Port of Seattle
Project: POS-LLA
Task Number: T 4010
Site Location: LL Apts Parcel
15001 Des Moines Memorial Dr.

Remarks:

SAMPLE INTERVAL	PID (ppm)	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS
MW12-0-0.5-080210	4.4		23 50/6"	0–1
MW12-1.5-2-080210	4.5		29 50/6"	1.5–2.5
MW12-2-4-080210	3.7		22 50/4"	3–4
MW12-4-5.5-080210	4.6		18 25 50/6"	4.5–6
MW12-5.5-7.5-080210	3.5		16 23 34	6–7.5
MW12-8-9.5-080210	4.3		14 23 39	7.5–9
MW12-10-11.5-080210	3.7		17 26 38	10–11.5
	3.1		17 34 50/3"	12.5–14
			50/3" 50/6"	15–16.5
MW12-17.5-19-0080210			14 28 35	17.5–19

USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS: (color, texture, moisture, MAJOR CONSTITUENT, odor, staining, sheen, debris, etc.)
SM	medium brown, dry, fine SILTY SAND with GRAVEL. bark and organics in top 4". no sheen, no odor. less silt with depth 1" layer of bark color grades to black
SP-SM	gray, fine SAND with SILT and streaks of black staining. no odor.
SP	light brown, moist, fine SAND with streaks of gray to orange (oxide). trace organics, no odor
SW ML SW	medium gray to brown, fine to coarse SAND with small GRAVEL. 3" lense of light gray, wet SILT with iron oxide staining at 10.9 ft, no odor.
SM	light brown, wet, fine SILTY SAND. no odor
	no recovery at 15 ft- loose, wet material
SP	light brown, wet, fine SAND with trace silt. no odor.

MONITORING WELL DETAIL



Notes:
FT BGS = feet below ground surface
ppm = parts per million
--- Dashed contact line in soil description indicates a gradational contact
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Monitoring Well ID: MW-13

Drill Date: August 2, 2010
Logged By: Megan McCullough
Drilled By: Cascade Drilling
Drill Type: Hollow Stem Auger
Sample Method: 18" split spoon
Boring Diameter: 8 inches
Boring Depth (ft bgs): 20 ft
Groundwater ATD (ft bgs): 13.75 ft

Ground Surf Elev. □ Datum: 289.89 ft
Coordinate System: NGVD29/NAD83
Latitude/Northing: 174904.8622 ft
Longitude/Easting: 1272777.633 ft
Casing Elevation: 289.43 ft

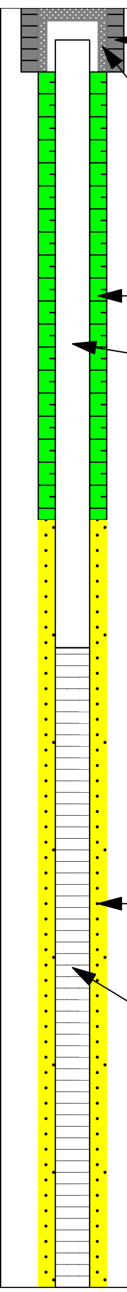
Client: Port of Seattle
Project: POS-LLA
Task Number: T 4010
Site Location: LL Apts Parcel
15001 Des Moines Memorial Dr.

Remarks:

SAMPLE INTERVAL	PID (ppm)	BLOW COUNT
MW13-0-0.5-080210	3.8	7, 10, 10
MW13-1.5-2-080210	4.0	9, 11, 13
MW13-2-4-080210	.5	10, 14, 17
MW13-4-6-080210	3.6	12, 14, 22
	4.3	60/6"
MW13-10-11.5-080210	3.7	12, 50/6"
MW13-14-14.5-080210	3.8	60/5"
	3.5	60/6"
MW13-18.5-19.5-080210	2.8	21, 50/6"

DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS: (color, texture, moisture, MAJOR CONSTITUENT, odor, staining, sheen, debris, etc.)
0	SM	medium brown to reddish brown, dry, fine SILTY SAND. no odor
2	SP	grades to light brown/gray, dry, fine SAND with few small areas of oxide staining. no odor, no sheen.
3	ML	grades to light gray, dry, SILT with fine SAND. abundant oxide staining and woody debris (small rootlets and bark). no odor, no sheen.
7.5	SP-SM	light brown/reddish brown, moist, fine SAND with SILT and increasing GRAVEL (2-4.5" diameter). no odor, no sheen
10	ML	light brown/gray, moist SILT. trace organics, oxide stains, no sheen, no odor.
11	SP	light brown/gray, fine SAND with GRAVEL. no odor, no sheen.
13		no recovery at 12.5 ft- rock blocking sampler
14	SW	medium blue/gray, fine and coarse SAND in interbedded lenses. trace silt and gravel in coarse lenses. no odor, no sheen.
15		medium gray and wet with trace silt and gravel at 15 ft.. large 4" diameter rock in core. no odor, no sheen.
18.5		dark gray with abundant gravel and trace silt at 18.5 ft. no odor, no sheen

MONITORING WELL DETAIL



Notes:
FT BGS = feet below ground surface
ppm = parts per million
--- Dashed contact line in soil description indicates a gradational contact
USCS = Unified Soil Classification System
▼ = denotes groundwater table

Monitoring Well ID: MW-14

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Drill Date: August 2, 2010
Logged By: Megan McCullough
Drilled By: Cascade Drilling
Drill Type: Hollow Stem Auger
Sample Method: 18" split spoon
Boring Diameter: 8 inches
Boring Depth (ft bgs): 25 ft
Groundwater ATD (ft bgs): 15.25 ft

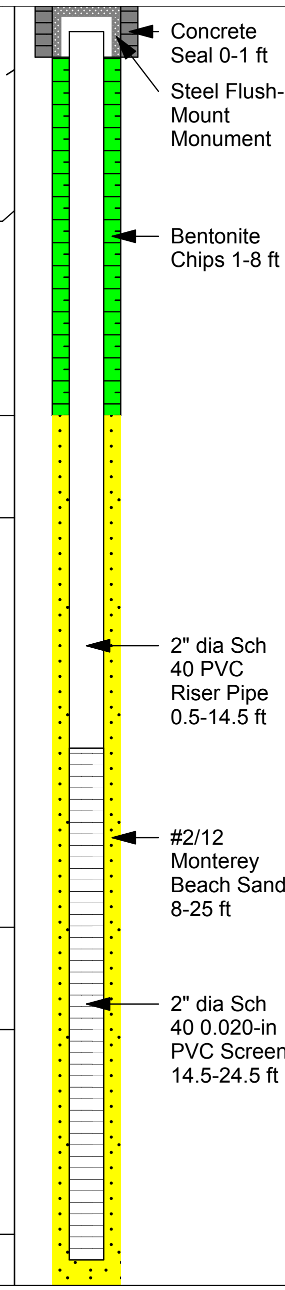
Ground Surf Elev. / Datum: 297.19 ft
Coordinate System: NGVD29/NAD83
Latitude/Northing: 174819.3889 ft
Longitude/Easting: 1272606.284 ft
Casing Elevation: 296.94 ft

Client: Port of Seattle
Project: POS-LLA
Task Number: T 4010
Site Location: LL Apts Parcel
15001 Des Moines Memorial Dr.

Remarks:

SAMPLE INTERVAL	PID (ppm)	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS: (color, texture, moisture, MAJOR CONSTITUENT, odor, staining, sheen, debris, etc.)
MW14-0-0.5-080210	2.1	15 22 34	0–1.4	SM	2" of asphalt above medium brown, moist SILTY SAND with GRAVEL. no odor, slight sheen
MW14-1.5-2-080210	1.4	33 50/6"	1.4–4	SP	grades to reddish brown, fine SAND with GRAVEL and trace silt. no odor, no sheen.
MW14-2-4-080210	2.5, 2.7	23 18 40 24 28 30			grades to coarse at 3 ft.. refusal on first 1.5-3 ft drive, poor recovery on second attempt. abundant gravel.
			4–8		no recovery 4-6 ft, multiple drives attempted. large cobbles and 2-4" diameter gravel in cuttings
	2.7	60/5"	8–10	SM	medium brown, moist, fine to medium SILTY SAND with GRAVEL. no odor, no sheen.
	2.1	100/6"	10–18	SP	brown/gray, moist, medium SAND with GRAVEL and few small silt clasts, small gravel ~30%. no sheen, no odor.
	2.5	28 36 36			light brown/gray and medium with trace silt at 12.5 ft. no odor, no sheen.
MW14-15-16.5-080210	2.8	15 38 50/5"			same as above at 15 ft. wet at 15.25 ft, grades to coarse at 16 ft with very slight sheen (1-2 small strands). no odor.
	3.4	12 22 38	18–20	SW	light brown/gray, wet, fine to medium SAND with trace silt. no odor, no sheen.
	2.7	17 28 25	20–24	SP	light brown, wet, fine SAND with grace silt and no gravel. no odor.
MW14-22.5-24-080210	3.6	15 21 30			same as above at 22.5 ft. no odor, no sheen.
			24–25		

MONITORING WELL DETAIL



Notes:
FT BGS = feet below ground surface
ppm = parts per million
--- Dashed contact line in soil description indicates a gradational contact
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Aspect CONSULTING

Monitoring Well Construction Log

Project Number	Well Number	Sheet
090134-001-04	MW-15	1 of 3

Project Name: Lora Lake Apartment Parcel RI/FS
Location: Burien, WA
Driller/Method: Cascade / Rotosonic
Sampling Method: Continuous core

Ground Surface Elev: --
Top of Casing Elev.: --
Depth to Water (ft BGS): 17.93
Start/Finish Date: 8/23/2010-8/24/2010

Borehole Completion: Flush mount monument; Neat cement (0-2'); Centralizer (2.5'); Bentonite chips (2-44.5'); 2" Sch40 PVC riser, flush-thread, O-rings (0.3-47.25'); 9/13/2010 (static water level, ~18 ft); 8/26/2010 (water level ATD, ~19 ft)

Depth (feet)	Sample Type/ID	Field Screening Observations	PID (ppm)	Density (psf)	Description
0–1.5		No odor, sheen, or staining			**FILL** Dry, dark brown, slightly silty, slightly gravelly SAND (SP-SM); fine to medium sand, fine subrounded gravel, scattered organics (roots)
1.5			2.0		Yellow-red/brown, fine to coarse gravel (1.5")
4					Decrease in gravel
5		No odor, sheen, or staining	7.0 (50)		Dry, yellow-red/brown, slightly silty, very gravelly SAND (SP-SM); predominantly fine to medium sand, fine to coarse subrounded gravel (2.5")
8	Soil: MW15-8-10-082310	Slight sheen, slight sweet odor, no staining	3.0 (37)		Slightly moist, gray, gravelly SAND (SP); predominantly medium sand, fine to coarse rounded to subrounded gravel (2.5")
10		No odor, sheen, or staining	5.0		Slightly moist, dark gray, silty, gravelly SAND (SM); fine to coarse sand, fine to coarse rounded to subrounded gravel (2.5")
12.5					Red brick
13		No odor, sheen, or staining	2.0 (4.0)		Slightly moist, dark gray, slightly silty SAND (SP-SM); trace fine to coarse rounded gravel (1"); predominantly fine to medium sand
15					**GLACIAL OUTWASH (Qvr/Qva)** Moist, light gray, silty SAND (SM); trace fine gravel, predominantly fine to medium sand
16		No odor, sheen, or staining	2.5 (2)		Moist, light gray SAND (SP); trace fine gravel, predominantly medium sand
19		No odor, sheen, or staining	2.7 (7)		
21.5	Soil: MW15-20-25-082310	No odor, sheen, or staining	2.8 (7.7)		Wet, light gray, slightly gravelly SAND (SP); predominantly coarse sand, fine gravel
22.5					SAND (SP); trace gravel, predominantly medium sand
23		No odor, sheen, or staining	(2.8)		Wet, light gray/brown, very gravelly SAND (SP); medium to coarse sand, fine to coarse gravel (3.5")
24					Gravelly SAND (SP); predominantly medium sand; fine gravel

Sampler Type:
No Recovery
Continuous Core

PID - Photoionization Detector
Static Water Level
Water Level (ATD)

Logged by: JMS
Approved by: JJS
Figure No.

PID concentration in parenthesis measured directly from sonic sample bag.

_MONITORING WELL_SONIC LORA LAKE.GPJ July 20, 2011

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Aspect CONSULTING

Monitoring Well Construction Log

Project Number	Well Number	Sheet
090134-001-04	MW-15	2 of 3

- Project Name: Lora Lake Apartment Parcel RI/FS
- Location: Burien, WA
- Driller/Method: Cascade / Rotosonic
- Sampling Method: Continuous core
- Ground Surface Elev: --
- Top of Casing Elev.: --
- Depth to Water (ft BGS): 17.93
- Start/Finish Date: 8/23/2010-8/24/2010

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Field Screening Observations	PID (ppm)	Density (psf)	Material Type	Description	Depth (ft)
							Wet, brown SAND (SP); trace fine gravel, predominantly medium sand	
26			No odor, sheen, or staining	(5.6)				26
27		Soil: MW15-25-30-082310						27
28							Wet, dark brown, very gravelly SAND (SP); fine to coarse gravel (4"), predominantly medium sand	28
29								29
30			No odor, sheen, or staining	(3.2)			Gravelly SAND (SP); fine to coarse gravel (1.5")	30
31								31
32		Soil: MW15-30-35-082310						32
33							Wet, dark brown SAND (SP); medium sand	33
34								34
35			No odor, sheen, or staining	2.0 (10)				35
36								36
37		Soil: MW15-35-40-082310						37
38							Dark brown/gray	38
39								39
40			No odor, sheen, or staining	(2.5)			Gray, medium sand, coarsens downward to 42.5'	40
41								41
42		Soil: MW15-40-45-082310						42
43			No odor, sheen, or staining	(1.6)			Fine sand Medium sand, coarsens downward to 49'	43
44								44
45	2-12 sand (44.5-57.75')							45
46			No odor, sheen, or staining	(3.4)				46
47	Centralizer (46.75')							47
48			No odor, sheen, or staining	(5.9)				48
49		Soil: 49-50					Fine sand	49

Sampler Type:

- No Recovery
- Continuous Core

PID - Photoionization Detector

- ▼ Static Water Level
- ▽ Water Level (ATD)

Logged by: JMS

Approved by: JJS

PID concentration in parenthesis measured directly from sonic sample bag.

Figure No.

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Aspect CONSULTING

Monitoring Well Construction Log

Project Number	Well Number	Sheet
090134-001-04	MW-15	3 of 3

Project Name:	Lora Lake Apartment Parcel RI/FS	Ground Surface Elev	--
Location:	Burien, WA	Top of Casing Elev.	--
Driller/Method:	Cascade / Rotosonic	Depth to Water (ft BGS)	17.93
Sampling Method:	Continuous core	Start/Finish Date	8/23/2010-8/24/2010

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Field Screening Observations	PID (ppm)	Density (psf)	Material Type	Description	Depth (ft)
50–52	2" Sch40 PVC screen, flush-thread, O-rings, 0.010" slot (47.25-57.25')	Soil: MW15-50-55-082310	No odor, sheen, or staining	(<1)			Slighlty moist to wet, gray SILT (ML)	51
52–55			No odor, sheen, or staining	2.1 (5.5)			Wet, gray SAND (SP); predominantly fine sand	52–54
55–60	Centralizer (57.25'); 2" Sch40 PVC sump (57.25-57.75'); Bentonite chips (57.75-60')	Soil: MW15-55-60-082310	No odor, sheen, or staining	(2.0)			Slightly moist to wet, gray, clayey SILT (CL-ML)	55–59
60							Bottom of boring at 60'.	60

Depth scale: 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74

Sampler Type:

- No Recovery
- Continuous Core

PID - Photoionization Detector

- Static Water Level
- Water Level (ATD)

PID concentration in parenthesis measured directly from sonic sample bag.

Logged by: JMS

Approved by: JJS

Figure No.

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Monitoring Well Construction Log

Project Number	Well Number	Sheet
090134-001-04	MW-16	1 of 2

Project Name:	Lora Lake Apartment Parcel RI/FS	Ground Surface Elev	--
Location:	Burien, WA	Top of Casing Elev.	--
Driller/Method:	Cascade / Rotosonic	Depth to Water (ft BGS)	11.54
Sampling Method:	Continuous core	Start/Finish Date	8/24/2010-8/25/2010

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Field Screening Observations	PID (ppm)	Density (psf)	Material Type	Description	Depth (ft)
0–2	Flush mount monument; Neat cement (0-2')						**FILL** Dry, brown, very sandy GRAVEL (GW); fine to coarse sand, fine to coarse subrounded gravel (3"), scattered organics	
1			No odor, sheen, or staining	3.3 (5.1)				1
2							Dry, brown/yellow-red, silty SAND (SM); trace fine gravel, predominantly medium sand; silt lense w/ trace gravel at 3'	2
3							Dry, brown, slightly silty, very gravelly SAND (SP-SM); fine to coarse subrounded gravel (3"), fine to coarse sand	3
4			No odor, sheen, or staining	1.4 (4.7)				4
5							Slightly moist, brown/dark brown	5
6							**GLACIAL OUTWASH (Qvr/Qva)** Slightly moist, red-brown/dark brown SAND (SP); trace silt; trace fine rounded gravel; medium sand	6
7	Bentonite chips (2-34.75')		No odor, sheen, or staining	2.2 (4.7)			Slightly moist, red-brown SAND (SP); medium sand	7
8								8
9							Moist, dark brown, SAND (SP); trace silt, medium sand	9
10			No odor, sheen, or staining	2.7 (1.7)				10
11	▽ 8/26/2010; ▼ 9/13/2010						Moist, red-brown, slightly silty SAND (SP-SM); medium sand	11
12								12
13			No odor, sheen, or staining	1.8 (1.8)				13
14							Wet	14
15	2" Sch40 PVC riser, flush-thread, O-rings (0.3-37.25')						Wet, dark brown SAND (SP); medium sand; gradational color change to gray at 18'	15
16			No odor, sheen, or staining	1.9 (0.4)			Gray-purple sand pocket	16
17		Soil: MW16-15-20-082410						17
18							Gray, trace silt	18
19			No odor, sheen, or staining	2.3 (1.4)				19
20							Wet, gray-purple SAND (SP); medium sand	20
21								21
22		Soil: MW16-20-25-082410	No odor, sheen, or staining	1.7 (2.6)				22
23								23
24								24

Sampler Type:
- ◯ No Recovery
- ▯ Continuous Core

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

Logged by: JMS

Approved by: JJS

Figure No.

PID concentration in parenthesis measured directly from sonic sample bag.

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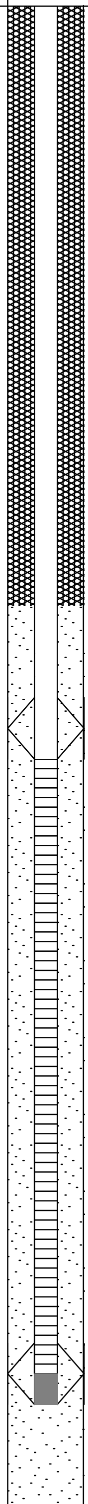
Monitoring Well Construction Log

Project Number	Well Number	Sheet
090134-001-04	MW-16	2 of 2

Project Name:	Lora Lake Apartment Parcel RI/FS	Ground Surface Elev	--
Location:	Burien, WA	Top of Casing Elev.	--
Driller/Method:	Cascade / Rotosonic	Depth to Water (ft BGS)	11.54
Sampling Method:	Continuous core	Start/Finish Date	8/24/2010-8/25/2010



Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Field Screening Observations	PID (ppm)	Density (psf)	Description	Depth (ft)
25–30		Soil: MW16-25-30-082410	No odor, sheen, or staining	0.6 (2.5)		Wet, dark brown SAND (SP); trace silt, medium-fine sand	26–30
29						Medium sand	29
30–35		Soil: MW16-30-35-082410	No odor, sheen, or staining	0.8 (3.2)			31–35
35	2-12 sand (34.75-48.5')						35
36–37	Centralizer (36.75')					Wet, dark brown SAND (SP); medium-fine sand; fining downward to silt at 39'	36–38
39		Soil (Dup): 39-40	No odor, sheen, or staining	1.5 (5.8)		Wet, light gray SILT (ML)	39
40–42	2" Sch40 PVC screen, flush-thread, O-rings, 0.010" slot (37.25-47.25')	Soil: MW16-40-42-082410		0.9 (1.2)		Wet, gray, sandy SILT (ML); scattered organics	40–41
42–47.5		Soil: MW16-42-47.5-082410	No odor, sheen, or staining	0.5 (1.5)		Wet, gray, very silty SAND (SM); fine sand	42–46
47	Centralizer (47.25') 2" Sch40 PVC sump (47.25-47.75')		No odor, sheen, or staining	0.5 (1.1)		Wet, gray, clayey SILT (CL-SM)	47–49
49.5						Bottom of boring at 49.5'	

Sampler Type:
- ○ No Recovery
- ▯ Continuous Core

PID - Photoionization Detector
- Static Water Level
- Water Level (ATD)

Logged by: JMS

Approved by: JJS

PID concentration in parenthesis measured directly from sonic sample bag.

Figure No.

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Monitoring Well Construction Log

Project Number	Well Number	Sheet
090134-001-04	MW-17	1 of 3

Project Name:	Lora Lake Apartment Parcel RI/FS	Ground Surface Elev	--
Location:	Burien, WA	Top of Casing Elev.	--
Driller/Method:	Cascade / Rotosonic	Depth to Water (ft BGS)	15.82
Sampling Method:	Continuous core	Start/Finish Date	8/25/2010-8/26/2010

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Field Screening Observations	PID (ppm)	Density (psf)	Material Type	Description	Depth (ft)
0-2	Flush mount monument; Neat cement (0-2')		No odor, sheen, or staining	0.0			**FILL** Dry, brown, slightly silty, gravelly SAND (SW-SM): fine to coarse sand, fine to coarse rounded to subrounded gravel (2.5"), scattered organics (roots)	1
3-5	2" Sch40 PVC riser, flush-thread, O-rings (0.3-42')	No Recovery (~4.5-5)	No odor, sheen, or staining	0.6			Dry, brown, gravelly SAND (SP); trace silt, predominantly medium sand, fine to coarse subrounded gravel (1.5"), occasional organics (wood)	3
5							Yellow-red (oxidized), silty, gravelly SAND (SM) lense (6")	5
6			No odor, sheen, or staining	0.8			Yellow-red (oxidized), silty, gravelly SAND (SM) lense (6")	6
6.5-8	Bentonite chips (2-39.5')						Dry, brown, slightly silty, very gavelly SAND (SW-SM); fine to coarse sand, fine to coarse subrounded gravel (1.5")	7
8.5-10.5			No odor, sheen, or staining	0.4			Dry, yellow-red, slightly gravelly SAND (SP); trace silt, predominantly medium sand, fine rounded to subrounded gravel	9
10.5-13			No odor, sheen, or staining	1.3			Dry, dark brown, gravelly, silty SAND (SM); fine to coarse sand, fine rounded to subrounded gravel	11
13-14.5			No odor, sheen, or staining	0.9			**GLACIAL OUTWASH (Qvr/Qva)** Slightly moist, dark brown SAND (SP); trace silt, medium-fine sand	13
14.5-15.5							Moist, dark brown SAND (SP); with red-brown, silty SAND (SM) lense	15
15.7	Static water level 9/13/2010	Soil: MW17-15-20-082610	No odor, sheen, or staining	0.9			Wet	16
16-17							Wet, dark brown SAND (SP); trace silt; with silty SAND (SM) lense	16
18-19			No odor, sheen, or staining	0.8			Wet, dark brown SAND (SP); medium-fine sand; with scattered red-brown (oxidized) slightly silty SAND (SP-SM) pockets	18
20-22		No Recovery (~21.5-22.5); Soil: MW17-20-25-082610	No odor, sheen, or staining	1.3				21
24-25			No odor, sheen, or staining	1.5			Brown, clayey silt laminae (0.25")	24

Sampler Type:

No Recovery

Continuous Core

PID - Photoionization Detector

Static Water Level

Water Level (ATD)

Logged by: JMS

Approved by: JJS

Figure No.

PID concentration in parenthesis measured directly from sonic sample bag.

_MONITORING WELL_SONIC LORA LAKE.GPJ September 27, 2010

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Monitoring Well Construction Log

Project Number	Well Number	Sheet
090134-001-04	MW-17	2 of 3

Project Name:	Lora Lake Apartment Parcel RI/FS	Ground Surface Elev	--
Location:	Burien, WA	Top of Casing Elev.	--
Driller/Method:	Cascade / Rotosonic	Depth to Water (ft BGS)	15.82
Sampling Method:	Continuous core	Start/Finish Date	8/25/2010-8/26/2010

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Field Screening Observations	PID (ppm)	Density (psf)	Material Type	Description	Depth (ft)
							Wet, dark brown/gray SAND (SP); medium sand	
26			No odor, sheen, or staining	1.4				26
27		Soil: MW17-25-30-082610						27
28								28
29			No odor, sheen, or staining	1.2				29
30							Medium-fine sand	30
31			No odor, sheen, or staining	2.2				31
32		Soil: MW17-30-35-082610						32
33								33
34			No odor, sheen, or staining	1.1				34
35								35
36			No odor, sheen, or staining	0.6				36
37		Soil: MW17-35-40-082610						37
38								38
39			No odor, sheen, or staining	0.7				39
40	2-12 sand (39.5-52.5')						Wet, gray SAND (SP); medium sand	40
41	Centralizer (41.5')	Soil: MW17-40-42.5-082610	No odor, sheen, or staining	1.0				41
42								42
43					3500		Stiff, moist, gray, very clayey SILT (CL-ML)	43
44			No odor, sheen, or staining	0.5			Wet, gray SAND (SP); medium sand	44
45	2" Sch40 PVC screen, flush-thread, O-rings, 0.010" slot (42-52')				2500		Stiff, moist, gray, clayey SILT (CL-ML)	45
46			No odor, sheen, or staining	0.0				46
47		Soil: MW17-45-50-082610					Wet, gray, silty SAND (SM); fine sand	47
48							Wet, gray SAND (SP); trace silt, medium sand	48
49			No odor, sheen, or staining	0.0				49

Sampler Type:
No Recovery
Continuous Core

PID - Photoionization Detector
Static Water Level
Water Level (ATD)

Logged by: JMS
Approved by: JJS
Figure No.

PID concentration in parenthesis measured directly from sonic sample bag.

_MONITORING WELL_SONIC LORA LAKE.GPJ September 27, 2010

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Monitoring Well Construction Log

Project Number	Well Number	Sheet
090134-001-04	MW-17	3 of 3

Project Name:	Lora Lake Apartment Parcel RI/FS	Ground Surface Elev	--
Location:	Burien, WA	Top of Casing Elev.	--
Driller/Method:	Cascade / Rotosonic	Depth to Water (ft BGS)	15.82
Sampling Method:	Continuous core	Start/Finish Date	8/25/2010-8/26/2010

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Field Screening Observations	PID (ppm)	Density (psf)	Description	Depth (ft)
50		Soil: 50-51			>5000	Very stiff, slightly moist, gray, very clayey SILT (CL-ML)	
51			No odor, sheen, or staining	1.6			51
52	Centralizer (52'); 2" Sch40 PVC sump (52-52.5')						52
53			No odor, sheen, or staining	1.5		Moist/very moist, gray, silty SAND (SM) lense (6"); very fine sand	53
54							54
55		No Recovery			4000	Moist	55
56			No odor, sheen, or staining	2.0			56
57							57
58	Bentonite chips (52.5-60')	Soil: MW17-57.5-60-082610			3000	Stiff, slightly moist/moist, gray, very clayey SILT (CL-ML); with silty SAND (SM) pockets at 58'	58
59			No odor, sheen, or staining	2.1			59
60						Bottom of boring at 60'	60
61							61
62							62
63							63
64							64
65							65
66							66
67							67
68							68
69							69
70							70
71							71
72							72
73							73
74							74

Sampler Type:

No Recovery

Continuous Core

PID - Photoionization Detector

Static Water Level

Water Level (ATD)

Logged by: JMS

Approved by: JJS

Figure No.

PID concentration in parenthesis measured directly from sonic sample bag.

ATTACHMENT B

Laboratory Testing

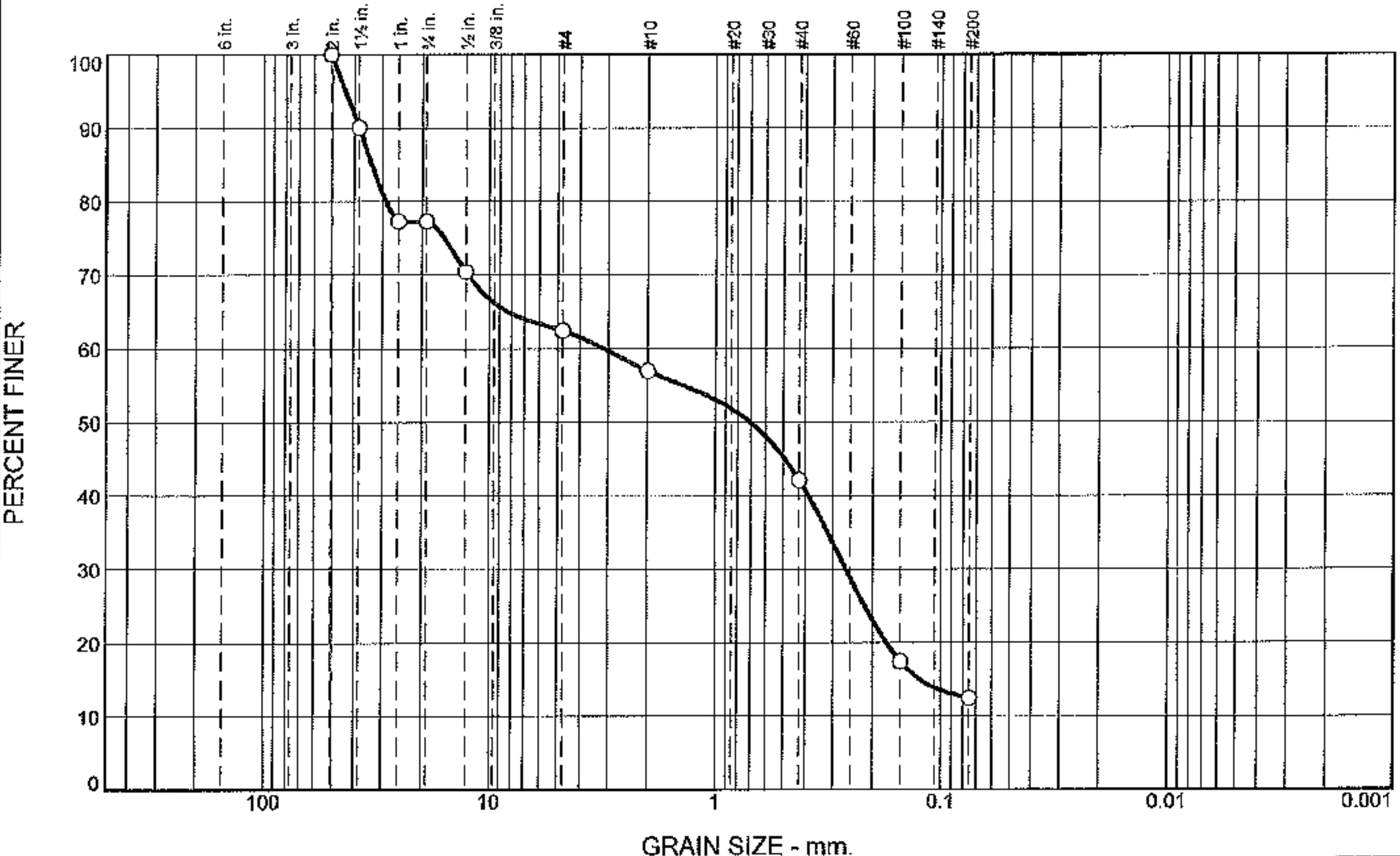
Hayre McElroy & Associates, LLC

Moisture Contents

Moisture Content Test Results (ASTM D2216) - Lora Lake Apartments Project# 110125/08-175

HMA Sample #	Sample #	Location	Date Received	Date of Test	Tare #	Wt of Tare	Tare+ Wet	Tare+ Dry	Moisture %
7807-1	PM-044	0-2	9/30/2015	10/1/2015	A-22	15.8	903.2	838.7	7.8
7807-2	PM-038	0.5-3	9/30/2015	10/1/2015	A-23	15.8	780.5	741.9	5.3
7807-3	PM-045	1.0-2.0	9/30/2015	10/1/2015	A-24	15.8	1144.2	1072.5	6.8
7807-4	PM-047	1.0-2.0	9/30/2015	10/1/2015	A-25	15.9	1068.4	1022.1	4.6
7807-5	PM-035	2.0	9/30/2015	10/1/2015	A-26	15.9	1194.6	1152.6	3.7
7807-6	PM-049	1.0-2.0	9/30/2015	10/1/2015	A-27	16.0	779.6	738.2	5.7

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	22.7	14.9	5.5	14.8	29.6	12.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1 1/2"	90.1		
1"	77.3		
3/4"	77.3		
1/2"	70.4		
#4	62.4		
#10	56.9		
#40	42.1		
#100	17.4		
#200	12.5		

* (no specification provided)

Soil Description

Silty Sand with Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 38.0163 D_{85}= 33.4526 D_{60}= 3.1546
D_{50}= 0.7050 D_{30}= 0.2623 D_{15}= 0.1235
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

PM-044 0-2'

Location: PM-044
Sample Number: 7807-1 **Depth:** 0-2 **Date:** 09/30/2015

Hayre McElroy & Associates, LLC

Redmond, WA

Client: Aspect Consulting
Project: Lora Lakes Apartments
Project No: 110125/08-175 **Figure**

Tested By: B.H **Checked By:** JAM

GRAIN SIZE DISTRIBUTION TEST DATA

10/6/2015

Client: Aspect Consulting
Project: Lora Lakes Apartments
Project Number: 110125/08-175
Location: PM-044
Depth: 0-2 **Sample Number:** 7807-1
Material Description: Silty Sand with Gravel
Date: 09/30/2015
USCS Classification: SM
Testing Remarks: PM-044 0-2'
Tested by: B,H **Checked by:** JAM

Sieve Test Data

Post #200 Wash Test Weights (grams): Dry Sample and Tare = 1021.50
Tare Wt. = 293.80
Minus #200 from wash = 11.6%

Dry Sample and Tare (grams)	Tare (grams)	Sieve Opening Size	Weight Retained (grams)	Sieve Weight (grams)	Percent Finer
1116.70	293.80	2"	0.00	0.00	100.0
		1 1/2"	81.60	0.00	90.1
		1"	105.20	0.00	77.3
		3/4"	0.00	0.00	77.3
		1/2"	56.50	0.00	70.4
		#4	65.80	0.00	62.4
		#10	45.30	0.00	56.9
		#40	122.20	0.00	42.1
		#100	203.20	0.00	17.4
		#200	40.40	0.00	12.5

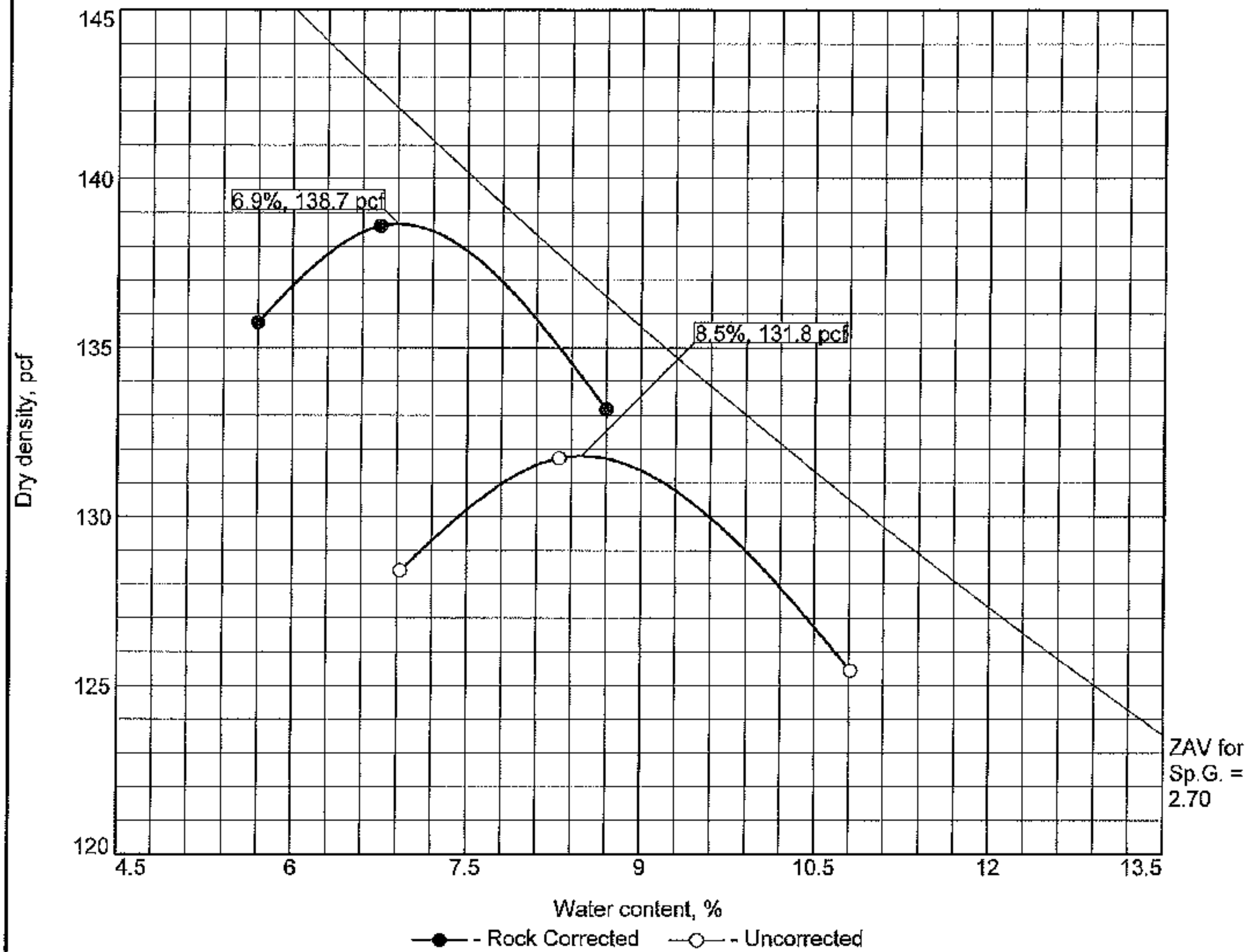
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	22.7	14.9	37.6	5.5	14.8	29.6	49.9			12.5

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
	0.1235	0.1735	0.2623	0.7050	3.1546	28.9598	33.4526	38.0163	43.6890

Fineness Modulus
3.93

COMPACTION TEST REPORT



Test specification: ASTM D 1557-00 Method C Modified
ASTM D 4718-87 Oversize Corr. Applied to Each Test Point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
0-2	SM						22.7	12.5

ROCK CORRECTED TEST RESULTS	UNCORRECTED	MATERIAL DESCRIPTION
Maximum dry density = 138.7 pcf	131.8 pcf	Silty Sand with Gravel
Optimum moisture = 6.9 %	8.5 %	

Project No. 110125/08-175 **Client:** Aspect Consulting
Project: Lora Lakes Apartments
Date: 10/01/2015
○ **Location:** PM-044 **Depth:** 0-2 **Sample Number:** 7807-1

Hayre McElroy & Associates, LLC

Redmond, WA

Remarks:
PM-044 0-2'

Figure

Tested By: B.H **Checked By:** JAM

MOISTURE DENSITY TEST DATA

10/6/2015

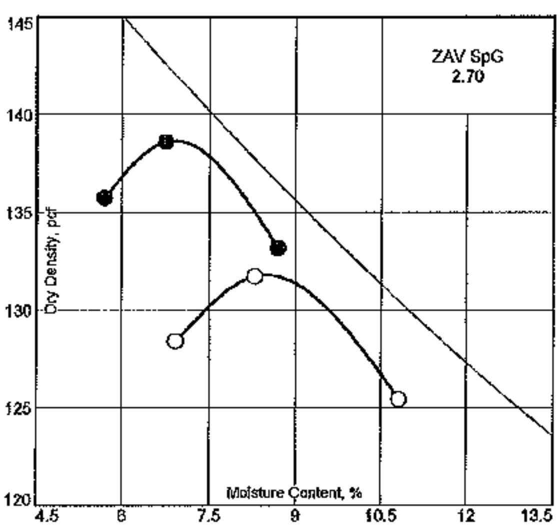
Client: Aspect Consulting
Project: Lora Lakes Apartments
Project Number: 110125/08-175
Location: PM-044
Depth: 0-2
Sample Number: 7807-1
Description: Silty Sand with Gravel
USCS Classification: SM
Test Date: 10/01/2015
Testing Remarks: PM-044 0-2'
Tested by: B.H
Checked by: JAM

Test Data and Results

Test Specification:

Type of Test: ASTM D 1557-00 Method C Modified

Mold Dia: 6.00 **Hammer Wt.:** 10 lb. **Drop:** 18 in. **Layers:** five **Blows per Layer:** 56



Point No.	1	2	3
Wt. M+S	10175.8	10357.9	10233.8
Wt. M	5504.9	5504.9	5504.9
Wt. W+T	515.8	515.8	515.8
Wt. D+T	483.4	477.5	467.0
Tare	15.8	15.8	15.8
Moist.	6.9	8.3	10.8
Moist.*	5.7	6.8	8.7
Dry Den.*	135.7	138.6	133.2

Rock Corrected Results: Max. Dry Den.= 138.7 pcf Opt. Moist.= 6.9%

Uncorrected Results: Max. Dry Den.= 131.8 pcf Opt. Moist.= 8.5%

Rock Correction Data:

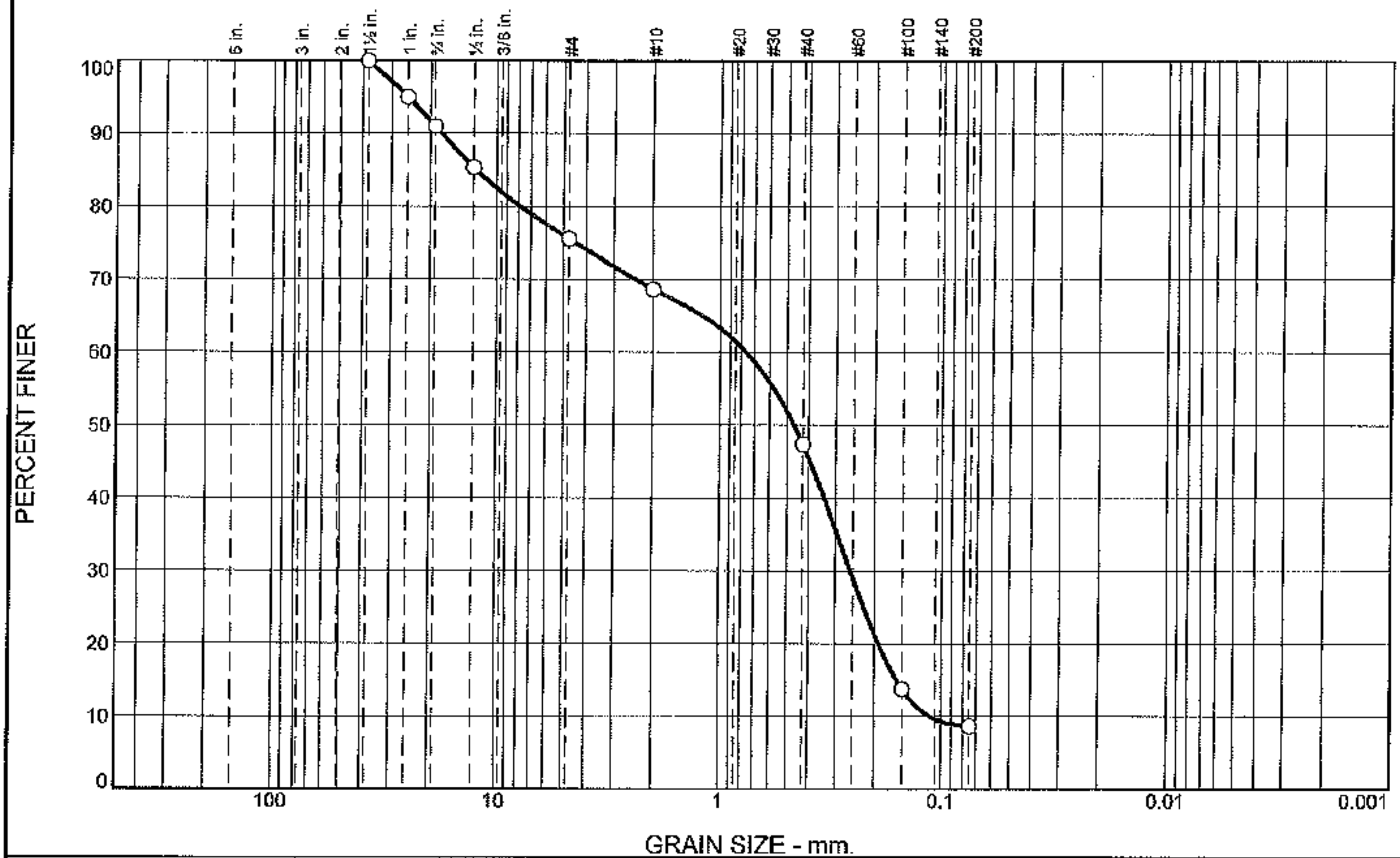
Correction Method: ASTM D 4718-87

Percentage of Oversize Material (%> 3/4 in.): 22.7 **Bulk Specific Gravity of Oversize Material:** 2.700

Oversize Material Moisture Content: 1.5

*Note: the rock correction was applied to every test point's density and moisture value.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	9.0	15.5	6.9	21.2	38.7	8.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 1/2"	100.0		
1"	95.0		
3/4"	91.0		
1/2"	85.3		
#4	75.5		
#10	68.6		
#40	47.4		
#100	13.8		
#200	8.7		

* (no specification provided)

Soil Description

Sand with Silt and Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 17.8042 D_{85}= 12.4139 D_{60}= 0.7639
D_{50}= 0.4663 D_{30}= 0.2580 D_{15}= 0.1591
D_{10}= 0.1124 C_u= 6.80 C_c= 0.78

Classification

USCS= SW-SM AASHTO=

Remarks

PM-038 0.5-3'

Location: PM-038
Sample Number: 7807-2 **Depth:** 0.5-3 **Date:** 09/30/2015

Hayre McElroy & Associates, LLC

Redmond, WA

Client: Aspect Consulting
Project: Lora Lakes Apartments
Project No: 110125/08-175 **Figure**

Tested By: B.H **Checked By:** JAM

GRAIN SIZE DISTRIBUTION TEST DATA

10/6/2015

Client: Aspect Consulting
Project: Lora Lakes Apartments
Project Number: 110125/08-175
Location: PM-038
Depth: 0.5-3 **Sample Number:** 7807-2
Material Description: Sand with Silt and Gravel
Date: 09/30/2015
USCS Classification: SW-SM
Testing Remarks: PM-038 0.5-3'
Tested by: B.H **Checked by:** JAM

Sieve Test Data

Post #200 Wash Test Weights (grams): Dry Sample and Tare = 1269.20
Tare Wt. = 598.70
Minus #200 from wash = 7.7%

Dry Sample and Tare (grams)	Tare (grams)	Sieve Opening Size	Weight Retained (grams)	Sieve Weight (grams)	Percent Finer
1324.80	598.70	1 1/2"	0.00	0.00	100.0
		1"	36.30	0.00	95.0
		3/4"	29.20	0.00	91.0
		1/2"	41.30	0.00	85.3
		#4	70.80	0.00	75.5
		#10	50.40	0.00	68.6
		#40	154.20	0.00	47.4
		#100	244.00	0.00	13.8
		#200	37.00	0.00	8.7

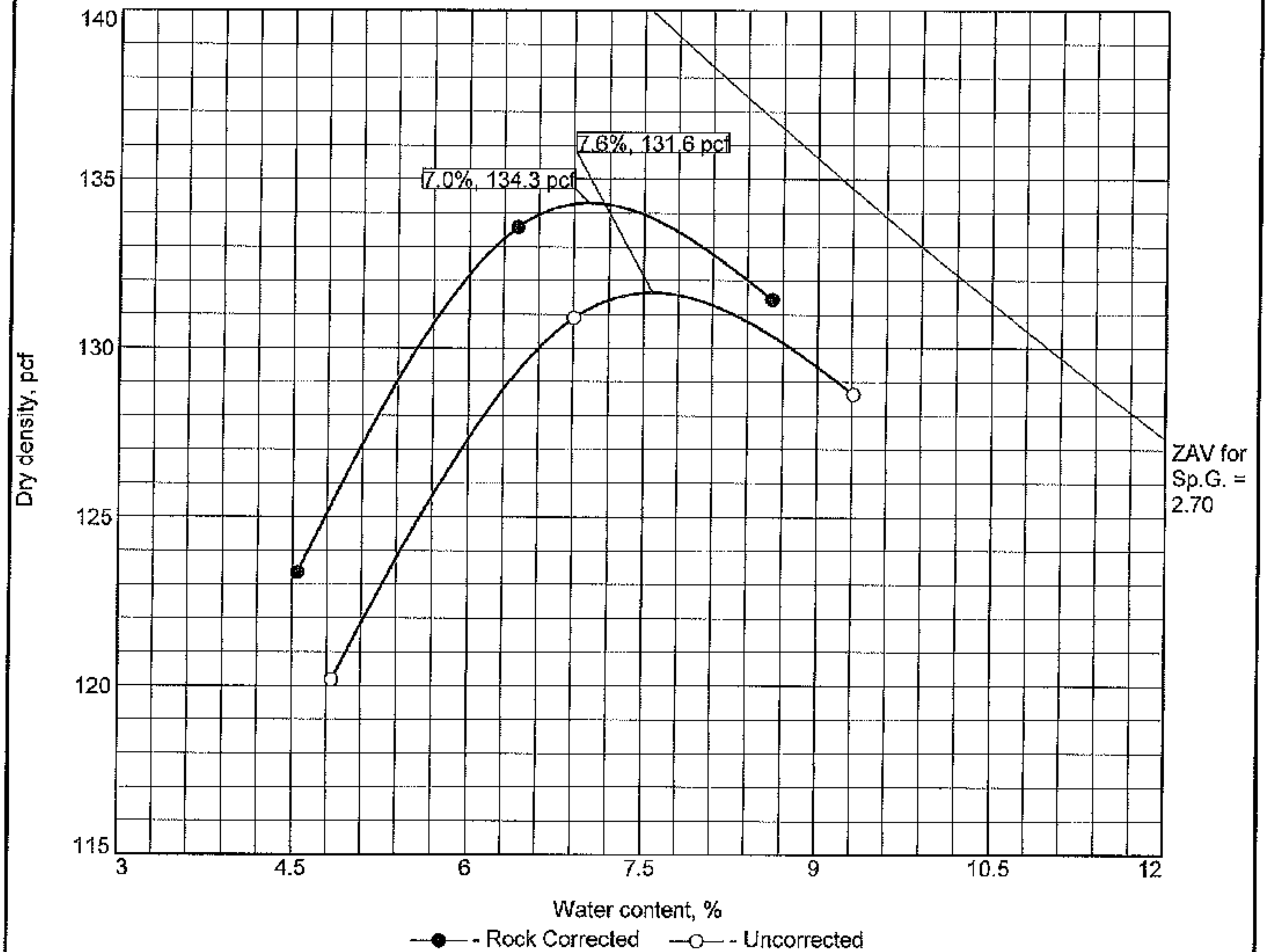
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	9.0	15.5	24.5	6.9	21.2	38.7	66.8			8.7

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.1124	0.1591	0.1919	0.2580	0.4663	0.7639	7.8695	12.4139	17.8042	25.3987

Fineness Modulus	C_u	C_c
3.12	6.80	0.78

COMPACTION TEST REPORT



Test specification: ASTM D 1557-00 Method C Modified
ASTM D 4718-87 Oversize Corr. Applied to Each Test Point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
0.5-3	SW-SM						9.0	8.7

ROCK CORRECTED TEST RESULTS	UNCORRECTED	MATERIAL DESCRIPTION
Maximum dry density = 134.3 pcf	131.6 pcf	Sand with Silt and Gravel
Optimum moisture = 7.0 %	7.6 %	

Project No. 110125/08-175 **Client:** Aspect Consulting
Project: Lora Lakes Apartments
Date: 10/01/2015
○ **Location:** PM-038 **Depth:** 0.5-3 **Sample Number:** 7807-2

Hayre McElroy & Associates, LLC

Redmond, WA

Remarks:
PM-038 0.5-3'

Figure

Tested By: B.H **Checked By:** JAM

MOISTURE DENSITY TEST DATA

10/6/2015

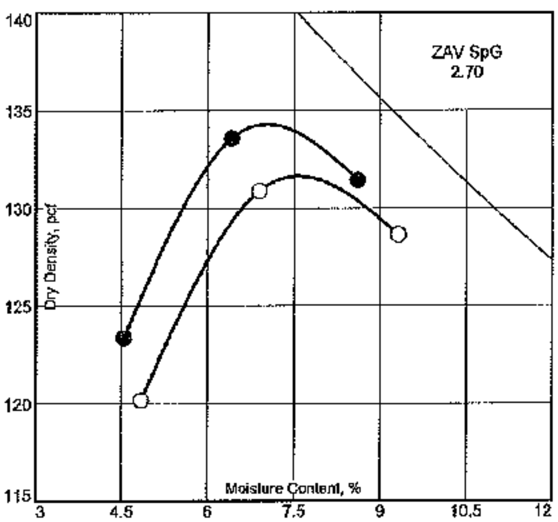
Client: Aspect Consulting
Project: Lora Lakes Apartments
Project Number: 110125/08-175
Location: PM-038
Depth: 0.5-3
Sample Number: 7807-2
Description: Sand with Silt and Gravel
USCS Classification: SW-SM
Test Date: 10/01/2015
Testing Remarks: PM-038 0.5-3'
Tested by: B.H
Checked by: JAM

Test Data and Results

Test Specification:

Type of Test: ASTM D 1557-00 Method C Modified

Mold Dia: 6.00 **Hammer Wt.:** 10 lb. **Drop:** 18 in. **Layers:** five **Blows per Layer:** 56



Point No.	1	2	3
Wt. M+S	9791.1	10265.2	10288.8
Wt. M	5504.9	5504.9	5504.9
Wt. W+T	515.9	516.0	515.7
Wt. D+T	492.8	483.7	473.1
Tare	15.9	16.0	15.7
Moist.	4.8	6.9	9.3
Moist.*	4.5	6.4	8.6
Dry Den.*	123.4	133.6	131.4

Rock Corrected Results: Max. Dry Den.= 134.3 pcf Opt. Moist.= 7.0%
Uncorrected Results: Max. Dry Den.= 131.6 pcf Opt. Moist.= 7.6%

Rock Correction Data:

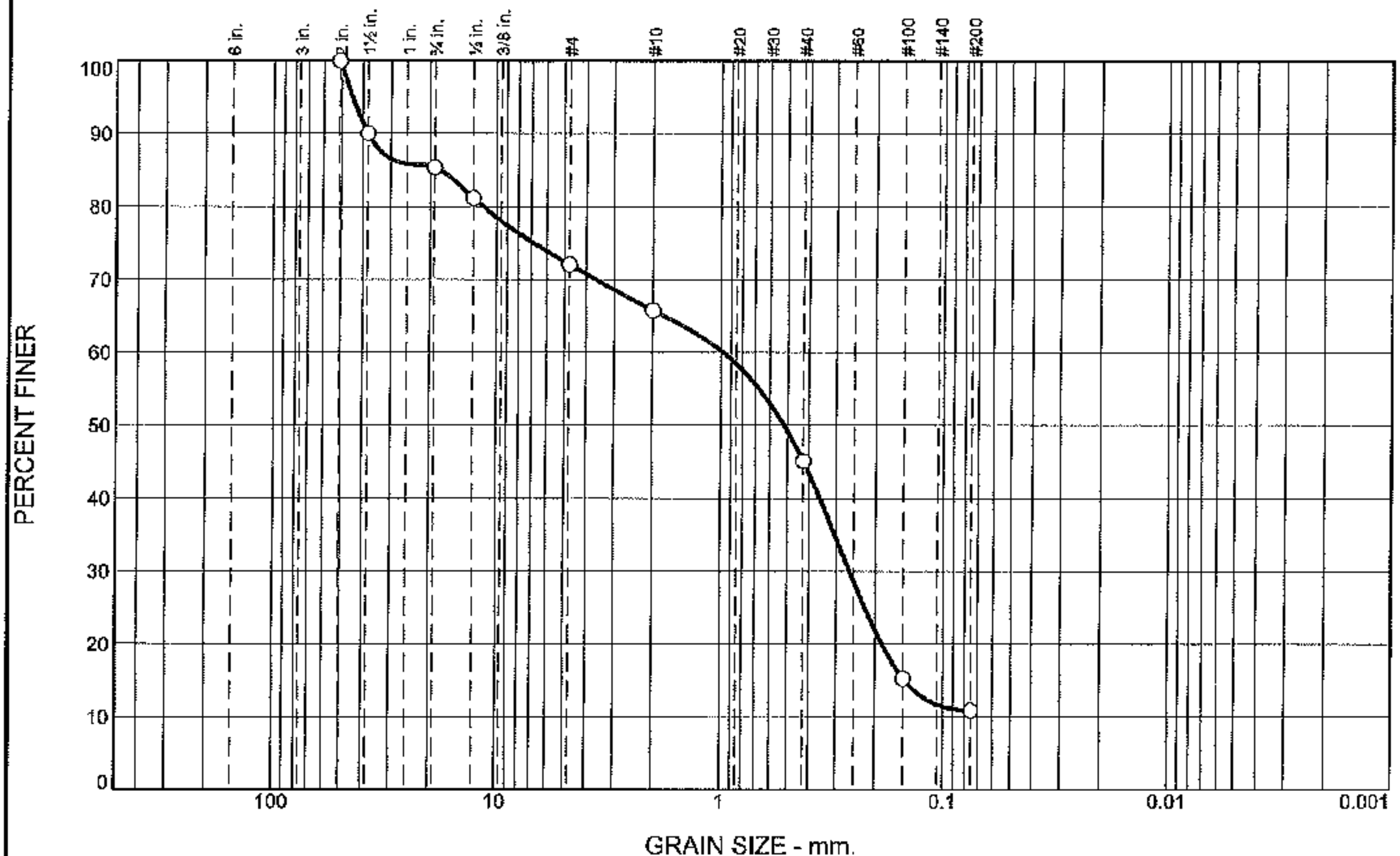
Correction Method: ASTM D 4718-87

Percentage of Oversize Material (%> 3/4 In.): 9.0 **Bulk Specific Gravity of Oversize Material:** 2.700

Oversize Material Moisture Content: 1.5

*Note: the rock correction was applied to every test point's density and moisture value.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	14.7	13.3	6.3	20.6	34.2	10.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1 1/2"	90.0		
3/4"	85.3		
1/2"	81.1		
#4	72.0		
#10	65.7		
#40	45.1		
#100	15.3		
#200	10.9		

* (no specification provided)

Soil Description

Sand with Silt and Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 38.0378 D_{85}= 18.0696 D_{60}= 0.9790
D_{50}= 0.5196 D_{30}= 0.2616 D_{15}= 0.1475
D_{10}= C_u= C_c=

Classification

USCS= SW-SM AASHTO=

Remarks

PM-045 1-2'

Location: PM-045
Sample Number: 7807-3 **Depth:** 1-2 **Date:** 09/30/2015

Hayre McElroy & Associates, LLC

Redmond, WA

Client: Aspect Consulting
Project: Lora Lakes Apartments
Project No: 110125/08-175 **Figure**

Tested By: B.H **Checked By:** JAM

GRAIN SIZE DISTRIBUTION TEST DATA

10/6/2015

Client: Aspect Consulting
Project: Lora Lakes Apartments
Project Number: 110125/08-175
Location: PM-045
Depth: 1-2
Sample Number: 7807-3
Material Description: Sand with Silt and Gravel
Date: 09/30/2015
USCS Classification: SW-SM
Testing Remarks: PM-045 1-2'
Tested by: B.H
Checked by: JAM

Sieve Test Data

Post #200 Wash Test Weights (grams): Dry Sample and Tare = 1733.50
Tare Wt. = 777.30
Minus #200 from wash = 9.5%

Dry Sample and Tare (grams)	Tare (grams)	Sieve Opening Size	Weight Retained (grams)	Sieve Weight (grams)	Percent Finer
1833.60	777.30	2"	0.00	0.00	100.0
		1 1/2"	105.20	0.00	90.0
		3/4"	49.80	0.00	85.3
		1/2"	44.20	0.00	81.1
		#4	96.20	0.00	72.0
		#10	66.60	0.00	65.7
		#40	218.30	0.00	45.1
		#100	314.60	0.00	15.3
		#200	46.70	0.00	10.9

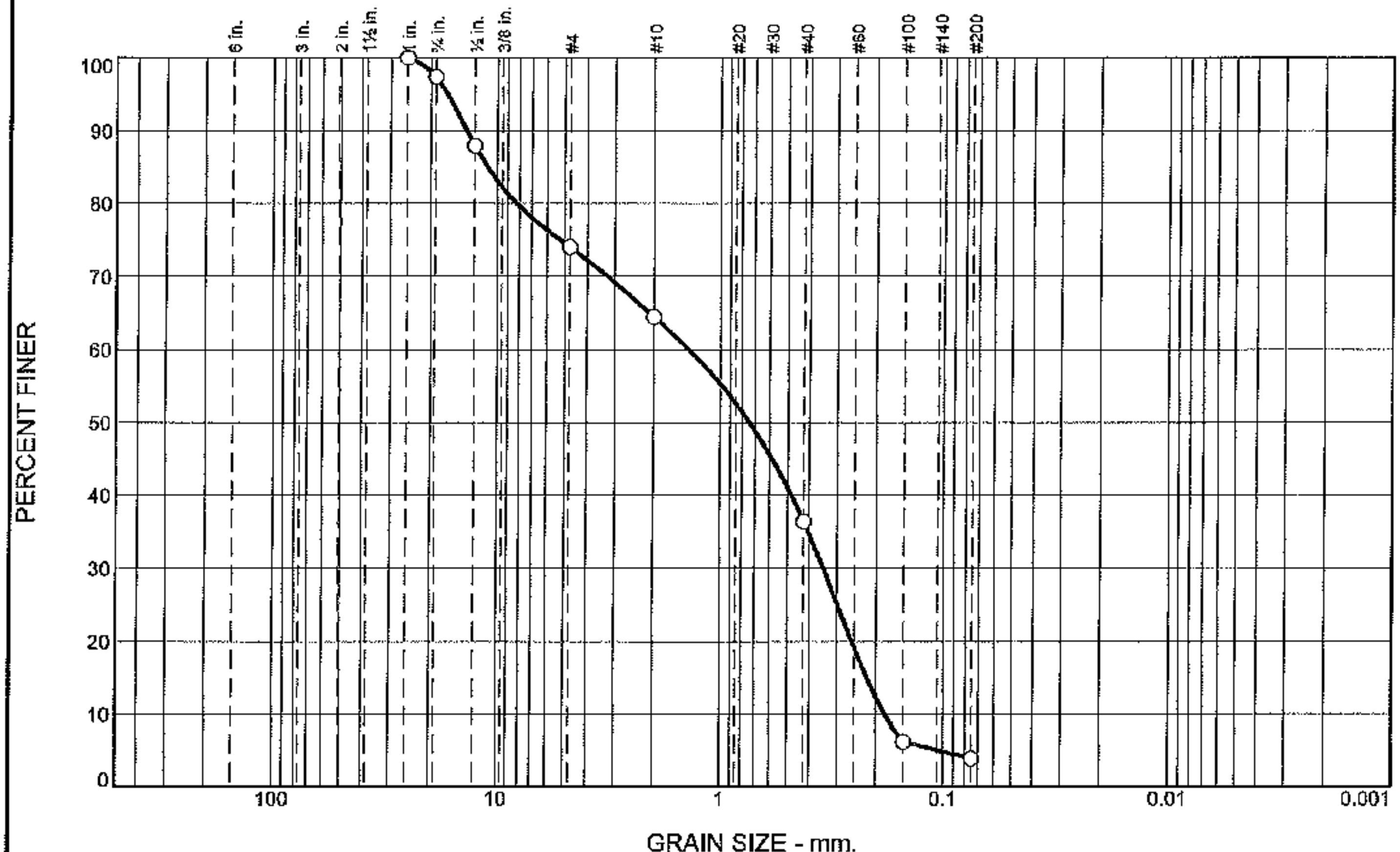
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	14.7	13.3	28.0	6.3	20.6	34.2	61.1			10.9

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
	0.1475	0.1865	0.2616	0.5196	0.9790	11.5192	18.0696	38.0378	44.6041

Fineness Modulus
3.43

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	2.6	23.4	9.5	28.1	32.5	3.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	97.4		
1/2"	87.9		
#4	74.0		
#10	64.5		
#40	36.4		
#100	6.2		
#200	3.9		

* (no specification provided)

Soil Description

Sand with Gravel

Atterberg Limits

PL= LL= SW PI=

Coefficients

D_{90}= 13.8128 D_{85}= 11.1214 D_{60}= 1.3895
D_{50}= 0.7402 D_{30}= 0.3474 D_{15}= 0.2193
D_{10}= 0.1820 C_u= 7.64 C_c= 0.48

Classification

USCS= SP AASHTO=

Remarks

PM-047 1-2'

Location: PM-047
Sample Number: 7807-4 **Depth:** 1-2 **Date:** 09/30/2015

Hayre McElroy & Associates, LLC

Redmond, WA

Client: Aspect Consulting
Project: Lora Lakes Apartments
Project No: 110125/08-175 **Figure**

Tested By: B.H **Checked By:** JAM

GRAIN SIZE DISTRIBUTION TEST DATA

10/6/2015

Client: Aspect Consulting
Project: Lora Lakes Apartments
Project Number: 110125/08-175
Location: PM-047
Depth: 1-2 **Sample Number:** 7807-4
Material Description: Sand with Gravel
Date: 09/30/2015 **LL:** SW
USCS Classification: SP
Testing Remarks: PM-047 1-2'
Tested by: B.H **Checked by:** JAM

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare** = 1568.70
Tare Wt. = 595.60
Minus #200 from wash = 3.3%

Dry Sample and Tare (grams)	Tare (grams)	Sieve Opening Size	Weight Retained (grams)	Sieve Weight (grams)	Percent Finer
1602.00	595.60	1"	0.00	0.00	100.0
		3/4"	26.40	0.00	97.4
		1/2"	95.30	0.00	87.9
		#4	139.60	0.00	74.0
		#10	96.30	0.00	64.5
		#40	282.30	0.00	36.4
		#100	304.10	0.00	6.2
		#200	23.00	0.00	3.9

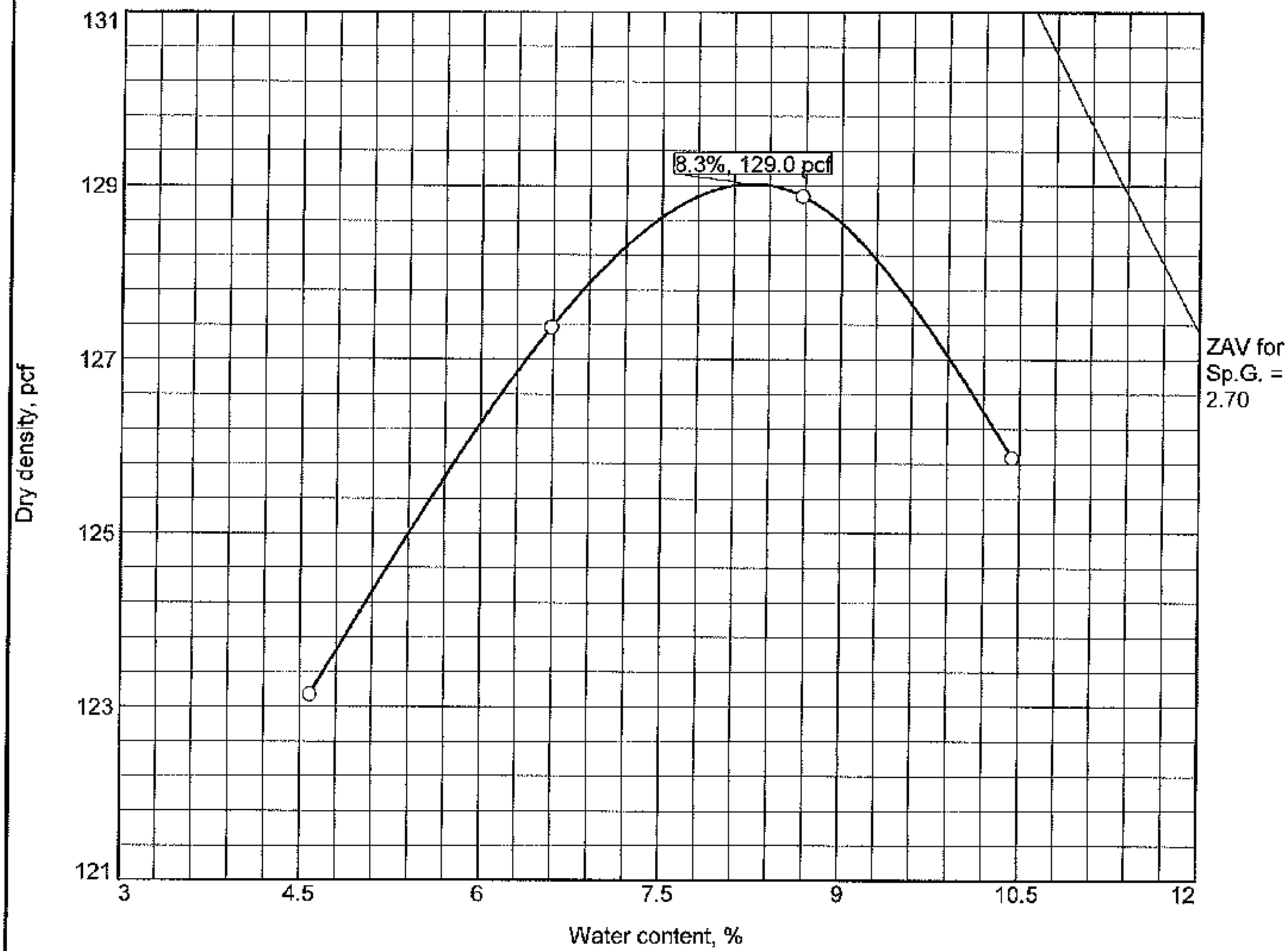
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	2.6	23.4	26.0	9.5	28.1	32.5	70.1			3.9

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.1820	0.2193	0.2575	0.3474	0.7402	1.3895	8.2153	11.1214	13.8128	16.8731

Fineness Modulus	C_u	C_c
3.45	7.64	0.48

COMPACTION TEST REPORT



Test specification: ASTM D 1557-00 Method C Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
1-2	SP				SW		2.6	3.9

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 129.0 pcf Optimum moisture = 8.3 %	Sand with Gravel

Project No. 110125/08-175 **Client:** Aspect Consulting

Project: Lora Lakes Apartments

Date: 10/01/2015

○ **Location:** PM-047 **Depth:** 1-2 **Sample Number:** 7807-4

Hayre McElroy & Associates, LLC

Redmond, WA

Remarks:
PM-047 1-2'

Figure

Tested By: B.H **Checked By:** JAM

MOISTURE DENSITY TEST DATA

10/6/2015

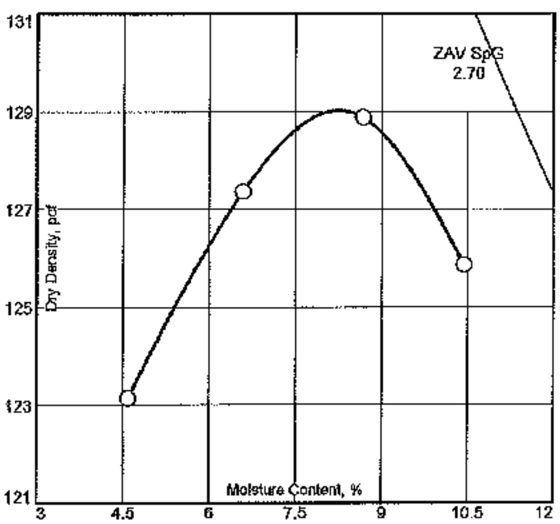
Client: Aspect Consulting
Project: Lora Lakes Apartments
Project Number: 110125/08-175
Location: PM-047
Depth: 1-2
Sample Number: 7807-4
Description: Sand with Gravel
USCS Classification: SP
Test Date: 10/01/2015
Liquid Limit: SW
Testing Remarks: PM-047 1-2'
Tested by: B.H
Checked by: JAM
Percent passing 3/4 in. sieve: 97.4

Test Data and Results

Test Specification:

Type of Test: ASTM D 1557-00 Method C Modified

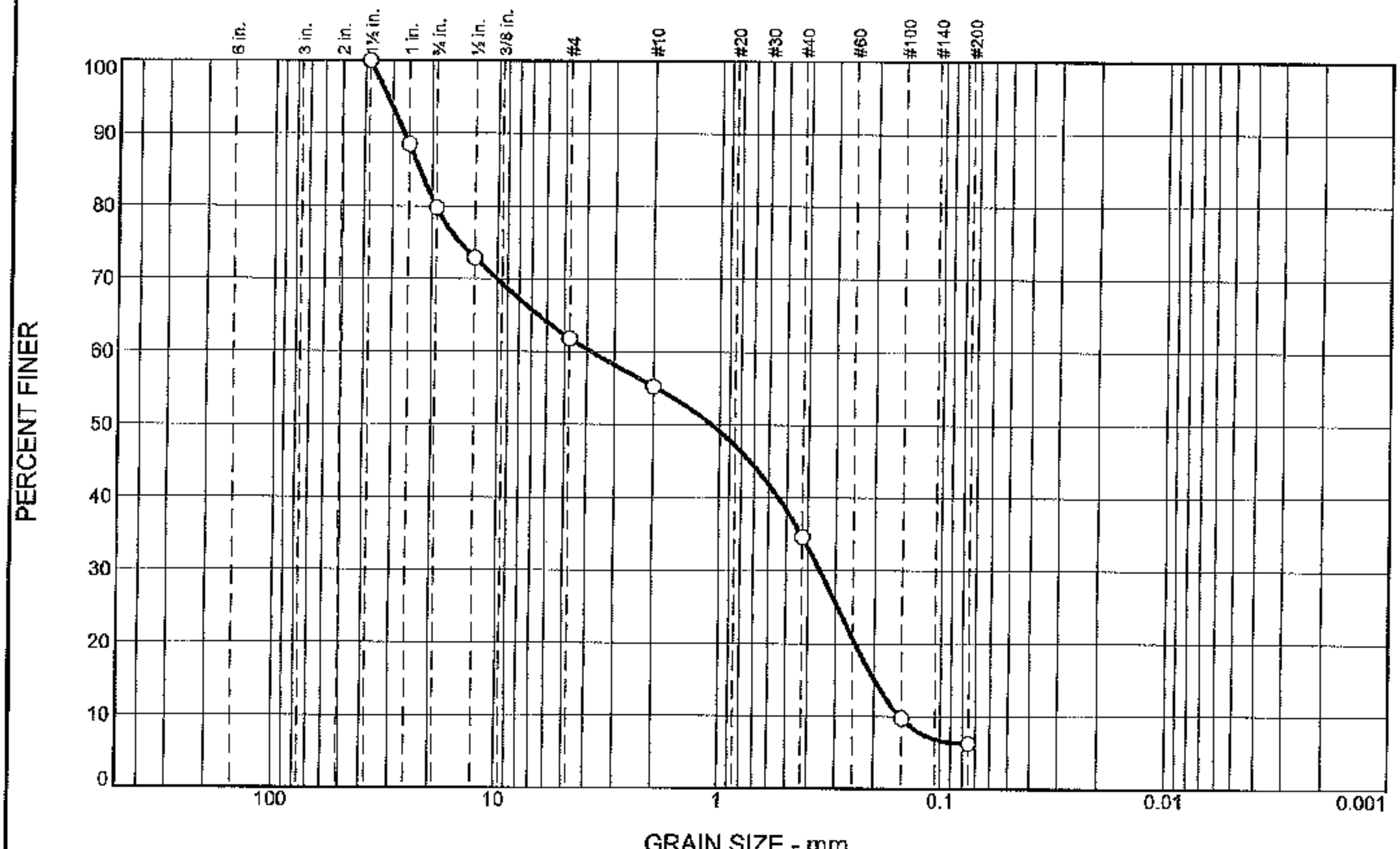
Mold Dia: 6.00 Hammer Wt.: 10 lb. Drop: 18 in. Layers: five Blows per Layer: 56



Point No.	1	2	3	4
Wt. M+S	9886.0	10123.4	10269.6	10233.8
Wt. M	5504.9	5504.9	5504.9	5504.9
Wt. W+T	515.9	515.9	516.1	709.2
Wt. D+T	494.0	485.0	476.2	643.7
Tare	15.9	15.9	16.1	16.0
Moist.	4.6	6.6	8.7	10.4
Dry Den.	123.1	127.4	128.9	125.9

Test Results: Max. Dry Den.= 129.0 pcf Opt. Moist.= 8.3%

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	20.3	17.9	6.6	20.6	28.3	6.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 1/2"	100.0		
1"	88.5		
3/4"	79.7		
1/2"	72.9		
#4	61.8		
#10	55.2		
#40	34.6		
#100	9.7		
#200	6.3		

* (no specification provided)

Soil Description

Sand with Silt and Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 26.6901 D_{85}= 22.7746 D_{60}= 3.8368
D_{50}= 1.0863 D_{30}= 0.3540 D_{15}= 0.1991
D_{10}= 0.1529 C_u= 25.10 C_c= 0.21

Classification

USCS= SW-SM AASHTO=

Remarks

PM-035 2'

Location: PM-035
Sample Number: 7807-5 **Depth:** 2' **Date:** 09/30/2015

Hayre McElroy & Associates, LLC	**Client:** Aspect Consulting
	Project: Lora Lakes Apartments
Redmond, WA	**Project No:** 110125/08-175 **Figure**

Tested By: B.H **Checked By:** JAM

GRAIN SIZE DISTRIBUTION TEST DATA

10/6/2015

Client: Aspect Consulting
Project: Lora Lakes Apartments
Project Number: 110125/08-175
Location: PM-035
Depth: 2' **Sample Number:** 7807-5
Material Description: Sand with Silt and Gravel
Date: 09/30/2015
USCS Classification: SW-SM
Testing Remarks: PM-035 2'
Tested by: B.H **Checked by:** JAM

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 1697.60
Tare Wt. = 621.30
Minus #200 from wash = 5.3%

Dry Sample and Tare (grams)	Tare (grams)	Sieve Opening Size	Weight Retained (grams)	Sieve Weight (grams)	Percent Finer
1758.00	621.30	1 1/2"	0.00	0.00	100.0
		1"	131.00	0.00	88.5
		3/4"	99.20	0.00	79.7
		1/2"	78.30	0.00	72.9
		#4	125.60	0.00	61.8
		#10	74.70	0.00	55.2
		#40	234.30	0.00	34.6
		#100	283.00	0.00	9.7
		#200	39.40	0.00	6.3

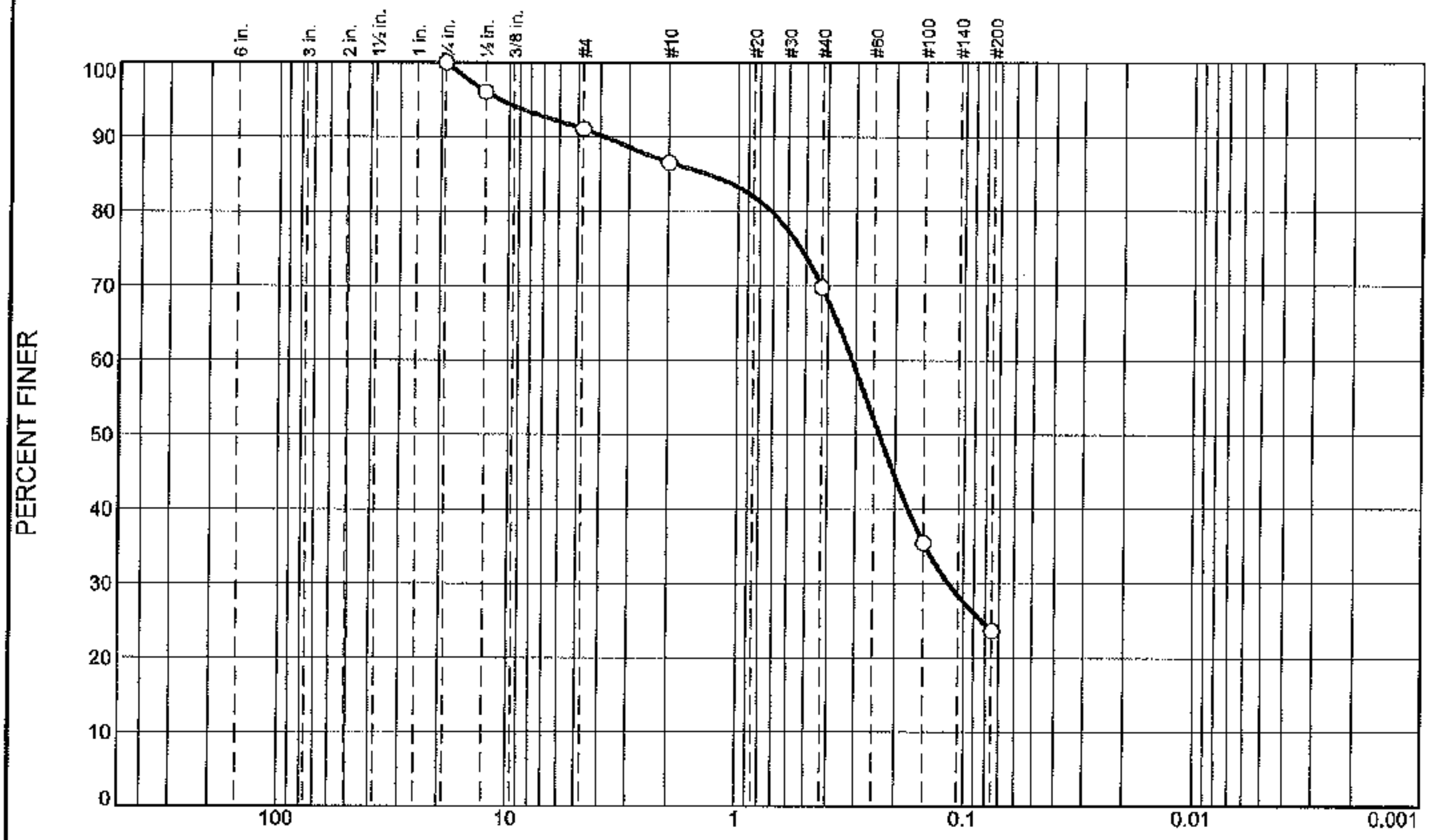
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	20.3	17.9	38.2	6.6	20.6	28.3	55.5			6.3

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.1529	0.1991	0.2441	0.3540	1.0863	3.8368	19.2373	22.7746	26.6901	31.7213

Fineness Modulus	C_u	C_c
4.05	25.10	0.21

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	8.9	4.6	16.7	46.2	23.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	96.1		
#4	91.1		
#10	86.5		
#40	69.8		
#100	35.4		
#200	23.6		

* (no specification provided)

Soil Description

Silty Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 3.8541 D_{85}= 1.3729 D_{60}= 0.3122
D_{50}= 0.2363 D_{30}= 0.1168 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

PM-049 1-2'

Location: PM-049
Sample Number: 7807-6 **Depth:** 1-2' **Date:** 09/30/2015

Hayre McElroy & Associates, LLC

Redmond, WA

Client: Aspect Consulting
Project: Lora Lakes Apartments
Project No: 110125/08-175 **Figure**

Tested By: B.H **Checked By:** JAM

GRAIN SIZE DISTRIBUTION TEST DATA

10/6/2015

Client: Aspect Consulting
Project: Lora Lakes Apartments
Project Number: 110125/08-175
Location: PM-049
Depth: 1-2'
Sample Number: 7807-6
Material Description: Silty Sand
Date: 09/30/2015
USCS Classification: SM
Testing Remarks: PM-049 1-2'
Tested by: B.H
Checked by: JAM

Sieve Test Data

Post #200 Wash Test Weights (grams): Dry Sample and Tare = 662.50
Tare Wt. = 87.10
Minus #200 from wash = 20.3%

Dry Sample and Tare (grams)	Tare (grams)	Sieve Opening Size	Weight Retained (grams)	Sieve Weight (grams)	Percent Finer
809.40	87.10	3/4"	0.00	0.00	100.0
		1/2"	28.50	0.00	96.1
		#4	36.10	0.00	91.1
		#10	32.70	0.00	86.5
		#40	120.80	0.00	69.8
		#100	248.40	0.00	35.4
		#200	85.10	0.00	23.6

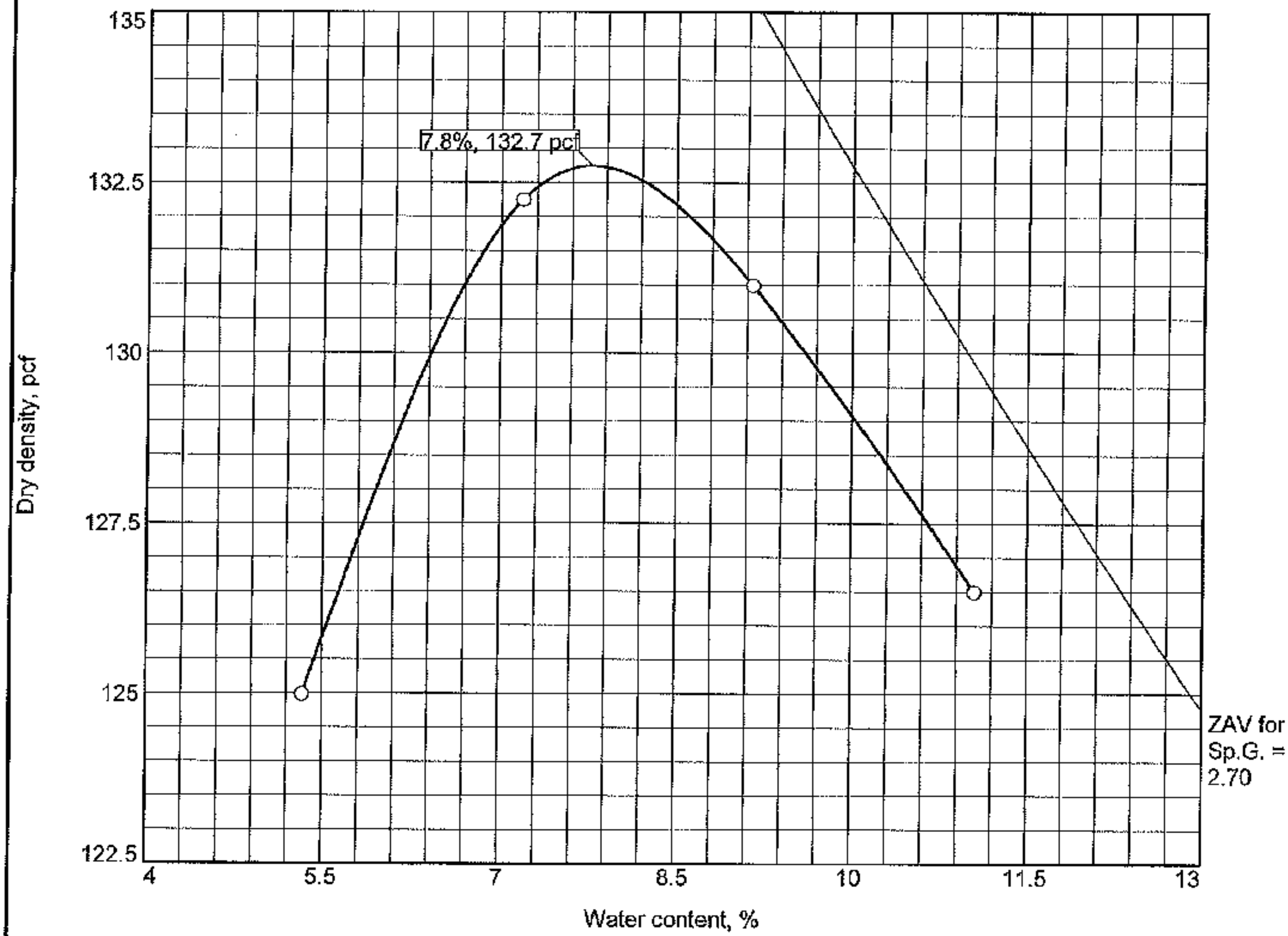
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	8.9	8.9	4.6	16.7	46.2	67.5			23.6

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
			0.1168	0.2363	0.3122	0.7150	1.3729	3.8541	11.0095

Fineness Modulus
1.72

COMPACTION TEST REPORT



Test specification: ASTM D 1557-00 Method C Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
1-2'	SM						0.0	23.6

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 132.7 pcf Optimum moisture = 7.8 %	Silty Sand

Project No. 110125/08-175 **Client:** Aspect Consulting

Project: Lora Lakes Apartments

Date: 10/01/2015

○ **Location:** PM-049 **Depth:** 1-2' **Sample Number:** 7807-6

Hayre McElroy & Associates, LLC

Redmond, WA

Remarks:
PM-049 1-2'

Figure

Tested By: B.H **Checked By:** JAM

MOISTURE DENSITY TEST DATA

10/6/2015

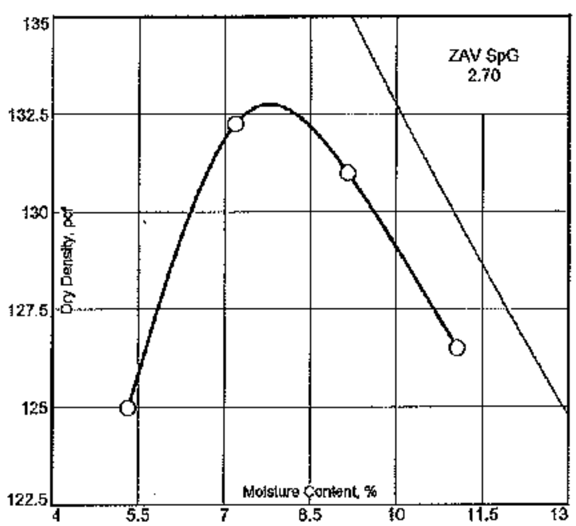
Client: Aspect Consulting
Project: Lora Lakes Apartments
Project Number: 110125/08-175
Location: PM-049
Depth: 1-2'
Sample Number: 7807-6
Description: Silty Sand
USCS Classification: SM
Test Date: 10/01/2015
Testing Remarks: PM-049 1-2'
Tested by: B.H
Checked by: JAM
Percent passing 3/4 in. sieve: 100.0

Test Data and Results

Test Specification:

Type of Test: ASTM D 1557-00 Method C Modified

Mold Dia: 6.00 **Hammer Wt.:** 10 lb. **Drop:** 18 in. **Layers:** five **Blows per Layer:** 56



Point No.	1	2	3	4
Wt. M+S	9983.4	10326.9	10368.7	10283.9
Wt. M	5504.9	5504.9	5504.9	5504.9
Wt. W+T	516.0	516.0	515.9	519.2
Wt. D+T	490.7	482.5	474.0	469.1
Tare	16.0	16.0	15.9	15.8
Moist.	5.3	7.2	9.1	11.1
Dry Den.	125.0	132.2	131.0	126.5

Test Results: Max. Dry Den.= 132.7 pcf Opt. Moist.= 7.8%

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Client:	Analytical Resources, Inc.	**Date:**	May 15, 2015
Address:	4611 S. 134th Place, Ste 100	**Project:**	Lora Lake Apartments
	Tukwila, WA 98168	**Project #:**	AMQ5
Attn:	Cheronne Oreiro	**Sample #:**	Multiple

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
	Sieve Analysis			Sulfate Soundness	
	Proctor			Bulk Density & Voids	
	Sand Equivalent			WSDOT Degradation	
	Fracture Count				
X	Moisture Content	See Attached			
	pH				
	Minimum Resistivity				
	Organic Content				
	Atterberg Limits				
	Asphalt Extraction/Gradation				
	Rice Density				

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,

Elizabeth Goble

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Project: Lora Lake Apartments
Project #: AMQ5
Date Received: September 21, 2015
Date Tested: September 28, 2015

Client: Analytical Resources, Inc.
Sampled by: Others
Tested by: A. Urban

Moisture Content - ASTM C-566, ASTM D-2216 & AASHTO T-265

Sample #	Location	Tare	Wet + Tare	Dry + Tare	Wgt. Of Moisture	Wgt. Of Soil	% Moisture
T15-1998-1	PM-084-25.0-26.0	1.52	51.49	41.62	9.9	40.1	24.6%
T15-1998-2	PM-084-25.0-26.0	1.55	64.36	51.87	12.5	50.3	24.8%
T15-1998-3	PM-084-25.0-26.0	1.55	60.43	48.71	11.7	47.2	24.9%
T15-1991	PM-086-19.0-20.0	1.54	66.52	54.04	12.5	52.5	23.8%
T15-1992	PM-094-5.0-6.0	1.55	57.06	53.30	3.8	51.8	7.3%
T15-1993	PM-094-10.0-11.0	1.56	67.64	62.90	4.7	61.3	7.7%
T15-1994	PM-094-19.0-20.0	1.57	76.68	64.41	12.3	62.8	19.5%
T15-1995	PM-095-01.0-02.0	1.57	42.83	40.20	2.6	38.6	6.8%
T15-1996	PM-095-10.0-11.0	1.53	49.58	46.29	3.3	44.8	7.4%
T15-1997	PM-095-19.0-20.0	1.56	38.33	35.45	2.9	33.9	8.5%
T15-1999	PM-086-5.0-6.0	1.56	74.47	71.88	2.6	70.3	3.7%
T15-2000	PM-086-10.0-11.0	1.54	48.35	42.87	5.5	41.3	13.3%

Reviewed by: [signature]

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SUBCONTRACTOR ANALYSIS REQUEST
CUSTODY TRANSFER 09/17/15

ANALYTICAL RESOURCES INCORPORATED

ARI Project: AMQ5

MTC JOB#15T001-111

Laboratory: Materials Testing & Consulting, In
Lab Contact: Harold Benny
Lab Address: 4611 S. 134th Pl
Tukwila, WA 98168
Phone: 360-255-9802
Fax:

ARI Client: Floyd Snider
Project ID: Lora Lake Apartments
ARI PM: Cheronne Oreiro
Phone: 206-695-6214
Fax: 206-695-6201
Email: subdata@arilabs.com

Analytical Protocol: In-house
Special Instructions: LV4

Requested Turn Around: 2 weeks
Email Results (Y/N): **Yes**

Limits of Liability. *Subcontractor is expected to perform all requested services in accordance with appropriate methodology following Standard Operating Procedures that meet standards for the industry. The total liability of ARI, its officers, agents, employees, or sucessors, arising out of or in connection with the requested services, shall not exceed the negotiated amount for said services. The agreement by the Subcontractor to perform services requested by ARI releases ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Subcontractor.*

ARI ID	Client ID/ Add'l ID	Sampled	Matrix	Bottles	Analyses
15-16551-AMQ5C T15-1991	PM-086-19.0-20.0	09/16/15 10:55	Soil	1	~~MS~~ MC ASTM D2216
Special Instructions: ASTM D-2216 Mosture Content					
15-16554-AMQ5F T15-1992	PM-094-5.0-6.0	09/16/15 13:10	Soil	1	MC
Special Instructions: ASTM D-2216 Mosture Content					
15-16555-AMQ5G T15-1993	PM-094-10.0-11.0	09/16/15 13:17	Soil	1	MC
Special Instructions: ASTM D-2216 Mosture Content					
15-16556-AMQ5H T15-1994	PM-094-19.0-20.0	09/16/15 13:35	Soil	1	MC
Special Instructions: ASTM D-2216 Mosture Content					
15-16558-AMQ5J T15-1995	PM-095-01.0-02.0	09/16/15 15:05	Soil	1	MC
Special Instructions: ASTM D-2216 Mosture Content					
15-16559-AMQ5K T15-1996	PM-095-10.0-11.0	09/16/15 15:15	Soil	1	MC
Special Instructions: ASTM D-2216 Mosture Content					
15-16560-AMQ5L T15-1997	PM-095-19.0-20.0	09/16/15 15:25	Soil	1	MC
Special Instructions: ASTM D-2216 Mosture Content					

Carrier		Airbill		Date	
Relinquished by	[signature]	Company	ARI	Date 9-21-15	Time 1101
Received by	[signature]	Company	MTC	Date 9-21-15	Time 1101

SUBCONTRACTOR ANALYSIS REQUEST
CUSTODY TRANSFER 09/17/15

ANALYTICAL RESOURCES INCORPORATED

ARI Project: AMQ5
MTC JOB # 15T001-111

Laboratory: Materials Testing & Consulting, In ARI Client: Floyd Snider
Lab Contact: Harold Benny Project ID: POS-LLA

ARI Sample ID	Client Sample ID/ Add'l Sample ID	Sampled	Matrix	Bottles	Analyses	
15-16564-AMQ5P T15-1998	PM-084-25.0-26.0	09/16/15 09:35	Soil	1	MC	ASTM D2216
Special Instructions: ASTM D-2216 Mosture Content						
15-16569-AMQ5U T15-1999	PM-086-5.0-6.0	09/16/15 10:35	Soil	1	MC	
Special Instructions: ASTM D-2216 Mosture Content						
15-16570-AMQ5V T15-2000	PM-086-10.0-11.0	09/16/15 10:40	Soil	1	MC	
Special Instructions: ASTM D-2216 Mosture Content						

- $15 per sample
- need QC
- need pkg

Carrier		Airbill		Date	
Relinquished by	Company ARI		Date 9/21/15		Time 1101
Received by	Company MTC		Date 9.21.15		Time 1101

Moisture Content Determination
ASTM D2216

MTC Job No.: 15T001-111
In Oven Date: 9.22.15

Tested by: aw
Out Oven Date: 9.23.15

MTC Sample ID	Tare #	Tare Wt. (g)	Wet Soil + Tare Wt. (g)	Dry Soil + Tare Wt. (g)	Moisture Content %
T15-1998-1	1998-1	1.52	51.49	41.62	24.6
T15-1998-2	1998-2	1.55	64.36	51.87	24.8
T15-1998-3	1998-3	1.55	~~60.36~~ 60.43	40.71	24.9
T15-1991	1991	1.54	66.52	54.04	23.8
T15-1992	1992	1.55	57.06	53.30	7.3
T15-1993	1993	1.56	67.64	62.90	7.7
T15-1994	1994	1.57	76.68	64.41	19.5
T15-1995	1995	1.57	42.83	40.20	6.8
T15-1996	1996	1.53	49.58	46.29	7.4
T15-1997	1997	1.56	38.33	35.45	8.5
T15-1999	1999	1.56	74.47	71.88	3.7
T15-2000	2000	1.54	48.35	42.87	13.3

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Client:	Analytical Resources, Inc.	**Date:**	October 16, 2015
Address:	4611 S. 134th Place, Ste 100	**Project:**	Lora Lake Apartments
	Tukwila, WA 98168	**Project #:**	ANM6
Attn:	Cheronne Oreiro	**Sample #:**	Multiple

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
	Sieve Analysis			Sulfate Soundness	
	Proctor			Bulk Density & Voids	
	Sand Equivalent			WSDOT Degradation	
	Fracture Count				
X	Moisture Content	See Attached			
	pH				
	Minimum Resistivity				
	Organic Content				
	Atterberg Limits				
	Asphalt Extraction/Gradation				
	Rice Density				

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,

Beth Goble

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Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Project: Lora Lake Apartments
Project #: ANM6
Date Received: October 2, 2015
Date Tested: October 16, 2015

Client: Analytical Resources, Inc.
Sampled by: Others
Tested by: A. Urban

Moisture Content - ASTM C-566, ASTM D-2216 & AASHTO T-265

Sample #	Location	Tare	Wet + Tare	Dry + Tare	Wgt. Of Moisture	Wgt. Of Soil	% Moisture
T15-2101	PM-038-00.0-01.0	1.5	50.4	47.0	3.4	45.5	7.5%
T15-2102	PM-038-01.0-02.0	1.5	58.3	55.3	3.0	53.8	5.7%
T15-2103	PM-038-02.0-03.0	1.5	60.6	57.4	3.2	55.9	5.7%

Reviewed by: ______________________

SUBCONTRACTOR ANALYSIS REQUEST
CUSTODY TRANSFER 09/30/15

ANALYTICAL RESOURCES INCORPORATED

ARI Project: ANM6
MTC JOB# 15T001-111

Laboratory: Materials Testing & Consulting, In
Lab Contact: Harold Benny
Lab Address: 4611 S. 134th Pl
Tukwila, WA 98168
Phone: 360-255-9802
Fax:

ARI Client: Floyd Snider
Project ID: Lora Lake Apartments
ARI PM: Cheronne Oreiro
Phone: 206-695-6214
Fax: 206-695-6201
Email: subdata@arilabs.com

Analytical Protocol: In-house
Special Instructions: LV4

Requested Turn Around: **10/14/15**
Email Results (Y/N): **Yes**

Limits of Liability. *Subcontractor is expected to perform all requested services in accordance with appropriate methodology following Standard Operating Procedures that meet standards for the industry. The total liability of ARI, its officers, agents, employees, or sucessors, arising out of or in connection with the requested services, shall not exceed the negotiated amount for said services. The agreement by the Subcontractor to perform services requested by ARI releases ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Subcontractor.*

ARI ID	Client ID/ Add'l ID	Sampled	Matrix	Bottles	Analyses
15-17745-ANM6F T15-2101	PM-038-00.0-01.0	09/29/15 11:21	Soil	1	ASTM D2216 Moisture Content
Special Instructions: None					
15-17746-ANM6G T15-2102	PM-038-01.0-02.0	09/29/15 11:23	Soil	1	ASTM D2216 Moisture Content
Special Instructions: None					
15-17747-ANM6H T15-2103	PM-038-02.0-03.0	09/29/15 11:25	Soil	1	ASTM D2216 Moisture Content
Special Instructions: None					

$15.00 per sample
- Need LV4 pkg

15.5°C

Carrier		Airbill		Date	
Relinquished by	Company ARI	Date 10-2-15		Time 0910	
Received by	Company MTC	Date 10.2.15		Time 0910	

Moisture Content Determination
ASTM D2216

MTC Job No.: 15T001-111 Tested by: au
In Oven Date: 10-2-15 Out Oven Date: 10-5-15

MTC Sample ID	Tare #	Tare Wt. (g)	Wet Soil + Tare Wt. (g)	Dry Soil + Tare Wt. (g)	Moisture Content %
T15-2101	2101	1.53	50.43	47.00	
T15-2102	2102	1.52	58.32	55.28	
T15-2103	2103	1.52	60.63	57.44	

Materials Testing & Consulting, Inc.

Geotechnical Engineering □Special Inspection □Materials Testing • Environmental Consulting

Client:	Analytical Resources, Inc.	**Date:**	October 19, 2015
Address:	4611 S. 134th Place, Ste 100	**Project:**	Lora Lake Apartments
	Tukwila, WA 98168	**Project #:**	ANI4
Attn:	Cheronne Oreiro	**Sample #:**	Multiple

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
	Sieve Analysis			Sulfate Soundness	
	Proctor			Bulk Density & Voids	
	Sand Equivalent			WSDOT Degradation	
	Fracture Count				
X	Moisture Content	See Attached			
	pH				
	Minimum Resistivity				
	Organic Content				
	Atterberg Limits				
	Asphalt Extraction/Gradation				
	Rice Density				

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,

Harold Benny
WABO Supervising Laboratory Technician

Corporate ~ 777 Chrysler Drive • Burlington, WA 98233 • Phone (360) 755-1990 • Fax (360) 755-1980

Regional Offices: Olympia ~ 360.534.9777 Bellingham ~ 360.647.6111 Silverdale ~ 360.698.6787 Tukwila ~ 206.241.1974

Visit our website: www.mtc-inc.net

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Project: Lora Lake Apartments
Project #: ANI4
Date Received: September 30, 2015
Date Tested: October 19, 2015

Client: Analytical Resources, Inc.
Sampled by: Others
Tested by: A. Urban

Moisture Content - ASTM C-566, ASTM D-2216 & AASHTO T-265

Sample #	Location	Tare	Wet + Tare	Dry + Tare	Wgt. Of Moisture	Wgt. Of Soil	% Moisture
T15-2088-1	PM-042-02.0-03.0	1.5	46.4	44.4	2.1	42.9	4.8%
T15-2088-2	PM-042-02.0-03.0	1.6	61.3	58.9	2.4	57.4	4.2%
T15-2088-3	PM-042-02.0-03.0	1.5	49.4	47.3	2.1	45.8	4.5%
T15-2087	PM-036-02.0-03.0	1.5	44.3	40.4	3.9	38.9	10.0%
T15-2089	PM-028-01.0-02.0	1.6	65.1	61.3	3.8	59.7	6.4%
T15-2090	PM-043-02.0-03.0	1.6	49.9	47.4	2.5	45.8	5.5%
T15-2091	PM-055-01.0-02.0	1.5	71.6	69.5	2.1	68.0	3.1%
T15-2092	PM-059-01.0-02.0	1.6	71.6	70.0	1.6	68.5	2.3%

Reviewed by: [signature]

Corporate ~ 777 Chrysler Drive • Burlington, WA 98233 • Phone (360) 755-1990 • Fax (360) 755-1980

Regional Offices: Olympia ~ 360.534.9777 Bellingham ~ 360.647.6111 Silverdale ~ 360.698.6787 Tukwila ~ 206.241.1974

Visit our website: www.mtc-inc.net

3.6°C

SUBCONTRACTOR ANALYSIS REQUEST
CUSTODY TRANSFER 09/28/15

ANALYTICAL RESOURCES INCORPORATED

ARI Project: ANI4

MTC JOB# 15T001-111

Laboratory: Materials Testing & Consulting, In
Lab Contact: Harold Benny
Lab Address: 4611 S. 134th Pl
Tukwila, WA 98168
Phone: 360-255-9802
Fax:

ARI Client: Floyd Snider
Project ID: Lora Lake Apartments
ARI PM: Cheronne Oreiro
Phone: 206-695-6214
Fax: 206-695-6201
Email: subdata@arilabs.com

Analytical Protocol: In-house
Special Instructions: LV4

Requested Turn Around: **10/15/15**
Email Results (Y/N): **Yes**

Limits of Liability. *Subcontractor is expected to perform all requested services in accordance with appropriate methodology following Standard Operating Procedures that meet standards for the industry. The total liability of ARI, its officers, agents, employees, or sucessors, arising out of or in connection with the requested services, shall not exceed the negotiated amount for said services. The agreement by the Subcontractor to perform services requested by ARI releases ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Subcontractor.*

ARI ID	Client ID/ Add'l ID	Sampled	Matrix	Bottles	Analyses
15-17487-ANI4E T15-2087	PM-036-02.0-03.0	09/25/15 10:10	Soil	1	Moisture ASTM D2216
Special Instructions: None					
15-17489-ANI4G T15-2088	PM-042-02.0-03.0	09/25/15 11:04	Soil	1	Moisture ASTM D2216
Special Instructions: None Need QC					
15-17491-ANI4I T15-2089	PM-028-01.0-02.0	09/25/15 08:20	Soil	1	Moisture ASTM D2216
Special Instructions: None					
15-17492-ANI4J T15-2090	PM-043-02.0-03.0	09/25/15 10:27	Soil	1	Moisture ASTM D2216
Special Instructions: None					
15-17493-ANI4K T15-2091	PM-055-01.0-02.0	09/25/15 13:10	Soil	1	Moisture ASTM D2216
Special Instructions: None					
15-17494-ANI4L T15-2092	PM-059-01.0-02.0	09/25/15 13:20	Soil	1	Moisture ASTM D2216
Special Instructions: None					

- $15 per sample
- need QC (N/C) on sample G
- need pkg (N/C)

Carrier		Airbill		Date
Relinquished by	Company ARI		Date 9/30/15	Time 1254
Received by	Company MTC		Date 9/30/15	Time 1254

Moisture Content Determination
ASTM D2216

MTC Job No.: 15T001-111 Tested by: au
In Oven Date: 10.1.15 Out Oven Date: 10.2.15

MTC Sample ID	Tare #	Tare Wt. (g)	Wet Soil + Tare Wt. (g)	Dry Soil + Tare Wt. (g)	Moisture Content %
* T15-2088-1	2088-1	1.51	46.41	44.36	
* T15-2088-2	2088-2	1.55	61.34	58.92	
* T15-2088-3	2088-3	1.54	49.40	47.33	
T15-2087	2087	1.53	44.30	40.41	@
T15-2089	2089	1.55	65.09	61.27	
T15-2090	2090	1.55	49.90	47.38	
T15-2091	2091	1.54	71.61	69.52	
T15-2092	2092	1.56	71.61	70.04	

* Sample was consumed 10/1/15 @

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Client:	Aspect Consulting	**Date:**	March 4, 2016
Address:	401 Second Ave South, Suite 201	**Project:**	Lora Lake Apartments
	Seattle, WA 98104	**Project #:**	16B013-02
Attn:	Matthew von der Ahe	**Sample #:**	B16-0201

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
	Sieve Analysis			Sulfate Soundness	
	Proctor			Bulk Density & Voids	
	Sand Equivalent			WSDOT Degradation	
	Fracture Count				
X	Moisture Content	7.80%			
	Specific Gravity, Coarse				
	Specific Gravity, Fine				
	Hydrometer Analysis				
	Atterberg Limits				
	Asphalt Extraction/Gradation				
	Rice Density				

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,
Cheryl Meredith
WABO Supervising Laboratory Technician

Corporate ~ 777 Chrysler Drive • Burlington, WA 98233 • Phone (360) 755-1990 • Fax (360) 755-1980

Regional Offices: Olympia ~ 360.534.9777 Bellingham ~ 360.647.6111 Silverdale ~ 360.698.6787 Tukwila ~ 206.241.1974

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Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Project: Lora Lake Apartments
Project #: 16B013-02
Date Received: March 2, 2016
Date Tested: March 3, 2016

Client: Aspect Consulting
Sampled by: Client
Tested by: M. Blodgett-Carrillo

Moisture Content - ASTM C-566, ASTM D-2216 & AASHTO T-265

Sample #	Location	Tare	Wet + Tare	Dry + Tare	Wgt. Of Moisture	Wgt. Of Soil	% Moisture
B16-0201	B-1 S-2 @ 10'	10.0	404.4	375.9	28.5	365.9	7.8%

Reviewed by:

Corporate ~ 777 Chrysler Drive • Burlington, WA 98233 • Phone (360) 755-1990 • Fax (360) 755-1980

Regional Offices: Olympia ~ 360.534.9777 Bellingham ~ 360.647.6111 Silverdale ~ 360.698.6787 Tukwila ~ 206.241.1974

Visit our website: www.mtc-inc.net

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Client:	Aspect Consulting	**Date:**	March 4, 2016
Address:	401 Second Ave South, Suite 201	**Project:**	Lora Lake Apartments
	Seattle, WA 98104	**Project #:**	16B013-02
Attn:	Matthew von der Ahe	**Sample #:**	B16-0197

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
X	Sieve Analysis	See Sieve Report		Sulfate Soundness	
	Proctor			Bulk Density & Voids	
	Sand Equivalent			WSDOT Degradation	
	Fracture Count				
	Moisture Content				
	Specific Gravity, Coarse				
	Specific Gravity, Fine				
	Hydrometer Analysis				
	Atterberg Limits				
	Asphalt Extraction/Gradation				
	Rice Density				

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,
Cheryl Meredith
WABO Supervising Laboratory Technician

Materials Testing & Consulting, Inc.

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Sieve Report

Project: Lora Lake Apartments
Project #: 16B013-02
Client: Aspect Consulting
Source: B-1 S-3 @ 15'
Sample#: B16-0197

Date Received: 2-Mar-16
Sampled By: Client
Date Tested: 3-Mar-16
Tested By: M. Blodgett-Carrillo

ASTM D-2487 Unified Soils Classification System
SP-SM, Poorly graded Sand with Silt and Gravel
Sample Color:
grey

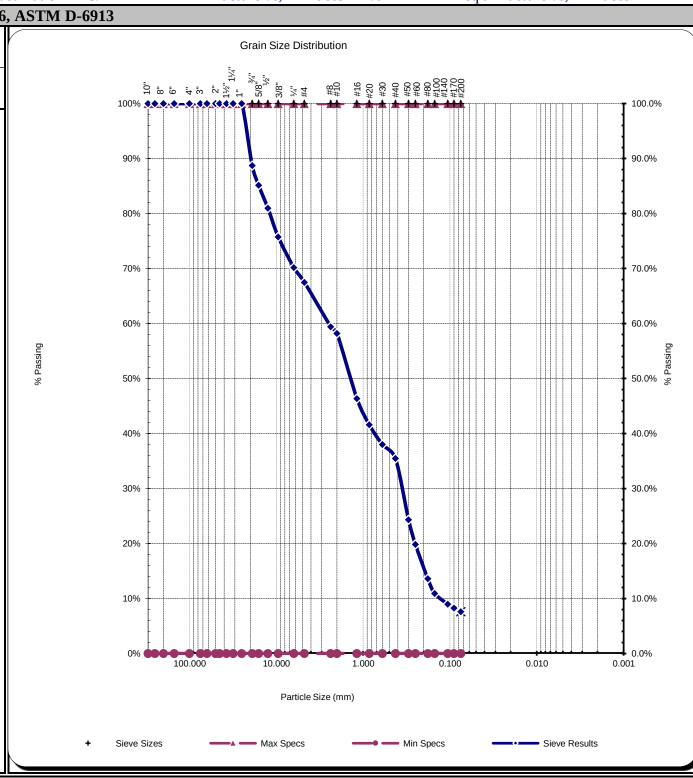
ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

Specifications
No Specs
Sample Meets Specs ? N/A

$D_{(5)}$ = 0.049 mm	% Gravel = 32.5%	Coeff. of Curvature, C_C = 0.40
$D_{(10)}$ = 0.129 mm	% Sand = 59.9%	Coeff. of Uniformity, C_U = 19.59
$D_{(15)}$ = 0.196 mm	% Silt & Clay = 7.6%	Fineness Modulus = 3.89
$D_{(30)}$ = 0.364 mm	Liquid Limit = n/a	Plastic Limit = n/a
$D_{(50)}$ = 1.432 mm	Plasticity Index = n/a	Moisture %, as sampled = 13.9%
$D_{(60)}$ = 2.531 mm	Sand Equivalent = n/a	Req'd Sand Equivalent =
$D_{(90)}$ = 19.668 mm	Fracture %, 1 Face = n/a	Req'd Fracture %, 1 Face =
Dust Ratio = 3/14	Fracture %, 2+ Faces = n/a	Req'd Fracture %, 2+ Faces =

ASTM C-136, ASTM D-6913

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00		100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00	100%	100%	100.0%	0.0%
3/4"	19.00	89%	89%	100.0%	0.0%
5/8"	16.00		85%	100.0%	0.0%
1/2"	12.50	81%	81%	100.0%	0.0%
3/8"	9.50		76%	100.0%	0.0%
1/4"	6.30		70%	100.0%	0.0%
#4	4.75	67%	67%	100.0%	0.0%
#8	2.36		59%	100.0%	0.0%
#10	2.00	58%	58%	100.0%	0.0%
#16	1.18		46%	100.0%	0.0%
#20	0.850		42%	100.0%	0.0%
#30	0.600		38%	100.0%	0.0%
#40	0.425	35%	35%	100.0%	0.0%
#50	0.300		24%	100.0%	0.0%
#60	0.250		20%	100.0%	0.0%
#80	0.180		14%	100.0%	0.0%
#100	0.150	11%	11%	100.0%	0.0%
#140	0.106		9%	100.0%	0.0%
#170	0.090		8%	100.0%	0.0%
#200	0.075	7.6%	7.6%	100.0%	0.0%



Comments:

Reviewed by:

Client:	Aspect Consulting	**Date:**	March 4, 2016
Address:	401 Second Ave South, Suite 201	**Project:**	Lora Lake Apartments
	Seattle, WA 98104	**Project #:**	16B013-02
Attn:	Matthew von der Ahe	**Sample #:**	B16-0198

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
X	Sieve Analysis	See Sieve Report		Sulfate Soundness	
	Proctor			Bulk Density & Voids	
	Sand Equivalent			WSDOT Degradation	
	Fracture Count				
	Moisture Content				
	Specific Gravity, Coarse				
	Specific Gravity, Fine				
	Hydrometer Analysis				
	Atterberg Limits				
	Asphalt Extraction/Gradation				
	Rice Density				

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,
Cheryl Meredith
WABO Supervising Laboratory Technician

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Sieve Report

Project: Lora Lake Apartments
Project #: 16B013-02
Client: Aspect Consulting
Source: B-1 S-4a @ 21.5'
Sample#: B16-0198

Date Received: 2-Mar-16
Sampled By: Client
Date Tested: 3-Mar-16
Tested By: M. Blodgett-Carrillo

ASTM D-2487 Unified Soils Classification System
SP-SM, Poorly graded Sand with Silt and Gravel
Sample Color:
grey

ACCREDITED

ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

Specifications
No Specs
Sample Meets Specs ? N/A

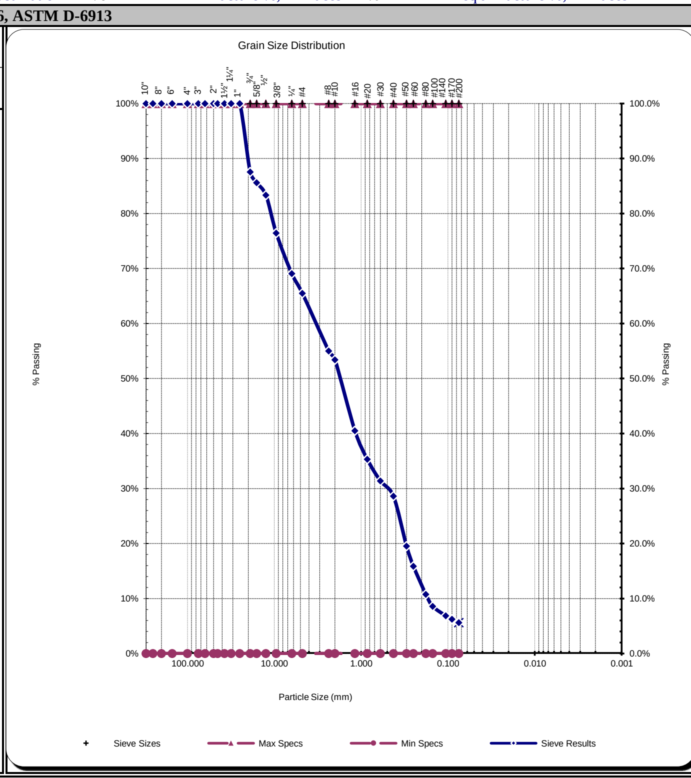
$D_{(5)}$ = 0.067 mm
$D_{(10)}$ = 0.169 mm
$D_{(15)}$ = 0.238 mm
$D_{(30)}$ = 0.512 mm
$D_{(50)}$ = 1.783 mm
$D_{(60)}$ = 3.500 mm
$D_{(90)}$ = 20.180 mm
Dust Ratio = 12/61

% Gravel = 34.5%
% Sand = 59.9%
% Silt & Clay = 5.6%
Liquid Limit = n/a
Plasticity Index = n/a
Sand Equivalent = n/a
Fracture %, 1 Face = n/a
Fracture %, 2+ Faces = n/a

Coeff. of Curvature, C_C = 0.44
Coeff. of Uniformity, C_U = 20.67
Fineness Modulus = 4.16
Plastic Limit = n/a
Moisture %, as sampled = 12.2%
Req'd Sand Equivalent =
Req'd Fracture %, 1 Face =
Req'd Fracture %, 2+ Faces =

ASTM C-136, ASTM D-6913

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00		100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00	100%	100%	100.0%	0.0%
3/4"	19.00	88%	88%	100.0%	0.0%
5/8"	16.00		86%	100.0%	0.0%
1/2"	12.50	83%	83%	100.0%	0.0%
3/8"	9.50		76%	100.0%	0.0%
1/4"	6.30		69%	100.0%	0.0%
#4	4.75	65%	65%	100.0%	0.0%
#8	2.36		55%	100.0%	0.0%
#10	2.00	53%	53%	100.0%	0.0%
#16	1.18		41%	100.0%	0.0%
#20	0.850		35%	100.0%	0.0%
#30	0.600		31%	100.0%	0.0%
#40	0.425	29%	29%	100.0%	0.0%
#50	0.300		20%	100.0%	0.0%
#60	0.250		16%	100.0%	0.0%
#80	0.180		11%	100.0%	0.0%
#100	0.150	9%	9%	100.0%	0.0%
#140	0.106		7%	100.0%	0.0%
#170	0.090		6%	100.0%	0.0%
#200	0.075	5.6%	5.6%	100.0%	0.0%



Comments:

Reviewed by:

Materials Testing & Consulting, Inc.
Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Client:	Aspect Consulting	**Date:**	March 4, 2016
Address:	401 Second Ave South, Suite 201	**Project:**	Lora Lake Apartments
	Seattle, WA 98104	**Project #:**	16B013-02
Attn:	Matthew von der Ahe	**Sample #:**	B16-0202

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
	Sieve Analysis			Sulfate Soundness	
	Proctor			Bulk Density & Voids	
	Sand Equivalent			WSDOT Degradation	
	Fracture Count				
X	Moisture Content	20.70%			
	Specific Gravity, Coarse				
	Specific Gravity, Fine				
	Hydrometer Analysis				
	Atterberg Limits				
	Asphalt Extraction/Gradation				
	Rice Density				

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,
Cheryl Meredith
WABO Supervising Laboratory Technician

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Project: Lora Lake Apartments
Project #: 16B013-02
Date Received: March 2, 2016
Date Tested: March 3, 2016

Client: Aspect Consulting
Sampled by: Client
Tested by: M. Blodgett-Carrillo

Moisture Content - ASTM C-566, ASTM D-2216 & AASHTO T-265

Sample #	Location	Tare	Wet + Tare	Dry + Tare	Wgt. Of Moisture	Wgt. Of Soil	% Moisture
B16-0202	B-1 S-5 @ 25'	10.2	594.1	493.9	100.2	483.7	20.7%

Reviewed by: ______________________

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Client:	Aspect Consulting	**Date:**	March 4, 2016
Address:	401 Second Ave South, Suite 201	**Project:**	Lora Lake Apartments
	Seattle, WA 98104	**Project #:**	16B013-02
Attn:	Matthew von der Ahe	**Sample #:**	B16-0203

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
	Sieve Analysis			Sulfate Soundness	
	Proctor			Bulk Density & Voids	
	Sand Equivalent			WSDOT Degradation	
	Fracture Count				
X	Moisture Content	22.50%			
	Specific Gravity, Coarse				
	Specific Gravity, Fine				
	Hydrometer Analysis				
	Atterberg Limits				
	Asphalt Extraction/Gradation				
	Rice Density				

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,
Cheryl Meredith
WABO Supervising Laboratory Technician

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Project: Lora Lake Apartments
Project #: 16B013-02
Date Received: March 2, 2016
Date Tested: March 3, 2016

Client: Aspect Consulting
Sampled by: Client
Tested by: M. Blodgett-Carrillo

Moisture Content - ASTM C-566, ASTM D-2216 & AASHTO T-265

Sample #	Location	Tare	Wet + Tare	Dry + Tare	Wgt. Of Moisture	Wgt. Of Soil	% Moisture
B16-0203	B-1 S-6 @ 30'	10.8	581.2	476.3	104.9	465.5	22.5%

Reviewed by: ______________________

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Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Client:	Aspect Consulting	**Date:**	March 4, 2016
Address:	401 Second Ave South, Suite 201	**Project:**	Lora Lake Apartments
	Seattle, WA 98104	**Project #:**	16B013-02
Attn:	Matthew von der Ahe	**Sample #:**	B16-0204

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
	Sieve Analysis			Sulfate Soundness	
	Proctor			Bulk Density & Voids	
	Sand Equivalent			WSDOT Degradation	
	Fracture Count				
X	Moisture Content	9.70%			
	Specific Gravity, Coarse				
	Specific Gravity, Fine				
	Hydrometer Analysis				
	Atterberg Limits				
	Asphalt Extraction/Gradation				
	Rice Density				

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,
Cheryl Meredith
WABO Supervising Laboratory Technician

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Project: Lora Lake Apartments
Project #: 16B013-02
Date Received: March 2, 2016
Date Tested: March 3, 2016

Client: Aspect Consulting
Sampled by: Client
Tested by: M. Blodgett-Carrillo

Moisture Content - ASTM C-566, ASTM D-2216 & AASHTO T-265

Sample #	Location	Tare	Wet + Tare	Dry + Tare	Wgt. Of Moisture	Wgt. Of Soil	% Moisture
B16-0204	B-2 S-1 @ 5'	11.3	328.9	300.7	28.2	289.4	9.7%

Reviewed by:

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Client:	Aspect Consulting	**Date:**	March 4, 2016
Address:	401 Second Ave South, Suite 201	**Project:**	Lora Lake Apartments
	Seattle, WA 98104	**Project #:**	16B013-02
Attn:	Matthew von der Ahe	**Sample #:**	B16-0205

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
	Sieve Analysis			Sulfate Soundness	
	Proctor			Bulk Density & Voids	
	Sand Equivalent			WSDOT Degradation	
	Fracture Count				
X	Moisture Content	9.70%			
	Specific Gravity, Coarse				
	Specific Gravity, Fine				
	Hydrometer Analysis				
	Atterberg Limits				
	Asphalt Extraction/Gradation				
	Rice Density				

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,
Cheryl Meredith
WABO Supervising Laboratory Technician

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Project: Lora Lake Apartments
Project #: 16B013-02
Date Received: March 2, 2016
Date Tested: March 3, 2016

Client: Aspect Consulting
Sampled by: Client
Tested by: M. Blodgett-Carrillo

Moisture Content - ASTM C-566, ASTM D-2216 & AASHTO T-265

Sample #	Location	Tare	Wet + Tare	Dry + Tare	Wgt. Of Moisture	Wgt. Of Soil	% Moisture
B16-0205	B-2 S-2 @ 10'	10.3	637.2	581.8	55.4	571.5	9.7%

Reviewed by: ______________________

Materials Testing & Consulting, Inc.

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Client:	Aspect Consulting	**Date:**	March 4, 2016
Address:	401 Second Ave South, Suite 201	**Project:**	Lora Lake Apartments
	Seattle, WA 98104	**Project #:**	16B013-02
Attn:	Matthew von der Ahe	**Sample #:**	B16-0199

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
X	Sieve Analysis	See Sieve Report		Sulfate Soundness	
	Proctor			Bulk Density & Voids	
	Sand Equivalent			WSDOT Degradation	
	Fracture Count				
	Moisture Content				
	Specific Gravity, Coarse				
	Specific Gravity, Fine				
	Hydrometer Analysis				
	Atterberg Limits				
	Asphalt Extraction/Gradation				
	Rice Density				

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,
Cheryl Meredith
WABO Supervising Laboratory Technician

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Sieve Report

Project:	Lora Lake Apartments	**Date Received:**	2-Mar-16
Project #:	16B013-02	**Sampled By:**	Client
Client:	Aspect Consulting	**Date Tested:**	3-Mar-16
Source:	B-2 S-3 @ 15'	**Tested By:**	M. Blodgett-Carrillo
Sample#:	B16-0199		

ASTM D-2487 Unified Soils Classification System
SP-SM, Poorly graded Sand with Silt and Gravel
Sample Color:
brown

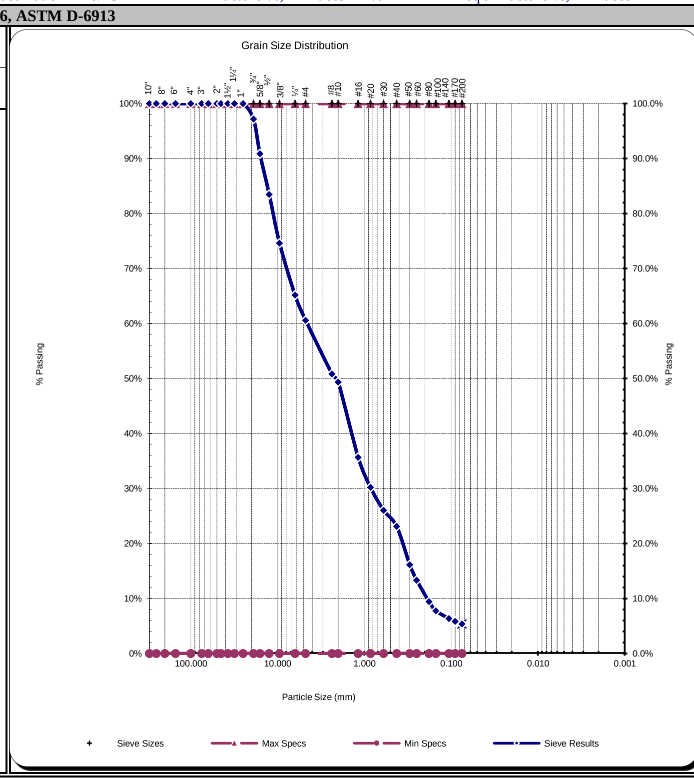
ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

Specifications
No Specs
Sample Meets Specs ? N/A

$D_{(5)}$ = 0.070 mm	% Gravel = 39.4%	Coeff. of Curvature, C_C = 0.80
$D_{(10)}$ = 0.190 mm	% Sand = 55.2%	Coeff. of Uniformity, C_U = 24.26
$D_{(15)}$ = 0.279 mm	% Silt & Clay = 5.4%	Fineness Modulus = 4.31
$D_{(30)}$ = 0.838 mm	Liquid Limit = n/a	Plastic Limit = n/a
$D_{(50)}$ = 2.159 mm	Plasticity Index = n/a	Moisture %, as sampled = 13.0%
$D_{(60)}$ = 4.605 mm	Sand Equivalent = n/a	Req'd Sand Equivalent =
$D_{(90)}$ = 15.592 mm	Fracture %, 1 Face = n/a	Req'd Fracture %, 1 Face =
Dust Ratio = 10/43	Fracture %, 2+ Faces = n/a	Req'd Fracture %, 2+ Faces =

ASTM C-136, ASTM D-6913

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00		100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00	100%	100%	100.0%	0.0%
3/4"	19.00	97%	97%	100.0%	0.0%
5/8"	16.00		91%	100.0%	0.0%
1/2"	12.50	83%	83%	100.0%	0.0%
3/8"	9.50		75%	100.0%	0.0%
1/4"	6.30		65%	100.0%	0.0%
#4	4.75	61%	61%	100.0%	0.0%
#8	2.36		51%	100.0%	0.0%
#10	2.00	49%	49%	100.0%	0.0%
#16	1.18		36%	100.0%	0.0%
#20	0.850		30%	100.0%	0.0%
#30	0.600		26%	100.0%	0.0%
#40	0.425	23%	23%	100.0%	0.0%
#50	0.300		16%	100.0%	0.0%
#60	0.250		13%	100.0%	0.0%
#80	0.180		9%	100.0%	0.0%
#100	0.150	8%	8%	100.0%	0.0%
#140	0.106		6%	100.0%	0.0%
#170	0.090		6%	100.0%	0.0%
#200	0.075	5.4%	5.4%	100.0%	0.0%



Comments:

Reviewed by:

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Client:	Aspect Consulting	**Date:**	March 4, 2016
Address:	401 Second Ave South, Suite 201	**Project:**	Lora Lake Apartments
	Seattle, WA 98104	**Project #:**	16B013-02
Attn:	Matthew von der Ahe	**Sample #:**	B16-0206

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
	Sieve Analysis			Sulfate Soundness	
	Proctor			Bulk Density & Voids	
	Sand Equivalent			WSDOT Degradation	
	Fracture Count				
X	Moisture Content	18.70%			
	Specific Gravity, Coarse				
	Specific Gravity, Fine				
	Hydrometer Analysis				
	Atterberg Limits				
	Asphalt Extraction/Gradation				
	Rice Density				

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,
Cheryl Meredith
WABO Supervising Laboratory Technician

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Project: Lora Lake Apartments
Project #: 16B013-02
Date Received: March 2, 2016
Date Tested: March 3, 2016

Client: Aspect Consulting
Sampled by: Client
Tested by: M. Blodgett-Carrillo

Moisture Content - ASTM C-566, ASTM D-2216 & AASHTO T-265

Sample #	Location	Tare	Wet + Tare	Dry + Tare	Wgt. Of Moisture	Wgt. Of Soil	% Moisture
B16-0206	B-2 S-4 @ 20'	10.3	503.3	425.6	77.7	415.3	18.7%

Reviewed by: ______________________

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Client:	Aspect Consulting	**Date:**	March 4, 2016
Address:	401 Second Ave South, Suite 201	**Project:**	Lora Lake Apartments
	Seattle, WA 98104	**Project #:**	16B013-02
Attn:	Matthew von der Ahe	**Sample #:**	B16-0200

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
X	Sieve Analysis	See Sieve Report		Sulfate Soundness	
	Proctor			Bulk Density & Voids	
	Sand Equivalent			WSDOT Degradation	
	Fracture Count				
	Moisture Content				
	Specific Gravity, Coarse				
	Specific Gravity, Fine				
	Hydrometer Analysis				
	Atterberg Limits				
	Asphalt Extraction/Gradation				
	Rice Density				

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,
Cheryl Meredith
WABO Supervising Laboratory Technician

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Sieve Report

Project: Lora Lake Apartments
Project #: 16B013-02
Client: Aspect Consulting
Source: B-2 S-5 @ 25'
Sample#: B16-0200

Date Received: 2-Mar-16
Sampled By: Client
Date Tested: 3-Mar-16
Tested By: M. Blodgett-Carrillo

ASTM D-2487 Unified Soils Classification System
SM, Silty Sand
Sample Color:
brown

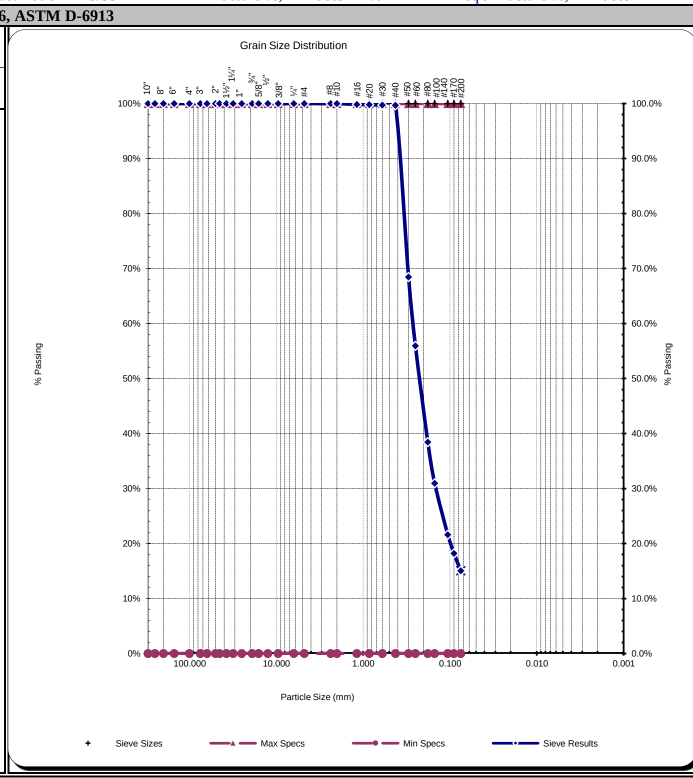
ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

Specifications
No Specs
Sample Meets Specs ? N/A

$D_{(5)}$ = 0.025 mm	% Gravel = 0.0%	Coeff. of Curvature, C_C = 1.59
$D_{(10)}$ = 0.050 mm	% Sand = 85.0%	Coeff. of Uniformity, C_U = 5.34
$D_{(15)}$ = 0.075 mm	% Silt & Clay = 15.0%	Fineness Modulus = 1.01
$D_{(30)}$ = 0.146 mm	Liquid Limit = n/a	Plastic Limit = n/a
$D_{(50)}$ = 0.226 mm	Plasticity Index = n/a	Moisture %, as sampled = 24.7%
$D_{(60)}$ = 0.266 mm	Sand Equivalent = n/a	Req'd Sand Equivalent =
$D_{(90)}$ = 0.386 mm	Fracture %, 1 Face = n/a	Req'd Fracture %, 1 Face =
Dust Ratio = 8/53	Fracture %, 2+ Faces = n/a	Req'd Fracture %, 2+ Faces =

ASTM C-136, ASTM D-6913

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00		100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00	100%	100%	100.0%	0.0%
3/4"	19.00	100%	100%	100.0%	0.0%
5/8"	16.00		100%	100.0%	0.0%
1/2"	12.50	100%	100%	100.0%	0.0%
3/8"	9.50		100%	100.0%	0.0%
1/4"	6.30		100%	100.0%	0.0%
#4	4.75	100%	100%	100.0%	0.0%
#8	2.36		100%	100.0%	0.0%
#10	2.00	100%	100%	100.0%	0.0%
#16	1.18		100%	100.0%	0.0%
#20	0.850		100%	100.0%	0.0%
#30	0.600		100%	100.0%	0.0%
#40	0.425	100%	100%	100.0%	0.0%
#50	0.300		68%	100.0%	0.0%
#60	0.250		56%	100.0%	0.0%
#80	0.180		38%	100.0%	0.0%
#100	0.150	31%	31%	100.0%	0.0%
#140	0.106		22%	100.0%	0.0%
#170	0.090		18%	100.0%	0.0%
#200	0.075	15.0%	15.0%	100.0%	0.0%



Comments:

Reviewed by:

Materials Testing & Consulting, Inc.

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Client:	Aspect Consulting	**Date:**	March 4, 2016
Address:	401 Second Ave South, Suite 201	**Project:**	Lora Lake Apartments
	Seattle, WA 98104	**Project #:**	16B013-02
Attn:	Matthew von der Ahe	**Sample #:**	B16-0207

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
	Sieve Analysis			Sulfate Soundness	
	Proctor			Bulk Density & Voids	
	Sand Equivalent			WSDOT Degradation	
	Fracture Count				
X	Moisture Content	24.20%			
	Specific Gravity, Coarse				
	Specific Gravity, Fine				
	Hydrometer Analysis				
	Atterberg Limits				
	Asphalt Extraction/Gradation				
	Rice Density				

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,
Cheryl Meredith
WABO Supervising Laboratory Technician

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Project: Lora Lake Apartments
Project #: 16B013-02
Date Received: March 2, 2016
Date Tested: March 3, 2016

Client: Aspect Consulting
Sampled by: Client
Tested by: M. Blodgett-Carrillo

Moisture Content - ASTM C-566, ASTM D-2216 & AASHTO T-265

Sample #	Location	Tare	Wet + Tare	Dry + Tare	Wgt. Of Moisture	Wgt. Of Soil	% Moisture
B16-0207	B-2 S-6 @ 30'	10.0	612.2	494.7	117.5	484.7	24.2%

Reviewed by: ____________________

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Client:	Aspect Consulting	**Date:**	March 4, 2016
Address:	401 Second Ave South, Suite 201	**Project:**	Lora Lake Apartments
	Seattle, WA 98104	**Project #:**	16B013-02
Attn:	Matthew von der Ahe	**Sample #:**	B16-0208

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
	Sieve Analysis			Sulfate Soundness	
	Proctor			Bulk Density & Voids	
	Sand Equivalent			WSDOT Degradation	
	Fracture Count				
X	Moisture Content	23.10%			
	Specific Gravity, Coarse				
	Specific Gravity, Fine				
	Hydrometer Analysis				
	Atterberg Limits				
	Asphalt Extraction/Gradation				
	Rice Density				

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,
Cheryl Meredith
WABO Supervising Laboratory Technician

Materials Testing & Consulting, Inc.

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Project: Lora Lake Apartments
Project #: 16B013-02
Date Received: March 2, 2016
Date Tested: March 3, 2016

Client: Aspect Consulting
Sampled by: Client
Tested by: M. Blodgett-Carrillo

Moisture Content - ASTM C-566, ASTM D-2216 & AASHTO T-265

Sample #	Location	Tare	Wet + Tare	Dry + Tare	Wgt. Of Moisture	Wgt. Of Soil	% Moisture
B16-0208	B-2 S-7 @ 35'	10.6	431.4	352.3	79.1	341.7	23.1%

Reviewed by:

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ATTACHMENT C

Aquifer Hydraulic Conductivity Estimates from Slug Tests

Table 1 - Aquifer Hydraulic Conductivity Estimates from Slug Tests

DRAFT

Project No. 110125-07

Lora Lake Slug Tests												
Monitoring Well	**MW-04**		**MW-05**		**MW-14**		**MW-09**		**MW-10**		**MW-12**	
Well Depth in Feet	**26.0**		**28.0**		**25.0**		**20.0**		**20.0**		**17.0**	
Screen Length in Feet	**15.8**		**15.0**		**10.0**		**10.0**		**10.0**		**10.0**	
Depth to Screen in Feet	**11.0**		**13.0**		**14.5**		**10.0**		**10.0**		**7.0**	
Depth to Aquitard in Feet	**45**		**45**		**45**		**45**		**45**		**45**	
Depth to Water in Feet	**14.73**		**19.30**		**12.96**		**12.19**		**12.82**		**5.15**	
Depth to Sandpack in Feet	**9.0**		**11.0**		**8.0**		**8.0**		**8.0**		**5.0**	
Slug Displacement (H_o) in Feet	**1.45**	**2.70**	**0.59**	**1.64**	**0.14**	**1.56**	**0.19**	**2.13**	**2.41**	**2.20**	**1.52**	**1.85**
Porosity (n)	**0.20**		**0.20**		**0.20**		**0.20**		**0.20**		**0.20**	
Radius of Casing (r_c) in Feet	**0.08**		**0.08**		**0.08**		**0.08**		**0.08**		**0.08**	
Radius of Borehole (r_w) in Feet	**0.34**		**0.34**		**0.33**		**0.18**		**0.18**		**0.33**	
Saturated Aquifer Thickness (H) in Feet	30.3		25.7		32.0		32.8		32.2		39.9	
Saturated Well Thickness (L_w) in Feet	12.0		8.7		11.5		7.8		7.2		11.9	
Effective Radius (r_{eff}) in Feet	0.171		0.171		0.167		0.109		0.109		0.167	
Effective Screen Length (L_e) in Feet	12.0		8.7		10.0		7.8		7.2		10.0	
Slug Size	5' x1.5"	5' x1.5"	5' x1.5"	5' x1.5"	5' x1.5"	5' x1.5"	5' x1.5"	5' x1.5"	5' x1.5"	5' x1.5"	5' x1.5"	5' x1.5"
Rising/Falling Head Test	Falling	Rising	Falling	Rising	Falling	Rising	Falling	Rising	Falling	Rising	Falling	Rising
Fully Submerged Sandpack	No	No	No	No	No	No	No	No	No	No	No	No
Transiently Exposed Sandpack	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Transiently Exposed Screen	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Partially Submerged Screen	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	No
Bouwer and Rice Analysis Parameters												
Normalized Head at t_1 (y_1) in Feet	0.88	0.27	0.78	0.18	0.98	0.05	0.93	0.11	0.15	0.05	0.95	0.94
Time - t_1 in Seconds	2.1	22.8	0.8	14.9	1.7	17.2	1.80	9.42	6.24	23.64	1.45	1.36
Normalized Head at t_2 (y_2) in Feet	0.37	0.02	0.53	0.09	0.63	0.02	0.31	0.06	0.05	0.02	0.64	0.78
Time - t_2 in Seconds	20.5	82.1	9.6	39.7	14.6	36.1	49.74	25.08	25.08	53.52	23.83	10.46
L_e/r_w	35.0	35.0	35.0	35.0	30.0	30.0	43.9	43.9	40.4	40.4	30.0	30.0
Coefficient A [a]	2.61	2.61	2.61	2.61	2.46	2.46	2.88	2.88	2.77	2.77	2.46	2.46
Coefficient B [a]	0.41	0.41	0.41	0.41	0.39	0.39	0.46	0.46	0.44	0.44	0.39	0.39
Coefficient C [a]	2.1	2.1	2.12	2.12	1.9	1.9	2.4	2.4	2.3	2.3	1.9	1.9
$\ln(R_e/r_w)$ [b]	2.3	2.3	2.0	2.0	2.2	2.2	2.5	2.5	2.4	2.4	2.2	2.2
Calculated K in cm/sec	4.0E-03	3.6E-03	4.4E-03	2.5E-03	3.3E-03	3.5E-03	1.3E-03	2.3E-03	3.3E-03	1.7E-03	1.6E-03	2.0E-03
Calculated K in ft/day	11.3	10.2	12.4	7.2	9.4	10.1	3.7	6.6	9.5	4.8	4.7	5.7
Geometric Mean K in cm/sec	3.8E-03		3.3E-03		3.4E-03		1.7E-03		2.4E-03		1.8E-03	
Geometric Mean K in ft/day	10.8		9		9.7		5.0		6.8		5.1	
Screened Interval Soil Type	SP		SP/SW/ML-SM		GP/SP		SP		SP		SP/SW/ML-SM	
Aquifer Geometric Mean K in cm/sec	2.62E-03											
Aquifer Geometric Mean K in ft/day	7.4											

Data analysis by method of Bouwer and Rice (1976; 1989) or Springer-Gelhar (1991).

Bold values are entered from field data and other values are calculated.

All depths are below ground surface

[a] The Bouwer and Rice A, B, and C coefficients are calculated using regression equations of Van Rooy (1988).

[b] R_e/r_w is the effective radial distance over which y is dissipated, divided by the radial distance of well development.