

**Port of Seattle
Lora Lake Apartments Site**

Construction As-Built Report



Prepared for

Port of Seattle
Aviation Environmental Programs
Seattle-Tacoma International Airport
17900 International Boulevard, Suite 402
SeaTac, Washington 98188-4238

January 2021

Certified



Corporation



100% Recycled
Paper

FLOYD | SNIDER

strategy ■ science ■ engineering

Two Union Square • 601 Union Street • Suite 600
Seattle, Washington 98101 • tel: 206.292.2078

LIMITATIONS

This report has been prepared for the exclusive use of Port of Seattle, their authorized agents, and regulatory agencies. It has been prepared following the described methods and information available at the time of the work. No other party should use this report for any purpose other than that originally intended, unless Floyd|Snider agrees in advance to such reliance in writing. The information contained herein should not be utilized for any purpose or project except the one originally intended. Under no circumstances shall this document be altered, updated, or revised without written authorization of Floyd|Snider.

The interpretations and conclusions contained in this report are based in part on construction and monitoring data collected by others and provided by Port of Seattle. Floyd|Snider cannot assure the accuracy of this information.

Lora Lake Apartments Site Construction As-Built Report

This document was prepared for
The Port of Seattle
under the supervision of:



Name: Megan King, PE
Date: January 22, 2021

Executive Summary

This Executive Summary provides a condensed overview of the Lora Lake Apartments Site Construction As-Built Report (As-Built Report) that has been prepared on behalf of the Port of Seattle (Port). This As-Built Report provides formal documentation of the remediation activities completed to address soil, groundwater, and sediment contamination at the Lora Lake Apartments Site (Site). The Site is located at 15001 Des Moines Memorial Drive in Burien, Washington, near the northwest corner of the Seattle-Tacoma International Airport (STIA) and consists of three parcels: the Lora Lake Apartments Parcel (LL Apartments Parcel), the Lora Lake Parcel (LL Parcel), and the 1982 Dredged Material Containment Area (DMCA).

The remedial work at the Site was conducted over two construction seasons: (1) Construction Season 1 occurred between April and December 2017 and involved contaminated soil excavation at the LL Apartments and LL Parcels and sediment capping and lake filling at Lora Lake on the LL Parcel; and (2) Construction Season 2. Construction Season 2 began in June 2018; however, work was suspended on August 21, 2018, due to unusually high seasonal precipitation and an operator strike. Work continued in July 2019 through January 2020. Work included additional filling and regrading of Lora Lake, lake berm construction, lake channel construction, regrading and pavement of the DMCA, and planting.

As a result of investigations conducted during the Remedial Investigation/Feasibility Study completed in January 2015 and subsequent soil compliance monitoring sampling in 2015 and 2016, approximately 42,000 tons of contaminated soil with dioxin/furan toxic equivalent (TEQ) concentrations greater than the LL Apartments Parcel remediation level were excavated from the LL Apartments Parcel and disposed of off-site at a Subtitle D landfill. The dioxin/furan TEQ remediation level for soil at the LL Apartments Parcel was 100 picograms per gram (pg/g). The excavation areas were backfilled with onsite common excavation soil during site regrading, and then covered with clean topsoil and hydroseeded for temporary protection of exposure to human and ecological receptors. A wildlife barrier will be installed over the entire LL Apartments Parcel to prevent exposure of human and ecological receptors by direct contact as part of site redevelopment actions conducted by the Port within 4 years of completion of the remedial action described in this As-Built Report. The current temporary wildlife barrier, as well as the future paved redevelopment wildlife barrier, will control exposure to dioxin/furan-contaminated soil with concentrations less than the remediation level of 100 pg/g and greater than the LL Apartments Parcel cleanup level of 13 pg/g.

Based on the extent of soil contamination identified on the LL Parcel, approximately 1,250 tons of soil with dioxin/furan TEQ and lead concentrations greater than the LL Parcel soil cleanup levels were excavated from the LL Parcel and disposed of off-site at a Subtitle D landfill. The excavation areas at the LL Parcel were backfilled with clean select borrow and topsoil, graded to match existing grade, replanted, and hydroseeded to match existing conditions.

To conduct remedial work and access sediment contamination within Lora Lake, a Temporary Construction Lake Access Road was constructed on the LL Parcel from the paved Port access road

to the perimeter of the north side of the lake. Remediation activities conducted at Lora Lake during Construction Season 1 included excavation of soil and sediment from the settling basin and rock berm located at the northwest corner of the lake, placement of geotextile on lake sediments to prevent resuspension of sediments during lake filling, and capping and filling the lake with carbon-amended sand. Approximately 58,200 tons of sand and 44.5 tons of granular activated carbon were placed during sediment capping and filling operations at Lora Lake in Construction Season 1. A temporary construction water treatment system was installed and operated to draw down and treat lake dewatering water during lake sediment capping and filling operations.

Unanticipated mounding of sediment within the central portion of the lake footprint as a result of Construction Season 1 filling activities required redesign of the sediment cap after Construction Season 1 to ensure remedy goals were achieved. The implementation of this redesign occurred during Construction Season 2. Activities at the LL Parcel during Construction Season 2 included regrading of the lake fill sand, placement of approximately 6,200 cubic yards of topsoil within the lake footprint, construction of the East Lake Berm Opening, and completion of the South Lake Connection to Miller Creek. Seven sediment cap monitoring wells were installed within the lake footprint and along the berm for future monitoring of sediment cap effectiveness. After grading, coir logs were installed along the edges of the swales and 260 tons of streambed cobble was placed in the swales. The lake surface (excluding the swales) was covered in biodegradable erosion control fabric, then planted with approximately 4,100 native plants. After completion of activities at the LL Parcel, the Temporary Construction Lake Access Road was decommissioned with placement of approximately 1,025 cubic yards of topsoil, and native plants.

At the DMCA during Construction Season 1, vegetation was cleared and grubbed and a portion of this area was covered with crushed rock to expand the existing working surface for use as a staging area for Lora Lake sediment capping and filling operations. Cleared and grubbed areas that were not covered with crushed rock were hydroseeded to stabilize the area between construction seasons. During Construction Season 2, activities at the DMCA included regrading, placement of excess sand removed from the lake surface, construction of a porous asphalt surface as a wildlife barrier that allows stormwater infiltration, placement of approximately 120 cubic yards of topsoil, and installation of more than 1,350 native plants and woodchip mulch in the planted filter strip bordering the east and southeast edge of the DMCA.

All work was completed in accordance with the Site Agreed Order, project plans and specifications, project permits, and applicable local and state regulations. Long-term monitoring of the Site in accordance with the Compliance Monitoring and Operations and Maintenance Plans included as appendices to this report has been initiated and will be conducted as described in those plans.

Table of Contents

1.0 Introduction 1-1

1.1 REGULATORY BACKGROUND AND ENVIRONMENTAL INVESTIGATIONS 1-1

1.2 DOCUMENT ORGANIZATION 1-3

2.0 Site Description 2-1

2.1 SITE LOCATION 2-1

2.2 PHYSICAL CHARACTERISTICS 2-1

2.2.1 Lora Lake Apartments Parcel 2-1

2.2.2 Lora Lake Parcel 2-1

2.2.3 1982 Dredged Material Containment Area 2-2

2.3 CONTAMINANTS OF CONCERN 2-3

3.0 Engineering Design 3-1

3.1 LORA LAKE APARTMENTS PARCEL 3-1

3.2 LORA LAKE PARCEL 3-2

3.2.1 Upland Soil Excavation 3-2

3.2.2 Lake Sediment Capping and Wetland Rehabilitation 3-3

3.3 1982 DREDGED MATERIAL CONTAINMENT AREA 3-4

4.0 Work Conducted 4-1

4.1 PERMITS AND REGULATORY COMPLIANCE 4-1

4.2 CONSTRUCTION ROLES AND RESPONSIBILITIES 4-3

4.3 SUMMARY SCHEDULE OF MAJOR ACTIVITIES 4-4

4.4 CHRONOLOGICAL SUMMARY OF LORA LAKE APARTMENTS PARCEL
CONSTRUCTION ACTIVITIES 4-6

4.4.1 Site Preparation 4-6

4.4.2 Construction Water Management 4-8

4.4.3 Contaminated Soil Excavation 4-9

4.4.4 Site Restoration 4-11

4.5 CHRONOLOGICAL SUMMARY OF LORA LAKE PARCEL CONSTRUCTION
ACTIVITIES 4-12

4.5.1 Construction Season 1 Activities 4-12

4.5.2 Construction Season 2 Activities 4-19

4.6 CHRONOLOGICAL SUMMARY OF 1982 DREDGED MATERIAL CONTAINMENT AREA CONSTRUCTION ACTIVITIES 4-22

 4.6.1 Construction Season 1 Activities..... 4-23

 4.6.2 Construction Season 2 Activities..... 4-24

4.7 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL..... 4-25

4.8 SPILLS (NON-REPORTABLE) 4-26

5.0 Quality Assurance/Quality Control..... 5-1

 5.1 CONSTRUCTION QUALITY ASSURANCE PROTOCOLS 5-1

 5.2 CHEMICAL AND GRADATION TESTING OF IMPORT MATERIAL 5-1

 5.3 COMPACTION OF BACKFILL 5-3

 5.4 WATER TREATMENT SYSTEM FUNCTION AND OPERATION 5-3

 5.5 SITE SURVEY 5-4

 5.6 PERMEABLE PAVEMENT 5-4

 5.7 PLANTINGS QUALITY 5-5

6.0 Compliance Monitoring..... 6-1

 6.1 AIR AND DUST MONITORING..... 6-1

 6.2 CONSTRUCTION WATER MANAGEMENT AND DISCHARGE MONITORING 6-1

 6.2.1 Lora Lake Apartments Parcel Construction Water Compliance Monitoring 6-2

 6.2.2 Lora Lake Parcel Construction Water Compliance Monitoring 6-2

 6.2.3 Ecology Permit Compliance Inspections 6-3

 6.3 EXCAVATION AREA SOIL SAMPLING AND COMPLIANCE MONITORING DATA 6-3

 6.3.1 Des Moines Memorial Drive Sidewall Soil Sampling 6-3

 6.3.2 Excavation Area 5 Base Sample 6-4

 6.4 GROUNDWATER MONITORING WELL INSTALLATION 6-4

 6.4.1 LL Apartments Parcel Groundwater Monitoring Locations..... 6-4

 6.5 SEDIMENT CAP MONITORING POINT INSTALLATION 6-5

7.0 Institutional Controls 7-1

 7.1 ENVIRONMENTAL COVENANTS 7-1

 7.2 DES MOINES MEMORIAL DRIVE RIGHT-OF-WAY 7-1

8.0 Public Involvement 8-1

8.1 PRE-CONSTRUCTION NOTICE 8-1

8.2 ONSITE SIGNAGE 8-1

8.3 CONSTRUCTION SEASON 1 COMPLETION 8-1

8.4 CONSTRUCTION SEASON 2 COMPLETION 8-1

9.0 Site Safety 9-1

9.1 OSHA-REPORTABLE INCIDENTS 9-1

9.2 WEEKLY SAFETY INSPECTIONS 9-1

10.0 Deviations from Design and Lessons Learned 10-1

10.1 YELLOW-PAINTED ASPHALT SPEED BUMPS 10-1

10.2 POLYSTYRENE UNDER CONCRETE FOUNDATION 10-1

10.3 LORA LAKE APARTMENTS PARCEL WATER TREATMENT SYSTEM 10-1

10.4 EXCESS COMMON EXCAVATION SOIL AND REGRADE AT LORA LAKE APARTMENTS PARCEL 10-2

10.5 LORA LAKE BATHYMETRIC SURVEY 10-2

10.6 ALLOWABLE LAKE DRAWDOWN PUMPING RATES 10-2

10.7 THIN-LIFT SAND PLACEMENT METHODS FOR LAKE FILLING 10-3

10.8 CONSTRUCTION SEASON 2 REDESIGN 10-4

11.0 Summary and Conclusions 11-1

11.1 LORA LAKE APARTMENTS PARCEL 11-1

11.2 LORA LAKE PARCEL 11-1

11.3 1982 DREDGED MATERIAL CONTAINMENT AREA 11-2

12.0 References 12-1

List of Tables

Table 2.1 Contaminants of Concern (embedded)

Table 4.1 Summary Schedule of Construction Activities (embedded)

Table 4.2 Lake Fill Settlement Monitoring Data

Table 4.3 Construction Waste Stream and Disposal (embedded)

Table 5.1 Import Select Fill and Topsoil Chemical Compliance Summary

Table 5.2 Import Lake Fill Chemical Compliance Summary

Table 5.3	Organic Carbon Amendment in Lake Fill Summary
Table 6.1	Construction Water Treatment Sampling Results
Table 6.2	Lora Lake Apartments Parcel Soil Sample Results
Table 6.3	Lora Lake Parcel Soil Sample Results

List of Appendices

Appendix A	Survey Data and As-Built Records
Appendix B	Stormwater Pollution Prevention Plan and Permitting Documents
Appendix C	Construction Completion Photograph Log
Appendix D	Weekly Construction Progress Reports
Appendix E	Resource Protection Well Reports and Well Installation Logs
Appendix F	Waste Disposal Information (Provided on Disc)
Appendix G	Compaction Test Reports
Appendix H	Import Material Tickets (Provided on Disc)
Appendix I	Construction Water Management Logs
Appendix J	Laboratory Analytical Data (Provided on Disc)
Appendix K	Ecology Construction Stormwater General Permit Inspection Reports and Daily Stormwater Inspection Reports
Appendix L	Plantings Lists and Planting Materials
Appendix M	Construction Weekly Meeting Minutes
Appendix N	Construction Bulletins
Appendix O	Environmental Covenants
Appendix P	Public Involvement Notice
Appendix Q	Pre-Construction Bathymetric Surveys
Appendix R	Updated Compliance Monitoring Plan
Appendix S	Operation and Maintenance Plan

List of Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
AO	Agreed Order
As-Built Report	Lora Lake Apartments Site Construction As-Built Report
Aspect	Aspect Consulting
bgs	Below ground surface
BMC	Burien Municipal Code
BMP	Best management practice
CAA	Controlled Activity Area
CAP	Cleanup Action Plan
CD	Consent Decree
CESF	Chitosan-enhanced sand filtration
CMS	Construction Management System
COC	Contaminant of concern
cPAH	Carcinogenic polycyclic aromatic hydrocarbon
CSWGP	Construction Stormwater General Permit
CTAPE	Chemical Technology Assessment Protocol - Ecology
DMCA	1982 Dredged Material Containment Area
EC	Environmental covenant
ECM	Environmental Compliance Manager
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
ESA	Environmental Science Associates
FAA	Federal Aviation Administration
FS	Feasibility Study
GAC	Granular activated carbon
gpm	Gallons per minute
HDPE	High-density polyethylene
HMA	Hot mix asphalt
KCHA	King County Housing Authority
LL Apartments Parcel	Lora Lake Apartments Parcel
LL Parcel	Lora Lake Parcel
mg/kg	Milligrams per kilogram

Acronym/ Abbreviation	Definition
mg/m ³	Milligrams per cubic meter
MTCA	Model Toxics Control Act
NAVD 88	North American Vertical Datum of 1988
NPDES	National Pollutant Discharge Elimination System
NRMP	Natural Resource Mitigation Plan
NTU	Nephelometric turbidity units
OSHA	Occupational Safety and Health Administration
pg/g	Picograms per gram
POC	Point of compliance
Port	Port of Seattle
PVC	Polyvinyl chloride
RI	Remedial Investigation
RPZ	Runway Protection Zone
Scarsella	Scarsella Brothers, Inc.
SEPA	State Environmental Policy Act
Site	Lora Lake Apartments Site
SMC	SeaTac Municipal code
SR 518	State Route 518
STIA	Seattle-Tacoma International Airport
TCE	Temporary Construction Easement
TEQ	Toxic equivalent
TESC	Temporary erosion and sediment control
TPH	Total petroleum hydrocarbons
TWA	Time weighted average
USACE	U.S. Army Corps of Engineers
VCP	Voluntary Cleanup Program
WAC	Washington Administrative Code
WHMP	Wildlife Hazard Management Plan
WQP	Water Quality Program
WSDOT	Washington State Department of Transportation
XOFA	Extended Object Free Area

1.0 Introduction

This draft Lora Lake Apartments Site Construction As-Built Report (As-Built Report) was prepared on behalf of the Port of Seattle (Port) and documents completion of cleanup construction activities conducted at the Lora Lake Apartments Site (Site) located at 15001 Des Moines Memorial Drive in Burien, Washington. The Site is located on Port-owned property near the northwest corner of the Seattle-Tacoma International Airport (STIA) and consists of three parcels: the Lora Lake Apartments Parcel (LL Apartments Parcel), the Lora Lake Parcel (LL Parcel), and the 1982 Dredged Material Containment Area (DMCA). The configuration of the Site is shown in the as-built records (Appendix A).

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 the Washington State Department of Ecology (Ecology) under the MTCA Cleanup Regulation Chapter 173-340 Washington Administrative Code (WAC), and in accordance with Consent Decree (CD) No. 15-2-21413-6, entered into by Ecology and the Port (State of Washington 2015). The CD requires that the Port implement the Cleanup Action Plan (CAP) for the Site, which was produced by Ecology in 2015 (Ecology 2015), and that construction activities be documented in a Construction Completion Report (or As-Built Report).

1.1 REGULATORY BACKGROUND AND ENVIRONMENTAL INVESTIGATIONS

Environmental contamination at the LL Apartments Parcel was first discovered and partially removed during construction of the apartment complex in the late 1980s. The Port acquired the LL Apartments Parcel in 1998. In 2007, the Port discovered soil and groundwater contamination at the LL Apartments Parcel during demolition of six apartment buildings to comply with Federal Aviation Administration (FAA) flight path requirements as part of the expansion at the STIA. The Port and King County Housing Authority (KCHA) submitted a Voluntary Cleanup Program (VCP) application in April 2008. The VCP application was modified in September 2008 to remove KCHA. The Port entered into Agreed Order (AO) DE 6703 with Ecology in July 2009 requiring the Port to complete interim remedial actions, prepare a Public Participation Plan, complete a Supplemental Data Gaps Report, and complete a Remedial Investigation (RI) and Feasibility Study (FS) for all releases at the Site.

The interim remedial action was completed in the summer of 2009 and included demolishing all buildings and ancillary aboveground facilities (excluding building foundations) at the LL Apartments Parcel.

RI field activities were completed between 2010 and 2011 and the final RI/FS was submitted in 2015. The RI/FS identified the following soil contaminants of concern (COCs):

- Arsenic
- Lead
- Total petroleum hydrocarbons (TPH)

- Pentachlorophenol
- Carcinogenic polycyclic aromatic hydrocarbons (cPAHs)
- Ethylbenzene
- Toluene
- Dioxins/furans

The RI/FS identified the following groundwater COCs:

- Arsenic
- TPH
- Pentachlorophenol
- cPAHs
- Dioxins/furans

The RI/FS identified the following sediment COCs:

- Arsenic
- Lead
- Pentachlorophenol
- cPAHs
- Dioxins/furans

During the RI/FS process, the Site was extended to include portions of the Port's property east of Des Moines Memorial Drive including the LL Parcel and DMCA. An active City of Burien stormwater system was identified running through the LL Apartments Parcel, connecting to the Des Moines Memorial Drive drainage system downstream of this parcel that then discharged into Lora Lake. A second, smaller stormwater sub-system was also identified on the LL Apartments Parcel that drained the northeast portion of this parcel and conveyed stormwater to the Des Moines Memorial Drive drainage system that discharged to Lora Lake. The RI/FS assessed stormwater chemical quality at multiple locations within the interior LL Apartments Parcel, where the City of Burien stormwater system entered and exited the LL Apartments Parcel, and where the secondary line exited the parcel. The assessment found that the City of Burien's stormwater contained multiple COCs, including dioxins/furans, and that stormwater from the LL Apartments Parcel was not contributing to degradation of the stormwater that was conveyed from upstream across the property and discharged to Lora Lake.

In September 2015, the Port and Ecology entered into a CD requiring implementation of the remedial action described in the CAP. In accordance with the CD (and documented in the CAP [Exhibit C to the CD]; State of Washington 2015 and Ecology 2015), the implemented remedy for the LL Apartments Parcel consisted of excavation of contaminated source material, backfilling,

construction of a wildlife barrier/cap, stormwater conveyance system improvements, and implementation of institutional controls. The implemented remedy for the LL Parcel contaminated soils included excavation, backfilling with clean soil, and replanting. The implemented remedy for the Lora Lake sediments included isolation of the sediments through capping and open-water filling of Lora Lake to rehabilitate the area to wetland conditions. Institutional controls for the LL Parcel Sediment Cleanup Area require the rehabilitated wetland to continue to be managed in accordance with recorded restrictive covenants already in place as part of the Port's Natural Resource Mitigation Plan (NRMP). The implemented remedy for the DMCA includes implementation of institutional controls that require the surface improvements provide a barrier to wildlife and require that the area remain in industrial use.

1.2 DOCUMENT ORGANIZATION

This document is organized into the following sections:

- **Section 2.0—Site Description:** Provides a brief summary of site location, physical characteristics, and COCs and extent.
- **Section 3.0—Engineering Design:** Provides an overview of the cleanup actions conducted in accordance with engineering design.
- **Section 4.0—Work Conducted:** Provides a summary of permits and regulatory compliance, key organizations and roles, and chronological descriptions of work conducted for each parcel.
- **Section 5.0—Quality Assurance/Quality Control:** Provides a summary of how construction quality was achieved throughout each phase of the project.
- **Section 6.0—Compliance Monitoring:** Provides a summary of compliance monitoring conducted throughout the project.
- **Section 7.0—Institutional Controls:** Describes the institutional controls in place at the Site to ensure long-term protection.
- **Section 8.0—Public Involvement:** Provides a summary of public outreach and involvement conducted for the project.
- **Section 9.0—Site Safety:** Provides a summary of weekly safety inspections and records.
- **Section 10.0—Deviations from Design and Lessons Learned:** Provides a summary of deviations from the design presented in the Engineering Design Report (EDR) and Project Manual.
- **Section 11.0—Summary and Conclusions:** Provides a summary of the cleanup actions completed on each parcel.
- **Section 12.0—References:** Provides references used in this report.

2.0 Site Description

2.1 SITE LOCATION

The Site straddles the boundary between the Cities of Burien and SeaTac, Washington (refer to Sheet CG06.1 of the as-built records in Appendix A). 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 east, and the DMCA is located to the 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. Collectively, these zones are called Runway Protection Zones (RPZs). Two subzones cover the Site, 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, residences and public gathering places, such as shopping centers, offices, or hospitals may not be constructed in the CAA. The Port will own the land within the RPZs in perpetuity. Residential land use is not a potential future use within the RPZs. The location of the Site within the RPZs did not impact construction means or methods.

2.2 PHYSICAL CHARACTERISTICS

2.2.1 Lora Lake Apartments Parcel

The LL Apartments Parcel consists of approximately 8.3 acres of previously 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, as well as the former Seattle City Light Sunnydale Substation, which was purchased by the Port in 2011. Prior to construction, the LL Apartments Parcel was covered by asphalt parking areas, concrete building foundations, and landscaped areas remaining from the previous Lora Lake Apartments complex. Land use to the west and north of the LL Apartments Parcel is primarily residential and light commercial. The LL Parcel and DMCA are across Des Moines Memorial Drive south of the LL Apartments Parcel.

2.2.2 Lora Lake Parcel

The LL Parcel is located on the east side of Des Moines Memorial Drive and consists of approximately 7.1 acres of land, including the former approximately 3-acre Lora Lake and a Port-constructed wetland aquatic habitat mitigation area. The LL Parcel 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 the former Lora Lake footprint. 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 security fence associated with the STIA. Entry by the public is prohibited.

The LL Parcel lies within a habitat mitigation area developed and enhanced by the Port in compliance with requirements of the 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 (hereafter referred to as the Port Mitigation Area; Parametrix 2001). The operation and maintenance requirements for the Port Mitigation Area are described in the NRMP. The NRMP 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 Port Mitigation Area (here after referred to as the Mitigation Area Restrictive Covenant; State of Washington 2003) prohibits any future development on the LL Parcel. The rehabilitated wetland on the LL Parcel constructed as part of this remedial action will be maintained as a protected wetland habitat, compliant with the NRMP and WHMP requirements in perpetuity.

2.2.3 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 security fence associated with the 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 located around the lake regarding excessive siltation caused by stormwater discharge into the lake. The dredging project was implemented in 1982. 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 dredged spoil containment area is now referred to as the DMCA.

Prior to remedy construction, the eastern half of the DMCA was 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 was the location of the approach lighting system for the STIA 3rd Runway, which was constructed in 2006. This area was regraded and covered with gravel and was kept vegetation-free by the Port; it was 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 FAA RPZs, such as temporary construction laydown or equipment storage.

2.3 CONTAMINANTS OF CONCERN

The COCs identified for the Site in the RI/FS and the CAP (and discussed in Section 1.1) are presented in Table 2.1.

**Table 2.1
Contaminants of Concern**

Contaminant	Soil	Groundwater	Lora Lake Sediment
Arsenic	✓	✓	✓
Lead	✓		✓
TPH (gasoline-, diesel-, and heavy oil-range hydrocarbons)	✓	✓	
Pentachlorophenol	✓	✓	✓
cPAHs	✓	✓	✓
Ethylbenzene	✓		
Toluene	✓		
Dioxins/Furans	✓	✓	✓

3.0 Engineering Design

Individual cleanup goals and remediation strategies for the Site's three parcels were developed for each distinct cleanup area to account for different exposure pathways and anticipated future use of each parcel. Cleanup was performed in accordance with the details described in the EDR (Floyd|Snider 2016), except with the deviations described in Section 10.0. The cleanup areas are described in the following sections with respect to their Ecology-approved remedy.

3.1 LORA LAKE APARTMENTS PARCEL

Four separate excavation areas (Area 1, Area 2, Area 3, and Area 4) within the LL Apartments Parcel were delineated vertically and horizontally based upon soil sampling performed for the RI in 2011 and additional soil performance monitoring conducted in 2015 and 2016. The location of each excavation area are shown in Sheets CG01.2, CG01.3, and CG01.4 of the as-built records (Appendix A). Contamination on this parcel was to be addressed through the removal of soil with dioxin/furan toxic equivalent (TEQ) concentrations exceeding the LL Apartments Parcel remediation level of 100 picograms per gram (pg/g). Generally, defining the soil removal based upon the dioxin/furan TEQ remediation level encompassed the soil removal necessary to address cleanup level exceedances of the other COCs. Two small modifications were made to the excavation extents that addressed dioxins/furans to encompass other site COCs in Excavation Area 3 and Excavation Area 4.

The excavation areas were subdivided into grid cells that defined the vertical point of compliance (POC) within each cell. Base elevations for cells were developed based on data from the RI sampling conducted in 2011 and the soil performance monitoring conducted in 2015 and 2016. The size of grid cells varied between the excavation areas from 20-square-foot cells to 43-square-foot cells. The determination of cell size and depth was accomplished by first identifying the "clean depth" of each sampling location as the deepest point where the remediation level was met and all deeper sample points were less than the remediation level. A "clean surface" was then created by connecting all of the points where the remediation level was met. The "clean surface" varied in elevation across the excavation area to match the varying "clean depths" of each boring. Next, the "clean surface" was transformed into an array of equally sized grid cells. Each grid cell had a uniform depth determined by the deepest elevation of the "clean surface" inside that grid cell. The optimum size of grid cells was determined by calculating the total volume of soil removal for each excavation area using grid sizes of 20, 25, 30, 35, or 40 square feet. Smaller grid sizes meant less clean soil would have to be removed to reach the excavation depth. Larger grid sizes were more constructible. The optimum grid size was chosen based upon minimizing the amount of clean soil that would be removed while maintaining constructability. The grid cell layout for each excavation area is shown in Appendix A, sheets CG01.2-01.4 and CG06.1. Summaries of the excavation activities at the LL Apartments Parcel are provided below.

- **Excavation Area 1.** This excavation area was 13,130 square feet and located in the northwest corner of the parcel. The excavation area was divided into 40-foot by 40-foot grid cells with elevations ranging from 301.6 to 305.8 feet relative to the North American Vertical Datum of 1988 (NAVD 88), or approximately 2 to 5 feet below former ground surface. The excavation included the removal of belowground

stormwater conveyance structures and concrete foundations. The excavation depth did not extend below the water table and dewatering was not required in this area.

- **Excavation Area 2.** This excavation area was 17,700 square feet and was located in the central portion of the parcel. The area was divided into 43-foot by 43-foot grid cells with elevations ranging from 301.6 to 307.8 feet NAVD 88, or approximately 1 to 6 feet below ground surface (bgs). Stormwater conveyance features, concrete foundations, and a swimming pool foundation required removal within this excavation area. The excavation depth did not extend below the water table, so no dewatering was required.
- **Excavation Area 3.** This excavation area was 47,400 square feet and was located centrally on the parcel, east of Excavation Area 2. This area was the historical source of contamination, resulting in Excavation Area 3 being the largest and deepest of the four excavations. The area was divided into 20-foot by 20-foot grid cells with elevations ranging from 306.9 to 276.9 feet NAVD 88, or depths ranging from approximately 1 to 24 feet bgs. The base of the excavation extended 5 feet below the groundwater table, so dewatering was required. Excavation in this area included removal of stormwater conveyance structures, concrete foundations, and a second pool foundation.
- **Excavation Area 4.** This excavation area was 7,130 square feet and was located on the eastern edge of the parcel. The area was divided into 20-foot by 20-foot grid cells with elevations ranging from 296.6 to 284.4 feet NAVD 88, or 1 to 10 feet bgs. Stormwater catch basins and pipes required removal during excavation in this area. It was anticipated in the EDR that dewatering may be necessary based upon historical groundwater table elevation data; however, dewatering was not required to complete the excavation.

Following these excavations on the LL Apartments Parcel, the parcel was regraded to facilitate stormwater drainage, covered with 6 inches of clean imported topsoil, and then hydroseeded for stabilization. The final future use of the LL Apartments Parcel is still pending but will consist of an airport-compatible use. The paved surface of future development will provide the final component of the remedial action—a barrier to wildlife—and is required by the CD to be constructed within 4 years of completion of excavation and backfilling. In the current temporary condition, the LL Apartments Parcel perimeter fencing, clean topsoil, and hydroseed protect against human and ecological direct contact to contamination remaining on-site at concentrations greater than the dioxin/furan TEQ cleanup level of 13 pg/g, but less than the remediation level of 100 pg/g.

3.2 LORA LAKE PARCEL

3.2.1 Upland Soil Excavation

The excavation extents of the two upland soil areas on the west side of Lora Lake were determined based upon sample results collected during the RI. The excavation areas are referred to as Excavation Area 5 and Excavation Area 6 to continue with the naming convention established for the LL Apartments Parcel and are shown on Sheet CG06.1 of the as-built records

(Appendix A). Excavation Area 5 is the northern excavation area on the LL Parcel. The width of Excavation Area 5 varies from approximately 25 feet at the southern end to approximately 65 feet at the northern end, and the area is approximately 165 feet long. The northern portion of the excavation was excavated to 1.5 feet bgs, for removal of all COC exceedances of cleanup standards in this area, and the southern portion was excavated to 6 feet bgs, for removal of soil with COC exceedances to the applicable POC of 6 feet bgs. Excavation Area 6 is the southern excavation area on the LL Parcel. This excavation area is 25 feet wide, 90 feet long, and 1.5 feet deep, resulting in removal of all COC exceedances of cleanup standards in this area. Following excavation, these areas were backfilled with approved select fill, regraded, and finished with a layer of topsoil, plantings, and hydroseed to return the area to existing conditions.

3.2.2 Lake Sediment Capping and Wetland Rehabilitation

3.2.2.1 Original Remedial Design—Construction Season 1

Contamination at concentrations greater than cleanup levels was identified at the LL Parcel in two general areas: within the Lora Lake sediments and in two shallow soil areas on the west side of the parcel. The lake sediment remedy consisted of immobilizing the dioxin/furan-contaminated sediment with a protective cap and rehabilitating the lake to its historical function as a wetland. Dioxin/furan and lead contamination in the upland soil areas was excavated and disposed of off-site.

The cleanup goals for the lake sediments are to protect ecological receptors from direct contact, control the pathway of contamination from the lake sediments to surface water, and convert the existing open water and benthic sediment conditions of the lake to a rehabilitated palustrine scrub-shrub wetland. The lake sediment cleanup was planned for and implemented over the course of two construction seasons. The first construction season consisted of immobilizing the lake sediment by placing a permeable geotextile fabric membrane over the lake sediments. The geotextile fabric was designed to reduce the suspension of soft sediments during the sediment cap and lake fill material placement and act as a wildlife barrier where the cap and fill thickness is less than 6 feet, protective of ecological receptors. Following placement of the membrane, the contaminated lake sediment was capped with at least 18 inches of sand amended with granular activated carbon (GAC). The remaining lake space was filled with additional carbon-amended sand to bring the surface up to the final Construction Season 1 elevation. Settlement occurring over the winter between construction seasons was monitored with settlement gauges.

3.2.2.2 Redesign Following Construction Season 1

Construction issues during Construction Season 1 (described in Section 10.7) and less than expected settlement between Construction Season 1 and Construction Season 2 required a redesign to adjust elevations and final grade of the carbon-amended sand cap and rehabilitated wetland. During Construction Season 1 placement of the sediment cap and lake fill material, unconsolidated contaminated sediment that was entrained beneath the geotextile fabric migrated toward the central portion of the lake and created an area of mounding. As a result of the sediment mounding contained by the geotextile fabric, the Construction Season 1 design grades could not be achieved in the mounded sediment area and contaminated sediments

(beneath the geotextile) were much closer to the final design grades than originally anticipated. Additionally, the minimum required sand cap thickness of 18 inches was not met in a portion of the mounded area, due to concerns about geotechnical stability under placement of the full 18-inches of material. These issues required a design modification that included the following:

- A slightly higher average surface elevation due to less than expected settlement and to accommodate the placement of additional sand cap
- Reorientation of the elevated hummocks to align their crest with the areas that required the greatest additional cap thickness
- Decreased number and length of swales to reduce subsurface drainage and allow for higher groundwater levels to match the higher ground elevations
- Addition of compensatory floodplain storage to the DMCA planted filter strip, located outside of and adjacent to the 100-year floodplain, to accommodate the additional fill placed within the footprint of Lora Lake, which is within the 100-year floodplain

The redesign maintained all requirements of the CAP for sediment remediation (minimum thickness of carbon-amended sand cap, minimum percentage of carbon amendment, and installation of monitoring points). These changes were provided to Ecology by email and in meetings that took place in August 2018. The redesign also maintained overall elevations and floodplain requirements, as documented in the Construction Season 2 permit updates provided to the USACE and the City of SeaTac (Appendix B).

During Construction Season 2, the lake was dewatered and regraded to a final elevation to form a minimum 18-inch cap over the entire Lora Lake Cleanup Area. Low-ground pressure machinery and a portable conveyor/rock slinger were implemented to disperse sand in thin lifts to prevent puncture of the geotextile fabric in areas of thin sand placement from Construction Season 1. The lake was then converted to its final use as a palustrine scrub-shrub wetland by grading the surface into series of swales supporting a high hydraulic conductivity and finishing with wetland topsoil and scrub-shrub vegetation. The finished scrub-shrub wetland was reconnected to the Miller Creek channel by constructing improvements to the eastern berm and installing a new southern swale outlet.

3.3 1982 DREDGED MATERIAL CONTAINMENT AREA

The DMCA qualifies as an industrial area pursuant to WAC 173-340-745(1) and there are no exceedances of site COCs in any media. Because the future use of the DMCA is as a construction laydown yard with restricted access, the selected cleanup remedy for the DMCA is implementation of institutional controls and construction of a wildlife barrier to prevent exposure of plants and wildlife to underlying low-level contamination. The wildlife barrier constructed of permeable pavement, gravel, and geotextile layers prevents ecological exposure to underlying soil and also allows for surface water infiltration. Construction of the wildlife barrier was completed during Construction Season 2.

4.0 Work Conducted

4.1 PERMITS AND REGULATORY COMPLIANCE

The MTCA remedial action at the Site was conducted under a CD with Ecology and, therefore, was exempt from certain procedural and permitting requirements of certain Washington laws and regulations and all local permits pursuant to WAC 173-340-710(9)(b). However, the cleanup action was conducted to meet the substantive requirements for applicable regulations and standards as identified in the CAP. Additionally, some local permits were obtained, to allow for ease of project coordination and approval by the local agencies. The following is a list of all permits obtained or the substantive requirements met if the permit was exempt.

- In compliance with the State Environmental Policy Act (SEPA), the Port completed a SEPA Checklist as part of the CAP and CD. Ecology, as the lead review agency, reviewed the checklist and decided on a mitigated determination of nonsignificance, provided in Appendix B. The required mitigation consisted of restoring the areas within the LL Parcel that were disturbed during the remediation. This mitigation is consistent with the Port's NRMP.
- The USACE has jurisdictional authority over the LL Parcel and, therefore, approved the remedial action under three nationwide permits (included in Appendix B). Due to Construction Season 2 extending beyond the original approved periods of these permits, they were applied for extension and approved by the USACE in July 2018. Design changes were documented in a May 2018 memorandum provided to the USACE by the Port. The Certificate of Compliance with Department of the Army Permit was signed on June 5, 2020 to close out these three nationwide permits:
 - Nationwide Permit No. 27: Aquatic Habitat Restoration, Enhancement, and Establishment Activities administered by the USACE (Permit No. NWP-2016-0314-WRD)
 - Nationwide Permit No. 33: Temporary Construction, Access, and Dewatering administered by the USACE (Permit No. NWP-2016-0314-WRD)
 - Nationwide Permit No. 38: Cleanup of Hazardous and Toxic Waste administered by the USACE (Permit No. NWP-2016-0314-WRD)
- Stormwater collected within construction areas was controlled through treatment and infiltration into the SR 518 Construction Stormwater Pond resulting in no discharge to waters of the state. When the rate of water discharge to the SR 518 Construction Stormwater Pond surpassed the pond's capacity, contingency overflow to Miller Creek was permitted. A National Pollutant Discharge Elimination System (NPDES) Construction Stormwater General Permit (CSWGP; Permit No. WAR304723) and the associated Administrative Order No. 13888 were obtained to cover any contingency overflow. Additional information covering permit compliance and treatment system performance is discussed in Section 5.4. The Administrative Order No. 13888 and the contractor's Stormwater Pollution Prevention Plan are included as part of Appendix B. Notice of Termination of Coverage under the CSWGP was received from Ecology on March 15, 2020.

- Local permitting for the LL Apartments Parcel fell within the jurisdiction of the City of Burien. A memorandum was submitted to the City of Burien on June 6, 2016, outlining how the work would comply with the substantive requirements of the City of Burien laws and regulations and is included in Appendix B. The following actions were taken to comply with the substantive requirements, and some permits were obtained, although not required:
 - **City of Burien Clearing and Grading Permit.** Drawings for grading and surfacing, subsurface demolition, and drainage features were included in the 90% Design submittal provided to the City of Burien to substantively comply with the City of Burien Clearing and Grading Permit. All electronic files of as-built conditions for grading and utilities will be provided followed the GIS and CAD requirements listed in the City of Burien Clearing and Grading permit.
 - **City of Burien Tree Removal.** In accordance with the City of Burien Municipal Code (BMC) 19.25.130(1), a tree survey was performed to document the quantity and characteristics of significant trees that were to be removed as part of the MTCA remedial action at the LL Apartments Parcel. A significant tree is defined by the City of Burien as an existing healthy tree that has a minimum diameter of 8 inches for evergreen trees or 12 inches for deciduous trees, when measured 4 feet above grade. A final significant tree replacement plan will be developed in conjunction with planning for the LL Apartments Parcel redevelopment. Documentation of significant trees removed was provided to the City of Burien in a memorandum dated July 28, 2017, and is included in Appendix B.
 - **City of Burien Demolition Permit.** The contractor was required to adhere to all of the requirements for foundation removal and surface restoration listed in BMC 15.10.060(23) to substantively comply with the City of Burien Demolition Permit.
 - **City of Burien Right-of-Way Disturbance.** The contractor obtained a City of Burien Haul Route permit for all work extending into the City of Burien right-of-way. The permit is included in Appendix B. The contractor was responsible for complying with all traffic control requirements and repairing any damage to the right-of-way resulting from the project. No damage occurred during the Construction Season 1 work that required repair. The final permit inspection was conducted on January 17, 2018, and closed out the City of Burien permit.
- Local permitting for the LL Parcel fell within the jurisdiction of the City of SeaTac. A memorandum submitted to the City of SeaTac on November 4, 2016, outlined how the work would comply with the substantive requirements of the City of SeaTac laws and regulations within the Interlocal Agreement overlay between the City of SeaTac and the Port. The memorandum is included in Appendix B. The following permits and actions were taken to comply with the substantive requirements:
 - **City of SeaTac Clearing and Grading Permit.** The City of SeaTac Municipal Code (SMC) operating conditions and standards of performance for clearing and grading (SMC 13.190.100) were discussed in the November 2016 memorandum in relation to how the work would comply with the applicable conditions. The City of SeaTac

was provided the Final Construction Set drawings for confirmation of compliance with applicable conditions. An updated memorandum was provided in August 2018 to discuss the Season 2 redesign; the memorandum included the revised drawings and an updated engineering floodplain analysis.

- **City of SeaTac Right of Way Permit.** The contractor obtained a Class E City of SeaTac Haul Permit per SMC 11.10. The permit is included in Appendix B. The contractor was responsible for complying with all traffic control requirements and repairing any damage to the right-of-way resulting from the work. No damage occurred during the work that required repair. The final permit inspection was conducted on January 18, 2018, and closed out the City of SeaTac permit.
- The contractor obtained a Temporary Discharge Permit from the Midway Sewer District to discharge wastewater from the two wheel-wash facilities at the Site. The permit is included in Appendix B.

4.2 CONSTRUCTION ROLES AND RESPONSIBILITIES

The construction activities were conducted by the following parties:

- The **Port of Seattle** is the current owner of the Site and was responsible for overall removal action implementation, oversight, health and safety, and contracting.
- **Floyd|Snider** was the design engineer of record and provided technical support during the remedial action. Floyd|Snider also performed the 2015 and 2016 confirmation sampling and post-excavation confirmation sampling.
 - **Aspect Consulting** (Aspect) was Floyd|Snider's subconsultant and provided hydrogeology and geotechnical engineering support during construction.
 - **Environmental Science Associates** (ESA) was Floyd|Snider's subconsultant and design landscape architect of record for wetland restoration components of the project. ESA also provided technical support for the LL Parcel remediation during construction.
- **Scarsella Brothers, Inc.** (Scarsella) was the primary contractor for the remedial action. The following primary subcontractors were hired by Scarsella for completion of the work:
 - **Clear Water Services:** All temporary water treatment services and support
 - **Northwest Linings & Geotextile Products, Inc.:** Lake cover supplier
 - **JMR Trucking:** Hauling and import
 - **Pro-Vac:** Vacuum truck services
 - **P&G Landscaping, Inc.:** Landscaping services
 - **Commercial Fence Corporation:** Fence installation services
 - **Cascade Drilling, Inc.:** Monitoring well decommissioning and new compliance well drilling
 - **Hydroseeding & Barkblowers, Inc.:** Thin-lift sand placement/rock slinger support

- **Miles Resources:** Permeable hot-mix asphalt placement
- **Construction Testing Laboratories, Inc.:** Infiltration testing and compaction testing
- **Mayes Testing Engineers, Inc.:** Compaction testing
- **B.R. Bernethy Construction, Inc.:** Laborer support, biodegradable erosion control fabric and coir log installation, and planting
- **Washington State Department of Ecology** provided agency oversight and approval of deviations from the engineering design. Ecology also provided NPDES permit condition review and approval. Ms. Sunny Becker was the Ecology Site Manager for the Toxics Cleanup Program, and Mr. Evan Dobrowski was the Water Quality Site Inspector for the project during Construction Season 1. No site inspections occurred during Construction Season 2.

4.3 SUMMARY SCHEDULE OF MAJOR ACTIVITIES

Table 4.1 summarizes the timeline of major events that occurred during Construction Seasons 1 and 2.

**Table 4.1
Summary Schedule of Construction Activities**

Major Event	Area	Dates
Contract Execution	Site-Wide	1/30/2017
Partial Notice to Proceed	Site-Wide	4/28/2017
Scarsella Mobilized to the Site (began best management practice [BMP] installation and site preparation)	Site-Wide	5/11/2017
LL Parcel Water Treatment System Installed	LL Parcel	5/11/2017 to 5/24/2017
LL Apartments Parcel Cleared, Grubbed, and Demolished	LL Apartments Parcel	5/12/2017 to 7/4/2017
Temporary Construction Lake Access Road Constructed	LL Parcel	5/16/2017 to 6/2/2017
Lead-Painted Asphalt and Concrete Removed	LL Apartments Parcel	6/5/2017 to 6/7/2017
DMCA Vegetation Clearing	DMCA	6/5/2017 to 6/7/2017
Lora Lake Berm Reinforced for Protection of Miller Creek	LL Parcel	6/8/2017
Washington State Department of Transportation (WSDOT) Temporary Construction Easement Prepared	LL Apartments Parcel	6/12/2017 to 6/21/2017

Major Event	Area	Dates
Wells Decommissioned	LL Parcel/ LL Apartments Parcel	6/19/2017
Full Notice to Proceed	Site-Wide	6/26/2017
Lora Lake Dewatered (Construction Season 1) and Maintained in a Dewatered State	LL Parcel	6/27/2017 to 12/5/2017
LL Apartments Parcel Water Treatment System Installed	LL Apartments Parcel	6/30/2017 to 7/7/2017
Excavation Areas 1 through 4 Excavated	LL Apartments Parcel	7/5/2017 to 8/14/2017
Lora Lake Rock Berm Demolished/Removed	LL Parcel	8/4/2017 to 8/7/2017
Crushed Rock Placed over DMCA	DMCA	8/14/2017 to 8/28/2017
LL Apartments Parcel Graded	LL Apartments Parcel	8/14/2017 to 9/8/2017
Geotextile Fabric Placed over Lora Lake	LL Parcel	8/21/2017 to 8/23/2017
New Wells Installed on LL Apartments Parcel	LL Apartments Parcel	9/7/2017 to 9/8/2017
LL Apartments Parcel Surface Restoration Performed	LL Apartments Parcel	9/8/2017 to 10/18/2017
Sediment Cap and Lake Fill Placed	LL Parcel	10/4/2017 to 11/21/2017
Excavation Areas 5 and 6 Excavated	LL Parcel	10/17/2017 to 10/25/2017
Partial Substantial Completion Granted for LL Apartments Parcel	LL Apartments Parcel	10/31/2017
Excavation Areas 5 and 6 Restoration Performed	LL Parcel	12/1/2017 to 12/5/2017
Partial Substantial Completion Granted for LL Parcel	LL Parcel	12/13/2017
Lora Lake Dewatered	LL Parcel	6/19/2018 to 8/28/2018
Scarcella Begins Mobilization	LL Parcel	8/20/2018
Operating Engineers Labor Strike, Scarcella Labor Union Stand-Down	LL Parcel	8/21/2018 to 9/7/2018
Temporary Contract Suspension for Completion of Remedial Action in 2019 Construction Season	LL Parcel	8/30/2018
LL Parcel Regraded	LL Parcel	7/17/2019 to 7/25/2019

Major Event	Area	Dates
Lora Lake Dewatered (Construction Season 2)	LL Parcel	7/18/2019 to 10/29/2019
East Lake Berm Opening Completed	LL Parcel	8/1/2019 to 8/7/2019
DMCA Graded	DMCA	8/8/2019 to 8/28/2019
South Lake Connection to Miller Creek Completed	LL Parcel	8/16/2019 to 8/19/2019
New Wells Installed on LL Parcel	LL Parcel	8/22/2019
Topsoil Placed	LL Parcel	8/28/2019 to 9/20/2019
DMCA Porous Pavement Placed and Planted Filter Strip Completed	DMCA	9/4/2019 to 9/6/2019
Temporary Construction Lake Access Road Decommissioned/Restored	LL Parcel	10/1/2019 to 10/4/2019
Site Fence Restored and All Plants Placed	LL Parcel and DMCA	12/2/2019 to 2/18/2020
Substantial Completion Granted	LL Parcel and DMCA	2/18/2020
Final Survey Completed	LL Parcel and DMCA	2/27/2020

4.4 CHRONOLOGICAL SUMMARY OF LORA LAKE APARTMENTS PARCEL CONSTRUCTION ACTIVITIES

Construction at the LL Apartments Parcel was completed during the Construction Season 1, between April and December 2017. Partial Notice to Proceed was granted on April 28, 2017, and Full Notice to Proceed was granted June 26, 2017. Partial substantial completion for the LL Apartments Parcel was issued by the Port on October 31, 2017. Representative photographs documenting construction progress are presented in Appendix C and weekly construction progress reports prepared by the Port Resident Engineer, Stacy Heilgeist, are presented in Appendix D. Construction activities completed during Construction Season 1 at the LL Apartments Parcel included site preparation, construction water management, contaminated soil excavation, and site restoration.

4.4.1 Site Preparation

- Site Control and Access.** A temporary construction fence was placed around the LL Apartments Parcel in all areas where the existing fencing required removal for site work, or current fencing did not secure the Site to establish site control. This included closure of both existing site entrances along Des Moines Memorial Drive and 8th Avenue South. Entrance to the work area was restricted to a single construction entrance at the southwest corner of the parcel that could only be accessed from the fenced Port property located south of the LL Apartments Parcel. Scarsella was

- responsible for controlling access to the adjacent Port property through a secured gate along Des Moines Memorial Drive.
- **Temporary Erosion and Sediment Controls.** BMPs including a silt fence, asphalt berms, and straw waddles were installed around the LL Apartments Parcel perimeter to prevent construction stormwater from migrating off-site. Catch basin inlet protection was installed in all catch basins on-site and in catch basins located in the right-of-way adjacent to the parcel. The temporary construction entrance on the southern property line was constructed with quarry spalls and a self-contained truck wheel wash. All vehicle traffic leaving the LL Apartments Parcel was required to drive through the wheel wash. Fugitive dust was managed by spraying water onto dry soil areas, wetting haul routes, and sweeping. Dust monitoring was conducted at the perimeter of the parcel throughout earth-disturbing work to document airborne particulates upwind and downwind of site activities. Dust monitoring is discussed in more detail in Section 6.1.
 - **Clearing and Grubbing.** All trees, brush, roots, and debris were removed from the LL Apartments Parcel to clear the surface for demolition (Appendix C.1, Photograph 1). A total of 95 cubic yards of vegetation that was suitable for recycling was transported to the Buckley Recycle Center in Auburn, Washington. Roots and other debris entrained with contaminated soil were disposed of as Subtitle D contaminated material.
 - **Temporary Construction Easement Area.** In order to accommodate the concurrent construction schedule of the WSDOT SR 518 off-ramp project, a small strip of area on the northern portion of the LL Apartments Parcel, shown in Sheet CG05.1 of the as-built records (Appendix A), was prepared by Scarsella, then transferred to WSDOT crews for management under a Temporary Construction Easement (TCE) between WSDOT and the Port. Scarsella installed temporary erosion and sediment control (TESC) and BMP controls around the TCE area; completed clearing, grubbing, and demolition of building foundations, paving, and abandoned utilities within the TCE; secured the TCE area with plastic sheeting and sandbags; and relocated the TESC and BMP controls to the southern edge of the TCE area before transferring the area to WSDOT (Appendix C.1, Photograph 2). This work was completed by May 31, 2017. WSDOT was responsible for all final grading, topsoil placement, permanent fencing installation, and seeding within the TCE. WSDOT completed their project in December 2017, with Port inspection and approval of the TCE. Final surface conditions for this area are depicted in the Season 2 photograph log (Appendix C.2).
 - **Demolition of Existing Asphalt, Concrete Foundations, and Structures.** Demolition of asphalt, concrete foundations, and other structures was completed concurrent to the excavations in order to utilize the paved surfaces as much as possible for truck traffic and dust control. The concrete structures and foundations were demolished by Scarsella, placed on-site in a central stockpile area, and later used as backfill (Appendix C.1, Photograph 3). A total of 1,566 tons of asphalt was transported to Washington Rock Quarries, Inc.'s Kapowsin Quarry in Orting, Washington, for

recycling. Yellow-painted concrete and yellow-painted asphalt speed bumps identified as being lead-contaminated were disposed of as Subtitle D material.

- **Monitoring Well Decommissioning.** Well decommissioning was completed by Cascade Drilling, Inc., on June 19, 2017. Cascade Drilling, Inc., decommissioned 10 wells on the LL Apartments Parcel by filling the well casings with bentonite and sealing the surface with concrete. A copy of the Resource Protection Well Reports is included in Appendix E.
- **Staging and Stockpiling Areas.** The Port property located on the south side of the LL Apartments Parcel was used as Scarsella's main staging area. Scarsella placed a job trailer on and expanded the entrance gate to the property. Stored material on the Port property included imported base course aggregate, large woody debris, and smaller equipment. Crushed concrete was stockpiled within the LL Apartments Parcel, and excavated soil was not stockpiled prior to loading for offsite disposal.

4.4.2 Construction Water Management

- **Truck Wash Water Disposal with Midway Sewer District.** Scarsella received a Temporary Discharge Permit from the Midway Sewer District to discharge wastewater from the LL Apartments Parcel wheel wash, as well as the LL Parcel wheel wash. As necessary during the project, spent water was transported from the wheel wash to a Midway Sewer District manhole located at Port Logistics Lot 5 via a tanker truck. Approximately 20,000 gallons of wastewater was discharged to the Midway Sewer District from both the LL Apartments Parcel and LL Parcel wheel washes, as estimated by Scarsella. Midway Sewer District did not require an exact measurement of volume of wastewater discharged.
- **Stormwater Control.** Stormwater BMPs around the LL Apartments Parcel were inspected daily by Scarsella's Environmental Compliance Manager (ECM) or assistant ECM and documented in their Daily Construction Reports. Stormwater was not allowed to enter stormwater conveyance features outside of the excavation areas due to the risk of stormwater loss through cracks in the conveyance system and into the surrounding soil. Prior to removal of the stormwater system and during excavation dewatering activities, segments of the existing stormwater conveyance system within excavation areas were used by Scarsella to collect and convey stormwater to a central collection point for pumping to the construction water treatment system.

The stormwater mainline entering the LL Apartments Parcel from the City of Burien was disconnected, and influent flow from the City of Burien was rerouted by a system upgrade completed by the City of Burien before work began so that only stormwater generated within the parcel required management. Prior to breaking ground, Scarsella plugged the stormwater pipe leaving the LL Apartments Parcel so that any water running through the LL Apartments Parcel stormwater system was collected in a single downstream manhole and pumped to the LL Apartments Parcel stormwater

treatment system. Stormwater management during removal of the stormwater system utility removal is described in Section 4.4.3.

- **Excavation Dewatering.** Sumps were installed in Excavation Area 3 beginning August 5, 2017, to draw down groundwater for excavation. The sumps, consisting of pumps placed inside temporary corrugated pipe set below the excavation base, were installed in two locations. Groundwater was pumped into a nearby manhole within Excavation Area 3 where it was then pumped to the LL Apartments Parcel water treatment system through dedicated piping installed by Scarsella. Dewatering was not required in any of the other excavation areas.
- **Water Treatment.** Stormwater and dewatering water generated on the LL Apartments Parcel was collected and pumped to a chitosan-enhanced sand filtration (CESF) water treatment system. The water treatment system met the requirements of Ecology's Chemical Technology Assessment Protocol - Ecology (CTAPE) and the Stormwater Management Manual for Western Washington (Ecology 2014). The water treatment system consisted of pre-treatment weir tanks that functioned as oil/water separators, automated chitosan dosing and pH adjustment, settling tanks, turbidity and pH probes for water quality monitoring, sand filtration units, and GAC for polishing. The water treatment system was operated by a trained technician from Clear Water Services during all periods of treatment and discharge.

Water from the water treatment system was discharged to the segment of the LL Apartments Parcel stormwater system mainline running beneath Des Moines Memorial Drive, then pumped from a manhole on the east side of the road to the SR 518 Construction Stormwater Pond for discharge.

4.4.3 Contaminated Soil Excavation

The excavation, utility removal, and backfill of Excavation Areas 1 through 4 within the LL Apartments Parcel were conducted in accordance with the design plans and specifications. Procedures were generally consistent across all four excavation areas.

- **Excavation Activities.** Excavation of Excavation Areas 1 through 4 was conducted from July 5 to August 14, 2017, starting in Excavation Area 1, moving to Excavation Area 2, then Excavation Area 4, and ending in Excavation Area 3. Prior to excavation in each area, an exclusion zone, delineated by high-visibility safety tape, and a decontamination area were set up (Appendix C.1, Photograph 4). Workers inside of the exclusion zone who were positioned to apply water for dust control or sweep loose soil back into the excavation area were required to wear Tyvek suits. Excavated soil was direct-loaded onto truck and trailers, and the excavations were sequenced to maintain a circular haul route around the LL Apartments Parcel. Truck and trailer combinations did not enter exclusion zones, and equipment operating inside exclusion zones were decontaminated prior to exiting the exclusion zones. Scarsella contracted two landfills to receive the contaminated soil as Subtitle D non-hazardous material, Waste Management's Columbia Ridge Recycling and Landfill and Republic

Services' Roosevelt Regional Landfill. Certificates of disposal for each facility are included in Appendix F. The total quantity of contaminated soil disposed of from the LL Apartments Parcel was 41,829 tons. Vertical and horizontal limits were checked during excavation by machine-mounted survey equipment monitored by the excavator operator. Once excavation was finished in each excavation area, the final grades were checked first by Scarsella and then confirmed by the Port's licensed surveyors, who gave permission to begin backfilling operations. Port survey data provide the final as-built conditions and provide the confirmation monitoring data required by the CD (described in Section 6.5 of the CAP). As-built survey data demonstrating final grade compliance with design are included in Appendix A.

- **Utility Removal.** The existing stormwater conveyance system at the LL Apartments Parcel was removed during remediation including all pipes, catch basins, manholes, and underground detection tanks. Stormwater segments were only removed once they were no longer being used by Scarsella to manage construction stormwater. In addition, previously undetected stormwater lines were discovered within the excavation areas during the excavations and were removed from within the excavation limits. All other utilities encountered within the excavation areas were determined to be inactive and removed.
- **Excavation Stabilization.** For each of the excavation areas, Scarsella was able to achieve the required depths of removal within each excavation unit without the need for sheetpile walls or laid-back slopes to stabilize the excavation walls. Areas that posed the highest risk of slope destabilization were backfilled as soon as possible to reduce the risk of collapsing. Due to the close proximity of Excavation Area 4 to Des Moines Memorial Drive, this excavation area's deepest excavation unit was immediately backfilled after confirmation by the Port's survey crew in order to remove any risk to the adjacent sidewalk and street.
- **Backfill.** Once survey confirmation was obtained by the Port's survey crew for each excavation unit within an excavation area, Scarsella was allowed to begin backfilling. Crushed concrete that met specification requirements for size and content and common excavation soil from the LL Apartments Parcel were used as backfill. During concrete crushing, inspections were conducted by the project geotechnical engineer. Crushed concrete was placed at and above an elevation of 292 feet NAVD 88 in Excavation Area 3, above the wet season groundwater table elevation. In addition to the onsite fill material, a total of 550 tons of approved select fill sourced from Miles Sand & Gravel Company was imported to bring Excavation Areas 1 through 4 to final grade (Appendix C.1, Photograph 5). A vibratory roller was used to compact each lift of backfilled material, and Mayes Testing Engineers, Inc., completed nuclear gauge density tests to confirm the necessary compaction had been met in each excavation area and throughout regraded areas of the parcel. Mayes Testing Engineers, Inc.'s proctor tests and compaction reports are included in Appendix G.

4.4.4 Site Restoration

Following excavation and backfill, the LL Apartments Parcel was regraded and finished to its current conditions. The LL Apartments Parcel will remain in this condition until a future site use and redevelopment plan is implemented within the next 4 years, as required by the CD. At that time, a wildlife barrier will be installed as the final surface.

- **Grading and Excess Material.** Following backfilling, Scarsella began grading the LL Apartments Parcel to the final design contours. At that time, it was determined that an excess of approximately 12,380 cubic yards of common excavation material was on the LL Apartments Parcel. A revised grading and surface completion plan was issued by the Port to Scarsella through a construction bulletin to address the excess soil. This revision is discussed further in Section 10.4. Excess soil was placed along the northern boundary of the parcel, creating a terrace that slopes in toward the central portion of the parcel. This terrace was constructed in accordance with the original design and specifications, and the final grade for the LL Apartments Parcel conveys the majority of stormwater falling onto the parcel to a new biofiltration swale located on the parcel's southern edge.
- **New Storm Drain System.** A new 48-inch-diameter Type 2 catch basin with beehive grate and 18-inch-diameter high-density polyethylene (HDPE) effluent stormwater pipe were installed to direct stormwater from the new biofiltration swale to a connecting City of Burien system stub at the South 152nd Street property line. A 48-inch-diameter Type 3 manhole was installed along the 18-inch-diameter pipe on the Port property south of the LL Apartments Parcel. Stormwater falling along the eastern slope of the parcel, draining toward Des Moines Memorial Drive, is directed by an open ditch running parallel to Des Moines Memorial Drive toward a second 48-inch-diameter Type 2 catch basin with beehive grate along the LL Apartments Parcel's eastern edge. Scarsella connected this catch basin to an existing catch basin along Des Moines Memorial Drive with an 18-inch-diameter HDPE stormwater pipe. The new stormwater system is shown on Sheet CG05.2 in the as-built drawings in Appendix A.
- **Final Surface.** A 24-foot-wide Temporary Access Road was constructed on the LL Apartments Parcel using 1,086 tons of approved 1.25-inch minus tailings from Washington Rock Quarries, Inc. The location of the Temporary Access Road is shown on Sheet CG05.1 in the as-built drawings in Appendix A. The remaining surface of the LL Apartments Parcel was covered with 6 inches of 3-Way Topsoil from Cedar Grove Composting, Inc., except for the biofiltration swale, which was filled with 12 inches of 3-Way Topsoil. A total of 4,875 cubic yards of topsoil was placed (Appendix C.1, Photograph 6). All topsoil areas were hydroseeded on October 10, 2017, for erosion control and site stabilization. To manage the greater erosion risk inside the biofiltration swale, coir fabric was placed over the swale after hydroseeding.
- **Fencing.** The installation of a new fence along Des Moines Memorial Drive and along 8th Avenue South across the former site entrance, and a new gate along the

southern boundary of the LL Apartments Parcel, was completed by the Commercial Fence Corporation on October 12, 2017. The fence and gate sections were installed in accordance with the design plans and specifications. New fence segments were connected to existing site fencing and to WSDOT's temporary site fence along the north property line to fully secure the Site. Permanent fencing along the north property was installed as part of the SR 518 off-ramp project, which was completed in December 2017.

- **Monitoring Well Installation.** Three new monitoring wells on the LL Apartments Parcel and one new monitoring well on the Port property south of the LL Apartments Parcel were installed between September 7 and 8, 2017, by Cascade Drilling, Inc., and logged by a Floyd|Snider geologist. A set of three bollards were installed around each well for protection, and each well received an Ecology Well Identification Tag. The wells were screened in the shallow aquifer and fill unit, consistent with the RI site monitoring well network. Well installation logs are included in Appendix E.

4.5 CHRONOLOGICAL SUMMARY OF LORA LAKE PARCEL CONSTRUCTION ACTIVITIES

Construction activities for the LL Parcel were conducted over two construction seasons to allow for the sediment cap and lake fill material placed during Construction Season 1 to settle over winter prior to the construction of the wetland during Construction Season 2. Construction Season 1 on the LL Parcel occurred from May to December 2017. An attempt to begin Construction Season 2 occurred in 2018 where dewatering restarted in June 2018; however, due to the contractor not fully mobilizing until August 2018, unusually high precipitation, and an operator strike in September 2018, work could not be completed in the dry season of 2018. The delay in the schedule was communicated to Ecology, and it was determined that a formal revision to the CD Schedule was not required. Construction Season 2 restarted in July 2019 and completed in February 2020.

4.5.1 Construction Season 1 Activities

Generally, construction activities completed during Construction Season 1 at the LL Parcel included site preparation; lake dewatering and construction water management; lake settling basin and rock berm remediation; geotextile placement on lake sediments; sediment capping and lake filling; and excavation, backfilling, and seeding of Excavation Areas 5 and 6. Representative photographs documenting construction progress are presented in Appendix C. Weekly construction progress reports are presented in Appendix D. Material import tickets are presented in Appendix H. The following sections provide greater detail on the LL Parcel Construction Season 1 activities.

4.5.1.1 Site Preparation

The first construction activity conducted at the LL Parcel was site preparation. These activities were conducted to install TESC, establish staging and construction access for Lora Lake, and

stabilize lake berms adjacent to Miller Creek. The following paragraphs describe the specific preparation activities that were conducted at the LL Parcel:

- **Site Control and Access.** The LL Parcel is located within the controlled access areas of the RPZs. Lora Lake and Excavation Areas 5 and 6 are contained within the STIA security fencing. Construction access for the LL Parcel occurred via Des Moines Memorial Drive and through a secured gate along South 156th Way via a Port access road. Temporary construction fencing was required along Des Moines Memorial Drive only when the existing fencing was removed to allow for completion of site work. Other temporary site control included placement of Restricted Access signage and required personal protective equipment signage at the site entrances.
- **Temporary Construction Lake Access Road.** The boundaries of the Temporary Construction Lake Access Road were surveyed to the areas established in the specifications, and the access road was constructed fully within this area. The allowable area to be used by Scarsella for the access road was established to minimize the impact on vegetation in the Port Mitigation Area to the extent practicable. The Temporary Construction Lake Access Road extended from the paved Port access road on the LL Parcel to the perimeter of the north side of Lora Lake. After clearing of vegetation, a separation layer of geotextile was placed over the cleared and grubbed area prior to the placement of quarry spalls (Appendix C.1, Photograph 7). Quarry spalls were placed on top of the geotextile and maintained as a working surface throughout the project.
- **Temporary Erosion and Sediment Controls.** Silt fences were installed along the paved haul routes in the LL Parcel work area and along the Temporary Construction Lake Access Road. High visibility construction fencing and straw wattles were installed along the eastern sidewalls at the downslope edges of Excavation Areas 5 and 6. Catch basin inlet protection was installed in two catch basins along Des Moines Memorial Drive with the potential to be impacted by the excavation activities in Excavation Area 5. Stormwater that fell on the LL Parcel migrated to the TESC measures and infiltrated at pervious surfaces. Haul trucks importing sediment cap and lake fill material to the LL Parcel drove through a wheel wash prior exiting the LL Parcel to prevent track out on to Des Moines Memorial Drive. Additional information for compliance with the CSWGP is presented in Section 4.5.1.2.
- **Clearing and Grubbing.** A limited amount of clearing and grubbing was conducted on the LL Parcel to construct the Temporary Construction Lake Access Road and prepare Excavation Areas 5 and 6 for excavation. All debris and unsuitable clearing and grubbing materials were transported off-site for disposal at a Subtitle D landfill. Downed trees, stumps, and roots within the Temporary Construction Lake Access Road remained in place to provide a base and were covered by geotextile fabric and quarry spalls; stumps and roots within Excavation Areas 5 and 6 were disposed of with excavated soil at a Subtitle D landfill. Canary grass and cattails removed from the existing enhanced wetland south of the lake were disposed of at a Subtitle D landfill.

- **Monitoring Well Decommissioning.** Well decommissioning for two wells located in the City of SeaTac right-of-way in the vicinity of Excavation Areas 5 and 6 was completed by Cascade Drilling, Inc., on June 19, 2017. Copies of the Resource Protection Well Reports are included in Appendix E.
- **Staging and Stockpiling Areas.** The DMCA was the primary area used for staging the LL Parcel equipment, including the construction water treatment system, as described in Section 4.5.1.2. A hopper and conveyor system was used to live load and mix the lake fill material and carbon amendment, which limited the need for stockpiling material. However, on a few occasions, clean fill materials were stockpiled at the DMCA due to delivery truck timing. Bagged carbon, topsoil, geotextile, and other construction materials were stockpiled at the DMCA, within the footprint of the gravel working surface. Staging for the carbon hopper and conveyor system is described in Section 4.5.1.5.
- **Lake Outlet Plug and Lake Berm Stabilization.** The existing lake discharge culvert was plugged with concrete prior to the start of any in-water work to prevent water from entering Miller Creek during the Lora Lake sediment capping and lake filling operations. Sandbags were placed to reinforce the low points of the berms between Miller Creek and Lora Lake and between the lake and the existing enhanced wetland. The augmented berms maintained a hydrologic barrier to prevent turbid lake water generated during lake filling activities from entering Miller Creek or the existing enhanced wetland.

4.5.1.2 Lora Lake Dewatering and Construction Water Management

A temporary construction water treatment system was installed and operated to draw down and treat lake dewatering water during the lake sediment capping and filling operations. Lake dewatering and construction water management consisted of the following:

- **Construction Water Management and Treatment System.** A CESF water treatment system was installed at the DMCA to pump and treat lake dewatering water during lake filling operations. The water treatment system met the requirements of CTAPE and the Stormwater Management Manual for Western Washington (Ecology 2014). The water treatment system was designed to operate at a maximum flow rate of 500 gallons per minute (gpm) and consisted of pre-treatment weir tanks that functioned as oil/water separators, automated chitosan dosing and pH adjustment, settling tanks, turbidity and pH probes for water quality monitoring, sand filtration units, and GAC for polishing. The water treatment system was operated by a trained technician from Clear Water Services during all periods of treatment and discharge. Monthly Summary Reports of treatment operations, system discharge volumes, and water quality parameters are included in Appendix I.
- **Lake Drawdown, SR 518 Construction Stormwater Pond, and Discharge to Miller Creek.** Lake water was pumped to the water treatment system by two submersible pumps anchored to a floating pontoon in Lora Lake. The floating pump system allowed

the pumps to remain submerged as the water level in the lake fluctuated during drawdown. Treated water was discharged to the SR 518 Construction Stormwater Pond. During periods when pumping rates exceeded the infiltration rate of the SR 518 Construction Stormwater Pond, treated water was allowed by permit to overflow and discharge to Miller Creek. Lake drawdown began on June 27, 2017, and continued between 8 to 24 hours per day and 5 to 7 days per week. Pumping rates ranged from approximately 175 to 465 gpm with an average pumping rate of 375 gpm. Dewatering pumping rates and durations were determined by Scarsella, to meet dewatering goals for the scheduled work. Treated water was analyzed per the requirements in the CSWGP and the associated Administrative Order No. 13888. Compliance monitoring is described in more detail in Section 6.2. Analytical results are presented in Appendix J.

4.5.1.3 Lake Settling Basin and Rock Berm Remediation

The settling basin and rock berm at the northwest corner of the lake were excavated after the lake discharge culvert was plugged and lake drawdown began. The lake level was drawn down to a sufficient elevation to allow for the excavator to operate on a firm, dewatered surface for excavation and removal of the material. The lake settling basin and rock berm were removed with an excavator and direct-loaded to trucks for export from the LL Parcel (Appendix C.1, Photograph 8). The lake settling basin and rock berm were removed to an elevation of 265.5 feet NAVD 88. In accordance with the project specifications, the approximate 138 tons of excavated soil and sediment from the settling basin was transported off-site and disposed of in a Subtitle D landfill. Excavated rock from the berm feature was placed offshore in deeper areas of the lake for coverage by the geotextile and lake fill.

4.5.1.4 Geotextile Placement

Geotextile was placed on the lake sediment prior to the start of sediment capping and lake filling operations to prevent the resuspension of soft lake sediments during filling. The following sections describe the geotextile placement operation and establishment of the wildlife barrier.

- **Geotextile Placement, Sinking, and Anchoring.** Prior to placement of the geotextile at the lake, individual geotextile panels (approximately 24 feet by 360 feet) were machine stitched together at the DMCA to construct one large geotextile panel, approximately 430 feet by 720 feet. Polystyrene floats were also stitched into the leading edge of the geotextile. Winches were placed on the Temporary Construction Lake Access Road at the north side of Lora Lake and steel cables were strung through pulleys anchored by trees at the southern lake berm. The steel cables were then attached to loops stitched into the leading edge of the large geotextile panel positioned at the north edge of the lake. The winch and pulley system pulled the large geotextile panel from the north edge of the lake to the southern berm (Appendix C.1, Photograph 9). Once the geotextile was pulled across the lake and was floating on the surface, sandbags were placed on to the geotextile to sink it in place. The polystyrene floats were removed from the geotextile, and excess geotextile material around the

perimeter of the lake was pulled in to the lake during the sinking operation and during subsequent lake filling operations. The edges of the geotextile panel were secured to the control points around the perimeter of the lake using rebar stakes (Appendix C.1, Photograph 10). Following fill placement, during Construction Season 2, these stakes were removed and excess fabric was cut and disposed of as construction debris.

- **Wildlife Barrier.** In areas within the LL Parcel Sediment Cleanup Area where the sediment cap and fill material are less than the 6-foot conditional POC (protective of ecological receptors), the geotextile provides a wildlife barrier to the underlying lake sediments, consistent with the CAP.

4.5.1.5 *Sediment Capping and Lake Filling*

After the geotextile was secured in place, an engineered sediment cap of carbon-amended sand was added to immobilize the existing contaminated sediment in place. Lake fill, which was composed of the same material as the sediment cap, was then placed during Construction Season 1 to provide the structural base for the construction of the palustrine scrub-shrub wetland constructed in Construction Season 2. The sediment cap and lake filling activities that occurred during Construction Season 1 are described in the following bullets:

- **Lake Fill and Carbon Blending.** Approximately 58,200 tons of sediment cap and lake fill material was imported to the LL Parcel and DMCA in truck and trailers. The GAC used to amend the cap and fill material was supplied in super sacks (approximately 1,100 pounds per sack) and stockpiled at the DMCA. On the LL Parcel, a truck basin and conveyor system were constructed on the existing paved Port access road north of the lake to receive the cap and fill material at the northeast access point of the Temporary Construction Lake Access Road. The conveyor system consisted of three belts that ran north to south along the eastern driveway of the Temporary Construction Lake Access Road and terminated at the northeast corner of the lake. Upon arriving at the LL Parcel, the truck and trailers drove up on to the truck basin pad and released the cap and fill sand onto the conveyor system (Appendix C.1, Photograph 11). Downstream of the truck basin release point, GAC super sacks were brought over from the DMCA and added directly to a hopper that metered the GAC into the fill on the conveyor (Appendix C.1, Photograph 12). Fill material and GAC were mixed at each drop point from one conveyor belt to the next and when the conveyor system deposited the material for placement at the lake (Appendix C.1, Photograph 13). Additional blending occurred during movement of the amended sediment cap and fill material by machinery during placement at the lake. Compliance monitoring for achievement of the minimum 0.1% organic carbon content in the cap and fill material is described in Section 5.2. Analytical results are presented in Appendix J.
- **Sediment Capping and Lake Filling Activities.** The conveyor system deposited carbon-amended sediment cap and fill material at the northeast corner of the lake. Heavy equipment including an excavator, dozer, and dump truck were used to spread the material across the lake footprint. The sediment cap and fill material was first placed

along the shoreline in an approximately 50-foot-wide swath, in accordance with the specifications, to secure the edges of the geotextile and to ensure that any soft sediments that may move during lake filling would not migrate out from underneath the geotextile at the edges of the lake. The perimeter fill was used as a working surface and road to move material around the perimeter of the lake. Once the 50-foot-wide swath was completed around the perimeter of the lake, carbon-amended sediment cap and lake fill material was placed inside the 50-foot-wide swath toward the center of the lake. Placement in this manner encouraged unconsolidated sediments underneath the geotextile fabric to migrate toward the center of the lake. Mass placement of material without an initial placement of a thin lift of sand to weigh down and stabilize underlying soft sediments was not in compliance with the specifications and resulted in migration of a significant volume of soft sediment underlying the geotextile. This is summarized here and described in more detail in Section 10.0.

During placement of the sediment cap and lake fill material, the loose contaminated sediment entrained beneath the geotextile in the central portion of the lake created an area of excessive build-up of sediment underneath the geotextile fabric. This excessive buildup caused tension on the geotextile, which resulted in a tear that exposed sediment in the central portion of the lake, approximately 100 feet from the eastern shoreline (Appendix C.1, Photograph 14). Another tear in the geotextile fabric occurred mid-lake approximately 55 feet north of the southern shoreline. The areas of the tears and exposed sediment were covered with additional geotextile fabric and lake fill was placed on top of the new fabric in thin lifts (Appendix C.1, Photograph 15) to reduce the pressure on the area and allow for material to be built up on the torn areas. In addition to the tears, the conditions reached a point where tension on the geotextile and elevation of the geotextile in relation to final grade required the Port to call a stop work order on November 6, 2017. On November 20, 2017, the Port instructed Scarsella to proceed with lake filling by using a sand slinger or equivalent method, to place thin lifts of no more than 4 to 6 inches of sand at a time over all remaining exposed areas of the geotextile. Scarsella first placed a second layer of geotextile fabric over the area to be filled as a contingency to prevent material migration if the underlying geotextile were to rupture. Due to the onset of the rainy season and the resulting increase in water levels in the lake, lake filling was discontinued after all remaining areas of the geotextile had been covered with a thin lift of 6 to 12 inches of sand. Approximately 58,200 tons of sand were placed during the Lora Lake sediment capping and filling operations in Construction Season 1. Lake water management during sediment capping and lake filling activities is discussed in Section 4.5.1.2.

- **Lake Fill Settlement Monitoring Equipment.** Settlement monitoring data collected within the lake footprint were installed to assess the amount and timing of settlement during and following Construction Season 1 fill placement. Nine settlement monitoring points were installed on top of the geotextile fabric and prior to sediment capping and lake filling to monitor settlement between the two construction seasons. The settlement monitoring points consisted of a weighted metal base and polyvinyl

chloride (PVC) pipe that extended above the lake fill surface. During lake filling operations, settlement monitoring point elevations were collected every 3 to 4 days. Settlement monitoring was conducted between the two construction seasons, generally every 2 to 3 weeks. The locations of the settlement monitoring points are presented in Sheet CU03.1 of the as-built records (Appendix A) and settlement data are included in Table 4.2.

- **End of Construction Season 1 Fill Surface Stabilization.** At the end of Construction Season 1, the lake fill surface was sloped from north to south to allow for surface water infiltration. The berm between Miller Creek and the southeastern portion of the lake was reinforced and raised with sandbags to prevent Miller Creek from entering the lake during periods of high flow. Lake fill material in the northwest corner of the lake (in the former rock berm area) that receives stormwater discharge from Des Moines Memorial Drive was graded to collect incoming stormwater discharge for infiltration and reduce the potential for erosion. Low points in the southern lake berm were reinforced with sandbags to limit overflow from the lake to the existing enhanced wetland during periods of heavy rain. At the end of Construction Season 1, per the CSWGP, Scarsella reduced inspection frequency for temporarily stabilized, inactive sites to once every calendar month. Daily contractor stormwater inspection forms are included in Appendix K.

4.5.1.6 Contaminated Soil Excavation in Excavation Areas 5 and 6

Site preparation activities for Excavation Areas 5 and 6 are described in Section 4.5.1.1. Excavation, backfilling, and restoration activities for Excavation Areas 5 and 6 are described in the following bullets.

- **Excavation Activities.** Excavation Areas 5 and 6 were accessed via Des Moines Memorial Drive. Traffic control was conducted for both northbound and southbound lanes on Des Moines Memorial Drive to allow trucks to park adjacent to the excavation areas during loading. The contaminated soil was excavated and direct loaded to the truck and trailers. Plastic sheeting was placed on the ground under the swing radius of the excavator to capture spilled soil during loading operations. Spilled soil was cleaned up with a shovel and added to the truck and trailers. A luminaire foundation that existed in Excavation Area 5 was demolished and removed from the LL Parcel. The excavations were completed to the design depths of 1.5 feet and 6 feet bgs in Excavation Area 5 and 1.5 feet bgs in Excavation Area 6 and confirmed by survey. Approximately 1,250 tons of contaminated soil was excavated from Excavation Areas 5 and 6 and disposed of off-site at a Subtitle D landfill.

The extent of Excavation Area 5 was determined by cleanup level exceedances of dioxins/furans. The extent of Excavation Area 6 was determined by cleanup level exceedances of dioxins/furans and lead. Soil samples were collected from the western sidewalls of the two excavation areas to document remaining concentrations of lead and dioxins/furans in inaccessible soil beneath the City of SeaTac right-of-way. A soil sample was also collected from the base of Excavation Area 5 at 6 feet bgs to

document dioxin/furan contamination remaining in soil below the conditional POC of 6 feet bgs for protection of ecological receptors. Lead was not analyzed in this sample, because previous RI data vertically bounded lead contamination to the top 1.5 feet of soil in this area. Soil sampling results are presented in Section 6.3. These excavation areas did not require dewatering, and stormwater that entered the excavation footprint infiltrated. Following completion, performance monitoring survey data were collected by the Port's survey crew to confirm excavation depths.

- **Backfill, Topsoil, and Compaction.** Excavation Areas 5 and 6 were backfilled with imported select fill sourced from Miles Sand & Gravel Company. Compaction testing indicated that a portion of Excavation Area 5 was over-compacted and exceeded the maximum compaction limit of 92% for areas that were receiving topsoil. The area was scarified and re-compacted, and topsoil was placed throughout the extent of the backfilled areas. Topsoil was compacted with an excavator to a firm condition. Analytical results for imported select fill and topsoil are discussed in Section 5.2 and presented in Appendix J.
- **Planting and Seeding.** Excavation Areas 5 and 6 were planted with trees and shrubs and seeded with erosion control seed mix consistent with the specifications, as approved by the USACE for mitigation zone plantings and as approved by the Port in accordance with the requirements and management goals of the NRMP. All planting and seeding materials will be maintained by the contractor for one full calendar year from the date of construction completion in Construction Season 2. Following the 1-year contractor maintenance period, the area will be maintained by the Port.

4.5.2 Construction Season 2 Activities

Generally, activities during Construction Season 2 at the LL Parcel included lake regrading, lake dewatering and construction water management, excess lake fill transfer to the DMCA, construction of the East Lake Berm Opening, construction of the drainage channel connection to Miller Creek, excavation of the Temporary Construction Lake Access Road fill, monitoring well installation, topsoil placement, planting and seeding, and fence restoration. Representative photographs documenting construction progress are presented in Appendix C. Weekly construction progress reports are presented in Appendix D. Material import tickets are presented in Appendix H. The following sections provide greater detail on the LL Parcel construction activities.

4.5.2.1 Lora Lake Dewatering and Discharge to SR 518 Stormwater Pond

After construction of the sediment cap during Construction Season 1, Scarsella obtained permission from the Ecology Water Quality Program (WQP) to treat water for turbidity resulting from cap material placement only, because contamination was contained beneath the geotextile. During Construction Season 2, lake water was discharged directly to the SR 518 Stormwater Pond through geotextile filter bags. Lake drawdown began on July 18, 2019, and continued through November 6, 2019. Pumps ran 8 to 24 hours per day, 5 to 7 days per week. Dewatering pumping rates and durations were determined by Scarsella, to meet dewatering goals for the scheduled

work. Turbidity at the discharge point was measured daily to ensure that the threshold of 5 nephelometric turbidity units (NTU) prescribed by the AO was not exceeded. Compliance monitoring is described in more detail in Section 6.2.

4.5.2.2 Sand Cap Regrading and Sand Export to DMCA

- **Regrading.** The lake fill redesign required regrading to meet revised elevations. Regrading of the lake fill sand was performed using an excavator, low ground pressure bulldozer, and rock slinger/conveyor belt equipment. Generally, regrading was performed from the lake berm perimeter gradually moving toward the center, where a thinner layer of sand cap and areas of exposed geotextile existed following Season 1 activities. To ensure that the geotextile fabric layer was not punctured during construction, large excavators did not track into the central portion of the lake footprint, the low ground pressure bulldozer performed grading on top of thinner layers of sand cap, and the sand slinger was used to place thin lifts of sand atop of exposed areas of geotextile fabric to achieve the design subgrade. Finished subgrade was achieved on July 25, 2019, and complied with the CD requirements for carbon-amended sand cap placement thicknesses.
- **Regrading Settlement Monitoring.** After observed mounding in the middle of the lake footprint described in Section 10.7, two settlement monitoring points were installed on March 1, 2018, in addition to the nine existing points to monitor settlement of the mound between construction seasons. These 11 settlement monitoring points were measured at approximately monthly intervals throughout the duration of grading activities in Construction Season 2 to monitor the timing and amount of settlement and/or heave from regrading activities. The settlement data are included in Table 4.2.
- **Export of Carbon-Amended Sand to DMCA.** Excess sand from the result of regrading was exported at the Temporary Construction Lake Access Road with an articulated offroad dump truck to the DMCA. Regrading was performed in a manner to push excess amended sand toward the Temporary Access Road for loading. Export of excess sand was performed continuously throughout regrading activities with the material stockpiled at the DMCA for use as fill under the porous pavement wildlife barrier.

4.5.2.3 East Lake Berm Opening Construction

To facilitate flow exchange between Miller Creek and the restored wetland during high flow events, the East Lake Berm Opening was constructed. A work area isolation dam consisting of temporary sandbags and plastic sheeting was constructed to protect the work area from the creek prior to excavation activities. A total of 310 cubic yards of soil from the berm was excavated and transported to the DMCA to construct a key trench and a rock berm. Because the excavated berm material consists of lake sediments, this material was transferred and placed at the DMCA and graded beneath the wildlife barrier.

To complete the key trench and rock berm, approximately 100 tons of riprap was placed in 10- to 14-inch lifts with live stakes placed between each lift. Topsoil was washed into the interstitial

spaces in the rocks to support the establishment of live stake plantings. The excavated area was covered in biodegradable erosion control fabric with two coir logs placed along the west bank of Miller Creek. Two keyed logs were installed in the East Lake Berm Opening prior to washing topsoil above the final riprap lifts. There were no confirmed exceedances of any water quality parameter during stream water quality monitoring during construction of the berm opening. Construction of the East Lake Berm Opening was completed on August 5, 2019.

In response to scour observed at the East Lake Berm Opening after a large rain event in late December 2019, adaptive management was implemented on February 18, 2020, with the placement of rounded streambed cobbles and sediment to minimize further erosion and salmon habitat concerns. Approximately 10 cubic yards of a mixture of 70% streambed cobbles and 30% streambed sediment was placed above ordinary high water along the streambank. Approximately 3 cubic yards of streambed cobble were placed around the southern keyed log.

4.5.2.4 Wetland Rehabilitation

Approximately 6,200 cubic yards of topsoil was placed on top of the carbon-amended sand subgrade using an excavator and low-ground-pressure dump trucks and bulldozers. The topsoil layer is a minimum of 12 inches thick at the topographic high points of the restoration, where minimum sand cap thickness and floodplain fill regulations controlled design, and is 18 inches thick or more over the remainder of the former lake footprint. Swales were constructed through the wetland rehabilitation area to manage the high groundwater table and provide a defined route for surface water expressions to leave the Site. Swales were surfaced with 260 tons of streambed cobbles. Final grading including swale installation was completed on September 30, 2019. All of the exposed topsoil in the planting areas was then covered with biodegradable erosion control fabric, and 1,700 linear feet of coir logs were placed along the margins of those swales deemed most susceptible to erosion for an added degree of stability. Fabric and coir log installation was completed on October 25, 2019. Temporary isolation dams still in place providing separation of the construction area from Miller Creek were removed on October 29, 2019, after the Site was stabilized.

4.5.2.5 Drainage Channel Connection to Miller Creek

A South Lake Berm Opening and Outlet to Miller Creek were constructed to allow drainage of the constructed wetland area. To prevent high turbidity discharge into Miller Creek, an isolation dam consisting of temporary sandbags and plastic sheeting was installed at the end of the designed outlet channel along the northern bank of Miller Creek. From the northern end of the drainage channel, approximately 220 cubic yards of material from the South Lake Berm was excavated and transported to the DMCA for capping under the permeable wildlife barrier. The outlet channel was then constructed sequentially south to north, from the creek toward the wetland rehabilitation area and the former Lora Lake. Material excavated from the drainage channel was cast to the sides of the channel and placed into low spots, then graded smooth. Compaction of the outlet channel side slopes was achieved by tamping of the excavator bucket. Four cleared trees with intact root systems were installed as keyed logs along the side slopes of the outlet channel. During the excavation of the outlet channel, a shallow piezometer (less than 10 feet in depth) used by the Port

for groundwater level observation, was damaged and subsequently removed with an excavator. At the connection to the Lora Lake footprint, streambed gravel was placed to complete the gravel swale. Throughout the installation of the Miller Creek drainage channel, stream water quality monitoring indicated no confirmed exceedances of parameters in Miller Creek. Construction of the South Lake Berm Opening and Outlet to Miller Creek was completed on August 19, 2019.

4.5.2.6 Monitoring Well Installation

Seven new compliance monitoring wells were installed in the wetland rehabilitation area including four wells within the former lake footprint and three in the lake berm/perimeter area. A list of compliance monitoring wells installed during Construction Season 2 is included in Section 6.5. Monitoring wells were installed by a licensed driller in accordance with WAC 173-160-420. Well screens were installed a minimum 18 inches above the geotextile fabric, which identifies the transition to underlying contaminated sediment. Each sediment cap monitoring well was completed with aboveground monuments protected by three bollards. The location of each sediment cap monitoring well is shown on Sheet CU03.1 of the as-built records in Appendix A, and monitoring well logs are included in Appendix E. Sediment cap monitoring well installation was completed on August 22, 2019.

During the installation of sediment cap monitoring wells, a replacement for the monitoring well MW-10 located on the south side of Des Moines Memorial Drive that was found to be partially filled with sand during the 2018 fourth quarter groundwater sampling event on December 12, 2018, was installed. Further details on this monitoring well are in Section 6.4, and the monitoring well installation log is located in Appendix E. The compromised MW-10 monitoring well was decommissioned by a licensed driller in accordance with WAC 173-160-460.

4.5.2.7 Planting and Seeding

The LL Parcel was planted with approximately 8,000 native plants in Construction Season 2. This includes the wetland rehabilitation area, the existing enhanced wetland, and the restored temporary lake access roads. All access roads were removed and restored during the planting process. Hydroseed was placed by hand in the restored temporary lake access roads prior to substantial completion on February 18, 2020. No seed was applied in the wetland rehabilitation area or in the existing enhanced wetland. The full plantings list including source purchase orders is included in Appendix L.

4.6 CHRONOLOGICAL SUMMARY OF 1982 DREDGED MATERIAL CONTAINMENT AREA CONSTRUCTION ACTIVITIES

Construction activities for the DMCA took place over two construction seasons to allow the area to be used for construction staging. Construction Season 1 occurred from May to December 2017. Construction Season 2 occurred from July 18, 2019, to February 18, 2020.

4.6.1 Construction Season 1 Activities

Generally, construction activities completed during Construction Season 1 at the DMCA included site preparation, rough grading, placement of a gravel working surface, installation and operation of the construction water management system for the LL Parcel, equipment storage, material stockpiling, and construction staging. Representative photographs documenting construction progress are presented in Appendix C.1. Weekly construction progress reports are presented in Appendix D. The following sections provide greater detail on the DMCA construction activities.

4.6.1.1 Site Preparation

The first construction activity conducted at the DMCA was site preparation. These activities were conducted to install TESC and establish staging and support areas for LL Parcel construction activities. The following paragraphs describe the specific preparation activities that were conducted at the DMCA:

- **Site Control.** The DMCA is located within the controlled access areas of the RPZs. Construction access for the DMCA occurred via Des Moines Memorial Drive and through a secured gate along South 156th Way via a Port access road. Ecology blocks were installed around the runway lighting foundations within the DMCA staging area to protect these structures during construction activities.
- **Temporary Erosion and Sediment Controls.** Prior to ground-disturbing activities, silt fences were installed at the DMCA boundary. A water truck was used for dust control to prevent dust from migrating off-site during construction operations. Exposed soil in areas that had been cleared and grubbed in Construction Season 1 that were not covered with a gravel temporary work surface were hydroseeded for stabilization.
- **Clearing and Grubbing.** The western portion of the DMCA consisted of an existing work area covered with compacted gravel. The eastern portion of the DMCA, which was covered with trees and vegetation, was cleared and grubbed to prepare this area for use as a staging area and for installation of the wildlife barrier. Cleared trees, shrubs, and other vegetation were disposed of at the Buckley Recycle Center in Auburn, Washington. Roots and other debris in contact with soil were disposed of as Subtitle D contaminated material. Crushed rock was placed on portions of the DMCA to provide a temporary work surface for Scarsella's staging and stockpiling.
- **Stormwater Control.** The DMCA was and remains covered by pervious surfaces. Stormwater that fell on the DMCA during construction infiltrated and was prevented from migrating off-site by silt fences installed at the DMCA boundary.
- **Monitoring Well Decommissioning.** One well was decommissioned at the DMCA by Cascade Drilling, Inc., on June 19, 2017. A copy of the Resource Protection Well Report is included in Appendix E.
- **Staging and Stockpiling Areas.** The DMCA was used to stage the LL Parcel construction water treatment system (described in Section 4.5.1.2), GAC super sacks for use as

carbon amendment in the lake sediment cap and fill, construction equipment, and a job trailer. Infrequent stockpiling of backfill material occurred on the crushed rock surface at the DMCA for placement at Excavation Areas 5 and 6.

4.6.2 Construction Season 2 Activities

Generally, construction activities completed during Construction Season 2 at the DMCA included rough grading, placement of excess sand cap and excavated lake berm soil from the LL Parcel, import of porous pavement subbase material, final grading, installation of a porous pavement wildlife barrier, and planted filter strip, and construction staging. Representative photographs documenting construction progress are presented in Appendix C.2. Weekly construction progress reports are presented in Appendix D. Material import tickets are presented in Appendix H. The following paragraphs provide greater detail on the DMCA construction activities during Season 2.

- **Import Sand from Lora Lake.** Excess sand cap material from the wetland rehabilitation area began being transported and stockpiled at the DMCA on July 24, 2019. Approximately 2,200 cubic yards of excess sand cap from the wetland rehabilitation area were moved to the DMCA for use as the sand filtration layer beneath the permeable hot mix asphalt (HMA) wildlife barrier. To meet subgrade for the planted filter strip along the east and southeast side of the DMCA, soil was excavated from the planted filter strip area and placed and graded along the west slope of the DMCA prior to placement of the crushed rock wildlife barrier. Final subgrade elevations throughout the DMCA were achieved on August 7, 2019, including approximately 2,164 tons of additional imported sand to meet final elevations.
- **Sediment from Lora Lake East Lake Berm Opening.** Approximately 310 cubic yards of sediment material was excavated to construct a key trench during the East Lake Berm Opening construction. This material was placed in the DMCA and graded with other soil under the wildlife barrier.
- **Permeable Ballast Placement.** Approximately 3,595 tons of permeable ballast was placed between August 6, 2019, and August 22, 2019, as a base aggregate layer above the underlying sand filter layer and the HMA.
- **Porous Hot Mix Asphalt Placement.** After grading, placement of filter fabric and ballast occurred in preparation for the placement of permeable pavement to construct the wildlife barrier. Permeable pavement was placed in continuous day and night shifts and completed on September 6, 2019. Upon arrival, temperatures of HMA (0.5-inch porous C15139) ranged from approximately 260 to 280 degrees Fahrenheit (°F). Permeable pavement was placed in two 3-inch lifts and compacted between lifts. No tack coat was applied between lifts, and peanut oil was used as a substitute for diesel for asphalt cleaning. A total of approximately 4,217 tons of porous HMA was placed to complete the permeable pavement wildlife barrier at the DMCA. Compaction and infiltration testing and results are described in Section 5.6. As-built records of the permeable wildlife barrier are included in Appendix A.

- Planted Filter Strip Construction.** A planted filter strip was installed along the east side of the DMCA just upstream of the Reba Lake control structure to provide compensatory flood plain storage and improve the water quality of runoff entering the wetland. Approximately 120 cubic yards of topsoil (18-inch thickness) was placed in the planted filter strip, and 1,368 native plants were installed with woodchip mulch rings. Planting was completed on December 30, 2019.
- Stormwater Runoff Adaptive Management.** In response to sheet flow of stormwater from the upstream SR 518 onramp north of the DMCA onto the DMCA wildlife barrier during a large rain event in late December 2019, adaptive management was implemented between January 6 and 8, 2020. This work consisted of clearing dense vegetation from existing stormwater drainage ditches located north of the DMCA and ensuring that future runoff from the SR 518 onramp would be channeled to the east, around the DMCA. No earthmoving was conducted as part of this effort.

4.7 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

Several different types of waste streams were generated by the project. Each construction waste stream, quantity of material disposed, and disposal or recycling facility receiving the waste are presented in Table 4.3. Final disposal documentation is included in Appendix F.

**Table 4.3
Construction Waste Stream and Disposal**

Construction Waste Stream	Quantity	Unit	Disposal or Recycling Facility
Clearing Vegetation	95	Yards	Buckley Recycle Center
LL Apartments Parcel Asphalt Recycled	1,566	Tons	Washington Rock Quarries, Inc. Kapowsin Quarry
LL Apartments Parcel Non-Reused Concrete	62	Tons	Republic Services
LL Apartments Parcel Contaminated Soil	41,829	Tons	Waste Management and Republic Services
LL Parcel Settling Basin and Rock Berm Material	138	Tons	Waste Management
LL Parcel Excavation Areas 5 and 6 Contaminated Soil	1,248	Tons	Waste Management
Non-Reused Concrete (Yellow Painted Curb)	64	Tons	Allied Waste Regional Disposal
DMCA Non-Reused Concrete	48	Tons	Renton Concrete Recyclers
DMCA Commingled Construction Debris and Land Clearing	20	Tons	Waste Management
DMCA Roots and Debris	142	Tons	Buckley Recycling Center and Republic Services
DMCA Asphalt	30	Tons	Renton Concrete Recyclers

4.8 SPILLS (NON-REPORTABLE)

Over the course of Construction Season 1, three de minimis spill events occurred at the Site, none of which were a reportable event. The following paragraphs describe the spills and the response actions implemented.

On June 24, 2017, approximately 3 gallons of hydraulic oil spilled from a water truck over a paved asphalt surface at the LL Apartments Parcel. The spill was immediately cleaned up with kitty litter and absorbent pads. A secondary water truck was mobilized to the Site the next day to maintain dust control until the leaking truck was serviced.

On August 14, 2017, a diesel spill was reported. A metal manhole cover reportedly pierced the diesel tank on a water truck at the LL Apartments Parcel between Excavation Areas 2 and 3. Approximately 15 gallons of diesel was spilled onto asphalt and drained onto soil. The spill was contained and cleaned up from the asphalt with commercial absorbent material. A total of 16 cubic yards of impacted soil was excavated and disposed of as contaminated soil.

On September 15, 2017, an area of quarry spalls at the LL Parcel was observed to be stained with an unknown amount of vegetable oil from the winches used to pull the geotextile fabric across Lora Lake. Scarsella was given permission to move the stained quarry spalls into the lake to weigh down the geotextile fabric and to be capped by the carbon-amended sand.

5.0 Quality Assurance/Quality Control

The following sections detail how construction quality assurance was achieved throughout all phases of the project.

5.1 CONSTRUCTION QUALITY ASSURANCE PROTOCOLS

All project correspondence, including contractor submittals and review documents, daily reports, meeting minutes, and design modifications, were documented in the Port's online Construction Management System (CMS). Submittals required by the contract for pre- and post-construction documentation were reviewed by the Port and Floyd|Snider (Engineer of Record) personnel, along with any other pertinent reviewers, including Aspect (Geotechnical Engineer) and ESA (Landscape Engineer) as necessary. Submittal responses and comments were logged in the CMS and returned to Scarsella. The construction work daily activities were overseen by personnel from the Port to ensure compliance with the contractor documents and design. Port inspectors overseeing the work submitted daily field reports and photographs to CMS. Daily work reports and environmental reports were also completed by Scarsella and submitted to the CMS.

Construction weekly progress meetings were held throughout construction to discuss schedule projections and construction issues. Attendees to these meetings included representatives from the Port, Scarsella, and Floyd|Snider, as well as Floyd|Snider's sub-consultants, ESA and Aspect, as necessary. Meeting minutes were prepared after each meeting to document ongoing and resolved meeting items. The minutes are included in Appendix M.

Any proposed modifications to the design drawings or specifications were submitted through the CMS. Modifications that were approved by the Port and Floyd|Snider were issued to Scarsella as a construction bulletin. Approved design modifications are discussed individually in Section 10.0, and Construction Bulletins are included in Appendix N.

5.2 CHEMICAL AND GRADATION TESTING OF IMPORT MATERIAL

All import material was tested for compliance with the chemical and gradation requirements in the specifications. Material imported to the LL Apartments Parcel and LL Parcel had to meet the respective cleanup standards for the COCs present at that parcel. Material that was processed on-site was tested to make sure that Scarsella's methods were adequate to meet all specifications. Material tests were reviewed and approved by Floyd|Snider and Aspect prior to placement at the Site (with the exception of total carbon in lake fill, discussed below). All laboratory reports for material quality assurance/quality control testing are presented in Appendix J. The following is a list of tests and testing frequencies that were required for each material used on the Site.

- **Excavation Backfill.** The source for select fill to be used as backfill for Excavation Areas 1 through 6 was tested for compliance with gradation and chemical specifications. Chemical compliance results for import backfill are shown in Table 5.1. Select borrow from Miles Sand & Gravel Company was approved for use at the LL Apartments Parcel and LL Parcel.

- **Construction Season 1 Topsoil.** The source for topsoil was tested for compliance with gradation and chemical specifications. Chemical compliance results are shown in Table 5.1. Initially, the topsoil from Cedar Grove Composting, Inc., was approved only for use at the LL Apartments Parcel. Follow-up testing on this topsoil provided results that indicated this material was acceptable for use at the LL Parcel as well.
- **Sediment Cap and Lake Fill Sand.** The source for sediment cap and lake fill sand, CalPortland, was tested for compliance with gradation and chemical specifications. Additionally, chemical compliance testing occurred on every 5,000 cubic yards of sand intended for delivery to the LL Parcel. All chemical compliance testing occurred during Construction Season 1, when the majority of lake fill sand was imported. Because import of lake fill sand during Construction Season 2 was less than 5,000 cubic yards, additional chemical compliance testing was not required during Construction Season 2. Chemical compliance results for imported sediment cap and lake fill sand are presented in Table 5.2
- **Sediment Cap and Lake Fill Carbon Amendment.** After blending on-site, a sample of carbon-amended sand was collected every 1,000 cubic yards to ensure that the sand contained a minimum of 0.1% carbon by weight. Samples were collected either as grab samples from the stockpile of sand at the end of the conveyor system or in situ from the area where material had been placed that day. Because Scarsella's process to mix and then immediately place the carbon-amended sand, the test result for each batch of sand was received after the sand was already placed within the lake footprint. To document placement locations for each batch of sand and its associated carbon sample, Scarsella maintained a map of daily sand placement extent. Of the 43 samples collected, 9 failed to meet the minimum carbon content requirement and represented 9,000 CY of placed sand. In response to these carbon content failures, the Port instructed Scarsella to collect a new sample from the placed sand batch represented by a failed result. Scarsella was instructed to collect a five-point composite sample from the top 18 inches of placed sand to more accurately represent the average carbon content in the area. This process was conducted for four of the nine areas with initial carbon tests with concentrations less than the minimum requirement, and results of the reanalysis were greater than the minimum requirement (0.17% to 0.43%). No additional action was required in the areas represented by these re-analysis samples. Five areas were not accessible in 2017 due to standing water conditions. Following the 2018 dewatering activities, these areas were re-tested as five-point composite samples from the top 18 inches of placed sand. Results of the reanalysis were greater than the minimum carbon content requirement (0.43% to 0.77%). Results are presented in Table 5.3, and laboratory analytical reports included in Appendix J.
- **Onsite Crushed Concrete.** Crushed concrete from the Site was visually observed by the Port and their consultants for conformance with the gradation specifications and to make sure that the concrete was free from debris such as rebar. The concrete was approved for use as backfill in the LL Apartments Parcel excavations based on visual

- inspections by the Port and Aspect. Crushed concrete was used only as fill at and above elevation of 292 feet NAVD 88 above the historical wet season groundwater elevation and was not placed within 2 feet of the final surface grade.
- **Permeable Ballast/Crushed Rock.** The source for permeable ballast, Cadman, was tested for compliance with gradation and chemical specifications.
 - **Porous HMA.** The aggregate component of the porous HMA from Miles Sand & Gravel Company was tested for compliance with gradation and physical properties was approved for use at the DMCA.
 - **Construction Season 2 Topsoil.** The source of topsoil for Construction Season 2 changed to Pacific Topsoils, Inc. Topsoil from this source was tested for compliance with gradation and chemical specifications. Initially, this topsoil source did not meet the specification requirements for heavy oil-range hydrocarbons, but retesting with a silica gel cleanup resulted in lower concentrations that met specifications, which was acceptable given the high organic content of the topsoil. Chemical results for topsoil are presented in Table 5.1.
 - **Streambed Aggregate.** Sample material from Washington Rock Quarries, Inc., was tested for compliance with gradation and physical characteristics and approved for use in gravel swales and ditches in the wetland rehabilitation area.

5.3 COMPACTION OF BACKFILL

During Construction Season 1, compaction tests using a nuclear density gauge were performed by Mayes Testing Engineers, Inc., after each lift of common excavation soil, crushed concrete, and select fill were placed, graded, and compacted. Compaction testing was performed in Excavation Areas 1 through 6, and complied with specification requirements. In Excavation Area 5, initial compaction tests exceeded the maximum allowable compaction percentage for healthy vegetation growth, so the area was scarified and recompacted. Compaction Test Reports are included in Appendix G.

Compaction of the DMCA permeable pavement is discussed in Section 5.6.

5.4 WATER TREATMENT SYSTEM FUNCTION AND OPERATION

During Construction Season 1, temporary water treatment systems at the LL Apartments Parcel and LL Parcel were operated and maintained by trained technicians from Clear Water Services. Scarsella was responsible for conducting work in accordance with CSWGP No. WAR304723, which was transferred from the Port to Scarsella at the start of construction. Scarsella was responsible for submitting all necessary Discharge Monitoring Reports to Ecology.

The flow-through treatment system maintained daily compliance with the requirements of Administrative Order No. 13888 through a series of in-line instruments to measure water quality parameters, including pH and turbidity. Discharge water not meeting criteria was automatically recirculated back into the system for further treatment. Clear Water Services' technicians were

required to keep daily performance logs that included influent and effluent flow measurements, chemical dosing rates, treatment modifications, and any reports of non-conformances or issues. Electronic summary construction water management logs were compiled each month to summarize treatment for both systems (LL Parcel and LL Apartments Parcel) and report influent and effluent turbidity, effluent pH, discharge flow rates, and total gallons discharged. Daily logs were available on-site at all times during water treatment for review by the Port inspectors and their consultants. The electronic summary construction water management logs are included in Appendix I. Water treatment systems were demobilized from the Site at the completion of Construction Season 1 and were not required for completion of Construction Season 2 construction activities.

5.5 SITE SURVEY

Scarsella was responsible for maintaining control points as necessary throughout the duration of the work. Scarsella used GPS-mounted excavators to ensure that all control points were reached during the excavation of Excavation Areas 1 through 4 on the LL Apartments Parcel and Excavation Areas 5 and 6 on the LL Parcel. The control points around Lora Lake were surveyed and staked prior to lake filling. During lake filling activities, Scarsella used GPS equipment to check the fill extents and ensure that the control limits were reached. Elevations of lake fill were checked during placement by GPS-mounted dozers and spot checked by GPS equipment.

The Port's licensed survey crew was responsible for maintaining survey records to produce final as-builts. The survey conducted at the LL Apartments Parcel for compliance monitoring is discussed in Section 6.3. As-built drawings for all three parcels are included in Appendix A.

5.6 PERMEABLE PAVEMENT

Along with gradation and physical properties testing described in Section 5.2, other construction quality control elements for the placement of permeable pavement were performed including review of mix design and binder information, compaction testing, and infiltration testing.

- **Mix Design.** The mix design properties for the porous HMA included percentages of binder, air voids, volume increase ration, drain-down at 265 °F, and drain-down at 283 °F that all met design specifications. Mix design also included gyratory density and viscosity-temperature curves. The binder consisted of U.S. Oil & Refining Co. product PG 70-22. Mix design submittals are included in Appendix G.
- **Compaction Testing.** Porous HMA was placed within DMCA during Construction Season 2 as part of the permeable wildlife barrier. Compaction testing was performed by Construction Testing Laboratories, Inc., after each lift of HMA placement and ranged between approximately 82% and 84% compaction, which complied with the specification requirements. Compaction Test Reports are included in Appendix G.
- **Infiltration Testing.** After completion of porous HMA, infiltration testing was performed on the pavement surface on September 10, 2019. Four distinct areas of pavement were tested. The average infiltration rate of the four locations met specifications. Infiltration test results are included in Appendix G.

5.7 PLANTINGS QUALITY

Scarcella provided the Port with submittals listing all plants to be used on the project including the plant supplier, species, size, quantity, quality, and the location of the material. Plantings lists, counts, materials submittals, and plans are included in Appendix L.

All plants were inspected and counted on-site by ESA's landscape architect prior to installation to ensure that they were healthy and met specification.

At the beginning of Construction Season 2, all Construction Season 1 planting areas were inspected by ESA's landscape architect and Port environmental compliance staff, and any dead, missing, or poorly performing plants were replaced.

The Port will conduct ongoing monitoring of both the Construction Season 1 and the Construction Season 2 planting areas. At the end of the 1-year plant establishment period for the Construction Season 2 planting areas, Scarcella is required to replace any dead or poorly performing plants.

6.0 Compliance Monitoring

This section provides a summary of compliance monitoring conducted throughout the project.

6.1 AIR AND DUST MONITORING

Dust monitoring at the perimeter of the LL Apartments Parcel was performed between July 7 and September 21, 2017, to monitor airborne particulates upwind and downwind of earth-disturbing activities. Two pDR 1000 air monitors were placed on the perimeter fences in an approximate upwind and downwind position relative to the active work area on the LL Apartments Parcel. The instrument locations were systematically moved around the parcel's perimeter during the construction season to adequately represent upwind and downwind conditions given shifting wind directions throughout the project and to document conditions at locations around the entire parcel perimeter. Over the course of construction, the average upwind measured concentration during working hours (approximately 7 AM to 5 PM) was 0.44 milligrams per cubic meter (mg/m^3) and the average downwind concentration during working hours was 1.4 mg/m^3 . Outside of working hours the average upwind concentration was 0.58 mg/m^3 and the average downwind concentration was 0.70 mg/m^3 . The maximum recorded 15-minute time weighted average (TWA) particulate concentration of 12.7 mg/m^3 occurred on July 20, 2017, at 6:45 PM at the downwind location near the north edge of Excavation Area 4. The maximum 8-hour TWA particulate concentration of 11.1 mg/m^3 also occurred on July 20, 2017, between 1:00 PM and 9:00 PM. Measurements on this day represented greater than average air particulate concentrations, even after construction work had ceased on the LL Apartments Parcel. Excluding July 20, 2017, the greatest 15-minute TWA and 8-hour TWA (7.2 mg/m^3 and 5.5 mg/m^3 , respectively) occurred on July 14, 2017, at the downwind location on the parcel's north fence. Data collected during this day may have also been influenced by the air monitor's proximity to the SR 518 off-ramp project, which had multiple pieces of heavy equipment working during that time. Overall, the air monitoring data show that Scarsella's methods of dust control were effective and respirable dust did not leave the project perimeter at concentrations to cause a level of concern.

6.2 CONSTRUCTION WATER MANAGEMENT AND DISCHARGE MONITORING

Two water treatment systems were installed for construction water management at the LL Apartments Parcel and LL Parcel. The system used to treat stormwater and excavation dewatering at the LL Apartments Parcel is described in Section 4.4.2. The system used to treat lake dewatering water at Lora Lake is described in Section 4.5.1.2. The following sections describe compliance monitoring conducted under the NPDES CSWGP and Administrative Order No. 13888 for both discharge to the SR 518 Construction Stormwater Pond (with no overflow discharge to Miller Creek) and for discharge to the SR 518 Construction Stormwater Pond with overflow discharge to Miller Creek.

6.2.1 Lora Lake Apartments Parcel Construction Water Compliance Monitoring

Prior to the start of treated water discharge to the SR 518 Construction Stormwater Pond from the LL Apartments Parcel treatment system, a proof of treatment sample was collected on July 20, 2017, and analyzed for cPAHs, metals, heavy oil- and diesel-range hydrocarbons, pentachlorophenol, and dioxins/furans. The treated water was held in storage tanks while the proof of treatment sample was analyzed. The proof of treatment sample results were less than Indicator Levels established in Administrative Order No. 13888, and treated construction water from the LL Apartments Parcel began discharging to the SR 518 Construction Stormwater Pond on August 4, 2018. Treated water was monitored daily for turbidity, pH, and TPH (visual monitoring) during discharge and infiltration at the SR 518 Construction Stormwater Pond (without overflow discharge to Miller Creek). During water treatment and discharge from the LL Apartments Parcel, overflow from the SR 518 Construction Stormwater Pond to Miller Creek did not occur. The proof of treatment sample results for the LL Apartments Parcel are presented in Table 6.1. Water treatment analytical data reports are presented in Appendix J.

6.2.2 Lora Lake Parcel Construction Water Compliance Monitoring

Prior to the start of discharge to the SR 518 Construction Stormwater Pond from the LL Parcel treatment system, a proof of treatment sample was collected on May 24, 2017, and analyzed for cPAHs, metals, heavy oil-range hydrocarbons, pentachlorophenol, and dioxins/furans. The treated water was held in storage tanks while the proof of treatment sample was analyzed. The proof of treatment sample results were less than Indicator Levels established in Administrative Order No. 13888, with the exception of heavy oil-range hydrocarbons. A proof of treatment retest sample was collected on June 19, 2017, to retest for heavy oil-range hydrocarbons. Heavy oil-range hydrocarbon concentrations in the proof of treatment retest sample were non-detect and the construction water management system was approved to discharge to the SR 518 Construction Stormwater Pond on June 23, 2017. Treated water was monitored daily for turbidity, pH, and TPH (visual monitoring) during discharge and infiltration at the SR 518 Construction Stormwater Pond (without overflow discharge to Miller Creek). Overflow discharge from the SR 518 Construction Stormwater Pond to Miller Creek first occurred during the week of October 1, 2017. Discharge to the SR 518 Construction Stormwater Pond with overflow to Miller Creek also occurred during the week of October 8, 2017. Weekly sampling and analysis (in addition to daily monitoring requirements for turbidity) of the overflow discharge to Miller Creek was required for cPAHs, metals, heavy oil-range hydrocarbons, pentachlorophenol, and dioxins/furans per Administrative Order No. 13888 requirements. Sample results for the treated overflow discharge for both weeks when discharge to Miller Creek occurred were less than Indicator Levels established in Administrative Order No. 13888. The analytical results for the treatment overflow discharge samples collected on October 5 and 12, 2017, are presented in Table 6.1. Water treatment analytical data reports are presented in Appendix J.

During Construction Season 2, activities were conducted along the bank of Miller Creek. Turbidity monitoring was conducted in the creek to confirm no release of turbidity to the creek at levels exceeding the CSWGP limit of 5 NTU. Work on the East Lake Berm Opening was completed on

August 7, 2019, and connection of the drainage channel to Miller Creek was completed on August 19, 2019. There were no exceedances of the turbidity limit during these activities. Daily stormwater inspection reports that include turbidity monitoring are included in Appendix K.

6.2.3 Ecology Permit Compliance Inspections

Ecology conducted NPDES CSWGP inspections on June 28, October 5, and November 14, 2017. Ecology did not identify any corrective actions but recommended continued repair and maintenance of the BMPs at the Site. The CSWGP inspection reports are presented in Appendix K. No CSWGP inspections were conducted during Construction Season 2.

6.3 EXCAVATION AREA SOIL SAMPLING AND COMPLIANCE MONITORING DATA

Soil performance and confirmation monitoring for excavations at the LL Apartments Parcel and the LL Parcel were conducted in 2015 and 2016, in accordance with the Ecology-approved EDR. This monitoring fully delineated the horizontal and vertical extent of contaminated soil at the Site (with the exception of the Excavation Areas 5 and 6 sidewalls, discussed in Section 6.3.1). Soil performance and confirmation monitoring was performed prior to construction because of the lengthy laboratory turnaround time required for dioxin/furan analysis. During construction, the completed excavation extents were verified to a horizontal and vertical accuracy of greater than 0.1 feet by the Port's licensed survey crew. A means and methods memorandum documenting the Port's survey equipment, accuracy, and licensure and the as-built surveys for Excavation Areas 1 through 6 are presented in Appendix A.

6.3.1 Des Moines Memorial Drive Sidewall Soil Sampling

Three soil samples were collected from the eastern sidewall of Excavation Areas 3 and 4 along Des Moines Memorial Drive. Samples were collected approximately midway down the excavation sidewalls to characterize contaminant concentrations that are left in place after the remedial action construction. The sample at location CM-1 was collected from the eastern sidewall of Excavation Area 3 at approximately 3 feet bgs. The sample at location CM-2 was collected from the eastern sidewall at the central portion of Excavation Area 4 at approximately 3 inches bgs. The sample at location CM-3 was collected from the eastern sidewall at the southern portion of Excavation Area 4 at approximately 2 feet bgs. Samples collected from CM-1, CM-2, and CM-3 were analyzed for lead, pentachlorophenol, cPAHs, and dioxin/furan TEQ. The samples collected at all three locations were greater than the LL Apartments Parcel cleanup level of 13 pg/g for dioxin/furan TEQ at concentrations ranging from 19 to 110 pg/g. All samples were less than cleanup levels for lead, pentachlorophenol, and cPAHs. Sample results are presented in Table 6.2.

Three soil samples were collected from the western sidewalls of Excavation Areas 5 and 6 along Des Moines Memorial Drive. Samples were collected approximately midway down the excavation sidewalls to characterize contaminant concentrations that are left in place after the remedial action construction. The sample at location CM-5 was collected from the western sidewall at the northern portion of Excavation Area 5 at approximately 6 inches bgs. The sample at location CM-6 was collected from the western sidewall of the central portion of Excavation Area 6 at approximately 6 inches bgs. The sample at location CM-7 was collected from the western portion

of Excavation Area 5 at approximately 3 feet bgs. The samples collected from CM-5, CM-6, and CM-7 were analyzed for lead and dioxin/furan TEQ, and the sample collected from CM-4 was analyzed for dioxin/furan TEQ. The samples collected at CM-5, CM-6, and CM-7 had dioxin/furan TEQ concentrations greater than the LL Parcel cleanup level of 5.2 pg/g, with concentrations ranging from 7.4 to 20 pg/g. The sample collected at CM-6 was greater than the LL Parcel cleanup level of 50 milligrams per kilogram (mg/kg) for lead at a concentration of 110 mg/kg. Sample results are presented in Table 6.3.

6.3.2 Excavation Area 5 Base Sample

One soil sample was collected at location CM-4 from the base of the southern portion of Excavation Area 5 at 6 feet bgs. The sample was analyzed for dioxin/furan TEQ to document if any concentrations of dioxin/furan TEQ remained in place at the conditional POC. The dioxin/furan TEQ concentrations were detected at 0.39 pg/g, which is less than the LL Parcel cleanup level of 5.2 pg/g. The sample results are presented in Table 6.3. This sample provides confirmation of removal of soil from the LL Parcel exceeding cleanup standards.

6.4 GROUNDWATER MONITORING WELL INSTALLATION

6.4.1 LL Apartments Parcel Groundwater Monitoring Locations

Four groundwater monitoring wells were installed on or adjacent to the LL Apartments Parcel on September 7 and 8, 2017. One groundwater monitoring well location (detailed below) was replaced during sediment cap monitoring point installation, which took place between July 30, 2019, through August 2, 2019. The groundwater monitoring wells installed include the following:

- **MW-C1/VB1.** This is a dual-purpose well providing both an upgradient LL Apartments Parcel groundwater monitoring well point and a LL Parcel sediment cap monitoring network vicinity background monitoring well. MW-C1/VB1 is located in the northwest corner of the LL Apartments Parcel, in the vicinity of decommissioned well MW-2.
- **MW-C2.** This is a LL Apartments Parcel groundwater monitoring well, centrally located in the former source area within Excavation Area 3, in the vicinity of decommissioned well MW-1.
- **MW-C3.** This is a LL Apartments Parcel groundwater monitoring well downgradient of the historical source area (Excavation Area 3), directly west of Des Moines Memorial Drive and in the vicinity of decommissioned well MW-5.
- **MW-C4.** This is a replacement well for existing monitoring well MW-10 that was found to be compromised and partially filled with sand and sediment during the 2018 fourth quarter groundwater sampling event on December 12, 2018. It is located on the south side of Des Moines Memorial Drive bordering the northwest portion of the LL Parcel and is within 5 feet of the original MW-10 well location.
- **MW-VB2.** This is an upgradient LL Parcel sediment cap monitoring network vicinity background monitoring well located on the Port property south of the LL Apartments Parcel, in the northwest corner of the parcel.

The final groundwater performance monitoring well locations were modified slightly from those proposed in the EDR based on field conditions and access. The locations of the groundwater monitoring wells and sediment cap monitoring network vicinity background wells are presented on Sheets CG03.1 and CU03.1 of the as-built records (Appendix A).

Groundwater confirmation monitoring at the LL Apartments Parcel will include the collection of groundwater samples from wells MW-C1/VB1, MW-C2, MW-C3, and MW-C4 located in the right-of-way on the east side of Des Moines Memorial Drive, between LL Parcel Excavation Areas 5 and 6. The wells in the LL Apartments Parcel confirmation monitoring network will be sampled for four quarterly events per year, consisting of two wet season monitoring events and two dry season monitoring events. Groundwater compliance monitoring began in the wet season of spring 2019.

Groundwater monitoring wells MW-VB2 and MW-C1/VB1 are both part of the LL Parcel sediment cap performance and confirmation monitoring network, described further in the following section.

6.5 SEDIMENT CAP MONITORING POINT INSTALLATION

Seven sediment cap monitoring wells were installed on the LL Parcel from July 30, 2019, through August 2, 2019. The seven sediment cap monitoring wells include the following:

- **MW-CP1.** This is a LL Parcel sediment cap monitoring well point, located within northwest portion of the former lake footprint. This well is screened within the sand cap and above the geotextile liner.
- **MW-CP2.** This is a LL Parcel sediment cap monitoring well point, located within the central to northeast portion of the former lake footprint. This well is screened within the sand cap and above the geotextile liner.
- **MW-CP3.** This is a LL Parcel sediment cap monitoring well point, located within the southwest portion of the former lake footprint. This well is screened within the sand cap and above the geotextile liner.
- **MW-CP4.** This is a LL Parcel sediment cap monitoring well point, located within the southeast portion of the former lake footprint. This well is screened within the sand cap and above the geotextile liner.
- **MW-CP5.** This is a downgradient LL Parcel sediment cap monitoring well point, constructed within the southern edge of the south lake berm. It is located within the vicinity of the South Lake Berm Opening and Outlet to Miller Creek.
- **MW-CP6.** This is a downgradient LL Parcel sediment cap monitoring well point, constructed within the southeast corner of the south lake berm.
- **MW-CP7.** This is a downgradient LL Parcel sediment cap monitoring well point, constructed on the eastern portion of the lake berm. It is located just north of the East Lake Berm Opening.

The final sediment cap performance monitoring point well locations were partially modified from those proposed in the Compliance Monitoring Plan based on field conditions (final cap thickness) and accessibility. The locations of the sediment cap monitoring network are presented in the as-built drawings presented in Appendix A.

7.0 Institutional Controls

7.1 ENVIRONMENTAL COVENANTS

Environmental covenants (ECs) to implement institutional controls will be placed on the LL Apartments Parcel, LL Parcel, and DMCA. Draft ECs are included in Appendix O and will be finalized in coordination with the Port, the FAA, and Ecology. Final ECs will be included in the final version of this as-built report. Draft ECs have been provided to the FAA and are undergoing review. The draft ECs included in Appendix O do not yet incorporate feedback from the FAA.

The ECs 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 (refer to Appendix O).

The EC for the LL Apartments Parcel addresses dioxin/furan contamination remaining in soil greater than applicable cleanup levels and arsenic contamination remaining in groundwater greater than the applicable cleanup level. The restrictions in the EC include general requirements for protection and maintenance of the constructed remedy, the requirement to keep the property designated for commercial use in perpetuity, and prohibitions on site activities that would compromise the integrity of the remedy. The EC also restricts extraction of groundwater and requires maintenance of site monitoring wells and provision of access to those monitoring locations.

The ECs for the LL Parcel and DMCA address dioxin/furan contamination remaining in soil greater than applicable cleanup levels. The restrictions in these ECs are consistent with those described above; however, because groundwater at the LL Parcel and DMCA is not impacted, the ECs for the LL Parcel and DMCA do not include restrictions on groundwater extraction. These parcels are also required to remain in industrial use in perpetuity. Access requirements for these ECs include language to account for FAA requirements given the location of the parcels within the restricted access areas for the STIA.

7.2 DES MOINES MEMORIAL DRIVE RIGHT-OF-WAY

As part of permitting discussions with the City of SeaTac during remedial design, the Port and City of SeaTac discussed the potential need for institutional controls to protect the Des Moines Memorial Drive right-of-way if contaminant concentrations remained in soils at the edges of the right-of-way in excess of cleanup standards. During construction activities, soil samples were collected along the eastern sidewall of Excavation Areas 3 and 4 and along the western sidewall of Excavation Areas 5 and 6 abutting Des Moines Memorial Drive in order to document any dioxin/furan TEQ concentrations remaining in place beneath the City of SeaTac right-of-way. Soil sample results (detailed in Section 6.3.1) indicate concentrations of dioxins/furans are present at the edges of the right-of-way at concentrations ranging from 19 to 110 pg/g on the west side of the roadway and from 7.4 to 20 pg/g on the east side of the roadway. These data will be shared with the City of SeaTac so that any future roadway projects conducted by the city will be informed of the potential to encounter dioxin/furan contamination at levels greater than the residential cleanup standard but less than the industrial cleanup standard.

8.0 Public Involvement

8.1 PRE-CONSTRUCTION NOTICE

In April 2017, the Port, City of Burien, and WSDOT conducted public notice to residents in the neighborhood around the Site by sending a mailer. The notice outlined the projects impacting the neighborhood including construction activities at the LL Apartments Parcel and LL Parcel by the Port, stormwater conveyance upgrades being conducted by the City of Burien, and construction of the new off-ramp from eastbound SR 518 to Des Moines Memorial Drive by WSDOT. The flyer sent to the public is provided in Appendix P.

8.2 ONSITE SIGNAGE

Signs were installed to notify the public of ongoing construction activities at the Site. The signs included an overview map of the Site, general project information, and points of contact for the Port and Ecology.

8.3 CONSTRUCTION SEASON 1 COMPLETION

Construction Season 1 ran from April to December 2017. The Port did not receive any calls or comments from members of the public during the duration of Construction Season 1.

In December 2017, the Port included a project status update in their quarterly newsletter, Airmail, that is delivered to City of Burien residents. The newsletter described the work that had been completed and the work planned for the following season. A copy of the Airmail article is provided in Appendix P.

8.4 CONSTRUCTION SEASON 2 COMPLETION

Construction Season 2 ran from July 2019 to February 2020. The Port did not receive any calls or comments from members of the public during the duration of Construction Season 2.

The Port is preparing to include a project completion notice in their quarterly newsletter, Airmail, that is delivered to City of Burien residents. A copy of the Airmail article will be included in Appendix P in the final version of this as-built report.

9.0 Site Safety

All construction activities were required to be in compliance with Scarsella's Health and Safety Plan, which was submitted and accepted prior to the start of construction. Any personnel working on the Site was first required to complete the Port's safety training course to be aware of the Port's safety standards for all personnel working on Port projects. Daily safety meetings, as noted in Scarsella's daily log reports, were held each morning before work began to discuss hazards associated with the day's activities.

9.1 OSHA-REPORTABLE INCIDENTS

There were no Occupational Safety and Health Administration (OSHA)-reportable incidents that occurred on the Site during Construction Season 1 or Construction Season 2.

9.2 WEEKLY SAFETY INSPECTIONS

Weekly safety inspections were performed at the Site by the Port's construction safety manager assigned to the project to identify any potential hazards or corrective actions required to bring the project in line with Port safety standards. Construction Safety Inspection Reports for each item requiring attention were presented to Scarsella after the site safety inspection. The reports were updated with the date corrective action was taken and the inspector's final comments. There were no ongoing issues of safety violations during Construction Season 1 or Construction Season 2.

10.0 Deviations from Design and Lessons Learned

Several deviations from the design presented in the EDR and/or Project Manual (construction plans and specifications) occurred over the course of the project. Each deviation is discussed in the following sections.

10.1 YELLOW-PAINTED ASPHALT SPEED BUMPS

During design, yellow-painted concrete curbing at the LL Apartments Parcel was determined to contain elevated concentrations of lead, and disposal at an approved Subtitle D landfill was required. Yellow-painted asphalt speed bumps, however, were not identified during design as potentially containing elevated concentrations of lead but were encountered during demolition activities at the LL Apartments Parcel. The yellow-painted asphalt speed bumps were segregated from asphalt being sent to a recycler and disposed of as non-hazardous contaminated material at an approved Subtitle D landfill along with the yellow-painted concrete curbing.

10.2 POLYSTYRENE UNDER CONCRETE FOUNDATION

A layer of polystyrene was encountered during demolition of one of the concrete building foundations at the LL Apartments Parcel. This polystyrene layer was not encountered during previous soil investigations on this parcel. During demolition, the polystyrene and any entrained concrete were determined to be an unsuitable backfill material and were disposed of at a Subtitle D landfill. Cleaned concrete from the foundation was recycled and used as backfill. The polystyrene layer was not encountered under other concrete foundations at the LL Apartments Parcel.

10.3 LORA LAKE APARTMENTS PARCEL WATER TREATMENT SYSTEM

Construction water management for the LL Apartments Parcel was originally designed to include slip-lining and pumping water through the existing stormwater infrastructure underneath Des Moines Memorial Drive to the construction water treatment system used for the Lora Lake dewatering operations. During construction, it was determined that the existing stormwater infrastructure beneath Des Moines Memorial Drive could not be effectively slip-lined. It was also determined that contaminated water could not cross through the existing stormwater infrastructure unlined due to potential loss of water to the subsurface through cracks and breaks in the existing system that could not be prevented. To manage construction water at the LL Apartments Parcel, a construction water treatment system was installed at the LL Apartments Parcel to treat water prior to discharging to the existing stormwater infrastructure underneath Des Moines Memorial Drive, so that any water that were to exit the system through cracks and breaks would be treated. The construction water treatment system on the LL Apartments Parcel was designed and installed to the same specifications identified for construction water management at the LL Parcel. Discharged water from the water treatment system was routed back into the stormwater system that ran across Des Moines Memorial Drive toward the LL Parcel. The water was then pumped from a manhole near Excavation Area 5 to the SR 518 Construction Stormwater Pond for infiltration. Proof of treatment testing prior to discharge demonstrated compliance with the NPDES CSWGP and the associated Administrative Order No. 13888.

A description of the construction water management system at the LL Apartments Parcel is provided in Section 4.4.2. Compliance monitoring for the LL Apartments Parcel construction water management system is described in Section 6.2.1.

10.4 EXCESS COMMON EXCAVATION SOIL AND REGRADE AT LORA LAKE APARTMENTS PARCEL

The design for soil excavation at the LL Apartments Parcel assumed that up to 10% of soil generated during site grading would be geotechnically unsuitable for use as backfill. This was not the case, and no soil was removed from the Site due to geotechnical unsuitability. As a result, and due to other factors such as inaccuracies in the pre-construction site topography and thinner layer of high-organic duff at the ground surface requiring disposal, there was more common excavation soil than anticipated remaining at the LL Apartments Parcel following completion of excavations and backfilling. A comparison of the final grading design to the as-built condition indicated the unanticipated excess material totaled approximately 12,380 cubic yards. Grading design was revised to incorporate the excess material. The excess common excavation soil was placed in a terrace along the northern portion of the parcel, while the design grades at all work area limits were maintained to match existing conditions at the property lines. This includes design grades at the TCE area and the west work area limit adjacent to 8th Avenue South. An inward gradient was maintained to drain stormwater toward the bioswale and newly installed catch basin at the southeast portion of the LL Apartments Parcel. The post-construction Temporary Access Road on this parcel was modified from initial design to accommodate the revised grading. The final grade of the LL Apartments Parcel is presented in the as-built drawings in Appendix A.

10.5 LORA LAKE BATHYMETRIC SURVEY

The project specifications required the selected contractor to conduct a survey or scan of the lake bottom via divers or other equivalent methods to identify significant obstructions that would cause the geotextile to tear or rupture if not removed. A lake bottom multibeam survey was performed on July 19, 2017; however, due to excessive vegetation in the lake, the results of the survey provided a limited ability to discern debris on the lake bottom with the potential to puncture the geotextile fabric. Due to the noise picked up in the multibeam survey, only a partial bathymetric image could be generated from the survey. The partial bathymetric image was consistent with the complete and detailed survey conducted in 2015 to inform remedial design, and no conditions are known to have changed. An additional review of the historical aerial photographs was conducted to assess the potential for remnant docks or debris that could puncture or tear the geotextile fabric. Based on the review of available information, the intent of the lake survey was met and geotextile placement was allowed to proceed without completion of the survey. The 2015 bathymetric survey and 2017 partial bathymetric survey are presented in Appendix Q.

10.6 ALLOWABLE LAKE DRAWDOWN PUMPING RATES

The Administrative Order No. 13888 allowing overflow discharge to Miller Creek was not granted until after the construction documents were let to bid. Original estimated allowable pumping rates for lake drawdown and discharge to the SR 518 Construction Stormwater Pond were restricted to not exceed the infiltration capacity of the pond and prohibit discharge to

Miller Creek. Following receipt of the Administrative Order, construction documents were updated to include the permit, but the specification text describing maximum pumping rates was not updated. The contractor's treatment system was sized to this flow rate, which limited the flow rate capacity and range of the treatment system and increased the labor and operation hours required to draw down the lake for filling operations.

10.7 THIN-LIFT SAND PLACEMENT METHODS FOR LAKE FILLING

The means and methods selected by Scarsella resulted in challenges with achieving the project design. For lake filling, Scarsella placed carbon-amended sediment cap and lake fill first around the edges of the lake to secure the geotextile at the control points and prevent soft sediments from migrating from underneath the geotextile and out over lake edge, as described in the design specifications. Following completion of the 50-foot-wide perimeter swath, as described in Section 4.5.1.5, Scarsella began mass placement of material moving toward the center of the lake. Scarsella elected not to place a thin lift of 6 to 12 inches of carbon-amended sediment cap and fill material over the entire footprint of the lake, as required by the design specifications, due to limitations of equipment on-site. As a result of mass placement, soft lake sediments contained beneath the geotextile migrated to the center of the lake. Pressure from the mass placement of fill resulted in ruptures of the geotextile fabric in two locations. One tear occurred approximately 100 feet from the eastern shoreline and a second tear occurred mid-lake approximately 55 feet north of the southern shoreline. The tears were covered by a second piece of geotextile, followed by placement of carbon-amended sediment cap and lake fill. Release of contaminated sediments beyond the immediate vicinity of the rupture was not observed.

Due to the late start to lake sediment cap and fill operations, work continued into the start of the rainy season. Scarsella was unable to maintain dewatered site conditions due to groundwater recharge and recirculation of water into the lake from the SR 518 Construction Stormwater Pond during rain events. Scarsella obtained permission from the Ecology WQP to treat water for turbidity resulting from cap material placement only, because contamination was contained beneath the geotextile, and discharge water from the lake through geotextile filter bags to the existing enhanced wetland south of the lake. Water treatment continued in this manner until turbidity exceeded the 5 NTU criterion required by Ecology WQP for discharge to the existing enhanced wetland. When turbidity increased to greater than 5 NTU, lake water was pumped to the treatment system for treatment prior to discharge to the SR 518 Construction Stormwater Pond. The Port then instructed Scarsella to cover all remaining exposed areas of geotextile with sediment cap and lake fill via thin-lift placement. Scarsella first placed a second layer of geotextile fabric over the area to be filled, as a contingency to prevent material migration if the underlying geotextile were to rupture. Scarsella then proceeded with thin-lift placement using a sand slinger, placing the remaining carbon-amended sediment cap and lake fill material that had been stockpiled at the northern portion of the lake. Through coordination with Ecology, sediment cap and lake fill operations ceased for Construction Season 1 once a minimum of 6 inches of material was placed on the area of exposed geotextile. At the end of Construction Season 1, approximately 6 to 12 inches of carbon-sediment cap and lake fill was estimated to be present over the entire former lake footprint.

10.8 CONSTRUCTION SEASON 2 REDESIGN

The CD requires 18 inches of carbon amended sand cap placed over contaminated sediment. A cap material thickness survey was conducted by the Port on May 15, 2018, to investigate the depth of carbon-amended sand placement at the end of Construction Season 1. A marked metal rod was used to measure the depth of carbon-amended sand above the geotextile along 50-foot transects in the center of the lake where sediment mounding beneath the geotextile had occurred. Observed carbon-amended sand thicknesses in this area ranged from 3 inches to greater than 72 inches.

A geotechnical analysis was performed during the EDR design process to evaluate the anticipated magnitude and extent of settlement of the underlying peat material due to the increased load from the sediment cap and fill material. A large portion of the expected settlement for the Site was anticipated to occur within 1 month after fill placement in Construction Season 1. Total settlement was estimated to range from 1 to 3 feet over the first 6 months, with an additional 0.5 feet occurring over the subsequent decade. Settlement monitoring gauges were installed after placement of the geotextile, and 0.02 to 1.36 feet of settlement was observed between October 2017 and July 2018.

An updated survey was performed May 8, 2019, after observations of settlement movement had leveled off. This information was used in concert with the sand cap depth survey to determine the necessary amount of carbon-amended sand required to meet the 18 inches of cap thickness. The initial design called for a target elevation of 266 feet NAVD 88 across the lake. As a result of the sediment mounding underneath the geotextile fabric, the Construction Season 1 design grades could not be achieved and contaminated sediments (underneath the geotextile) were much closer to the final design grades than originally anticipated. As part of the Construction Season 2 redesign, a revised sand grading map was created to ensure that the minimum cap design thickness of 18 inches was met in areas of thinly placed carbon-amended sand.

These issues required the following design modifications to the wetland:

- A slightly higher average surface elevation due to less than expected settlement and to accommodate the placement of additional sand cap
- Reorientation of the elevated hummocks to align their crest with the areas that required the greatest additional cap thickness
- The number and length of swales were decreased to reduce subsurface drainage and allow for higher groundwater levels to match the higher ground elevations

Flow models for the Site were rerun to confirm that the redesigned conditions would not impact groundwater and surface flow (Appendix B). To accommodate the additional fill, compensatory floodplain storage was added to the DMCA planted filter strip by expanding its square footage.

11.0 Summary and Conclusions

11.1 LORA LAKE APARTMENTS PARCEL

Following completion of Construction Season 1, the remedial action at the LL Apartments Parcel accomplished the cleanup goals on this parcel. A total of 41,829 tons of contaminated material was removed from the four excavation areas on the LL Apartments Parcel, meeting the dioxin/furan TEQ remediation level for the LL Apartments Parcel soil across the parcel per the requirements of the CD. Following excavation, the LL Apartments Parcel was regraded to redirect storm drainage to a biofiltration swale on the south side of the parcel. Two new catch basins and associated conveyance pipes were installed to pipe stormwater away from the parcel and into the City of Burien stormwater system and the Port Mitigation Area. The LL Apartments Parcel was covered with topsoil and hydroseeded to stabilize the surface, and a Temporary Access Road was constructed on the parcel.

Four groundwater monitoring wells were installed on or near the LL Apartments Parcel. Three wells on the LL Apartments Parcel and one downgradient well in the City of SeaTac right-of-way provide the compliance monitoring network for long-term monitoring of site groundwater. Quarterly groundwater monitoring began in the spring of 2019 following completion and approval of construction activities and development of the project Compliance Monitoring Plan presented in Appendix R. These events will confirm groundwater compliance with the cleanup standards, now that the source of contamination to groundwater has been removed. An EC on the property will control the potential for damage of the containment remedy or contact with contaminated soil remaining on-site at concentrations greater than cleanup standards.

It is the Project Engineer's opinion that the cleanup of the LL Apartments Parcel was performed in accordance with applicable requirements under MTCA and met the objectives of the CD.

11.2 LORA LAKE PARCEL

The excavation of contaminated soil in Excavation Areas 5 and 6 was completed in Construction Season 1. A total of 1,248 tons of soil with contamination at concentrations greater than cleanup levels for the LL Parcel was removed and replaced with clean fill. Removal of this soil resulted in compliance with the LL Parcel soil cleanup standards, as confirmed by excavation confirmation samples including the base sample collected from Excavation Area 5. Due to this, institutional controls associated with contaminated soil are not required in the upland excavation areas of the LL Parcel. Following excavation and backfill of the contaminated soils within the Port Mitigation Area of the LL Parcel, the final surfaces for these areas were restored to their original condition and planted in accordance with the requirements of the NRMP. This accords with provisions of the Mitigation Area Restrictive Covenant that any activity in the Port Mitigation Area shall use methods that minimize damage to the Port Mitigation Area (State of Washington 2003).

Wetland rehabilitation was initiated in Construction Season 1 with placement of a geotextile fabric over the lake footprint, then placement of approximately 58,200 tons of sand amended with 44.5 tons of GAC. Wetland rehabilitation work was completed in Construction Season 2.

The final installation and regrading of the lake sediment cap and wetland rehabilitation activities at the LL Parcel were completed in Construction Season 2. Approximately 1,540 cubic yards of excess carbon-amended sand cap material were placed in the DMCA area as part of fill below the permeable pavement and crushed rock wildlife barriers. The East Lake Berm Opening and Miller Creek outlet channel were then constructed to facilitate drainage of the wetland rehabilitation area. Compliance monitoring wells were installed within the former Lora Lake footprint for future monitoring of the effectiveness of the sediment cap prior to the placement of approximately 6,200 cubic yards of topsoil and wetland rehabilitation activities. These compliance monitoring wells will be sampled as part of quarterly groundwater monitoring in the Compliance Monitoring Plan (Appendix R). These events will confirm groundwater compliance with the cleanup standards, now that the sediment cap and wetland rehabilitation are complete. An EC on the property will control the potential for damage of the containment remedy or contact with contaminated soil remaining in place in the footprint of the former Lora Lake.

It is the Project Engineer's opinion that the cleanup of the LL Parcel was performed in accordance with applicable requirements under MTCA and met the objectives of the CD.

11.3 1982 DREDGED MATERIAL CONTAINMENT AREA

The DMCA was cleared, regraded, and covered with aggregate to create a working surface that was used as a laydown yard for Construction Season 1.

The construction of the porous pavement and crushed rock wildlife barriers and planted filter strip were completed in Construction Season 2. These wildlife barriers were placed with imported sand, carbon-amended sand (from Lora Lake), permeable ballast, permeable geotextile, and porous HMA to prevent wildlife exposure to buried contaminated sediments from past dredging of Lora Lake while allowing infiltration of stormwater. Approximately 1,200 cubic yards were excavated from the planted filter strip area and placed beneath the crushed rock wildlife barrier before being covered with topsoil, planted, and seeded in accordance with the NRMP. An EC is placed on this area for the maintenance of the wildlife barriers and planted filter strip and to keep the DMCA only for industrial use. Details of the operations and maintenance requirements of the wildlife barriers is presented in the Operations and Maintenance Plan in Appendix S.

It is the Project Engineer's opinion that the cleanup and construction at the DMCA was performed in accordance with applicable requirements under MTCA and met the objectives of the CD.

12.0 References

- Floyd|Snider. 2016. *Port of Seattle Lora Lake Apartments Site, Engineering Design Report*. Prepared for Port of Seattle, Aviation Environmental Programs, Seattle-Tacoma International Airport. September.
- Parametrix, Inc. (Parametrix). 2001. *Natural Resource Mitigation Plan, Seattle-Tacoma International Airport, Master Plan Update Improvements*. Prepared for the Port of Seattle, Seattle-Tacoma International Airport. November.
- Port of Seattle. 2005. *Wildlife Hazard Management Plan, Seattle-Tacoma International Airport*. Unabridged Section 26 of the Airport Certification Manual for SEA. September.
- _____. 2011. *2010 Wetland Mitigation Monitoring Report, Port of Seattle MPU Natural Resource Mitigation*. Prepared by Port of Seattle, Aviation Division. April.
- State of Washington. 2003. *Declaration of Restrictive Covenants (Miller Creek/Lora Lake/Vacca Farm Wetland Floodplain Mitigation Area)*. Port of Seattle. 12 March.
- _____. 2015. *State of Washington, Department of Ecology v. Port of Seattle, Consent Decree RE: Lora Lake Apartments Site, Burien, Washington*. King County Superior Court. 9 September.
- Van den Berg, M., L.S. Birnbaum, M. Denison, M. De Vito, W. Farland, M. Feeley, H. Fiedler, H. Hakansson, A. Hanberg, L. Haws, M. Rose, S. Safe, D. Schrenk, C. Tohyama, A. Tritscher, J. Tuomisto, M. Tysklind, N. Walker, and R.E. Peterson. 2006. "The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds." *Toxicological Sciences* 93(2):223–241.
- Washington State Department of Ecology (Ecology). 2014. *2012 Stormwater Management Manual for Western Washington*. Publication No. 14-10-055. As amended December.
- _____. 2015. *Lora Lake Apartments Site, Final Cleanup Action Plan*. September.

**Port of Seattle
Lora Lake Apartments Site
Construction As-Built Report**

Tables

**Table 4.2
Lake Fill Settlement Monitoring Data**

Monitoring Point ID	SMP-01	SMP-02	SMP-03	SMP-04	SMP-05	SMP-06	SMP-07	SMP-08	SMP-09	SMP-10	SMP-11
Installation Date	10/10/17	10/10/17	10/10/17	11/3/17	10/5/17	10/5/17	10/6/17	10/23/17	10/23/17	3/1/18	3/1/18
Northing	174173.70	174254.30	174342.88	174181.42	174286.40	174241.51	174201.36	174064.70	174072.88	174212.04	174187.20
Easting	1272684.17	1272759.87	1272795.22	1272842.31	1272881.95	1272970.90	1273098.25	1273064.07	1272923.91	1272857.53	1272946.32
Top of Rod Elevation (feet NAVD 88)	273.21	272.92	273.12	275.44	271.21 (276.46) ¹	269.96 (275.16) ¹	272.43	272.10	274.03	271.98	273.14
Date Surveyed											
First 24 Hours After Installation	273.11	272.90	273.12	NM	270.50	268.90	272.31	272.08	274.02		
10/10/17					269.94	269.33	272.31				
10/13/17	272.95	272.39	272.93		270.03	269.25	272.31				
10/16/17	273.02	272.30	272.95		269.90	269.23	272.33				
10/19/17	273.00	272.40	272.95		269.86	269.20	272.45				
10/23/17	273.00	272.30	272.90		269.90	269.17	272.30				
10/26/17	273.00	272.25	272.95		269.85	269.10	272.25	272.00	273.93		
10/30/17	272.90	272.22	272.90		269.75	269.15	272.30	272.00	273.95		
11/2/17	272.98	272.25	272.90	275.44	274.95	274.25	272.25	272.05	273.90		
11/6/17	272.93	272.25	272.89	275.07	275.05	274.43	272.30	272.00	273.90		
11/9/17	272.95	272.28	272.89	274.95	275.10	274.40	272.33	272.00	273.84		
11/28/17	273.02	272.26	272.82	274.55	275.08	274.40	272.20	272.02	273.77		
12/19/17	272.97	272.26	272.90	274.50	275.10	274.48	272.30	272.01	273.76		
1/5/18	272.97	272.26	272.90	274.51	275.10	274.48	272.30	272.08	273.76		
1/19/18	272.97	272.26	272.90	274.52	275.10	274.47	272.30	272.06	273.76		
2/5/18	272.96	272.26	272.90	274.51	275.10	274.48	272.30	272.08	273.76		
2/19/18	272.96	272.26	272.89	274.50	275.09	274.48	272.29	272.08	273.76		
3/1/18	272.97	272.27	272.90	274.50	275.12	274.49	272.32	272.07	273.78	271.98	273.14
4/11/18	272.97	272.26	272.90	274.51	275.11	274.49	272.30	272.07	273.77	271.98	273.14
5/8/18	273.01	272.27	272.90	274.27	275.11	274.46	272.40	272.07	273.77	271.87	273.15
7/3/18	272.99	272.25	272.88	274.20	275.10	274.45	272.30	272.00	273.60	271.85	273.12
Total Settlement Prior to Season 2 Construction (feet)²	0.22	0.67	0.24	1.24	1.36	0.71	0.13	0.1	0.43	0.13	0.02
5/24/19	273.00	272.30	273.00	274.10	275.10	274.40	272.30	272.00	273.62	271.60	272.22
6/3/19	272.99	272.28	272.98	274.12	275.09	274.42	272.29	272.00	273.62	271.60	272.22
8/6/19	272.98	272.30	272.99	274.10	275.08	274.40	272.27	272.06	273.58	271.33	271.65
9/4/19	272.98	272.28	272.95	273.99	275.08	274.40	272.27	272.03	273.58	271.05	271.17
9/18/19	272.99	272.29	272.96	274.00	275.07	274.41	272.28	272.03	273.59	270.75	271.07
10/30/19	272.98	272.28	272.80	273.99	275.08	274.40	NM	272.03	273.58	270.50	270.95
Total Project Settlement (feet)³	0.23	0.64	0.32	1.45	1.38	0.76	0.15	0.07	0.45	1.48	2.19

Notes:
 1 The rod top elevations of monitoring points SMP-05 and SMP-06 were adjusted on November 1, 2017. The adjusted elevations are shown in parentheses.
 2 Total settlement prior to Construction Season 2 (as of July 3, 2018).
 3 Total settlement as of September 4, 2019.

Abbreviations:
 NAVD 88 North American Vertical Datum of 1988
 NM Not measured

Table 5.1
Import Select Fill and Topsoil Chemical Compliance Summary

Analytes	Units	Toxic Equivalent Factor	LL Apartments Parcel and DMCA Maximum Allowable Concentration	LL Parcel Maximum Allowable Concentration	Sample ID	Select Borrow	3 Way Topsoil	3 Way Topsoil ¹	3 Way Topsoil
					Sample Date	6/21/17	9/27/17	11/1/17	7/19/19
Metals by USEPA 6010C & 7471B									
Arsenic	mg/kg		20	20		1.34 J	5.4	--	6.8
Cadmium	mg/kg		2	4		0.283 J	0.03	--	0.3
Chromium	mg/kg		2,000	42		21.7	26.4	--	27
Lead	mg/kg		250	50		3.33 J	9.9	--	29
Mercury	mg/kg		2	0.1		0.0383	0.053	--	0.091
Total Petroleum Hydrocarbons by NWTPH-Gx & NWTPH-Dx									
Gasoline-Range Hydrocarbons	mg/kg		100	100		4.69 U	5.62 U	0.576 U	3 U
Diesel-Range Hydrocarbons	mg/kg		--	--		5.28 U	63.6	7.89	25 U
Heavy Oil-Range Hydrocarbons	mg/kg		--	--		15.9	185	32.4	190 SGA
Sum of Diesel- and Heavy Oil-Range Hydrocarbons	mg/kg		2,000	200		21.18	248.6	40.29	215
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) by USEPA 8270D									
Benzo(a)anthracene	µg/kg	0.1	--	--		19.2 U	8.4 J	--	41
Chrysene	µg/kg	0.01	--	--		19.2 U	17.4 J	--	50
Total Benzofluoranthenes	µg/kg	0.1	--	--		38.5 U	17.4 J	--	97
Benzo(a)pyrene	µg/kg	1	--	--		19.2 U	19.8 U	--	52
Dibenzo(a,h)anthracene	µg/kg	0.1	--	--		19.2 U	19.8 U	--	20 U
Indeno(1,2,3-cd)pyrene	µg/kg	0.1	--	--		--	--	--	37
Summed cPAH TEQ with One-Half of the Reporting Limit ^{2,3}	µg/kg		137	137		13.5 U, 9	12.3 J, 9	--	71
Phenols by USEPA 8041A									
Pentachlorophenol	µg/kg		2,500	2,500		5.95 U	8.51	--	20 U
Volatile Organic Compounds by USEPA 8260C									
Ethylbenzene	µg/kg		8,000,000	8,000,000		0.93 U	1.03 U	--	10 U
Toluene	µg/kg		6,400,000	6,400,000		0.93 U	1.03 U	--	10 U
Dioxins/Furans by USEPA 1613B									
2,3,7,8-TCDD	ng/kg	1	--	--		0.08 U	0.169 U	--	0.666
1,2,3,7,8-PeCDD	ng/kg	1	--	--		0.125 U	0.497 U	--	1.02 J
1,2,3,4,7,8-HxCDD	ng/kg	0.1	--	--		0.153 U	0.536 U	--	1.85 J
1,2,3,6,7,8-HxCDD	ng/kg	0.1	--	--		0.166 U	1.07 B	--	7.27
1,2,3,7,8,9-HxCDD	ng/kg	0.1	--	--		0.294 EMPC, J, B	0.884 U	--	3.63
1,2,3,4,6,7,8-HpCDD	ng/kg	0.01	--	--		1.95 J, B	29.2 B	--	201
OCDD	ng/kg	0.0003	--	--		20.7 B	282 B	--	1880
2,3,7,8-TCDF	ng/kg	0.1	--	--		0.085 U	0.208 J	--	1.05
1,2,3,7,8-PeCDF	ng/kg	0.03	--	--		0.067 J	0.685 U	--	0.534 J, K

Table 5.1
Import Select Fill and Topsoil Chemical Compliance Summary

Analytes	Units	Toxic Equivalent Factor	LL Apartments Parcel and DMCA Maximum Allowable Concentration	LL Parcel Maximum Allowable Concentration	Sample ID	Select Borrow	3 Way Topsoil	3 Way Topsoil ¹	3 Way Topsoil
					Sample Date	6/21/17	9/27/17	11/1/17	7/19/19
Dioxins/Furans by USEPA 1613B (cont.)									
2,3,4,7,8-PeCDF	ng/kg	0.3	--	--	0.062 U	0.566 U	--	--	1.9 J, K
1,2,3,4,7,8-HxCDF	ng/kg	0.1	--	--	0.103 U	0.804 U	--	--	2.48 J, K
1,2,3,6,7,8-HxCDF	ng/kg	0.1	--	--	0.1 U	0.655 U	--	--	1.49 J, K
1,2,3,7,8,9-HxCDF	ng/kg	0.1	--	--	0.153 U	0.586 U	--	--	0.941 J, K
2,3,4,6,7,8-HxCDF	ng/kg	0.1	--	--	0.11 U	0.675 U	--	--	2.44 J
1,2,3,4,6,7,8-HpCDF	ng/kg	0.01	--	--	0.182 EMPC, J, B	4.27 B	--	--	32.8
1,2,3,4,7,8,9-HpCDF	ng/kg	0.01	--	--	0.18 U	0.874 U	--	--	2.35 J, K
OCDF	ng/kg	0.0003	--	--	0.235 EMPC, J	12.1 B	--	--	122
Summed Dioxin/Furan TEQ with One-Half of the Detection Limit including EMPCs ^{4,5,6}	ng/kg		13	5.2	0.391 J	3.82 J, B	--	--	--
Summed Dioxin/Furan TEQ with One-Half of the Detection Limit excluding EMPCs ^{4,7,8}	ng/kg		13	5.2	0.375 J	3.82 J, B	--	--	--
Summed Dioxin/Furan TEQ including EMPCs ^{4,5,6}	ng/kg		13	5.2	--	--	--	--	7.35 J, K

Notes:

Blank cells are not applicable.

-- Not analyzed.

Value exceeded the Minimum Allowable Concentration for use at the LL Parcel.

- 1 Follow-up topsoil sample was submitted for reanalysis of diesel- and heavy oil-range hydrocarbons due to initial failed results. Resubmittal material was verified by the contractor as the same material used in the first analysis.
- 2 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.
- 3 Calculated using detected cPAH concentrations plus one-half the reporting limit for cPAHs that were not detected, and rounded to three significant figures.
- 4 World Health Organization 2005 Toxic Equivalency Factors were used for calculation of dioxin/furan TEQ (Van den Berg et al. 2006).
- 5 For non-detect concentrations, dioxins/furans are reported to the estimated detection limit; all other analytes are reported to the reporting limit.
- 6 EMPCs are treated as detected concentrations.
- 7 Calculated using detected dioxin/furan concentrations plus one-half the detection limit for dioxins/furans that were not detected, and rounded to three significant figures.
- 8 EMPCs are treated as non-detected concentrations.
- 9 Estimated TEQ excluding Indeno(1,2,3-cd)pyrene that was not reported, potentially biased low.

Abbreviations:

DMCA	1982 Dredged Material Containment Area	mg/kg	Milligrams per kilogram
LL Apartments Parcel	Lora Lake Apartments Parcel	ng/kg	Nanograms per kilogram
LL Parcel	Lora Lake Parcel	TEQ	Toxic equivalent
µg/kg	Micrograms per kilogram		

Qualifiers:

- B This analyte was detected in the method blank.
- EMPC Estimated maximum possible concentration.
- J Estimated concentration value detected at levels less than the reporting limit.
- K ALS Laboratory flag for EMPC - When the ion abundance ratios associated with a particular compound are outside QC limits, samples are flagged with a 'K' flag.
- SGA Analysis performed with silica gel cleanup.
- U This analyte is not detected at concentrations greater than the applicable reporting or detection limit.

Table 5.2
Import Lake Fill Chemical Compliance Summary

Sample ID	T-2 (C-P Seattle Yard)		T2 Sand Sample	T3 Sand Sample	T4 Sand Sample	T5 Sand Sample	T6 Sand Sample	T7 Sand Sample		
	Sample Date	10/11/17	10/16/17	10/20/17	10/23/17	10/31/17	11/1/17	11/3/17		
Analyte	CAS No.	Units	Maximum Allowable Concentration							
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) by USEPA 8270D										
Benzo(a)anthracene	56-55-3	mg/kg	--	0.0186 U	0.0184 U	0.0186 U	0.0184 U	0.0184 U	0.0188 U	0.0188 U
Chrysene	218-01-9	mg/kg	--	0.0186 U	0.0184 U	0.0186 U	0.0184 U	0.0184 U	0.0188 U	0.0188 U
Benzo(a)fluoranthene, Total	--	mg/kg	--	0.0372 U	0.0368 U	0.0373 U	0.0367 U	0.0369 U	0.0375 U	0.0375 U
Benzo(a)pyrene	50-32-8	mg/kg	--	0.0186 U	0.0184 U	0.0186 U	0.0184 U	0.0184 U	0.0188 U	0.0188 U
Indeno(1,2,3-cd)pyrene	193-39-5	mg/kg	--	0.0186 U	0.0184 U	0.0186 U	0.0184 U	0.0184 U	0.0188 U	0.0188 U
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--	0.0186 U	0.0184 U	0.0186 U	0.0184 U	0.0184 U	0.0188 U	0.0188 U
Benzo(g,h,i)perylene	191-24-2	mg/kg	--	0.0186 U	0.0184 U	0.0186 U	0.0184 U	0.0184 U	0.0188 U	0.0188 U
Summed cPAH TEQ with One-Half of the Detection Limit ^{1,2}	--	mg/kg	0.137	0.0140 U	0.0139 U	0.0140	0.0139 U	0.0139 U	0.0142 U	0.0142 U
Summed cPAH TEQ ^{1,3}	--	mg/kg	0.137	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Metals by USEPA 6010 or 7471										
Arsenic		mg/kg	20	0.73 J	4.37 J	3.24 J	1.17 J	3.82 J	3.32 J, D	3.74 J
Cadmium		mg/kg	4	0.17 J	0.22	0.26	0.37	0.28	0.45 J, D	0.22
Chromium		mg/kg	42	22	18	24	23	23	36 D	22
Lead	7439-92-1	mg/kg	50	2.4	2.2	1.5 J	1.6 J	1.9 J	1.5 J, D	1.6 J
Mercury		mg/kg	0.1	0.02 U	0.02 U	0.02 U	0.05	0.02 U	0.02 U	0.02 U
Petroleum Hydrocarbons by NWTPH-Gx/Dx										
Gasoline-Range Hydrocarbons	--	mg/kg	100	5 U	5 U	5 U	5 U	5 U	5 U	4 U
Diesel-Range Hydrocarbons	--	mg/kg	200	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Heavy Oil-Range Hydrocarbons	--	mg/kg	200	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Volatile Organic Compounds by USEPA 8260C										
Ethylbenzene	100-41-4	mg/kg	8,000	0.0009 U	0.00088 U	0.00086 U	0.00085 U	0.00076 U	0.00082 U	0.00019 U
Toluene	108-88-3	mg/kg	6,400	0.0009 U	0.00088 U	0.00061 J	0.00045 J	0.00028 J	0.00082 U	0.00014 U
Semivolatile Organic Compounds by USEPA 8041										
Pentachlorophenol	87-86-5	mg/kg	2.5	0.0058 U	0.00585 U	0.00579 U	0.0115	0.00568 J, B	0.00547 J, B	0.0064
Dioxins/Furans Congeners by USEPA 1613B										
2,3,7,8-TCDD	1746-01-6	ng/kg	--	0.031 U	0.044 U	0.036 U	0.042 U	0.061 U	0.052 U	0.136 U
1,2,3,7,8-PeCDD	40321-76-4	ng/kg	--	0.058 U	0.068 U	0.066 U	0.105 U	0.137 U	0.113 U	0.092 U
1,2,3,4,7,8-HxCDD	39227-28-6	ng/kg	--	0.089 EMPC, J, B	0.084 U	0.066 U	0.152 U	0.362 U	0.183 U	0.078 U
1,2,3,6,7,8-HxCDD	57653-85-7	ng/kg	--	0.098 EMPC, J, B	0.085 U	0.326 J	0.275 J	0.372 U	0.171 EMPC, J	0.075 U
1,2,3,7,8,9-HxCDD	19408-74-3	ng/kg	--	0.221 EMPC, J, B	0.09 U	0.122 J, B	0.238 EMPC, J, B	0.389 U	0.194 U	0.098 U
1,2,3,4,6,7,8-HpCDD	35822-46-9	ng/kg	--	2.16 J, B	0.596 EMPC, J, B	6.42 B	7.42 B	7.94 B	2.32 J, B	0.057 U
OCDD	3268-87-9	ng/kg	--	27.8 B	3.81 J, B	49.8 B	92.6 B	134 B	38.3 B	12 B
2,3,7,8-TCDF	51207-31-9	ng/kg	--	0.023 U	0.037 U	0.035 U	0.042 U	0.072 U	0.066 U	0.104 U
1,2,3,7,8-PeCDF	57117-41-6	ng/kg	--	0.048 U	0.047 U	0.053 U	0.061 U	0.097 U	0.076 U	0.092 U

Table 5.2
Import Lake Fill Chemical Compliance Summary

Sample ID				T-2 (C-P Seattle Yard)	T2 Sand Sample	T3 Sand Sample	T4 Sand Sample	T5 Sand Sample	T6 Sand Sample	T7 Sand Sample
Sample Date				10/11/17	10/16/17	10/20/17	10/23/17	10/31/17	11/1/17	11/3/17
Analyte	CAS No.	Units	Maximum Allowable Concentration							
Dioxins/Furans Congeners by USEPA 1613B (cont.)										
2,3,4,7,8-PeCDF	57117-31-4	ng/kg	--	0.05 U	0.056 U	0.055 U	0.063 U	0.095 U	0.077 U	0.093 U
1,2,3,4,7,8-HxCDF	70648-26-9	ng/kg	--	0.039 EMPC, J	0.04 U	0.052 EMPC, J	0.077 U	0.172 U	0.097 U	0.078 U
1,2,3,6,7,8-HxCDF	57117-44-9	ng/kg	--	0.043 U	0.037 U	0.046 U	0.078 U	0.169 U	0.096 U	0.075 U
1,2,3,7,8,9-HxCDF	72918-21-9	ng/kg	--	0.052 U	0.053 EMPC, J, B	0.047 U	0.087 U	0.201 U	0.114 U	0.098 U
2,3,4,6,7,8-HxCDF	60851-34-5	ng/kg	--	0.047 U	0.043 U	0.054 U	0.079 U	0.171 U	0.1 U	0.079 U
1,2,3,4,6,7,8-HpCDF	67562-39-4	ng/kg	--	0.14 EMPC, J, B	0.089 J, B	0.753 J, B	0.761 J, B	0.664 EMPC, J, B	0.215 J, B	0.057 U
1,2,3,4,7,8,9-HpCDF	55673-89-7	ng/kg	--	0.049 U	0.066 U	0.057 U	0.108 U	0.362 U	0.193 U	1.03 J, B
OCDF	39001-02-0	ng/kg	--	0.188 EMPC, J	0.134 U	2.72 B	3.16 EMPC, B	3.56 B	1.09 J, B	0.199 U
Summed Dioxin/Furan TEQ with One-Half of the Detection Limit ^{4,5,6}	--	ng/kg	5.2	0.137 J	0.100 J	0.210 J	0.272 J	0.339 J	0.193 J	0.178 J
Summed Dioxin/Furan TEQ ^{4,5,7}	--	ng/kg	5.2	0.076 J	0.013 J	0.137 J	0.162 J	0.127 J	0.054 J	0.014 J
Summed Dioxin/Furan TEQ with One-Half of the Detection Limit ^{4,5,8}	--	ng/kg	5.2	0.114 J	0.094 J	0.208 J	0.260 J	0.336 J	0.184 J	0.178 J
Summed Dioxin/Furan TEQ ^{5,7,8}	--	ng/kg	5.2	0.030 J	0.002 J	0.132 J	0.137 J	0.121 J	0.037 J	0.014 J

Notes:

-- Not applicable or not available.

RED/BOLD Detected exceedance of Indicator Level criteria.

1 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.

2 Calculated using detected cPAH concentrations.

3 Calculated using detected cPAH concentrations plus one-half the reporting limit for cPAHs that were not detected.

4 EMPC qualified concentrations are considered to be detects.

5 World Health Organization 2005 toxic equivalency factors were used for calculation of dioxin/furan TEQ (Van den Berg et al. 2006).

6 Calculated using detected dioxin/furan concentrations plus one-half the detection limit for dioxins/furans that were not detected. Results rounded to three significant figures.

7 Calculated using detected dioxin/furan concentrations only. Results rounded to three significant figures.

8 EMPC qualified concentrations are considered to be non-detects.

Abbreviations:

DMCA 1982 Dredged Material Containment Area

LL Apartments Parcel Lora Lake Apartments Parcel

LL Parcel Lora Lake Parcel

mg/kg Milligrams per kilogram

ng/kg Nanograms per kilogram

TEQ Toxic equivalent

Qualifiers:

B This analyte was detected in the method blank.

EMPC Estimated maximum possible concentration qualifier for High Resolution Gas Chromatography Dioxin.

J Estimated concentration value detected at levels less than the reporting limit.

U This analyte is not detected, the concentration given is the estimated detection limit.

Table 5.3
Organic Carbon Amendment in Lake Fill Summary

Sample ID ¹	Sample Date	Sample Time	Total Carbon (%) ²	Total Solids (%)	Dry Weight (grams)
Carbon Mix	9/28/17	3:23	0.78	97.22	0.97
Sand Mix	9/28/17	3:23	0.13	98.04	0.98
Carbon & Sand Mix	10/4/17	16:09	0.18	97.13	0.97
S3 Belt Pile	10/6/17	7:00	0.68	96.14	0.96
S4 Belt Pile	10/6/17	13:00	0.85	97.51	0.98
S5 (East of Belt)	10/6/17	13:00	2.35	97.38	0.97
S6 Under Belt	10/9/17	15:15	0.08	96.92	0.97
S7 NW Corner of Lake	10/9/17	15:15	0.09	96.47	0.96
S8 (West Edge)	10/10/17	14:50	0.09	97.01	0.97
S9 (Pile Under Belt)	10/10/17	14:50	0.04	97.17	0.97
S10 (Under Belt)	10/11/17	14:15	0.30	96.06	0.96
S11 (SW Corner of Lake)	10/11/17	14:15	0.10	96.65	0.97
Sand and Gravel Mix	10/13/17	NR	0.77 B	96.21	0.96
S13 SW Lakeside	10/16/17	15:15	0.63	96.91	0.97
S14 SW Lakeside	10/16/17	15:15	0.93	97.10	0.97
S15 SE Corner Lake	10/16/17	15:15	0.48	97.95	0.98
S16 S. Side of Lake	10/17/17	15:00	0.69	95.84	0.96
S17 (SE Corner)	10/18/17	15:00	0.61	95.87	0.96
S18 (SE End)	10/18/17	15:00	1.41	96.15	0.96
S20 (S Side of Lake)	10/19/17	13:30	1.25	95.66	0.96
S21 (S Side of Lake)	10/19/17	13:30	2.93	94.92	0.95
S22 (South Side of Lake)	10/20/17	13:00	0.63	96.25	0.96
S23 (South Side of Lake)	10/20/17	13:00	1.10	95.85	0.96
SE side of Lake	10/23/17	NR	0.07	95.55	0.96
SE side of Lake (corner)	10/23/17	NR	0.07	97.14	0.97
S-26	10/23/17	11:45	2.1	94.78	0.95
S-27	10/23/17	11:45	0.53	96.04	0.96
S28 (W.Side)	10/25/17	11:30	0.13	96.90	0.97
S 29 (W.Side)	10/25/17	11:30	0.04	96.09	0.96
S30 SW Corner	10/26/17	10:30	0.09	96.16	0.96
S31 SW Corner	10/26/17	10:30	0.04	96.36	0.96
S30 W. Side	10/27/17	11:30	0.81	96.48	0.96
S31 W. Side	10/27/17	11:30	0.55	96.56	0.97
S (W. Side)	10/30/17	15:30	0.23	97.40	0.98
S (South Side)	10/30/17	15:30	0.69	96.69	0.97
S-37 (PILE)	10/31/17	11:30	0.22	96.96	0.97
S-38 (SW CORNER)	10/31/17	11:30	0.37	97.23	0.97
S-39 S. End (Middle)	11/1/17	10:00	0.24	96.93	0.97
S-40 N. End (Middle)	11/1/17	10:00	0.13	97.20	0.97
S-40 (SW-Side)	11/2/17	13:30	0.36	96.22	0.96
S-41 (South Side)	11/2/17	13:30	0.34	95.89	0.96
S-43 S. End (Middle)	11/3/17	10:25	0.90	95.88	0.96
S-44 N. End (Middle)	11/3/17	10:25	1.01	95.06	0.95
S7R1 ³	11/9/17	10:15	0.17	96.64	0.97
S24R1 ⁴	11/9/17	10:15	0.43	92.37	0.92
S8R1 ⁵	7/17/18	14:00	0.77	97.30	0.97
S9R1 ⁶	7/17/18	14:00	0.49	98.14	0.98
S29R1 ⁷	7/17/18	14:00	0.73	97.48	0.97
S30R1 ⁸	7/17/18	14:00	0.48	97.52	0.98
S31R1 ⁹	7/17/18	14:00	0.73	97.89	0.98

Notes:

RED/BOLD Result failed requirement of 0.1 percent carbon by weight.

Five point composite sample submitted as a retest for a previously failed area.

- 1 A sample of carbon-amended sand was collected every 1,000 cubic yards. The sample was collected from the stockpile at the end of the conveyor system or in-situ from the area where material had been placed that day.
- 2 Lake fill was required to contain at least 0.1 percent carbon by weight.
- 3 Sample S7R1 was approved to replace the results of failed sample S6 and S7 on November 14, 2017.
- 4 Sample S24R1 was approved to replace the results of failed sample "SE side of Lake" and sample "SE side of Lake (corner)" on November 14, 2017.
- 5 Sample S8R1 was approved to replace the results of failed sample "S8 (West Edge)" on October 10, 2017.
- 6 Sample S9R1 was approved to replace the results of failed sample "S9 (Pile Under Belt)" on October 10, 2017.
- 7 Sample S29R1 was approved to replace the results of failed sample "S29 (West Side)" on October 25, 2017.
- 8 Sample S30R1 was approved to replace the results of failed sample "S30 (SW Corner)" on October 26, 2017.
- 9 Sample S301R1 was approved to replace the results of failed sample "S31 (SW Corner)" on October 26, 2017.

Abbreviation:

NR Not recorded

Qualifier:

B This analyte was detected in the method blank.

Table 6.1
Construction Water Treatment Sampling Results

Sample ID				POSLL-PTS-052417	POSLL-PTS-061917	LLA	GAC Effluent	GAC Effluent
Sample Description				LL Parcel Proof of Treatment	LL Parcel Proof of Treatment Retest ¹	LL Apartments Parcel Proof of Treatment	Overflow to Miller Creek Week 1	Overflow to Miller Creek Week 2
Sample Date				05/24/2017	6/19/17	7/20/17	10/5/17	10/12/17
Analyte	CAS No.	Units	Indicator Level ²					
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)								
Benzo(a)anthracene	56-55-3	µg/L	0.6	0.100 U	--	0.100 U	0.10 U	0.10 U
Chrysene	218-01-9	µg/L	0.6	0.100 U	--	0.100 U	0.10 U	0.10 U
Metals								
Lead	7439-92-1	µg/L	23.51	0.100 U	--	0.144	0.100 U	0.100 U
Petroleum Hydrocarbons								
Heavy Oil-Range Hydrocarbons	--	µg/L	250	280	200 U	200 U	220 U	200 U
Diesel-Range	--	µg/L	--	221	100 U	146	110 U	100 U
Semivolatile Organic Compounds (SVOCs)								
Pentachlorophenol	87-86-5	µg/L	9.07	0.25 U	--	0.50 U	0.25 U	0.25 U
Dioxin/Furan Congeners								
2,3,7,8-TCDD	1746-01-6	pg/L	10	0.42 U	--	1.86 EMPC, J	0.36 U	0.38 U
1,2,3,7,8-PeCDD	40321-76-4	pg/L	50	0.99 EMPC, J	--	0.88 U	0.43 EMPC, J, B	0.55 EMPC, J, B
1,2,3,4,7,8-HxCDD	39227-28-6	pg/L	50	1.20 EMPC, J	--	1.88 EMPC, J	0.44 EMPC, J	0.80 U
1,2,3,6,7,8-HxCDD	57653-85-7	pg/L	50	1.14 EMPC, J, B	--	1.58 U	0.43 U	1.24 EMPC, J
1,2,3,7,8,9-HxCDD	19408-74-3	pg/L	50	1.89 EMPC, J	--	1.69 U	0.50 EMPC, J, B	0.86 U
1,2,3,4,6,7,8-HpCDD	35822-46-9	pg/L	50	1.82 J, B	--	1.80 EMPC, J, B	1.19 EMPC, J, B	3.85 J, B
OCDD	3268-87-9	pg/L	100	8.88 J, B	--	9.88 EMPC, J, B	9.19 EMPC, J, B	92.3 B
2,3,7,8-TCDF	51207-31-9	pg/L	10	0.034 U	--	0.82 U	0.26 U	0.45 U
1,2,3,7,8-PeCDF	57117-41-6	pg/L	50	1.32 EMPC, J, B	--	1.83 EMPC, J	0.39 EMPC, J, B	0.85 EMPC, J
2,3,4,7,8-PeCDF	57117-31-4	pg/L	50	0.96 EMPC, J	--	1.28 U	0.38 U	0.62 J
1,2,3,4,7,8-HxCDF	70648-26-9	pg/L	50	0.88 EMPC, J	--	0.95 EMPC, J	0.32 EMPC, J, B	0.55 U
1,2,3,6,7,8-HxCDF	57117-44-9	pg/L	50	0.55 EMPC, J	--	1.01 U	0.37 EMPC, J, B	0.54 U
1,2,3,7,8,9-HxCDF	72918-21-9	pg/L	50	2.66 EMPC, J, B	--	2.98 EMPC, J	0.90 J, B	1.48 EMPC, J, B
2,3,4,6,7,8-HxCDF	60851-34-5	pg/L	50	1.02 J	--	2.12 J	0.24 U	0.59 U
1,2,3,4,6,7,8-HpCDF	67562-39-4	pg/L	50	0.76 EMPC, J, B	--	2.50 EMPC, J	0.64 J, B	2.31 J, B
1,2,3,4,7,8,9-HpCDF	55673-89-7	pg/L	50	1.82 J, B	--	1.20 U	0.30 U	0.83 EMPC, J, B
OCDF	39001-02-0	pg/L	100	3.58 J	--	4.35 J	2.14 EMPC, J, B	4.23 EMPC, J
Summed Dioxin/Furan TEQ with One-Half of the Detection Limit ^{4,5,6,7}	--	pg/L	6.7	2.49 J	--	3.65 J	1.00 J	1.51 J
Summed Dioxin/Furan TEQ ^{4,5,6,8}	--	pg/L	6.7	2.3 J	--	2.76 J	0.716 J	1.13 J
Summed Dioxin/Furan TEQ with One-Half of the Detection Limit ^{5,6,7,9}	--	pg/L	6.7	1.41 J	--	2.38 J	0.691 J	1.08 J
Summed Dioxin/Furan TEQ ^{5,6,8,9}	--	pg/L	6.7	0.142 J	--	0.212 J	0.0964 J	0.275 J

Notes:

-- Not available or not analyzed.

RED/BOLD Detected exceedance of Indicator Level criteria.

1 A second proof of treatment sample was collected for the LL Parcel treatment system on June 19, 2017, and re-run for petroleum hydrocarbons.

2 Indicator Levels as presented in Administrative Order No. 13888.

3 Indicator Level for diesel-range hydrocarbons were not established in Administrative Order No. 13888.

4 EMPC qualified concentrations are considered to be detects.

5 The Indicator Level for dioxin/furan TEQ is representative of the site-wide groundwater cleanup level. An Indicator Level for dioxin/furan TEQ was not established in Administrative Order No. 13888.

6 World Health Organization 2005 toxic equivalency factors were used for calculation of dioxin/furan TEQ (Van den Berg et al. 2006).

7 Calculated using detected dioxin/furan concentrations plus one-half the detection limit for dioxins/furans that were not detected. Results rounded to three significant figures.

8 Calculated using detected dioxin/furan concentrations only. Results rounded to three significant figures.

9 EMPC qualified concentrations are considered to be non-detects.

Abbreviations:

CAS	Chemical Abstracts Service	OCDD	Octachlorodibenzo-p-dioxin
GAC	Granular activated carbon	OCDF	Octachlorodibenzofuran
HpCDD	Heptachlorodibenzo-p-dioxin	pg/L	picogram per liter
HpCDF	Heptachlorodibenzofuran	PeCDD	Pentachlorodibenzo-p-dioxin
HxCDD	Hexachlorodibenzo-p-dioxin	PeCDF	Pentachlorodibenzofuran
HxCDF	Hexachlorodibenzofuran	TCDD	Tetrachlorodibenzo-p-dioxin
LL Apartments Parcel	Lora Lake Apartments Parcel	TCDF	Tetrachlorodibenzofuran
LL Parcel	Lora Lake Parcel	TEQ	Toxic equivalent
µg/L	Microgram per liter		

Qualifiers:

B This analyte was detected in the method blank.

EMPC Estimated maximum possible concentration qualifier for High Resolution Gas Chromatography Dioxin.

J Estimated concentration value detected at levels less than the reporting limit.

U This analyte is not detected, the concentration given is the estimated detection limit.

Table 6.2
Lora Lake Apartments Parcel Soil Sample Results

Location Name				CM-1	CM-2	CM-3
Field Sample ID				A3-3-072517	A4N-0-072517	A4S-2-072017
Sample Date				7/25/17	7/25/17	7/20/17
Depth (ft bgs)				3.0	0.25	2.0
Analytes	CAS No.	Cleanup Level	Units			
Metals						
Lead	7439-92-1	250	mg/kg	39	100	10.0
Semivolatile Organic Compounds (SVOCs)						
Pentachlorophenol	87-86-5	2,500	µg/kg	53	120	4.9 JN
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)						
Benzo(a)anthracene	56-55-3	--	µg/kg	20 U	15 J	19 U
Benzo(a)pyrene	50-32-8	--	µg/kg	20 U	19	19 U
Benzo(b)fluoranthene (total)	--	--	µg/kg	14 J	49	39 U
Chrysene	218-01-9	--	µg/kg	9.0 J	30	19 U
Dibenzo(a,h)anthracene	53-70-3	--	µg/kg	20 U	19 U	19 U
Indeno(1,2,3-cd)pyrene	193-39-5	--	µg/kg	20 U	15 J	19 U
Summed cPAH TEQ with One-Half of the Reporting Limit ^{1,2}	--	137	µg/kg	14 J	28 J	15 U
Summed cPAH TEQ ^{1,3}	--	137	µg/kg	1.5 J	28 J	0 U
Dioxin/Furan Congeners						
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	pg/g	3,200	3,400	750
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	pg/g	910	920	160
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	pg/g	32	33	5.4
1,2,3,4,7,8-HxCDD	39227-28-6	--	pg/g	31	28	3.1
1,2,3,4,7,8-HxCDF	70648-26-9	--	pg/g	23	18	2.1
1,2,3,6,7,8-HxCDD	57653-85-7	--	pg/g	94	93	15
1,2,3,6,7,8-HxCDF	57117-44-9	--	pg/g	17	15	1.8
1,2,3,7,8,9-HxCDD	19408-74-3	--	pg/g	58	68	9.4
1,2,3,7,8,9-HxCDF	72918-21-9	--	pg/g	2.6	3.2	0.62 U
1,2,3,7,8-PeCDD	40321-76-4	--	pg/g	16	21	3.4
1,2,3,7,8-PeCDF	57117-41-6	--	pg/g	1.5 J	2.1 J	0.38 U
2,3,4,6,7,8-HxCDF	60851-34-5	--	pg/g	25	24	3.0
2,3,4,7,8-PeCDF	57117-31-4	--	pg/g	4.6	4.3	0.68 J
2,3,7,8-TCDD (Dioxin)	1746-01-6	--	pg/g	2.4	2.8	0.60 J
2,3,7,8-TCDF	51207-31-9	--	pg/g	0.97 J	1.6 J	0.16 U
Total OCDD	3268-87-9	--	pg/g	32,000	38,000 J	7,900 J
Total OCDF	39001-02-0	--	pg/g	2,500	3,500	590
Summed Dioxin/Furan TEQ ^{4,5}	--	13	pg/g	97 J	110 J	19 J
Summed Dioxin/Furan TEQ with One-Half of the Detection Limit ^{4,6}	--	13	pg/g	97 J	110 J	19 J

Notes:

-- Not applicable or not available.

RED/BOLD Detected concentration exceeds the cleanup level.

- 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 plus one-half the reporting limit for cPAHs that were not detected.
- 3 Calculated using detected cPAH concentrations.
- 4 World Health Organization 2005 Toxic Equivalency Factors were used for calculation of dioxin/furan TEQ (Van den Berg et al. 2006).
- 5 Calculated using detected dioxin/furan concentrations.
- 6 Calculated using detected dioxin/furan concentrations plus one-half the detection limit for dioxins/furans that were not detected.

Abbreviations:

CAS	Chemical Abstracts Service	OCDD	Octachlorodibenzo-p-dioxin
ft bgs	Feet below ground surface	OCDF	Octachlorodibenzofuran
HpCDD	Heptachlorodibenzo-p-dioxin	PeCDD	Pentachlorodibenzo-p-dioxin
HpCDF	Heptachlorodibenzofuran	PeCDF	Pentachlorodibenzofuran
HxCDD	Hexachlorodibenzo-p-dioxin	pg/g	Picograms per gram
HxCDF	Hexachlorodibenzofuran	TCDD	Tetrachlorodibenzo-p-dioxin
µg/kg	Micrograms per kilogram	TCDF	Tetrachlorodibenzofuran
mg/kg	Milligrams per kilogram	TEQ	Toxic equivalent

Qualifiers:

- J Analyte was detected, concentration is considered an estimate.
- U Analyte was not detected at the given reporting limit.

Table 6.3
Lora Lake Parcel Soil Sample Results

Location Name				CM-4	CM-5	CM-6	CM-7
Field Sample ID				LL-CM4-6-102517	LL-CM5-0.5-102517	A6-0.5-101817	LL-CM7-3-102517
Sample Date				10/25/17	10/25/17	10/18/17	10/25/17
Depth (ft bgs)				6.0	0.5	0.5	3.0
Analytes	CAS No.	Cleanup Level	Units				
Metals							
Lead	7439-92-1	50	mg/kg	--	12	110	45
Dioxin/Furan Congeners							
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	pg/g	12 U	170	330	730
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	pg/g	0.42 U	30	44	150
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	pg/g	0.62 U	2.7	1.8	6.6
1,2,3,4,7,8-HxCDD	39227-28-6	--	pg/g	0.28 U	1.5	4.5	3.5
1,2,3,4,7,8-HxCDF	70648-26-9	--	pg/g	0.24 U	2.6	3.5	3.8
1,2,3,6,7,8-HxCDD	57653-85-7	--	pg/g	0.29 U	6.1	17	21
1,2,3,6,7,8-HxCDF	57117-44-9	--	pg/g	0.24 U	3.5	2.9	3.3 U
1,2,3,7,8,9-HxCDD	19408-74-3	--	pg/g	0.25 U	3.3	8.6	18
1,2,3,7,8,9-HxCDF	72918-21-9	--	pg/g	0.27 U	1.6 U	1.9	3.6
1,2,3,7,8-PeCDD	40321-76-4	--	pg/g	0.19 U	1.1	2.3	3.0 U
1,2,3,7,8-PeCDF	57117-41-6	--	pg/g	0.10 U	0.57 U	1.7 J	1.2
2,3,4,6,7,8-HxCDF	60851-34-5	--	pg/g	0.25 U	9.0	3.8	7.8
2,3,4,7,8-PeCDF	57117-31-4	--	pg/g	0.11 U	1.9	2.7	2.7
2,3,7,8-TCDD (Dioxin)	1746-01-6	--	pg/g	0.067 U	0.21 U	1.5	0.44 U
2,3,7,8-TCDF	51207-31-9	--	pg/g	0.12 U	0.53 J	1.2	2.8
Total OCDD	3268-87-9	--	pg/g	250 J	2,400 J	2,800	8,500 J
Total OCDF	39001-02-0	--	pg/g	5.3	120	50	470
Summed Dioxin/Furan TEQ ^{1,2}	--	5.2	pg/g	0.077 J	7.2 J	14 J	19 J
Summed Dioxin/Furan TEQ with One-Half of the Detection Limit ^{1,3}	--	5.2	pg/g	0.39 J	7.4 J	14 J	20 J

Notes:

-- Indicates not applicable or not available.

RED/BOLD Detected concentration exceeds the cleanup level.

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

2 Calculated using detected dioxin/furan concentrations.

3 Calculated using detected dioxin/furan 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

µg/kg Micrograms per kilogram
mg/kg Milligrams per kilogram
OCDD Octachlorodibenzo-p-dioxin
OCDF Octachlorodibenzofuran
PeCDD Pentachlorodibenzo-p-dioxin
PeCDF Pentachlorodibenzofuran

pg/g Picograms per gram
TCDD Tetrachlorodibenzo-p-dioxin
TCDF Tetrachlorodibenzofuran
TEQ Toxic equivalent

Qualifiers:

J Analyte was detected, concentration is considered an estimate.

U Analyte was not detected at the given reporting limit.