April 2024
Luther Burbank Park Waterfront Improvements

Critical Areas Study

Prepared for City of Mercer Island

April 2024
Luther Burbank Park Waterfront Improvements

Critical Areas Study

Prepared for
City of Mercer Island Public Works
9611 SE 36th Street
Mercer Island, Washington 98040

Prepared by
Anchor QEA
1201 3rd Avenue, Suite 2600
Seattle, Washington 98101

LIST OF REPORT CONTRIBUTORS

Report prepared by:

Sara Noland, Senior Biologist/Planner, Anchor QEA

Josh Jensen, Senior Managing Planner, Anchor QEA

Geotechnical review completed by Geoengineers (see Appendices C and D)

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

ABBREVIATIONS

ADA	Americans with Disabilities Act
BMP	best management practice
CAS	Critical Areas Study
City	City of Mercer Island
DNR	Department of Natural Resources
DPS	distinct population segment
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FRP	fiberglass-reinforced plastic
FWHCA	fish and wildlife habitat conservation area
lf	linear feet
LID	low impact development
LWD	large woody debris
MICC	Mercer Island City Code
NAVD88	North American Vertical Datum of 1988
NMFS	National Marine Fisheries Service
OHWM	ordinary high water mark
Project	Luther Burbank Park Waterfront Improvements Project
sf	square foot
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
UST	underground storage tank
WDFW	Washington Department of Fish and Wildlife

1 Introduction

The City of Mercer Island (City) is proposing the Luther Burbank Park Waterfront Improvements Project (Project) to repair, maintain, and enhance the waterfront program at Luther Burbank Park in the City of Mercer Island, Washington (Figures 1 and 2).

This Critical Areas Study (CAS) has been prepared by Anchor QEA to support the local permitting and land use review for the Project consistent with the critical areas reporting requirements in the Mercer Island City Code (MICC) Chapter 19.07.110. The Project is located within the City's regulated shoreline area. According to MICC 19.13.010D, critical areas within shoreline jurisdiction are regulated by the critical areas code requirements in MICC 19.07.010 through and including MICC 19.07.190, Ordinance 19C-05.

This CAS evaluates the presence of existing critical areas within the Project area and potential impacts to the critical areas and regulated buffers as defined in MICC Chapter 19.07. Critical areas regulated by the City include wetlands, watercourses, fish and wildlife conservation areas (FWHCAs), and geologically hazardous areas. Per MICC 19.07.170, the site review also included a survey for bald eagle (*Haliaeetus leucocephalus*) nests within the Park to identify areas used by bald eagles for foraging, nesting, and roosting, or within 660 feet of a bald eagle nest.

Project staff gathered and reviewed existing information consistent with MICC Chapter 19.07 to assess existing critical areas. Anchor QEA performed a critical areas site visit on February 19, 2020. Subsequent site visits have occurred in 2021 and 2022 as part of this Project, confirming existing conditions within the Project area.

A Project plan set is provided as Appendix A. Site photographs are provided in Appendix B.

1.1 Project Purpose

Luther Burbank Park is a popular park used by the residents of Mercer Island and the greater Seattle-Bellevue metro area for many waterfront recreational activities. The dock structures in their current configuration were constructed in 1974 to accommodate small boats in a different shoreline and recreational setting than exists today. The purpose of the Project is to modernize and optimize public access, recreational uses, and public safety, including reconfiguring the waterfront park to better accommodate small boats and nonmotorized watercraft and improve Americans with Disabilities Act (ADA) and universal access to the docks, viewing deck, and beach, while avoiding and minimizing potential impacts to sensitive environments and resulting in no net loss of ecological function.

1.2 Project Background and Description

The Project includes repairing and replacing portions of the existing dock structures, including repairs to the north dock structure, and replacing and reconfiguring the central and south dock structures to accommodate waterfront programming and current and projected watercraft uses. Other waterside improvements include installing a grated overwater public access platform in the nearshore to improve access to the water along the existing plaza area.

The Project also includes upgrades to the waterfront plaza and Boiler Building. These include Boiler Building repairs (i.e., new roof, seismic retrofits, and new lighting); Boiler Building restroom annex renovation to improve the restroom facilities and construct a new rooftop viewing deck; concession stand repairs; and waterfront plaza renovations and access upgrades.

The Project will improve access to the waterfront by creating new ADA and universally accessible routes from the plaza to the viewing deck on the existing Boiler Building annex restroom rooftop, and to the expanded north beach area that will be improved with fish habitat gravel and riparian plantings. The accessible route will connect to the adjacent future south shoreline trail that will be constructed as part of a separate project. The accessible route will also connect to the existing trail that continues north of the Project area. All proposed waterfront improvements including the dock structures and gangways will also meet accessibility requirements.

Based on requirements provided by the Fire Department in an on-site meeting with KPFF Consulting Engineers in December 2022, the project will add a new ductile fire water line, fire hydrants, and a fire access apparatus access road (hammerhead). While installing that fire line, the project will excavate an existing gravel trail (1,235 square feet [sf]) and replace it with an in-kind gravel trail (1,235 sf). The project will also take advantage of some existing paved areas and expand it with permeable geogrid (2,384 sf) to create the hammerhead. Existing trees will be protected in place for the extent of the trenching, and the disturbed lawn and plant area will be renovated to match existing conditions.

The waterfront plaza renovations and access upgrades will incorporate low impact development (LID) features that will provide stormwater buffering and biofiltration functions similar to a vegetated shoreline. An irrigation intake system will also be installed at the south end of the plaza.

The Project includes upland, shoreline, in-water, and overwater work along Lake Washington. Figures 3 and 4 provide an overview of the project components. Appendix A provides a detailed plan set. Project details and construction methods are described in the following subsections.

1.3 Upland and Shoreline Improvements

The proposed upland and shoreline improvements include the following (Figure 3):

- **Boiler Building Repairs:** installing a new roof, seismic retrofits, and new lighting on the existing building

- **Boiler Building Restroom Annex Renovation (Rooftop Viewing Deck):** renovating the existing restrooms, constructing a new rooftop viewing deck, and installing new lighting on the existing building
- **Concession Stand Repairs:** installing improvements and a new electrical panel within the concession area of the existing building
- **Waterfront Plaza Renovations and Access Upgrades:**
  - Installing 1,970 sf of planting and irrigation
  - Installing 1,800 sf of plaza paving improvements
  - Installing three benches and one picnic table
  - Installing 65 linear feet (lf) of a new structural ADA-accessible ramp to the viewing deck
  - Expanding the north beach access with a new 120-lf ADA-accessible pathway connection and beach expansion
  - Installing a 6-foot concrete seatwall at north beach pathway
  - Installing 61 lf of split rail fencing
  - Installing a new 140-lf on-grade pathway connection between the structural ramp, south shoreline trail, and upland plaza
  - Replacing an existing 252-lf gravel trail (1,235 sf) with an in-kind gravel trail (1,235 sf) at the new fire line installation
  - Installing a ductile iron fire water line and fire hydrants
  - Installing geogrid to expand an existing hardscape area to create an approved fire apparatus access turnaround for fire trucks
  - Installing granite steps at the new on-grade pathway
- **Shoreline and Beach Enhancements:** expanding the north beach by placing fish habitat gravel landward of the upland edge of the existing beach, relocating boulders and large woody debris (LWD) along the shoreline, enhancing riparian vegetation.
- **Waterfront Drainage LID:** installing new site drainage improvements including 2,500 sf of pervious paver drainage design at the plaza, installing a silva cell biofiltration array with a new stormwater outfall to the lake, and complying with all associated storm drainage reporting and compliance requirements
- **Irrigation Intake System Installation:** replacing and installing a new irrigation intake, pump system, and supply lines
- **Fire Department Required Updates:** adding a fire water line, fire hydrants, and a fire access apparatus access road and renovating an existing gravel trail

1.3.1 Boiler Building Repairs

Exterior repairs to the Boiler Building will include installing seismic retrofits, a new roof, and replacing and installing wall-mounted light fixtures to enhance public safety.

1.3.2 Boiler Building Restroom Annex Renovation (Viewing Deck)

The Boiler Building restroom annex rooftop will be renovated to facilitate a new rooftop viewing deck. The viewing deck will be constructed with Bison wood-paneled deck-surfacing material on pedestals with a 1/2-inch maximum gap for ADA accessibility on top of the existing concrete roof. The existing rooftop elevation is 29 feet, and the rooftop itself is 40 feet by 21 feet in length and width. The new rooftop will be elevated to approximately 30 feet in height to match the future second level of the Boiler Building and will match the existing extent of the rooftop area. Amenities, such as a new guardrail, light fixtures, new signage displays, and site furnishings, will be installed.

1.3.3 Concession Stand Repairs

The concession stand is located between the Boiler Building and restrooms and is approximately 160 sf in area. An existing casework area on the east side of the wall will be removed and replaced with a new 6-inch concrete wall with concrete counter above. A new sink will be installed in the southwest corner of the concession area and a new electrical panel will be installed in the northwest corner.

1.3.4 Waterfront Plaza Renovations and Access Upgrades

Table 1 describes each Project element and the impervious surface removed, replaced, or installed for each feature. Approximately 25% of the Project area is currently impervious surfaces (buildings, pavement, driveway, and docks). The Project will reduce overall impervious surface area by approximately 5%.

Plaza renovations for the Project include removing 5,205 sf of concrete pavers, brick pavers, concrete paving, and a small area of asphalt paving in front of the Boiler Building restroom annex under the breezeway. Approximately 2,595 sf of existing impervious surface will be replaced, including 2,015 sf of new concrete paving in the western portion of the plaza by the Boiler Building and 580 sf of gravel driveway paving. Approximately 2,410 sf of pervious pavers will be installed in the eastern part of the plaza (not included in impervious surface calculations). Two benches are proposed along the outside of Boiler Building in the plaza, and one picnic table is proposed at southern end of the plaza.

The Project includes several shoreline trail access improvements (on-grade pathway and ramp, north beach pathway). The new on-grade pathway south of the plaza will be an accessible, crushed rock surfaced pedestrian trail. Approximately 42 cubic yards of terraced rock wall (375 sf) will be placed to accommodate ADA-accessible slopes along this pathway. An existing stormwater outfall will be temporarily removed and reinstalled during this construction.

A new structural ADA-accessible ramp is designed to provide access to the new viewing deck and will be located behind the Boiler Building restroom annex on the northwest side of the rooftop. Several footings will be installed to support the viewing deck access ramp, ranging from 3.5 to 5.5 feet deep and requiring excavation of approximately 20 cubic yards of soil total. The ramp will connect to the new on-grade crushed gravel pathway that will lead down to the plaza, dock, and future south shoreline trail. The on-grade pathway will also lead uphill to a new granite step feature that connects to an existing uphill trail network. Construction of the upland trail will be completed with standard heavy equipment including small excavators, small bulldozer, dump truck, and similar equipment.

The north beach access will be expanded with a new universally accessible pathway connection. A gravel pathway will connect to a concrete trail segment leading to a seatwall. A sheet pile wall with concrete cap will be installed at the east end of the trail. The trail will be supported by a rock terrace on the landward side and a rock revetment adjacent to the beach.

Table 1
Impervious Surfaces Summary

Project Element	Impervious Surface Removed (sf)	Impervious Surface Replaced (sf)	New Impervious Surface Installed (sf)
Waterfront Plaza			
Concrete pavers, brick pavers, and concrete paving at waterfront plaza	4,425	2,015	n/a
Asphalt paving at Boiler Building restroom annex breezeway	320	n/a	n/a
Driveway and ADA Trail/Ramp			
Gravel driveway paving	580	580	n/a
Gravel on-grade pathway south of plaza	170	n/a	700
Structural concrete ADA-accessible ramp to the new viewing deck	n/a	n/a	260
Rock terrace at on-grade pathway	n/a	n/a	375
Granite steps at on-grade pathway	n/a	n/a	60
Fire Department Updates			
Gravel trail renovation at fire line	1,235	1,235	n/a
Fire apparatus access hammerhead	n/a	n/a	86
North Beach Access			
Gravel pathway at north beach	30	n/a	400
Concrete pathway segment	n/a	n/a	150
Rock revetment at north beach	n/a	n/a	300
Concrete cap for sheet pile wall	n/a	n/a	11
Rock terrace at north beach	n/a	n/a	60
Concrete seatwall	n/a	n/a	11
Total	**6,440**	**3,830**	**2,413**

1.3.5 Shoreline and Beach Enhancements

In addition to improving public access and safety, the design includes shoreline and beach enhancements. The Project will expand the north beach by placing fish habitat gravel landward of the upland edge of the existing beach, relocate boulders and LWD along the shoreline, and enhance riparian vegetation. The beach expansion includes placing 45 cubic yards of habitat gravel and cobble underlayment (605 sf) and relocating intermittent boulders and LWD along the existing beach and riparian buffer area. The expanded beach and riparian area will maintain nearshore habitat functions. The planting plan to replace removed riparian vegetation and trees is described in Section 1.5.

Habitat gravel will consist of naturally rounded material that complies with WDFW grain size criteria for Lake Washington. Gravel depth is a maximum of 2- to 3-foot thickness on the landward side, tapering on the waterward toe of placement. The material will be placed from the upland or by barge using a conveyor (e.g., telebelt or similar) to place the material precisely and evenly. All materials will be sourced from an approved off-site distributor.

1.3.6 Waterfront LID

Approximately 2,410 sf of concrete and brick pavers at the plaza will be replaced with pervious pavers along the eastern edge of the plaza. The pervious pavers will abut the new concrete paving on the western portion of the plaza and will end at the waterfront edge. A silva cell system will be installed under the south end of the plaza to provide biofiltration of stormwater. A new outfall from this system will be installed in the bulkhead south of the pedestrian plaza. A vegetated conveyance swale will be installed along the resurfaced gravel maintenance driveway.

1.3.7 Irrigation Intake System Installation

The irrigation intake system includes installing a new water pump station south of the Boiler Building and a new freshwater intake screen in Lake Washington east of the pump station. The City will connect the proposed system to upland irrigation systems within the park. Upland work will include installing the pump station, trenching approximately 50 feet east from the pump station under the plaza to the intake screen, and installing pipe bedding material and the piping in the trench.

A coring saw, or similar, will be used to core a hole through the existing retaining wall to insert the intake and filter backwash pipes through the wall and into the lake. A small portion of the lake, in and around the area where the pipe penetration will be constructed through the bulkhead wall, will be temporarily dewatered to allow for drilling through the bulkhead and installation of the screen in the dry. Once the penetration is sealed and grout has cured, the screen will be installed on the end of the pipe and the temporary cofferdam used to dewater that portion of the lake will be removed and the lake will be allowed to submerge the fish screen.

The intake screen will be a self-cleaning suction screen designed to screen fish from entering the intake facilities in compliance with current fish screening guidelines from WDFW and the National Marine Fisheries Service. The irrigation intake system will draw water from Lake Washington at a maximum rate of 0.089 cubic foot per second (40 gallons per minute), as allowed by the approved water right change (Water Right Claim 158498AH).

1.4 In-Water and Overwater Activities

The in-water and overwater Project elements are described in this section and shown in Figures 3 and 4. A detailed plan set is provided in Appendix A.

1.4.1 North Dock Repairs

The Project proposes to retain and repair the northernmost segment of the dock (approximately 188 feet long and 8 feet wide). Approximately 235 sf of the existing concrete dock connecting to the waterfront plaza will be removed and replaced with fiberglass-reinforced plastic (FRP) grating. Approximately 120 sf of an existing wood finger dock will be removed.

Some timber piles supporting the north dock have decayed and need repair. The project includes removing and replacing the top portion of up to five decayed timber piles with ACZA-treated timber. The damaged portions of the pile will be cut away, and a new timber section will be attached to the remaining pile with steel straps.

As part of the north dock repairs, 38 creosote-treated timber piles will be wrapped with fiberglass jackets. The area around the bottom of each pile will be excavated a minimum of 2 feet deep to allow the jacket to be extended below the mudline. A marine epoxy grout will be injected between the pile and the jacket. The jackets will isolate the creosote-treated piles from the water to prevent further leaching of creosote into the water column, reducing a source of water pollution into the lake.

1.4.2 Central Dock Reconfiguration

The central dock, a fixed concrete structure, will be entirely removed and replaced in a new configuration. The reconfigured central dock will include a wave attenuator/mooring float attached to the existing fixed concrete dock by an ADA-compliant grated gangway. The wave attenuator/mooring float will be 10 feet wide with 2 feet of freeboard. To provide adequate wave attenuation, the float material will be concrete, with light penetration options where possible. The bulk of the structure is located as far offshore as practical in approximately 36 to 38 feet of water to reduce the effect of shading on the lake bottom. The float will attach to 16 new steel piles (24-inch diameter). Attached to the inside of the wave attenuator/mooring float will be two new grated finger floats, each 25 feet long with 1.5 feet of freeboard.

The intended use of the wave attenuator/mooring float is for small (up to 26-foot) powerboat moorage. The width is designed to attenuate passing vessel wakes and protect moored boats. The wave attenuation function is critical because the area is frequented by wake surfing boats, a recent boating trend that uses back-weighted boats designed to produce large wakes for surfing without the use of the tow rope that is typically required for waterskiing and wake boarding. In the last decade, wake surfing has become popular in Lake Washington. The large waves this generates cause floating docks to pitch excessively. The waves affect the docks intermittently, unpredictably, and without warning. These conditions create unstable surfaces on floating docks, posing a risk to dock users and prohibiting ADA-compliant access. The wave attenuation provided by this mooring float addresses this problem. This project will also install regulatory buoys offshore of the float to inform boaters of wake regulations in proximity to the shoreline (Section 1.4.5).

According to the Mercer Island Shoreline Master Program, breakwaters are prohibited, except for those structures installed to protect or restore ecological functions. These structures shall provide for mitigation according to the sequence defined in Washington Administrative Code 173-26-201(2)(e). The proposed wave attenuation float has been designed to reduce wave energy along both the south and north shorelines of the park. The float reduces wave energy from both storm waves present during winter months and large boat wakes present primarily during summer months. Wave modeling completed as part of the design process for the dock predicts that wave heights will be reduced between 0.5 and 1.0 foot along portions of the shoreline compared to adjacent shorelines (Appendix E). This reduction in wave height will subsequently reduce wave energy along the nearshore and shoreline areas of the park, thus reducing the erosion due to waves and boat wake in these areas. This will provide protection to the recently restored area that was supplemented by placement of habitat-grade gravel and LWD and the planting of native riparian plant species (permitted under City Permit Nos. SHL20-016 and SHL SHL21-009).

1.4.3 South Dock Reconfiguration

The south dock is a fixed concrete structure that will be removed and replaced in a new configuration. As with the central dock, per MICC 19.13.050(H)(5), the south dock is required to have a grated surface that allows for 40% light transmittance over 100% of the dock. The new south dock is intended for nonmotorized watercraft—kayaks, canoes, rowboats, and small sailboats—to accommodate public use and boating programs such as rentals, classes, and camps. The design includes the reuse of an existing 10-foot by 50-foot grated float and construction of a new 8-foot-wide-by-50-foot-long, 9-inch-freeboard general-purpose float. The proposed floating structures will connect to the existing fixed dock by an ADA-compliant grated gangway. The floats will attach to five new steel piles (16-inch diameter).

The new general-purpose float will be constructed with a low freeboard to make the use of kayaks and stand-up paddleboards easier and with grated surfacing to meet light transmittance requirements. Two grated finger floats (each 15 feet long by 3 feet wide) will extend from the general-purpose float to provide areas for kayak launching, including one ADA-accessible kayak launch point.

1.4.4 Overwater Access Platform

The Project includes a new grated overwater platform as part of the goal to improve access to the waterfront. Portions of the “Handsome Bollards” chain will be removed to allow the public past the art feature and onto the platform where they can access the lake at water level. The platform will only provide access to the water level and will not descend to the beach substrate. The platform will attach to the existing concrete bulkhead at the plaza as an overwater feature and will be of FRP grating material. The platform is being permitted separately with the U.S. Army Corps of Engineers (USACE) but will be incorporated with the Project for other permit agencies.

1.4.5 Buoys

To meet reduce the risks created by passing vessels, the City will replace one buoy and add two new buoys in the lake. Two will be “no wake” buoys located east and southeast of the docks, and one will be a “nonmotorized vessel” buoy located near the south dock.

1.4.6 Summary of Pile and Overwater Cover Quantities

Table 2 summarizes the in-water piles and overwater cover to be removed, repaired, and installed.

Up to sixty-seven 12- to 14-inch creosote-treated timber piles and two 16-inch concrete encapsulated piles in total will be removed during dock demolition and repair. A total of 23 new steel piles (16- and 24-inch diameter) will be installed for the reconfigured docks, and six new pin piles (6-inch diameter) will be installed for the overwater platform. The Project will result in a net reduction of 40 piles in Lake Washington, and removal or fiberglass encapsulation of creosote-treated timber piles.

Piles will be installed using a water-based pile driver and a vibratory and/or impact hammer. It is anticipated that impact pile driving will be limited to proofing or if obstructions are encountered during vibratory pile driving. During all impact driving, sound-attenuation devices such as wooden cushion blocks or similar devices will be employed to minimize sound-related impacts.

The Project will result in a net reduction of approximately 5 sf of overwater cover (4,665 sf removed and 4,660 sf added). Much of the new overwater cover will consist of grated material that will allow light penetration.

Table 2
In-Water and Overwater Work Summary

Project Portion	Element	Features Removed	Features Replaced	Net Change
North Dock Repairs[1]	In-water piles	One 12- to 14-inch creosote-treated timber pile[1]	Not applicable	Net decrease of one in-water pile
	Overwater cover	Approximately 355 sf of overwater cover (235 sf of existing concrete dock; 120 sf of one wood finger dock)	235 sf FRP grating	Net decrease of 120 sf overwater cover
Central Dock Reconfiguration	In-water piles	Approximately twenty-six 12- to 14-inch creosote-treated timber piles)	Approximately 17 piles (sixteen 24-inch steel piles; one 16-inch steel pile)	Net decrease of nine in-water piles
	Overwater cover	Approximately 1,500 sf fixed concrete dock	Approximately 3,160 sf of new overwater cover (2,610 sf of wave attenuator float, 175 sf of two grated finger floats, 375 sf of grated gangway)	Net increase of 1,660 sf overwater cover
South Dock Reconfiguration	In-water piles	Approximately 42 piles (forty 12- to 14-inch creosote-treated timber piles; two 16-inch concrete encapsulated piles)	Approximately six 16-inch steel piles	Net decrease of 36 in-water piles
	Overwater cover	Approximately 2,810 sf existing cover (1,930 sf of fixed concrete dock; 40 sf of aluminum ramp; seven 120-sf wood finger docks)	Approximately 713 sf of new overwater cover (380 sf of general-purpose float, 90 sf of two grated finger floats, 225 sf of grated gangway, 18 sf of concrete gangway abutment)	Net decrease of 2,097 sf overwater cover
Overwater Access Platform	In-water piles	Not applicable	Approximately six pin piles (6-inch steel piles)	Net increase of six in-water piles
	Overwater cover	Not applicable	Approximately 552 sf of grated overwater cover	Net increase of 552 sf overwater cover
Total	**In-water piles**	**Approximately 69 piles removed**	**Approximately 29 piles installed**	**Net decrease of 40 in-water piles**
	Overwater cover	**Approximately 4,665 sf of existing cover removed**	**Approximately 4,660 sf of new overwater cover installed**	**Net decrease of approximately 5 sf of overwater cover**

Notes:

1. Table does not include repair and fiberglass encapsulation of existing north dock piles. Up to five 14-inch decayed creosote-treated timber pile tops will be removed and replaced with ACZA treated timber piles and wrapped with fiberglass jacket.
2. Approximately 2,000 sf of new overwater cover will consist of FRP grating.

3. An existing floating wood dock will be removed from the south dock during demolition, temporarily stored on site, and replaced for reuse as part of the reconfigured south dock. This floating wood dock is not included in the overwater cover calculations shown here.

1.5 Vegetation Disturbance and Restoration

To construct the new access pathways, plaza paving, and expanded north beach, up to 12 trees located along the shoreline and in the uplands will be removed and replaced with 20 new trees (Table 3; Figures 5 and 6). Approximately 4,300 sf of invasive native and non-native riparian and upland vegetation will be removed during construction, and 2,020 sf of native shrub and groundcover vegetation will be installed, including shoreline riparian, upland, and stormwater swale vegetation.

All planting areas will be irrigated and maintained per the park maintenance plan to establish and support species growth. Table 3 summarizes the proposed tree and vegetation removal and replacement activities. All plant installations will occur above the ordinary high water mark (OHWM).

Table 3
Areas of Vegetation Disturbance and Restoration

Project Component	Location	Quantity or Area
Vegetation removal	North beach	1,800 sf (riparian)
	South on-grade pathway	2,500 sf (upland)
	Total	**4,300 sf removed**
Shrub and groundcover planting	North beach	730 sf (riparian)
	South on-grade pathway	1,290 sf (upland)
	Total	**2,020 sf installed**
Tree removal	North beach	6 trees (deciduous)
	South on-grade pathway and ramp	3 trees (deciduous)
	Plaza	3 trees (deciduous)
	Total	**12 trees removed**
Tree installation	North beach	11 trees
	South on-grade pathway	8 trees
	Plaza	1 tree
	Total	**20 trees installed**

1.6 Project Schedule

The Project is anticipated to be constructed in two phases and will occur over 14 months beginning in or around July 2023, or once all permits and approvals are issued. In-water work will occur during the approved regulatory work window for Lake Washington, which is typically between July 16 and March 15. Overwater or upland activities may occur outside of the in-water work window. The following construction phase and sequences are proposed:

2. **Phase 1: July 2023 to January 2024**
    a. Boiler Building Repairs
    b. Boiler Building Restroom Annex Renovation
    c. Concession Stand Repairs
3. **Phase 2: January 2025 to November 2025**
    a. North Dock Repairs
    b. Central Dock Reconfiguration
    c. South Dock Reconfiguration
    d. Overwater Access Platform
    e. Waterfront Plaza Renovation and Access Upgrades
    f. North Beach Enhancements
    g. Waterfront LID
    h. Irrigation Intake System

1.7 Statement of Accuracy and Assumptions

The information provided in this CAS has been prepared by professional biologists, planners, and engineers using the best available science to provide an evaluation of critical areas and potential impacts. This CAS documents that there are no wetlands or watercourses present in or near the Project area. In addition, no bald eagle nests were identified within 660 feet of the Project area, as identified per U.S. Fish and Wildlife Service (USFWS) bald eagle nest disturbance management guidelines (USFWS 2007). The Project area contains geologic hazard areas and FWHCAs as defined by MICC 19.07.160 and 17.07.170, respectively. Discussion of risk mitigation through design and construction, and no net loss of ecological functions, is provided.

1.8 Review of Existing Information

Anchor QEA reviewed the following sources of information to support field observations:

- City of Mercer Island GIS mapping (City of Mercer Island 2022)
- King County interactive mapping (King County 2022)
- National Marine Fisheries Service and U.S. Fish and Wildlife Service information about federally listed species (NMFS 2022, USFWS 2022a)
- Natural Resources Conservation Service soils mapping (NRCS 2020)

- National Wetland Inventory mapping (USFWS 2022b)
- Washington Department of Fish and Wildlife Priority Habitats and Species and salmonid mapping (WDFW 2022a, 2022b)
- Geotechnical reports prepared by GeoEngineers for the Project (Appendices C and D)
- Wave and Wake Modeling Report prepared by Blue Coast Engineering for the Project (Appendix E)
- Tree Report prepared by the City for the Project (Appendix F)
- Pre-Construction Subsurface Investigation Results Summary (Appendix G)
- Luther Burbank Park Waterfront Improvements Shoreline Vegetation Plan (Appendix H)

2 Project Area Description

Existing structures in the Project area include the dock and Boiler Building. The Boiler Building is located within the waterfront plaza west of the dock and is currently used for park storage and restrooms. The shoreline is defined by a vertical concrete bulkhead spanning approximately 200 lf. The bulkhead delineates the plaza area, which includes concrete paving and pavers. To the north of the dock along the plaza's shoreline bulkheads is an art installation called "Handsome Bollards" that includes a series of bollards approximately 6 feet apart with bronze hands that hold a metal chain. Current access to the plaza is limited to the gravel maintenance driveway at the south end of the Project area and an asphalt pathway at the north end.

Existing stormwater features include a stormwater conveyance swale that abuts the western edge of the gravel maintenance driveway and drains to an existing catch basin. The catch basin drains to the lake through a 6-inch PVC storm drain to an outfall south of the plaza. Two additional catch basins located north of the plaza, between the asphalt pathway and Boiler Building, drain to the lake through a 6-inch PVC storm drain and outfall in the north end of the plaza. The northern outfall runs underneath the plaza and through the existing bulkhead to the lake.

Two decommissioned underground storage tanks (USTs) associated with previous boiler plant operations are located in the Project area. These are registered with the Washington State Department of Ecology. Petroleum hydrocarbons and polycyclic aromatic hydrocarbons associated with the tanks and former boiler have been detected in site soil and groundwater (GeoEngineers 2022), with some concentrations above Model Toxics Control Act Method A cleanup levels (see Appendix G). The City has engaged an environmental consultant to develop a remediation plan to implement with construction of the proposed Project. Any contaminated materials removed from the site will be properly disposed of at an approved upland landfill. The existing dock is a fixed 5,500-sf dock structure with wood and concrete decking, supported by 107 creosote-treated timber piles (14- to 16-inch-diameter). The deck is solid concrete with no grating and currently impedes light transmission to the aquatic environment. The existing dock structure includes three main segments, each measuring 8 feet wide. Eight narrow (22-by-4-foot) timber fixed dock fingers provide moorage opportunities for small powerboats along the existing dock. A 500-sf float and gangway (ramp) flank the existing dock structure. The float is intended to be reused in the new design.

Shoreline structures within the Project area include the concrete bulkhead, brick and concrete pavers at the plaza, and the gravel maintenance road. The concrete bulkhead is in good condition; however, the brick pavers and the maintenance road present hazards. The brick pavers are a potential tripping hazard with uneven surfaces, and the maintenance road shows signs of erosion from runoff on the road and adjacent areas. Overwater structures within the Project area include the concrete dock, finger docks, and the timber piles. The concrete dock and creosote-treated timber piles are in good condition. However, the timber cap beams and mooring piles on the south end of the dock show signs of decay and need repair.

Outside of the Project area, portions of the Park have been left undeveloped as wildlife habitat. Wetlands are located at the north and south ends of the Park, outside of the Project area. The Park also contains areas with maintained lawns surrounded by stands of trees.

As described in Section 3 of this CAS, the critical areas analysis for wetlands, watercourses, FWHCAs, and geologically hazardous areas was completed within the Project area, and the bald eagle nest survey area was expanded to include the entire Park.

2.1 Topography

The topography of the Park and Project area slopes down from the inland side of the Park to the Lake Washington shoreline. Topographic maps identify the highest elevation in the Project area as approximately 44 feet North American Datum of 1988 (NAVD88), sloping down toward the shoreline (Figure 7).

GeoEngineers completed a geotechnical assessment and report for the upland portions of the Project area (Appendix C). The report describes that the Boiler Building and restroom annex are constructed into the toe of an upland slope that grades downward from the higher elevation portions of the Park to the west to shoreline of Lake Washington. The slope behind the buildings is on the order of 50 to 60 feet tall and is inclined between 2 Horizontal to 1 Vertical (2H:1V) and 1.25H:1V (50% to 80% slopes). There is about a 1-foot gap between the back (western) sides of the building and the slope except for the lower 4 to 5 feet of the slope toe where the western walls of the building retains the lower portion of the slope.

2.2 Soils

The Natural Resources Conservation Service (NRCS) Web Soil Survey identifies one soil series, Kitsap silt loam, 2% to 8% slopes, within the Project area (NRCS 2020; Figure 8).

The Washington State Department of Natural Resources (DNR) Geologic Information Portal (DNR 2020) identified nearby hand augers conducted for the former steam plant. These investigations indicate the subsurface consists of alluvial sand overlying glacial drift deposits of silty clay.

Geotechnical testing conducted for the upland portion of the Project (Appendix C) included three upland borings that revealed the following:

- B-1 and B-2: 6 inches of sod above glacial till
- B-3: 10 inches of concrete and base course over 7 feet of fill, over glacial till

Three in-water borings revealed “lake sediments underlain by weathered glacially consolidated soil” (Appendix D).

2.3 Hydrology

The Project is located in the Cedar-Sammamish Basin Water Resource Inventory Area 8 (Ecology 2020). Hydrologic characteristics in the Park are influenced by regional groundwater, direct precipitation, surface water runoff, wetlands, and Lake Washington. Wetlands and watercourses are located in the Park but are not present within the Project area, as described in Sections 3.2 and 3.3.

No stream channels, areas of inundation, or seeps were identified in the Project area during the February 19, 2020, site visit. However, based on conversations with the project team we understand that groundwater seepage is routinely observed on the face of the hillside in some areas. This is not unusual on slopes composed of glacially consolidated soils. Perched groundwater tends to accumulate within portions of the deposits that contain higher percentages of sand and gravel and lower percentages of silt and clay, or within areas that have higher degree of weathering. Perched groundwater volumes tend to fluctuate throughout the year, typically being highest during winter and spring months and during periods of prolonged precipitation (Appendix C).

Lake Washington is hydraulically controlled by USACE, as described in Section 3.4.3. Washington Department of Fish and Wildlife (WDFW) mapping does not identify any freshwater surface stream channels to Lake Washington within the Project area (WDFW 2022a, 2022b).

2.4 Plant Communities

The Project area includes trees, mowed lawn, developed recreational facilities, a small gravel beach with adjacent shrubs, and the docks. No wetlands are located within the Project area, as described in Section 3.2. In Lake Washington, areas of dense non-native aquatic vegetation, Eurasian milfoil (*Myriophyllum spicatum*), can be found intermittently along the shoreline of the Park.

Freshwater emergent wetland habitat is mapped several hundred feet north of the Project area (Figure 9). These wetland features were reviewed during the bald eagle survey. No freshwater wetland habitat is mapped within the Project area (USFWS 2022a; WDFW 2022a; King County 2022; City of Mercer Island 2022). Anchor QEA ecologists did not identify any freshwater wetlands in the Project area during the site visits, substantiating the online data.

3 Critical Areas Description

This section describes the presence of critical areas within the Project area as defined under MICC Chapter 19.07. Critical areas evaluated include wetlands, watercourses, FWHCAs, and geologically hazardous areas.

3.1 Methods

To document and describe wetlands, watercourses, FWHCAs, and geologically hazardous areas within the Project area, Anchor QEA reviewed existing information (Section 1.8) and performed an aerial photograph assessment. Additionally, Anchor QEA conducted a critical areas site visit at the Project area on February 19, 2020. Subsequent site visits have occurred in 2021 and 2022 as part of this Project, confirming existing conditions within the Project area. The entire Project area was accessible during the site visits. During the site visits, Anchor QEA documented general information regarding habitats and dominant plant species and communities. Potential wetland features were evaluated based on MICC wetland delineation criteria; however, no wetland conditions were observed within the Project area.

Visible wildlife species, tracks, and other signs observed during the site visits were documented. The bald eagle nest survey was performed by walking and scanning trees within the Park using binoculars.

The OHWM of Lake Washington was not delineated during the site visit because Lake Washington is hydraulically controlled, and the low- and high-water elevations are established. Photographs taken to document vegetation and habitat conditions are included in Appendix B.

3.2 Wetlands

No wetland conditions were observed within the Project area during the February 2020 site visit, subsequent site visits, or as identified by online mapping. Within the Park, USFWS (2022b) and WDFW (2022a) identify wetlands located in the northern and southern parts of the park, more than 800 feet away from the Project area. These wetlands were observed during the site visit but not delineated because they are well outside of the Project area. Because there are no wetlands within the Project area, and no impacts to wetlands or wetland buffers will result from the Project, no further evaluation of wetlands is provided in this CAS.

3.3 Watercourses

No streams, drainage channels, areas of inundation, seeps, or associated riparian habitat were observed within the Project area during the February 2020 site visit, subsequent site visits, or as identified by online mapping. Two riverine channels are mapped south of the Park boundary (and more than 1,000 feet from the Project area; Figure 9; USFWS 2022a; WDFW 2022a). Because there are no streams or other watercourses within the Project area, and no impacts to streams or stream buffers will result from the Project, no further evaluation of watercourses is provided in this CAS.

3.4 Fish and Wildlife Habitat Conservation Areas

Per MICC Chapter 19.07.170, FWHCAs include the following:

- Areas where state or federally listed endangered, threatened, sensitive, or candidate species, or species of local importance, have primary association
- Priority habitats and areas associated with priority species identified by the WDFW
- Areas used by bald eagles for foraging, nesting, and roosting, or within 660 feet of a bald eagle nest
- Watercourses and wetlands and their buffers
- Biodiversity areas

The only FWHCA within the Project area is Lake Washington, which contains federally listed and state priority fish species, and potential bald eagle habitat.

3.4.1 Vegetation and Shoreline Conditions

The Project area contain a mixture of native and non-native trees and shrubs, mowed lawn areas, developed recreation facilities, concrete bulkheads, and a small beach. Photographs of the Project area are included in Appendix B.

North of the Boiler Building, riparian vegetation near the lake shoreline includes deciduous trees (e.g., big-leaf maple and Lombardy poplar), native shrubs, and invasive Himalayan blackberry. Upslope from the shoreline, vegetation includes coniferous and deciduous trees, native shrubs, abundant Himalayan blackberry, and areas of mowed lawn. The area in front of the Boiler Building consists of the waterfront plaza and shoreline supported by concrete bulkheads, with no riparian vegetation. Also north of the Boiler Building is a narrow nearshore (beach) area with a gravel substrate, chained logs, and boulders. Dense non-native aquatic vegetation, Eurasian milfoil, is present in the lake around the docks.

South of the waterfront plaza is an existing gravel access driveway running through a mixed coniferous-deciduous forest. Native shrubs and Himalayan blackberry are also present in this area. The South Shoreline Trail Restoration Project, which is being permitted separately, begins south of the waterfront plaza and is located between the gravel access driveway and the lake shoreline.

3.4.2 Wildlife and Habitat

Vegetation communities within the Project area provide a range of habitat for terrestrial wildlife. Wildlife relies on vegetation for food, shelter, and cover from predators. Wildlife diversity is generally related to the structure and composition of plant species within vegetative communities. In general, vegetation communities that contain few species or vegetative layers (herbaceous vegetation, shrubs, or trees) support a low diversity of wildlife, whereas vegetation communities that are more complex and contain a wide variety of plant species and vegetative layers can support a greater diversity of wildlife. The dominant presence of non-native vegetation and high level of human activity reduce the overall quality of potential habitat for wildlife species. The Park is surrounded by residential development, so vegetated corridors connecting habitat within the Project area to undisturbed habitats are limited.

Although a comprehensive wildlife survey has not been conducted within the Project area, with the exception of the bald eagle survey, vegetation communities within the Project area likely provide habitat for a variety of terrestrial wildlife species common to King County and western Washington that are adapted to park settings within urban residential areas. The Project area provides habitat for native and non-native bird, amphibian, reptile, insect, and small mammal species to breed, forage, and rest.

Portions of Lake Washington provide quality habitat for aquatic species, as described in Section 3.4.3. Within the Project area, the shoreline condition, categorized by the south, central, and north areas, includes the following:

- The south Project area shoreline is located south of the waterfront plaza. This area consists of small areas of lawn, shrubby riparian vegetation along the lake shore, a gravel driveway, and trees/shrubs and invasive vegetation farther upslope. Improvements to the south shoreline trail (outside the Project area) are being permitted as part of a separate project.
- The central Project area shoreline, adjacent to the waterfront plaza, has a vertical bulkhead slope. The lake bottom substrate contains sand and silt with small rocks and remnant concrete and timber debris from past uses. The central shoreline is mostly developed, and vegetation is limited to dense non-native aquatic vegetation, Eurasian milfoil (*Myriophyllum spicatum*), found near the park's shoreline.
- The north Project area shoreline consists of a small gravel beach with fringing trees and shrubs, with a trail, grass lawn areas, and trees located farther upslope.

3.4.2.1 Bald Eagle Survey

One bald eagle nest was observed in the north portion of the Park in a Douglas fir tree, about 1,400 feet from the Project area boundary. During the 2020 site visit, a pair of bald eagles were observed perched on the nest tree and on adjacent Douglas fir trees.

Trees within the Project area are generally less than 40 feet tall, and not of a size typically associated with bald eagle perching and roosting. Overall, no potential bald eagle nest trees were observed within the Project area and no bald eagle nests were identified within 660 feet of the Project area, the minimum distance identified under USFWS bald eagle nest disturbance management guidelines to avoid disturbances to nesting bald eagles (USFWS 2007) and as regulated per MICC 19.07.170.

3.4.3 Lake Washington

Lake Washington is a FWHCA per the criteria in MICC 19.07 (Critical Areas). The OHWM of Lake Washington was not delineated during the February 2020 site visit, or more recently, because the lake is hydraulically controlled by USACE at the Hiram M. Chittenden Ballard Locks. USACE lowers the lake in the winter months (typically in December) to a low-water elevation of 16.67 feet NAVD88 to allow for flood storage. In the summer (typically in June), the lake level is raised to a high-water elevation of 18.67 feet NAVD88. Therefore, the Project defines the OHWM as 18.67 feet NAVD88 and the ordinary low water mark as 16.67 feet NAVD88.

Lake Washington provides habitat for a variety of aquatic species. Salmonids documented in Lake Washington include bull trout (*Salvelinus confluentus*), Chinook salmon (*Oncorhynchus tshawytscha*), Puget Sound steelhead (*O. mykiss*), sockeye salmon (*O. nerka*), coho salmon (*O. kisutch*), and kokanee (*O. nerka*) (WDFW 2022a, 2022b). Other fish species that are present in Lake Washington include coastal cutthroat trout (*O. clarkii clarkii*), largemouth and smallmouth bass (*Micropterus salmoides* and *M. dolomieu*), yellow perch (*Perca flavescens*), and black crappie (*Pomoxis nigromaculatus*).

3.4.4 Priority Species and Habitats

The WDFW Priority Habitats and Species data (WDFW 2022a) do not document occurrences of any terrestrial species or priority habitats in the Project area or the Park. South of I-90, several areas are mapped as priority habitat biodiversity corridors. Priority fish species documented in Lake Washington are described in Section 3.4.3. Analysis of federally listed species and critical habitats is described in Section 3.4.5.

3.4.5 ESA-Listed Species and Critical Habitat

Species and critical habitats listed under the federal Endangered Species Act (ESA) and under National Marine Fisheries Service (NMFS) and USFWS jurisdiction in western Washington are referenced on the agencies' websites. The NMFS identifies ESA-listed species that occur or may occur within a broad geographic area, such as an evolutionarily significant unit (ESU) or a distinct population segment (DPS), rather than a project-specific location (NMFS 2022). The USFWS identifies ESA-listed species that may occur within a specific location where a project is proposed (USFWS 2022a). Table 4 lists species and critical habitat that are likely to occur in the vicinity of the Project. A separate Biological Evaluation has been prepared for the Project that describes these species in detail (Anchor QEA 2022).

Table 4
Federally Listed Species and Critical Habitat Likely to Occur in the Project Vicinity

Species	Jurisdiction	ESA Status	Critical Habitat
Chinook salmon (*Oncorhynchus tshawytscha*) Puget Sound ESU	NMFS	Threatened	Designated
Steelhead (*O. mykiss*) Puget Sound DPS	NMFS	Threatened	None designated within the action area
Bull trout (*Salvelinus confluentus*) Coastal-Puget Sound DPS	USFWS	Threatened	Designated
Marbled murrelet *(Brachyramphus marmoratus*)	USFWS	Threatened	None designated within the action area

3.5 Geologically Hazardous Areas

MICC 19.07.160 describes three categories of geologically hazardous areas subject to critical areas review: 1) erosion hazard areas, 2) landslide hazard areas, and 3) seismic hazard areas. Information about these features in the Project area is described in the following sections, based on City and resource agency mapping and code definitions. Geotechnical engineering review of the area is summarized from the Project geotechnical reports in Appendices C and D (see also Section 4).

3.5.1 Erosion Hazard Areas

As defined in MICC 19.16.010 , erosion hazard areas are those areas greater than 15% slope and subject to a severe risk of erosion due to wind, rain, water, slope, and other natural agents, including those soil types or areas identified by the NRCS as having a "severe" or "very severe" rill and inter-rill erosion hazard.

The upland portion of the Project area is located within a mapped erosion hazard area (Figure 10). Mapped soils in the Project area consist of Kitsap silt loam, 2% to 8% slopes (Figure 8). This soil type has a slight to moderate erosion hazard (SCS 1973).

3.5.2 Landslide Hazard Areas

Per MICC 19.16.010, a landslide hazard is defined as an area with one or a combination of the geologic, topographic, and hydrologic factors as follows:

1. Areas of historic failures
2. Areas with all three of the following characteristics:
    a. Slopes steeper than 15%
    b. Hillsides intersecting geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock
    c. Springs or groundwater seepage

3. Areas that have shown evidence of past movement or that are underlain or covered by mass wastage debris from past movements
4. Areas potentially unstable because of rapid stream incision and streambank erosion
5. Steep slopes consisting of any slope of 40% or greater calculated by measuring the vertical rise over any 30-foot horizontal run.

The upland portion of the Project area is located within a mapped landslide hazard area (Figure 11). The Project area contains slopes greater than 15% and 40%, meeting the above code definitions.

The City's development standards for landslide hazard areas require the following buffers (when more than one condition applies to a site, the largest buffer shall be applied):

- Steep slope buffer widths shall be equal to the height of a steep slope, but not more than 75 feet, and applied to the top and toe of slopes.
- Shallow landslide hazard areas shall have minimum 25-foot buffers applied in all directions.
- Deep-seated landslide hazard areas shall have 75-foot buffers applied in all directions.

Portions of the Project would be located within landslide hazard areas (based on slope and potential seepage near the boiler building and restroom annex) and toe-of-slope buffer areas.

3.5.3 Seismic Hazard Areas

Seismic hazard areas are defined by the City as areas subject to severe risk of damage as a result of earthquake-induced ground shaking, slope failure, settlement, soil liquefaction, or surface faulting (MICC 19.16.010).

The upland shoreline in the Project area is mapped within a seismic hazard area and is in the vicinity of the Seattle Fault zone (Figure 12).

4 Critical Areas Impacts Assessment and Mitigation

This section provides a summary of potential impacts to FWHCAs and geologically hazardous areas, and mitigation to avoid and minimize impacts. As discussed in Section 3, these are the only types of critical areas that occur within the Project area and that could potentially be affected by the Project.

The applicant must avoid, minimize, and mitigate impacts to environmentally critical areas and associated buffers consistent with mitigation sequencing described in MICC 19.07.100. Mitigation sequencing and best management practices (BMPs) are described further in Section 5.

4.1 Fish and Wildlife Habitat Conservation Areas

4.1.1 City Code Requirements

The City's regulations for FWHCAs (MICC 19.07.170.C) state that development proposals shall implement wildlife and habitat protection measures identified in the wildlife habitat assessment and follow the USFWS (2007) National Bald Eagle Management Guidelines.

4.1.2 Project Impacts

The primary potential construction impact on fish and wildlife species and associated habitat is temporary disturbance and removal of vegetation (Section 1.5). Temporary disturbance during construction will include in-air noise generated by heavy construction equipment such as small excavators and bulldozers, dump trucks, and other standard construction equipment, and both in-air and underwater noise created by pile driving. Small areas of the shoreline below the OHWM will need to be dewatered during installation of the irrigation intake and stormwater outfall. Construction also has the potential to impact water quality through potential spills of fuels or other petroleum products used in construction equipment, and through increased turbidity during removal and installation of piles.

These potential impacts are discussed in this section. A separate Biological Evaluation has been prepared for the Project to address impacts on federally listed fish species and marbled murrelet that may use the Project area (Anchor QEA 2022). Measures to address these impacts are described in Section 5.

4.1.2.1 Construction Noise and Disturbance

In-air noise will occur periodically throughout the construction period described in Section 1.6. Underwater noise generated by pile driving will be limited to the approved in-water work period (July 16 to March 15) to minimize impacts on salmonid species.

Noise associated with construction could result in avoidance behavior by some fish and wildlife species. Areas near the pile driving location could experience underwater noise levels injurious to fish, as described in the Biological Evaluation prepared for the project. Fish would be able to move out of affected areas, and in-water work would be limited to the agency-approved work windows to minimize impacts on listed fish species.

The Project area is within a popular park that experiences ongoing human disturbance, and it is expected that wildlife would resume use of the Project area once construction is complete. No bald eagle nests are located within the 660-foot minimum distance identified under USFWS bald eagle management guidelines to avoid disturbances to nesting bald eagles (USFWS 2007) and as regulated per MICC 19.07.170 (2020). The noise levels associated with operation of the Park after construction are expected to be consistent with current noise levels.

The small areas of the shoreline below the OHWM that will be dewatered during installation of the irrigation intake and stormwater outfall are located along the existing waterfront plaza where habitat has been degraded by past land use. Given the short period of dewatering required, small area affected, and low habitat quality, impacts to aquatic habitat would be minor.

4.1.2.2 Water Quality Impacts

The use of construction equipment over, in, and near the waters of Lake Washington has the potential to release petroleum products into the water if a leak or accidental spill occurs. The risk of such impacts is low provided that contractors adhere to the BMPs listed in Section 5.

Removal, repair, and installation of piles could result in temporary minor increased turbidity in Lake Washington. This would be localized to the areas near the piles. Fish would be able to move away from the construction area to avoid turbidity. In-water work will be restricted to the approved in-water work period (July 16 to March 15) to minimize impacts on salmonid species.

The potential for soil erosion from upland areas is discussed in Section 4.2.1 and BMPs are discussed in Section 5. With implementation of these measures, it is unlikely that eroded soil would enter nearby surface waters during construction or operation of the Project.

4.1.2.3 Vegetation Removal

Construction will require the removal of native and non-native vegetation as described in Section 1.5. While this represents a relatively small amount of vegetation removal relative to vegetation throughout the Park, it is a loss of potential habitat for terrestrial wildlife species. Removal of riparian vegetation would reduce the amount of shade and sources of invertebrate prey for fish species in the area north of the waterfront plaza. This impact is considered temporary because additional native plantings will be installed in the Project area, as described in Section 5. The replacement of non-native vegetation with native riparian plants will improve ecological function from existing conditions.

4.1.3 Mitigation Measures

With implementation of the mitigation sequencing and construction BMPs described in Section 5, and the planting plan, nearshore habitat restoration, and aquatic habitat improvements discussed below, the Project would result in no net loss of fish and wildlife habitat functions in the Project area.

4.1.3.1 Planting Plan

As described in Section 1.5, construction will include the removal of up to 10 trees and replacement with 20 new trees (Table 3; Figures 5 and 6). Approximately 4,300 sf of native and non-native riparian and upland vegetation will be removed during construction, and 2,020 sf of native shrub and groundcover vegetation will be installed, including shoreline riparian, upland, and stormwater swale vegetation. Installation of the stormwater swale along the driveway will help to filter stormwater. A portion of the vegetation to be removed consists of non-native invasive species, which will be replaced with native plants that provide more diversity and habitat value for wildlife.

The Tree Report in Appendix F describes compliance with MICC 19.10 – Trees.

4.1.3.2 Nearshore and Aquatic Habitat Restoration

The Project will expand the area of nearshore habitat along the lake to approximately 605 sf. The beach enhancement, installed above the OHWM, will increase the beach area by 204 sf. Western red cedars will be installed near the north beach, providing additional shading for the lake.

The completed Project will provide a minor benefit to aquatic habitat in Lake Washington. A net reduction of 45 piles and 5 sf of overwater cover would occur. Creosote-treated piles will be replaced with steel piles, or encapsulated in fiberglass, improving water quality. Existing concrete decking will be replaced with grating, allowing better light penetration. The center and south docks will be shifted into deeper water to open up the nearshore habitat for use by salmonids.

4.2 Geologically Hazardous Areas

The Project will alter existing geologically hazardous areas and their associated buffers. These impacts can be effectively mitigated through Project design and application of BMPs, as discussed in this section.

4.2.1 Erosion Hazard Areas

4.2.1.1 City Code Requirements

The City's development standards for erosion hazard areas (MICC 19.07.160.E) require all development proposals to demonstrate compliance with MICC 15.09, stormwater management program, and to show that the proposed work will not create a net increase in geological instability on or off site.

4.2.1.2 Project Impacts

Construction of the Project will include removal of existing concrete and pavers, clearing of vegetation, trenching to install irrigation piping, and excavation of soils to install ADA-accessible features and stormwater improvements. There is the potential for disturbed soils to erode and potentially be washed into Lake Washington unless proper measures are taken.

4.2.1.3 Mitigation Measures

The Project geotechnical report indicates that the Project area should not be susceptible to erosion hazards with implementation of geotechnical engineering recommendations (Appendix C). Additional BMPs are described in Section 5. With these measures in place, no impacts to erosion hazard areas are anticipated during construction. All disturbed areas will be revegetated or resurfaced, as applicable, and stormwater management measures meeting applicable requirements will be installed, as discussed in Section 1.3. Therefore, the Project will not create a net increase in geological instability on or off site that would result in additional erosion.

4.2.2 Landslide and Seismic Hazard Areas

4.2.2.1 City Code Requirements

The Project will be constructed consistent with City code requirements for landslide and seismic hazard areas. City code (MICC 19.07.160.B) contains the following requirements for alteration of landslide and seismic hazard areas:

1. Alteration of landslide hazard areas and seismic hazard areas and associated buffers may occur if the critical area study documents find that the proposed alteration:
    a. Will not adversely impact other critical areas;
    b. Will not adversely impact the subject property or adjacent properties;
    c. Will mitigate impacts to the geologically hazardous area consistent with best available science to the maximum extent reasonably possible such that the site is determined to be safe; and
    d. Includes the landscaping of all disturbed areas outside of building footprints and installation of hardscape prior to final inspection.
2. Alteration of landslide hazard areas, seismic hazard areas and associated buffers may occur if the conditions listed in subsection (B)(2) of this section are satisfied and the geotechnical professional provides a statement of risk matching one of the following:
    a. An evaluation of site-specific subsurface conditions demonstrates that the proposed development is not located in a landslide hazard area or seismic hazard area;
    b. The landslide hazard area or seismic hazard area will be modified or the development has been designed so that the risk to the site and adjacent property is eliminated or mitigated such that the site is determined to be safe;

c. Construction practices are proposed for the alteration that would render the development as safe as if it were not located in a geologically hazardous area and do not adversely impact adjacent properties; or
d. The development is so minor as not to pose a threat to the public health, safety and welfare.

4.2.2.2 Project Impacts

Construction will include grading on steep slopes and within toe-of-slope buffer areas (MICC 19.07.160.C) for construction of trails, ADA ramp, and the stormwater conveyance. Grading in these areas has the potential to increase the likelihood of a landslide during construction.

While the Project area is located within a seismic hazard area, the geotechnical reports (Appendices C and D) found that the Project area is underlain by dense to very dense, glacially consolidated soils with a low risk of liquefaction. Liquefaction occurs during vibration or shaking of the ground, usually during an earthquake, when soils lose strength and become more like a liquid than a solid, posing risks to structures. Another potential risk during earthquakes is lateral spreading, which occurs when large blocks of soil on the surface move when an underlying soil layer loses strength. Due to the low liquefaction risk at the Project area, the geotechnical reports conclude there is also a low risk of lateral spreading occurring at this site (Appendices C and D).

The Project area is in the vicinity of the Seattle Fault zone. However, because bedrock in this area is covered by hundreds of feet of glacial soils, it is unlikely that movement of the fault would result in significant surface rupture at the ground surface (Appendices C and D).

4.2.2.3 Mitigation Measures

The Project will incorporate the geotechnical engineering design and construction recommendations described in Appendix C to avoid and minimize potential impacts to landslide hazard areas.

The Project will be designed to meet current seismic design standards and geotechnical engineering recommendations (Appendices C and D). The Boiler Building will be retrofitted to withstand a seismic event, and the dock piles will be driven to depth to meet a competent soil criterion based on design structural loads. Additional construction BMPs are described in Section 5.

5 Mitigation Sequencing and Best Management Practices

The City requires Projects to implement mitigation sequencing as described in MICC 19.07.100. The following summarizes how the Project fulfills each step in the mitigation sequencing process:

A. **Avoiding the impact altogether by not taking a certain action or parts of an action.** The Project is designed to include the minimum necessary impacts to critical areas to support the purpose and need. Therefore, other potential impacts from material expansion of structures, use of less environmentally friendly materials, or further encroachment into critical areas have been avoided through Project design. For example, the new float is the least impactful option for providing the necessary wave attenuation, as compared to other alternatives, including in-water fill to construct more traditional attenuation components such as jetties, weirs, or similar.

B. **Minimizing impacts by limiting the degree or magnitude of the action and its implementation.** The Project design limits vegetation removal and soil disturbance to the minimum needed. New overwater structures will allow for light penetration to the water to the maximum extent feasible, minimizing shading impacts to aquatic habitat, and there will be no net increase in overwater cover. The wave attenuator float was relocated further offshore from where the existing concrete pier is located in response to feedback from the Washington Department of Fish and Wildlife to minimize nearshore shading impacts of the overwater structure. The wave attenuator float minimizes impacts to the shoreline environment by providing protection from wave and wake energy to the recently restored shoreline area that was supplemented by placement of habitat grade gravel and LWD and the planting of native riparian plant species.

C. **Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.** Areas that are disturbed during construction and that are located outside of pathways, plaza surfacing, and other developed facilities will be revegetated. The minor impacts to the shoreline environment from replacing the existing concrete pier with a wave attenuator float are offset by avoidance and minimization measures described above.

   To rehabilitate and restore the affected environment, the City prepared a shoreline vegetation plan to monitor and manage vegetation within 20 feet of the shoreline. Management activities proposed in the plan include removal of invasive species and planting with a variety of groundcover, shrubs, and trees native to the Central Puget Sound lowlands as needed. The vegetation plan is included in Appendix H.

D. **Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.** Creosote-treated pilings will be either removed or encapsulated in fiberglass to reduce leaching to the water. New pilings will be steel, reducing future maintenance needs. The Project includes LID measures to improve stormwater management. The new irrigation intake will be screened to prevent entrainment of fish, per agency requirements.

There are 3,851 sf of removed vegetation and 1,936 sf of proposed vegetation. This is a net loss of 1,915 sf of vegetated area. There are 2,437 sf of new permeable paving added in the plaza area as well. The beach enhancement, installed above the OHWM, will increase the beach area by 204 square feet. The increased beach and nearshore area provide increased and improved habitat opportunities for migrating juvenile salmon and other aquatic habitats. Public access to the water is also significantly increased with the installation of ramps and universal walkways to the OHWM; although these contribute to the impermeable surface areas, it is a significant improvement because it will create universal access to the water for all members of the public.

E. **Compensating for the impact by replacing, enhancing, or providing substitute resources or environments.** The Project is a pier replacement project intended to provide added functionality and safety for park users while also providing protection to shoreline restoration areas. The pier replacement will result in a net reduction in overwater cover, will shift pier infrastructure away from the nearshore shoreline environment, and is designed to result in no net loss of shoreline ecological functions. The Project will reduce overall impervious surface area by approximately 5% and will reduce peak runoff by providing infiltration potential and reducing impervious surfaces. Riparian and upland vegetation will be planted and the north beach nearshore will be expanded to enhance lakeshore habitats. The 12 trees proposed to be removed by the Project will be replaced by 20 new trees. Approximately 3,680 sf of riparian and upland vegetation will be removed during construction to accommodate expanded public access opportunities, including increasing the size of the north beach area. Approximately 1,940 sf of new native shrub and groundcover vegetation will be installed around these areas and will include riparian, upland, and stormwater swale vegetation.

   Though there is no prescriptive mitigation ratio given in MICC 19.07 for vegetation removal within a FWHCA, vegetation will be replaced at a ratio of less than 1:1 due to the placement of habitat gravels within the north beach expansion area. This action meets the overall standards of no net loss of shoreline or habitat function by reducing overall vegetation and increasing nearshore aquatic habitat and public access opportunities with the placement of these gravels and replacement of non-native vegetation with native plant species. The Tree Report in Appendix F describes compliance with MICC 19.10 – Trees.

F. **Monitoring the impact and taking appropriate corrective measures to maintain the integrity of compensating measures.** The City will develop a maintenance and monitoring plan for all installed plantings to ensure success.

To avoid or minimize potential adverse impacts to the aquatic environment, the following BMPs will be employed during construction:

- Applicable permits for the Project will be obtained prior to construction. Work will be performed according to the requirements and conditions of these permits.
- In-water work will occur during the approved regulatory work window for Lake Washington; expected to be July 16 to March 15.
- The contractor will be responsible for the preparation and implementation of a spill plan to be used for the duration of construction, which will include spill prevention, control, and response BMPs. In addition, the spill plan will outline roles and responsibilities, notifications, inspections, and response protocols to be implemented in the event of an inadvertent spill during construction.
- The contractor will supply to the Project Engineers a Temporary Erosion and Sediment Control (TESC) Plan and/or a Construction Stormwater Pollution Prevention Plan (SWPPP) that will use BMPs to prevent erosion and sediment-laden runoff from leaving the site. These plans will be implemented prior to the start of ground-disturbing activities. All areas disturbed by Project construction will be stabilized as soon as possible to prevent erosion and re-vegetated as soon as practicable post-construction and prior to the removal of TESC/SWPPP measures.
- Excess or waste materials will not be disposed of or abandoned waterward of the OHWM or allowed to enter waters of the state.
- No petroleum products, chemicals, or other toxic or deleterious materials will be allowed to enter surface waters.
- Barges will not be allowed to ground out during construction.
- A temporary floating debris boom will be installed around the work area. The contractor will be required to retrieve any floating debris generated during construction using a skiff and a net. Debris will be disposed of at an appropriate upland facility.
- Demolition and construction materials will not be stored where wave action or upland runoff can cause materials to enter surface waters.
- No uncured concrete or grout will be in contact with surface waters.
- Piles will be removed as practicable, using best efforts, equipment preferences, and BMPs identified in Washington Department of Natural Resources *Puget Sound Initiative Derelict Creosote Piling Removal: Best Management Practices for Pile Removal and Disposal* (WDNR 2017).
- All creosote-treated materials will be disposed of in a landfill or recycling facility approved to accept these types of materials.
- Vibratory pile driving will be used to the maximum extent practicable, with limited impact pile driving to reach required pile depths and for pile proofing. During all impact driving, sound-attenuation devices such as a wooden cushion blocks or similar devices will be

employed to minimize sound-related impacts, as determined through federal Endangered Species Act consultation.

- New light fixtures for overwater structures will be directed away from the water to the extent practicable to minimize impacts on aquatic species.
- Geotechnical engineering recommendations will be incorporated into the Project (Appendices C and D).
- The City has developed an environmental construction contingency plan for soil management for Luther Burbank Park, with GeoEngineers as a geotechnical consultant. This identifies and provides direction on how to handle any contaminated soils encountered in the vicinity of the two decommissioned USTs.
- Any additional measures required by the agencies during ESA review will be incorporated into the Project to avoid impacts on federally listed species.

6 References

Anchor QEA, 2022. *Biological Evaluation, Luther Burbank Park Waterfront Improvements Project*. Prepared for City of Mercer Island. 2022.

City of Mercer Island, 2022. City of Mercer Island GIS Portal. Accessed May 2022. Available at: https://chgis1.mercergov.org/Html5Viewer/Index.html?viewer=PubMaps&viewer=PubMaps.

DNR (Washington Department of Natural Resources), 2017. "Derelict Creosote Piling Removal Best Management Practices for Pile Removal & Disposal." Accessed May 2022. Available at: https://www.dnr.wa.gov/publications/aqr_rest_pileremoval_bmp_2017.pdf.

DNR, 2020. Geologic Information Portal. Accessed February 2020. Available at: https://geologyportal.dnr.wa.gov/.

Ecology (Washington State Department of Ecology), 2020. "Environmental Information; Water Resource Inventory Area Maps, Cedar-Sammamish Basin WRIA 8." Accessed February 18, 2020. Available at: https://fortress.wa.gov/dfw/score/score/maps/map_details.jsp?geocode=wria&geoarea=WRIA08_Cedar_Sammamish.

GeoEngineers, 2022. *Environmental Construction Contingency Plan for Soil Management*. *Luther Burbank Park Mercer Island, Washington*. Prepared for City of Mercer Island. 2022.

King County, 2022. King County iMap Interactive Mapping Tool. Accessed May 2022. Available at: https://gismaps.kingcounty.gov/iMap/.

NMFS (National Marine Fisheries Service), 2022. "ESA Section 7 Consultations on the West Coast." Accessed May 2022. Available at: https://www.fisheries.noaa.gov/west-coast/consultations/esa-section-7-consultations-west-coast#puget-sound-(central-and-south).

NRCS (U.S. Department of Agriculture Natural Resources Conservation Service), 2020. "Natural Resources Conservation Service (NRCS) Web Soil Survey." Accessed February 18, 2020. Available at: http://websoilsurvey.nrcs.usda.gov/app.

SCS (Soil Conservation Service), 1973. *Soil Survey of King County Area, Washington*. November 1973. Accessed May 2022. Available at: https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/washington/KingWA1973/KingWA_1974.pdf.

USFWS (U.S. Fish and Wildlife Service), 2007. *National Bald Eagle Management Guidelines*. May 2007. Accessed June 2022. Available at: https://www.fws.gov/sites/default/files/documents/national-bald-eagle-management-guidelines_0.pdf.

USFWS, 2022a. iPAC – Information for Planning and Consultation. Accessed May 2022. Available at: https://ipac.ecosphere.fws.gov/location/62S6O2PYEFB35N56QNISZXCIAQ/resources.

USFWS, 2022b. National Wetland Inventory Wetlands Mapper. Accessed May 2022. Available at: https://www.fws.gov/program/national-wetlands-inventory/wetlands-mapper.

WDFW (Washington Department of Fish and Wildlife), 2022a. Priority Habitats and Species Mapping. Accessed May 2022. Available at: https://geodataservices.wdfw.wa.gov/hp/phs/.

WDFW, 2022b. "SalmonScape." Accessed May 23, 2022. Available at: http://apps.wdfw.wa.gov/salmonscape.

Figures

Publish Date: 2023/03/31, 1:13 PM | User: tweldy
Filepath: \\orcas\GIS\Jobs\City_of_Mercer_Island_1018\Luther_Burbank\Maps\LutherBurbankWaterfrontImprovements\LutherBurbank_WtrfrntImprovements.aprx

ANCHOR QEA

0 1
Miles

Figure 1
Vicinity Map
Critical Areas Study
Luther Burbank Park Waterfront Improvements

LEGEND:

Project Area

Luther Burbank Park

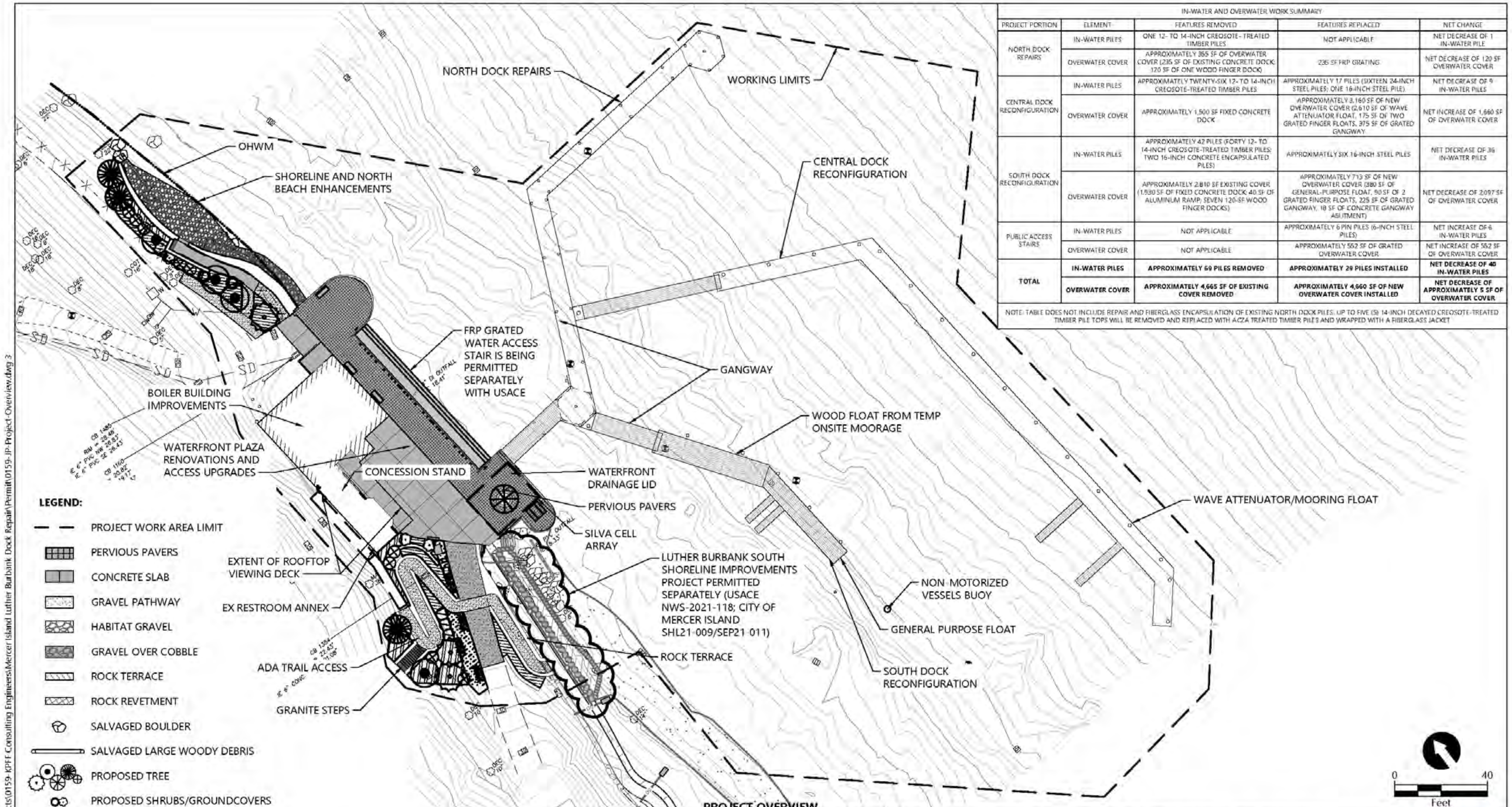
NOTE:
1. Aerial imagery: USA NAIP Streaming Imagery

0 500
Feet

Publish Date: 2023/03/31, 1:02 PM | User: tweldy
Filepath: \\orcas\GIS\Jobs\City_of_Mercer_Island_1018\Luther_Burbank\Maps\LutherBurbankWaterfrontImprovements\LutherBurbank_WtrfrntImprovements.aprx

ANCHOR QEA

Figure 2
Aerial Photograph of Park and Project Area
Critical Areas Study
Luther Burbank Park Waterfront Improvements



IN-WATER AND OVERWATER WORK SUMMARY

PROJECT PORTION	ELEMENT	FEATURES REMOVED	FEATURES REPLACED	NET CHANGE
NORTH DOCK REPAIRS	IN-WATER PILES	ONE 12- TO 14-INCH CREOSOTE-TREATED TIMBER PILES	NOT APPLICABLE	NET DECREASE OF 1 IN-WATER PILE
	OVERWATER COVER	APPROXIMATELY 355 SF OF OVERWATER COVER (235 SF OF EXISTING CONCRETE DOCK; 120 SF OF ONE WOOD FINGER DOCK)	235 SF FRP GRATING	NET DECREASE OF 120 SF OVERWATER COVER
CENTRAL DOCK RECONFIGURATION	IN-WATER PILES	APPROXIMATELY TWENTY-SIX 12- TO 14-INCH CREOSOTE-TREATED TIMBER PILES	APPROXIMATELY 17 PILES (SIXTEEN 24-INCH STEEL PILES; ONE 16-INCH STEEL PILE)	NET DECREASE OF 9 IN-WATER PILES
	OVERWATER COVER	APPROXIMATELY 1,500 SF FIXED CONCRETE DOCK	APPROXIMATELY 3,160 SF OF NEW OVERWATER COVER (2,610 SF OF WAVE ATTENUATOR FLOAT, 175 SF OF TWO GRATED FINGER FLOATS, 375 SF OF GRATED GANGWAY	NET INCREASE OF 1,660 SF OF OVERWATER COVER
SOUTH DOCK RECONFIGURATION	IN-WATER PILES	APPROXIMATELY 42 PILES (FORTY 12- TO 14-INCH CREOSOTE-TREATED TIMBER PILES; TWO 16-INCH CONCRETE ENCAPSULATED PILES)	APPROXIMATELY SIX 16-INCH STEEL PILES	NET DECREASE OF 36 IN-WATER PILES
	OVERWATER COVER	APPROXIMATELY 2,810 SF EXISTING COVER (1,930 SF OF FIXED CONCRETE DOCK; 40 SF OF ALUMINUM RAMP; SEVEN 120-SF WOOD FINGER DOCKS)	APPROXIMATELY 713 SF OF NEW OVERWATER COVER (380 SF OF GENERAL-PURPOSE FLOAT, 90 SF OF 2 GRATED FINGER FLOATS, 225 SF OF GRATED GANGWAY, 18 SF OF CONCRETE GANGWAY ABUTMENT)	NET DECREASE OF 2,097 SF OF OVERWATER COVER
PUBLIC ACCESS STAIRS	IN-WATER PILES	NOT APPLICABLE	APPROXIMATELY 6 PIN PILES (6-INCH STEEL PILES)	NET INCREASE OF 6 IN-WATER PILES
	OVERWATER COVER	NOT APPLICABLE	APPROXIMATELY 552 SF OF GRATED OVERWATER COVER	NET INCREASE OF 552 SF OF OVERWATER COVER
TOTAL	**IN-WATER PILES**	**APPROXIMATELY 69 PILES REMOVED**	**APPROXIMATELY 29 PILES INSTALLED**	**NET DECREASE OF 40 IN-WATER PILES**
	OVERWATER COVER	**APPROXIMATELY 4,665 SF OF EXISTING COVER REMOVED**	**APPROXIMATELY 4,660 SF OF NEW OVERWATER COVER INSTALLED**	**NET DECREASE OF APPROXIMATELY 5 SF OF OVERWATER COVER**

NOTE: TABLE DOES NOT INCLUDE REPAIR AND FIBERGLASS ENCAPSULATION OF EXISTING NORTH DOCK PILES. UP TO FIVE (5) 14-INCH DECAYED CREOSOTE-TREATED TIMBER PILE TOPS WILL BE REMOVED AND REPLACED WITH ACZA TREATED TIMBER PILES AND WRAPPED WITH A FIBERGLASS JACKET

Oct 19, 2022 1:49pm chewett K:\Projects\0159-KPFF Consulting Engineers\Mercer Island Luther Burbank Dock Repair\Permit\0159-JP-Project-Overview.dwg 3

SOURCE: SURVEY AND PIER PLAN CAD FILE PROVIDED BY KPFF.

REFERENCE #:

APPLICANT: CITY OF MERCER ISLAND

LOCATION: 2040 84TH AVENUE SE, MERCER ISLAND, WA 98040

ADJACENT PROPERTY OWNERS:
1 - CITY OF MERCER ISLAND, PARCELS 0724059054, 0124049018, 0124049002

NAME: LUTHER BURBANK WATERFRONT IMPROVEMENTS PROJECT

PROPOSED: REPAIR AND REPLACE DOCK STRUCTURES

PURPOSE: IMPROVE PUBLIC ACCESS AND RECREATIONAL USES

HORIZONTAL DATUM: WASHINGTON STATE PLANE, NORTH ZONE, NAD83
VERTICAL DATUM: NAVD88

LATITUDE: 47.591034 N
LONGITUDE: -122.224481 W
S-T-R: 6-25N-5E

IN: LAKE WASHINGTON
NEAR/AT: MERCER ISLAND
COUNTY: KING
STATE: WASHINGTON

DATE: OCTOBER 2022

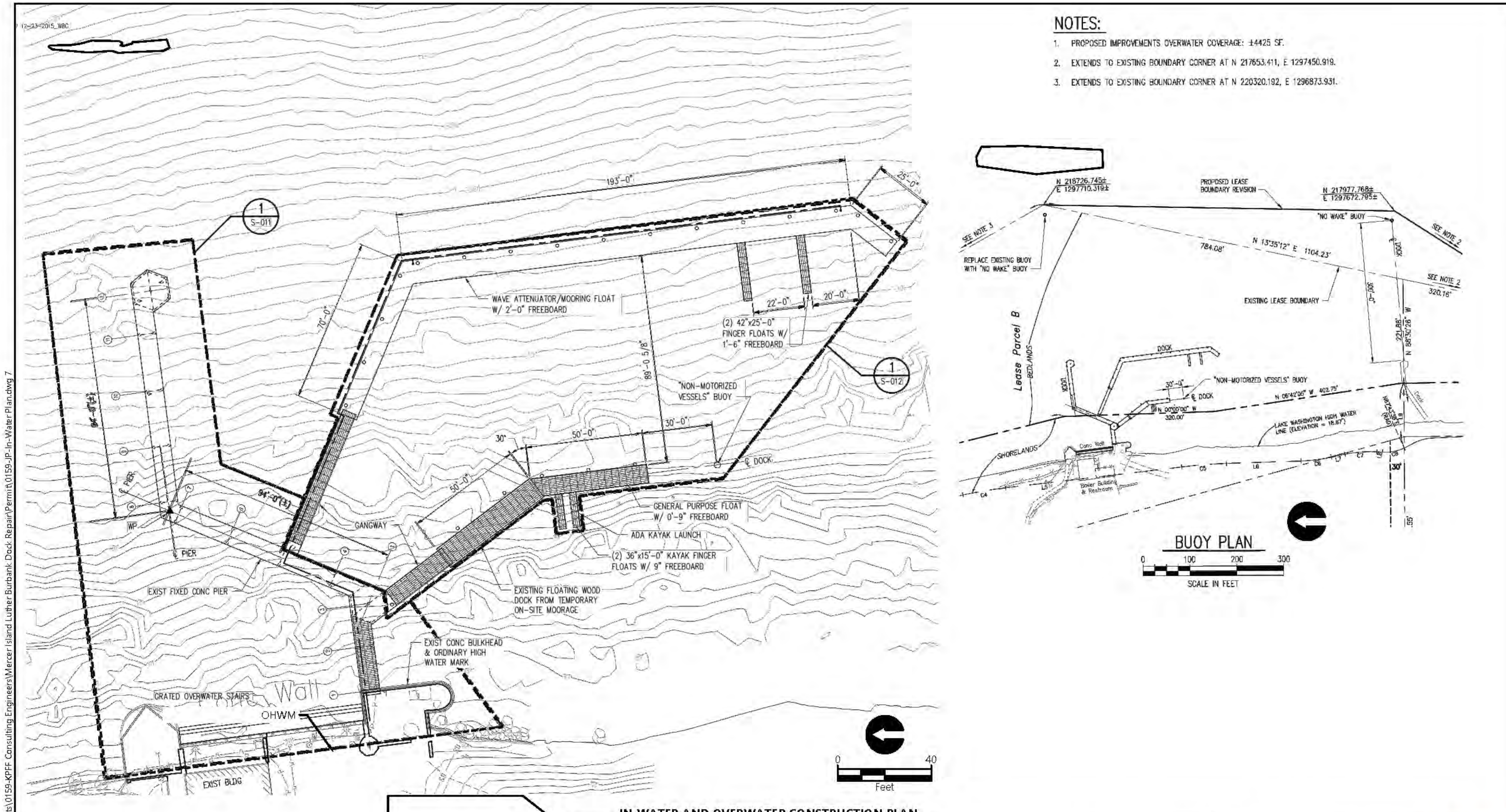
ANCHOR QEA
1201 3rd Ave, Suite 2600
Seattle, WA 98101
206-287-9130

Filepath: \\fuji\anchor\Projects\City of Mercer Island\KPFF\Luther Burbank LBDR\Permitting\CAR\Figures\Figure 3_Project Overview.docx

ANCHOR QEA

Figure 3
Project Overview
Critical Areas Study
Luther Burbank Park Waterfront Improvements

K:\Projects\0159-KPFF Consulting Engineers\Mercer Island Luther Burbank Dock Repair\Permit\0159-JP-In-Water Plan.dwg 7
Oct 19, 2022 1:50pm chewett



IN-WATER AND OVERWATER CONSTRUCTION PLAN

REFERENCE #:

APPLICANT: CITY OF MERCER ISLAND

LOCATION: 2040 84TH AVENUE SE,
MERCER ISLAND, WA 98040

ADJACENT PROPERTY OWNERS:
1 - CITY OF MERCER ISLAND, PARCELS 0724059054, 0124049018, 0124049002

NAME: LUTHER BURBANK WATERFRONT IMPROVEMENTS PROJECT

PROPOSED: REPAIR AND REPLACE DOCK STRUCTURES

PURPOSE: IMPROVE PUBLIC ACCESS AND RECREATIONAL USES

HORIZONTAL DATUM: WASHINGTON STATE PLANE, NORTH ZONE, NAD83

VERTICAL DATUM: NAVD88

LATITUDE: 47.591034 N
LONGITUDE: -122.224481 W
S-T-R: 6-25N-5E

IN: LAKE WASHINGTON
NEAR/AT: MERCER ISLAND
COUNTY: KING
STATE: WASHINGTON

DATE: OCTOBER 2022

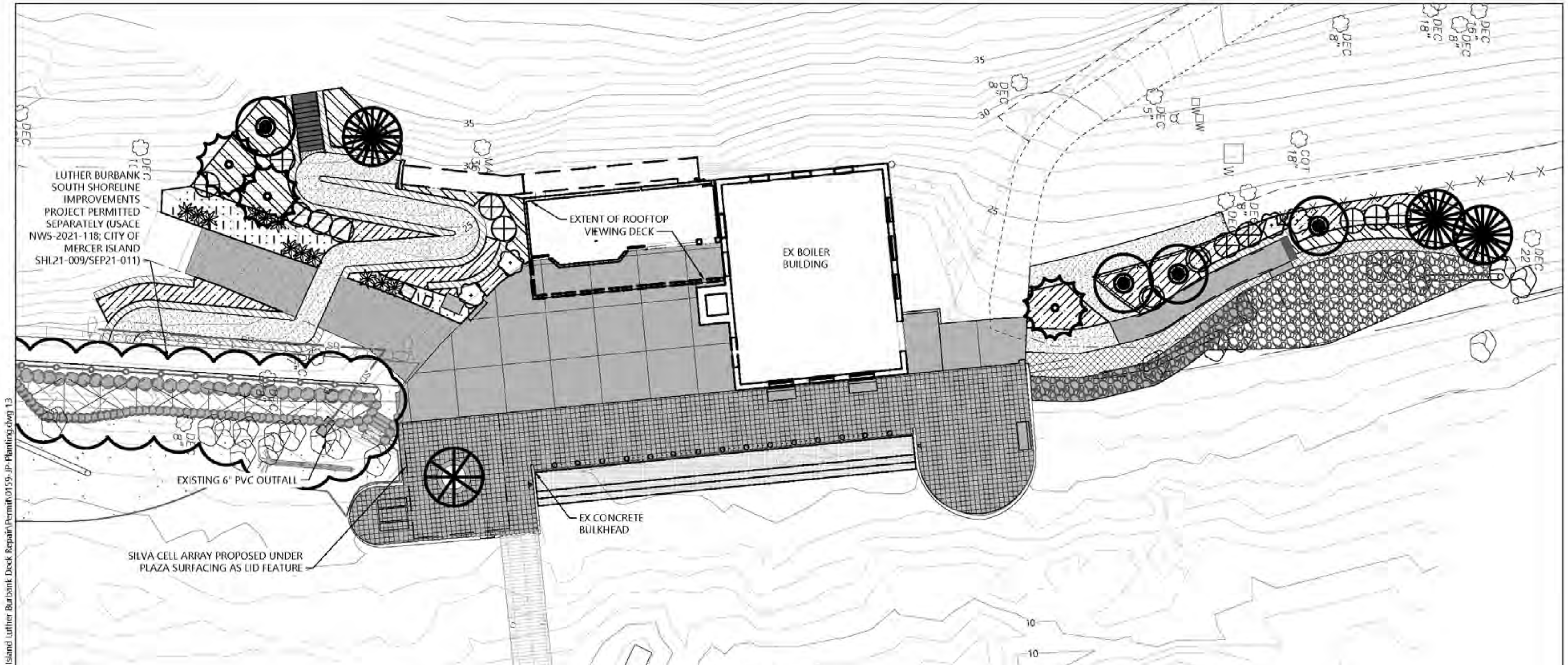
ANCHOR QEA
1201 3rd Ave, Suite 2600
Seattle, WA 98101
206-287-9130

SOURCE: IN-WATER AND OVERWATER CONSTRUCTION PLAN PROVIDED BY KPFF.

Filepath: \\fuji\anchor\Projects\City of Mercer Island\KPFF\Luther Burbank LBDR\Permitting\CAR\Figures\Figure 4_Overwater Plan.docx

ANCHOR QEA

Figure 4
In-Water and Overwater Construction Plan
Critical Areas Study
Luther Burbank Park Waterfront Improvements



LEGEND:

- EXISTING CONTOUR
- EXISTING TREE TO RETAIN
- EXISTING ORDINARY HIGH WATER LINE
- EXISTING BOULDER TO RETAIN
- PROPOSED CONTOUR
- PERVIOUS PAVERS
- CONCRETE SLAB ON GRADE WITH SAWCUT JOINT SCORING
- CRUSHED GRAVEL PATHWAY
- GRAVEL DRIVEWAY PAVING
- EXISTING BOLLARD AND CHAIN TO REMAIN
- HABITAT GRAVEL
- GRAVEL OVER COBBLE
- ROCK TERRACE
- ROCK REVETMENT
- FRP GRATING
- HANDRAIL
- SPLIT RAIL FENCING
- PICNIC TABLE
- BENCH
- SALVAGED LOG
- SALVAGED BOULDER

LEGEND (PROPOSED PLANTING):

- PROPOSED TREE
- PROPOSED SHRUBS/GROUNDCOVERS
- RIPARIAN SHRUBS
- NATIVE UPLAND PLANTING/GROUNDCOVER
- STORMWATER CONVEYANCE PLANTING

0 20 Feet

SOURCE: SURVEY AND PIER PLAN CAD FILE PROVIDED BY KPFF.

Oct 19, 2022 1:51pm chewett K:\Projects\0159-KPFF Consulting Engineers\Mercer Island Luther Burbank Dock Repair\Permit\0159-JP-Planting.dwg 13

PLANTING PLAN

REFERENCE #:

APPLICANT: CITY OF MERCER ISLAND

LOCATION: 2040 84TH AVENUE SE, MERCER ISLAND, WA 98040

ADJACENT PROPERTY OWNERS:
1 - CITY OF MERCER ISLAND, PARCELS 0724059054, 0124049018, 0124049002

NAME: LUTHER BURBANK WATERFRONT IMPROVEMENTS PROJECT

PROPOSED: REPAIR AND REPLACE DOCK STRUCTURES

PURPOSE: IMPROVE PUBLIC ACCESS AND RECREATIONAL USES

HORIZONTAL DATUM: WASHINGTON STATE PLANE, NORTH ZONE, NAD83
VERTICAL DATUM: NAVD88

LATITUDE: 47.591034 N
LONGITUDE: -122.224481 W
S-T-R: 6-25N-5E

IN: LAKE WASHINGTON
NEAR/AT: MERCER ISLAND
COUNTY: KING
STATE: WASHINGTON

DATE: OCTOBER 2022

ANCHOR QEA
1201 3rd Ave, Suite 2600
Seattle, WA 98101
206-287-9130

Filepath: \\fuji\anchor\Projects\City of Mercer Island\KPFF\Luther Burbank LBDR\Permitting\CAR\Figures\Figure 5_Planting Plan.docx

ANCHOR QEA

Figure 5
Planting Plan
Critical Areas Study
Luther Burbank Park Waterfront Improvements

PLANT SCHEDULE

COMMON NAME	SCIENTIFIC NAME	SIZE	SPACING
TREES			
GRAND FIR	ABIES GRANDIS	5-6' HT	AS SHOWN
WESTERN RED CEDAR	THUJA PLICATA	5-6' HT	AS SHOWN
BIG LEAF MAPLE	ACER MACROPHYLLUM	1.5" CAL	AS SHOWN
SWAMP OAK	QUERCUS PALUSTRIS	2" CAL	AS SHOWN
VINE MAPLE	ACER CIRCINATUM	5 GAL	AS SHOWN
HIGH SHRUBS			
INDIAN PLUM	OEMLERIA CERASIFORMIS	2 GAL	AS SHOWN
MOCK ORANGE	PHILADELPHUS LEWISII	2 GAL	AS SHOWN
SHRUBS - RIPARIAN			
SWORD FERN	POLYSTICHUM MUNITUM	1 GAL	3' O.C.
RED FLOWERING CURRANT	RIBES SANGUINEUM	1 GAL	3' O.C.
NOOTKA ROSE	ROSA NUTKANA	1 GAL	3' O.C.
THIMBLEBERRY	RUBUS PARVIFLORUS	1 GAL	3' O.C.
SNOWBERRY	SYMPHORICARPOS ALBUS	1 GAL	3' O.C.
GROUNDCOVERS			
SWORD FERN	POLYSTICHUM MUNITUM	1 GAL	3' O.C.
OREGON GRAPE	MAHONIA NERVOSA	1 GAL	3' O.C.
SHRUBS/GROUNDCOVERS - STORMWATER CONVEYANCE AREA			
RED OSIER DOGWOOD	CORNUS SERICEA	1 GAL	AS SHOWN
LADY FERN	ATHYRIUM FILIX-FEMINA	1 GAL	AS SHOWN
SEED MIX - STORMWATER CONVEYANCE AREA			

PLANT SCHEDULE

REFERENCE #:

APPLICANT: CITY OF MERCER ISLAND

LOCATION: 2040 84TH AVENUE SE, MERCER ISLAND, WA 98040

ADJACENT PROPERTY OWNERS:
1 - CITY OF MERCER ISLAND, PARCELS 0724059054, 0124049018, 0124049002

NAME: LUTHER BURBANK WATERFRONT IMPROVEMENTS PROJECT

PROPOSED: REPAIR AND REPLACE DOCK STRUCTURES

PURPOSE: IMPROVE PUBLIC ACCESS AND RECREATIONAL USES

HORIZONTAL DATUM: WASHINGTON STATE PLANE, NORTH ZONE, NAD83
VERTICAL DATUM: NAVD88

LATITUDE: 47.591034 N
LONGITUDE: -122.224481 W
S-T-R: 6-25N-5E

IN: LAKE WASHINGTON
NEAR/AT: MERCER ISLAND
COUNTY: KING
STATE: WASHINGTON

DATE: OCTOBER 2022

Filepath: \\fuji\anchor\Projects\City of Mercer Island\KPFF\Luther Burbank LBDR\Permitting\CAR\Figures\Figure 6_Plant Schedule.docx

Figure 6
Plant Schedule
Critical Areas Study
Luther Burbank Park Waterfront Improvements

LEGEND:

Project Area

Major 10-foot Contour

Minor 2-foot Contour

NOTES:
1. Aerial imagery: USA NAIP Streaming Imagery
2. Topographic contours from City of Mercer Island.

0 200
Feet

Publish Date: 2023/03/31, 1:03 PM | User: tweldy
Filepath: \\orcas\GIS\Jobs\City_of_Mercer_Island_1018\Luther_Burbank\Maps\LutherBurbankWaterfrontImprovements\LutherBurbank_WtrfrntImprovements.aprx

ANCHOR QEA

Figure 7
Project Area Boundary and Topography
Critical Areas Study
Luther Burbank Park Waterfront Improvements

LEGEND:

Project Area

Park Boundary

USDA NRCS Soil Type

Seattle Muck

Puget Silty Clay Loam

Kitsap silt loam, 2 to 8 percent slopes

Kitsap silt loam, 15 to 30 percent slopes

NOTE:
1. Aerial imagery: USA NAIP Streaming Imagery

0 500
Feet

Publish Date: 2023/03/31, 1:04 PM | User: tweldy
Filepath: \\orcas\GIS\Jobs\City_of_Mercer_Island_1018\Luther_Burbank\Maps\LutherBurbankWaterfrontImprovements\LutherBurbank_WtrfrntImprovements.aprx

ANCHOR QEA

Figure 8
USDA NRCS Soils
Critical Areas Study
Luther Burbank Park Waterfront Improvements

LEGEND:

Project Area

Park Boundary

NWI Wetland Type

Lake

Riverine

Freshwater Emergent Wetland

Freshwater Forested/Shrub Wetland

NOTE:
1. Aerial imagery: USA NAIP Streaming Imagery

0 500
Feet

Publish Date: 2023/03/31, 1:05 PM | User: tweldy
Filepath: \\orcas\GIS\Jobs\City_of_Mercer_Island_1018\Luther_Burbank\Maps\LutherBurbankWaterfrontImprovements\LutherBurbank_WtrfrntImprovements.aprx

ANCHOR QEA

Figure 9
USFWS National Wetlands Inventory
Critical Areas Study
Luther Burbank Park Waterfront Improvements

LEGEND:

Project Area

Park Boundary

Erosion Hazard

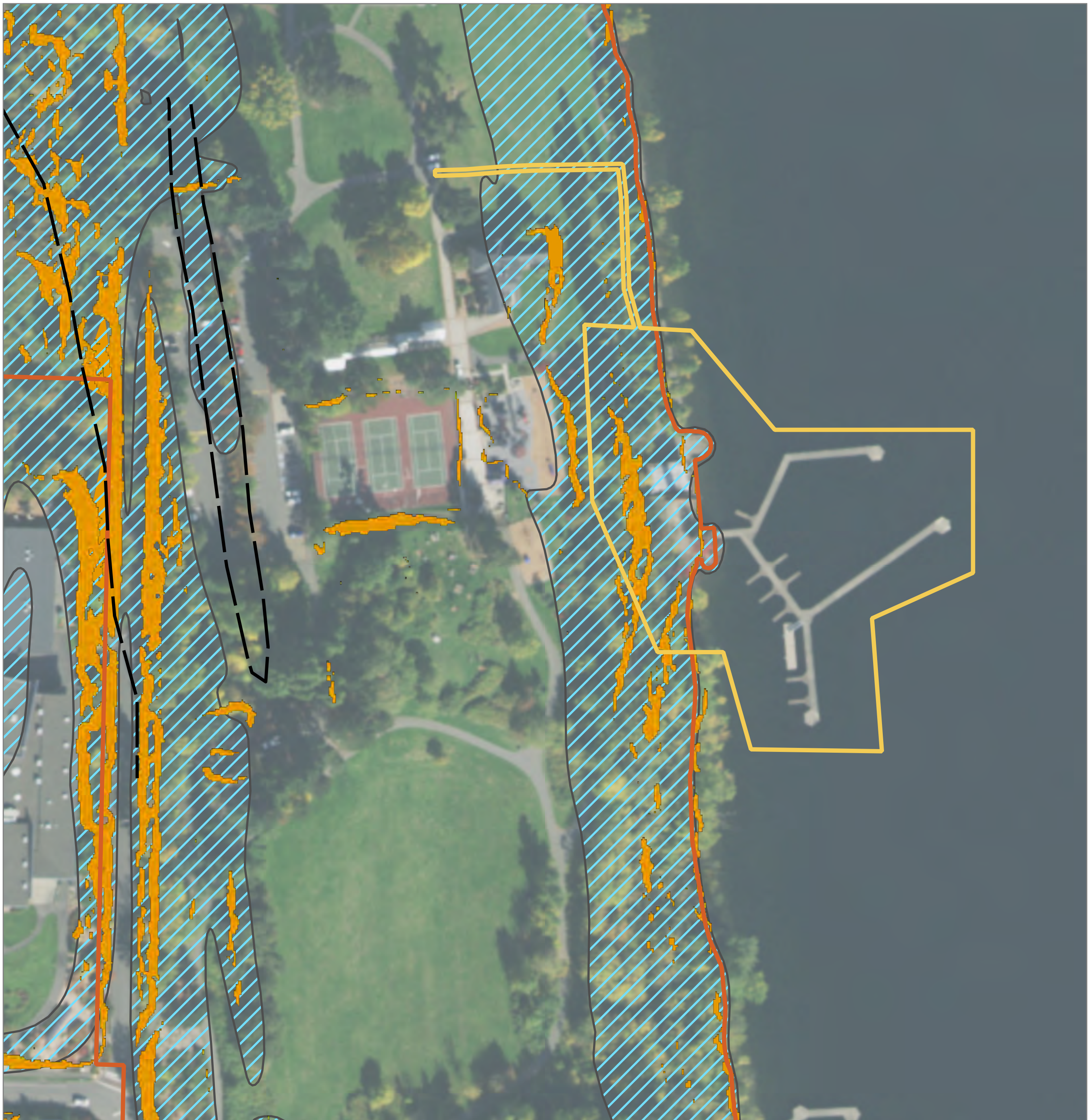
NOTES:
1. Aerial imagery: USA NAIP Streaming Imagery
2. Erosion hazards from City of Mercer Island.

0 500
Feet

Publish Date: 2023/03/31, 1:07 PM | User: tweldy
Filepath: \\orcas\GIS\Jobs\City_of_Mercer_Island_1018\Luther_Burbank\Maps\LutherBurbankWaterfrontImprovements\LutherBurbank_WtrfrntImprovements.aprx

ANCHOR QEA

Figure 10
Erosion Hazard Areas
Critical Areas Study
Luther Burbank Park Waterfront Improvements



LEGEND:

- Project Area
- Park Boundary
- Geologic Contacts
- Potential Slide
- Steep Slope Area (Slope > 40%)

NOTES:
1. Aerial imagery: USA NAIP Streaming Imagery
2. Geologic contacts and potential slide areas from City of Mercer Island.
3. Steep slope areas calculated using Lidar data provided by City of Mercer Island.

0 150
Feet

Publish Date: 2023/03/31, 1:10 PM | User: tweldy
Filepath: \\orcas\GIS\Jobs\City_of_Mercer_Island_1018\Luther_Burbank\Maps\LutherBurbankWaterfrontImprovements\LutherBurbank_WtrfrntImprovements.aprx

ANCHOR QEA

Figure 11
Landslide Hazard Areas
Critical Areas Study
Luther Burbank Park Waterfront Improvements

LEGEND:

- Project Area
- Park Boundary
- Seismic Hazard Area
- Fault Line (Seattle Fault Zone)

NOTES:
1. Aerial imagery: USA NAIP Streaming Imagery
2. Seismic hazard areas and fault line from City of Mercer Island.

0 500
Feet

Publish Date: 2023/03/31, 1:10 PM | User: tweldy
Filepath: \\orcas\GIS\Jobs\City_of_Mercer_Island_1018\Luther_Burbank\Maps\LutherBurbankWaterfrontImprovements\LutherBurbank_WtrfrntImprovements.aprx

ANCHOR QEA

Figure 12
Seismic Hazard Areas
Critical Areas Study
Luther Burbank Park Waterfront Improvements

Appendix A
Project Plan Set

This appendix is submitted under a separate cover.

Appendix B
Photographs

Photograph 1. Looking southeast from existing pathway toward Boiler Building and existing docks (April 2021).

Photograph 2. Looking northwest over existing north beach (April 2021).

Photograph 3. Looking east from plaza over existing docks (April 2021).

Photograph 4. Handsome Bollards chain and existing bulkhead in front of Boiler Building (April 2021).

Photograph 5. Existing Boiler Building (April 2021).

Photograph 6. Existing restroom annex building (April 2021).

Photograph 7. Existing gravel access driveway and footpath with wooden stairs at south end of plaza (April 2021).

Photograph 8. Looking southeast from north beach over existing docks (May 2022).

Photograph 9. Looking south from north beach toward existing bulkhead and Boiler Building (May 2022).

Appendix C
Geotechnical Report for Upland Improvements

Geotechnical Engineering Services

Luther Burbank Park Upland Improvements Mercer Island, Washington

for

City of Mercer Island

August 5, 2022

GeoEngineers
Earth Science + Technology

Geotechnical Engineering Services

Luther Burbank Park Upland Improvements
Mercer Island, Washington

for
City of Mercer Island

August 5, 2022

GeoEngineers

1101 Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

Geotechnical Engineering Services

Luther Burbank Park Upland Improvements
Mercer Island, Washington

File No. 0817-024-01

August 5, 2022

Prepared for:

City of Mercer Island Public Works
9601 SE 36th Street
Mercer Island, Washington 98040

Attention: Paul West, CIP Project Manager

Prepared by:

GeoEngineers, Inc.
1101 Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

Brett E. Larabee, PE
Senior Geotechnical Engineer

Lyle J. Stone, PE
Associate Geotechnical Engineer

BEL:LJS:kjb

Table of Contents

LIST OF FIGURES

APPENDICES

1.0 INTRODUCTION AND PROJECT UNDERSTANDING

This report presents the results of our geotechnical engineering services for the Luther Burbank Park Upland Improvements project. The project site is located at 2040 84th Avenue SE in Mercer Island, Washington. A vicinity map is provided as Figure 1. Our understanding of the project is based on our communications with you and project partners, KPFF and Swenson Say Faget, review of the 30 percent upland improvement plans (dated September 8, 2022), review of construction plans for the existing dock and portions of the shoreline bulkhead dated April 1973 (1973 Dock Plans), and our prior experience at the site. We are currently providing geotechnical engineering services to support improvements to the existing docks at the park. This work is ongoing, and our services related to the dock will be provided in a separate geotechnical report.

Proposed upland improvements are expected to consist of four main components:

- A seismic retrofit of the existing boiler plant building, and installation of a perimeter drain around the structure boiler plant and concessions/restroom building.
- Construction of a new Americans with Disability Act (ADA) accessible pedestrian ramp leading from existing trails to a second-story rooftop classroom area on top of the restroom building.
- Replacement of existing pavement with low impact surfacing such as permeable pavers, Silva Cells or other similar products intended to limit stormwater runoff and construction.
- Decommissioning of underground storage tanks (USTs) in accordance with applicable regulations.

We understand that seismic design for the restroom building retrofit will be competed in accordance with ASCE 41-17. Seismic design for the pedestrian ramp will be completed in accordance with the 2018 International Building Code (IBC). We expect that stormwater management facilities at the site will be designed in accordance with 2014 Washington State Department of Ecology Stormwater Management Manual for Western Washington (SWMMWW) which has been adopted by the City of Mercer Island.

Based on the available information, we understand that there are two abandoned USTs in the project vicinity that were associated with previous boiler plant operations and that petroleum hydrocarbons associated with the tanks have been detected in site soil. We understand that the City of Mercer Island (City) is assessing the status of the tanks and current plans include leaving the tank in place, however removal of the tank is also being evaluated. GeoEngineers is providing environmental service to support decommissioning of the USTs. Our environmental services are being provided in separate deliverables.

2.0 SCOPE OF SERVICES

The purpose of our services was to explore subsurface conditions at the site as a basis for providing geotechnical recommendations for design and construction. Our services were completed in accordance with our signed agreement dated January 4, 2022. Our specific scope of services is summarized in our proposal dated January 4, 2022.

3.0 SITE CONDITIONS

3.1. Surface Conditions

The project site is located on the shoreline of Lake Washington approximately in the geographical center of the parks' shoreline frontage. Development at the site includes the historic brick boiler plant building, a brick restroom building that connects to the southwest corner of the boiler plant, a concrete shoreline bulkhead, concrete and brick paved sidewalks and landscaped areas.

The boiler plant and restroom buildings are constructed into the toe of an upland slope that grades downward from the higher elevation portions of the park to the west to shoreline of Lake Washington. The slope behind the buildings is on the order of 50 to 60 feet tall and is inclined between 2 Horizontal to 1 Vertical (2H:1V) and 1.25H:1V. There is about a 1-foot gap between the back (western) sides of the buildings and the slope except for the lower 4 to 5 feet of the slope toe where the western walls of the buildings retain the lower portion of the slope. The upland slope behind the buildings is vegetated with trees and developed with foot-trails that provide access to the shoreline. Access to the shoreline area is also provided by two more primary routes: (1) a gravel surfaced maintenance road to the south of the buildings that is inclined around 4H:1V and (2) an asphalt paved walkway to the north of the building that is inclined on the order of 2H:1V. An apparent stormwater conveyance swale (ditch) is located along the western edge of the gravel maintenance road.

The existing shoreline bulkhead is approximately 200 feet long. The southern terminus of the bulkhead is just south of the access point to docks and the northern terminus of the bulkhead is about 15 feet north of the boiler plant building. The bulkhead has two circular "push-outs" that provide viewing areas. The southern push-out is planted with three trees. Based on our review of historic areal imagery, we understand the straight section of bulkhead in front of the boiler plant building was construed at the same time as the boiler plant (approximately 1928). The push-outs appear to have been constructed at the same time as the restroom building (1970's). According to the 1973 Dock Plans, the push out sections of the bulkhead are supported on shallow foundations. We expect that the original section of bulkhead and the existing boiler plant and restroom buildings are also supported on shallow foundations.

3.2. Subsurface Conditions

3.2.1. Literature Review

We reviewed the Geologic Map of King County (2007). According to the map the project site is underlain by glacial till (Qvt). Glacial till is typically comprised of a mixture of sand, gravel and cobbles in a silt matrix. Glacial till soils were consolidated by the weight of the overriding glacier and are typically dense to very dense.

We reviewed geologic and geotechnical information provided to us for other projects completed within Luther Burbank Park. This included photos from installation of a stormwater utility on the north side of the boiler plant building in 2018. The soils exposed in the reviewed photos are consistent with glacial till or other glacially consolidated soils.

We also searched for readily available geotechnical information in the project vicinity using the Washington State Department of Natural Resources Geologic Information Portal. We reviewed summary exploration logs associated with design of the Mercer Island Community and Event Center which is located to the west and upland of Luther Burbank Park. Reviewed exploration logs indicated that dense glacially consolidated soils were present near existing ground surface at that site.

3.2.2. Subsurface Explorations and Laboratory Testing

As part of our study, we advanced three hollow stem auger borings in the vicinity of the proposed improvements. The locations of our explorations are shown on the Site Plan, Figure 2. The borings were drilled on April 1, 2020 to depths between 11 and 13.5 feet below ground surface (bgs). A description of the field exploration program and the boring logs are presented in Appendix A.

Soil samples obtained from the borings were taken to our Redmond geotechnical laboratory for further evaluation. Testing included moisture content determinations, percent fines determinations and gradation analyses. A description of the laboratory test procedures and test results are presented in Appendix A.

3.2.3. Soil Conditions

Borings B-1 and B-2 were advanced in areas currently surfaced with sod. Sod thicknesses were typically on the order of 6 inches or less. Below the sod in B-1 and B-2 we observed what we interpret to be glacial till. Glacial till soils typically consisted of hard silt with sand and sandy silt with. We observed occasional gravel within the till and while not directly observed, we expect that cobbles and boulders could also be present within the glacial till. Practical drilling refusal was encountered in B-1 around 13.5 feet bgs and around 11 feet bgs in B-2.

B-3 was advanced within a concrete paved sidewalk area near the location of the relic USTs. Concrete thickness was on the order of 6 inches at the boring location and the concrete was underlain by about 4 inches of base course material. Below the base course in B-3 we observed what we interpret to be fill extending to around 7 feet bgs. Underlaying the fill was glacial till. Observed fill generally consisted of stiff sandy silt which we expect is reworked native soil. Underlying glacial till was hard and consisted of material similar to the glacial till observed in B-1 and B-2.

3.2.4. Groundwater Conditions

Our understanding of groundwater conditions is based on conditions observed during drilling of our borings and groundwater measurements taken in two previously installed monitoring wells at the site. The monitoring wells are located about 5 feet from the eastern edge of the shoreline bulkhead within the brick paved sidewalk area in front of the restroom building. Groundwater was measured in these wells around 2 feet below ground surface which was consistent with the distance to the water level in Lake Washington as measured from the ground surface elevation of the bulkhead. We expect that the groundwater observed in the wells is hydraulically connected with the water levels in Lake Washington and will fluctuate seasonally with lake levels.

Groundwater was observed in B-3 around 3 feet bgs during drilling. B-3 was located about 5 feet west of the previously mentioned monitoring wells. The groundwater observed in B-3 was located within the fill and was perched on top of the underlying glacial till soils which were observed to be moist.

We did not observe groundwater during drilling of B-1 and B-2. Soil samples collected in B-1 and B-2 appeared moist and we did not observe indications of soil oxidation or staining that would suggest that groundwater periodically flows through the glacial till. Based on these observations it does not appear that the water in Lake Washington penetrates into or flows through the intact glacial till at the site.

During our surface reconnaissance we did not observe active groundwater seepage on the face of the hillside behind the boiler plant and restroom building. However, based on our conversations with the project team we understand that groundwater seepage is routinely observed on the face of the hillside in some areas. This is not unusual on slopes comprised of glacially consolidated soils and perched groundwater tends to accumulate within portions of the deposits that contain higher percentages of sand and gravel and lower percentages of silt and clay or within areas that have higher degree of weathering. Perched groundwater volumes tend to fluctuate throughout the year typically being highest during winter and spring months and during periods of prolonged precipitation.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1. Geologic Hazards

We evaluated the site for geologic hazards as described in Mercer Island City Code 19.07.160 – Geologically Hazardous Areas. This includes landslide hazard areas, seismic hazard areas, and erosion hazard areas. We did not observe indicators of a landslide hazard area during our study. Potential seismic hazards are addressed in the Seismic Design section. In our opinion, the site does not pose an erosion hazard provided best management practices are implemented and our erosion and sedimentation control recommendations are followed as outlined in the Site Development and Earthwork section. Based on our review of available information, to our knowledge, no other geologic hazards are mapped in the project area.

4.2. Seismic Design

4.2.1. Seismic Design Parameters

The tables below provide seismic design parameters developed in accordance with ASCE 41-17 for the BSE-1 (5 percent chance of exceedance in 50 years) and BSE-2 (20 percent chance of exceedance in 50 years) seismic events and in accordance with the 2018 IBC which references ASCE 7-16. The project site is underlain by dense to very dense glacially consolidated soils and we recommend using a response spectrum for Site Class C for this site.

TABLE 1. SEISMIC DESIGN PARAMETERS ASCE 41-17

Seismic Design Parameter	BSE-1 (5% exceedance in 50 years)	BSE-2 (20% exceedance in 50 years)
Spectral Response Acceleration at Short Periods (S_S)	1.034g	0.489
Spectral Response Acceleration at 1-Second Periods (S_1)	0.351g	0.152
Site Class	C	C
Site Modified Spectral Response Acceleration at Short Periods (S_{XS})	1.241g	0.635
Site Modified Spectral Response Acceleration at 1-Second Periods (S_{X1})	0.527g	0.228

TABLE 2. SEISMIC DESIGN PARAMETERS 2018 IBC

2018 IBC Seismic Design Parameters	
Spectral Response Acceleration at Short Periods (S_S)	1.388g
Spectral Response Acceleration at 1-Second Periods (S_1)	0.482g
Site Class	C
Site Modified Peak Ground Acceleration (PGA_M)	0.712g
Design Spectral Response Acceleration at Short Periods (SD_S)	1.11g
Design Spectral Response Acceleration at 1-Second Periods (SD_1)	0.483g

4.2.2. Liquefaction, Lateral Spreading and Surface Rupture

Liquefaction refers to a condition where vibration or shaking of the ground, usually from earthquake forces, results in development of excess pore pressures and subsequent loss of strength in the affected soil deposit. In general, soils that are susceptible to liquefaction include loose to medium dense “clean” to silty sands that are below the water table.

Based on the soil conditions observed in our explorations and our understanding of the site geology, in our opinion it is unlikely that there are potentially liquefiable soils present at the project site and there is a low risk of liquefaction occurring during the seismic design events.

Lateral spreading related to seismic activity typically involves lateral displacement of large, surficial blocks of non-liquefied soil when an underlying soil layer loses strength during seismic shaking. Lateral spreading usually develops in areas where sloping ground or large grade changes (including retaining walls) are present. Due to the low liquefaction risk at the site, in our opinion there is also a low risk of lateral spreading occurring at this site.

According to the Department of Natural Resources Seismic Hazards Map, the project site is in the vicinity of the Seattle Fault zone. However, because bedrock in this area is covered by hundreds of feet of glacial soils, it is unlikely that movement of the fault would result in significant surface rupture at the ground surface.

4.3. Foundation Support

4.3.1. General

The sections below provide design and construction recommendations for conventional shallow foundations (spread footings), drilled pier type foundations (pier foundations) and micropiles. We have also included recommendations for evaluating the foundations of existing structures at the site.

We understand that a perimeter footing drain will be installed on the west side of the existing restroom and boiler plant buildings. Recommendations for design of footing drains are included in Section 4.3.2.6.

4.3.2. Spread Footings

4.3.2.1. General

In our opinion, the proposed structures can be adequately supported on shallow foundations bearing on glacial till soils. Glacial till soils are expected to be present within about a foot of the ground surface across the site. The depth to glacial till could vary in areas where grading or fill activities have occurred. Because glacial till soils are expected to be present at shallow depths, we recommend that existing fill, if present, be removed from below footings.

For spread foundation design, we recommend that footings be established at least 18 inches below the lowest adjacent grade and have minimum widths of 24 inches.

4.3.2.2. Foundation Bearing Surface Preparation and Protection

Shallow footing excavations should be performed using a smooth-edged bucket to limit bearing disturbance. We recommend that the base of all footing excavations be proof compacted to a uniformly firm and unyielding condition prior to placement of structural fill, formwork or rebar. Loose or disturbed materials present at the base of footing excavations should be removed or compacted. Fill, if present, should be removed from below spread footings. If soft or otherwise unsuitable areas are observed at the foundation bearing surface that cannot be compacted to a stable and uniformly firm condition the following options may be considered: (1) the exposed soils may be moisture conditioned and recompacted; or (2) the unsuitable soils may be overexcavated and replaced with compacted structural fill, as needed.

Foundation bearing surfaces should not be exposed to standing water. If water is present in the excavation, it must be removed before placing structural fill, formwork and reinforcing steel. Protection of exposed soil should be considered during the wetter times of the year. Typically, a 3- to 4-inch lean concrete mat or a 6- to 8-inch crushed rock section is suitable for foundation bearing surface protection.

Prepared foundation bearing surfaces should be observed and evaluated by a member of our firm prior to placement of structural fill, formwork or steel reinforcement. Our representative will confirm that the bearing surfaces have been prepared in accordance with our recommendations and is suitable for supporting the design footing load and provide recommendations for remediation, if necessary.

4.3.2.3. Allowable Soil Bearing Resistance

Spread footings bearing on subgrades prepared as recommended may be designed using an allowable soil bearing pressure of 4,000 pounds per square foot (psf). This bearing pressure applies to the total of dead and long-term live loads and may be increased by one-third when considering total loads, including earthquake or wind loads. This bearing pressure assumes that footings are located on level ground. If footings are located in areas of sloping ground, the allowable bearing pressure should be decreased by a factor of 0.5 for slope inclinations up to 2H:1V. We do not recommend that spread footings be located on slopes that are steeper than 2H:1V.

These are net bearing pressures. The weight of the footing and overlying backfill can be ignored in calculating footing sizes. Higher bearing pressures may be applicable on a case-by-case basis provided footing elevations, loading conditions are known, and subgrades are protected during construction. We can work with the design team to evaluate increased bearing pressures, if this would provide value to the project.

4.3.2.4. Foundation Settlement

Disturbed soil must be removed from the base of footing excavations and the bearing surface should be prepared as recommended. Provided these measures are taken, we estimate the total static settlement of shallow foundations will be on the order of 1 inch or less for the bearing pressures presented above. Differential settlements could be on the order of ¼ to ½ inch between comparably loaded isolated column footings or along 50 feet of continuous footing. Settlement is expected to occur rapidly as loads are applied. Settlements could be greater than estimated if loose or disturbed soil is present beneath footings.

4.3.2.5. Lateral Resistance

The ability of the soil to resist lateral loads is a function of frictional resistance, which can develop on the base of footings and slabs and the passive resistance, which can develop on the face of below-grade elements of the structure as these elements tend to move into the soil. The allowable frictional resistance on the base of the footing may be computed using a coefficient of friction of 0.4 applied to the vertical dead-load forces. The allowable passive resistance on the face of the footing or other embedded foundation elements may be computed using an equivalent fluid density of 350 pounds per cubic foot (pcf) for undisturbed site soils or structural fill extending out from the face of the foundation element a distance at least equal to two and one-half times the depth of the element. These values include a factor of safety of about 1.5.

The passive earth pressure and friction components may be combined provided that the passive component does not exceed two-thirds of the total. For level ground conditions, the top foot of soil should be neglected when calculating passive lateral earth pressure unless the area adjacent to the foundation is covered with pavement or a slab-on-grade. If footings are located on sloping ground, the top 2 feet of soil should be neglected when calculating passive lateral earth pressures.

4.3.2.6. Perimeter Footing Drains

We understand that a perimeter drain will be installed on the west side of the existing building. Perimeter footing drains should be provided with cleanouts and should consist of at least 4-inch-diameter perforated pipe surrounded on all sides by 6 inches of drain material enclosed in a non-woven geotextile fabric for underground drainage to prevent fine soil from migrating into the drain material. We recommend that the drainpipe consist of either heavy-wall solid pipe or rigid corrugated smooth interior polyethylene pipe. We do not recommend using flexible tubing for footing drainpipes. The drain material should consist of pea gravel or material similar to "Gravel Backfill for Drains" per Washington State Department of Transportation (WSDOT) Standard Specifications Section 9-03.12(4). The perimeter drains should be sloped to drain by gravity, if practical, to a suitable discharge point. Water collected in roof downspout lines must not be routed to the perimeter footing drains. Provided the envisioned perimeter footing drain is installed as recommended, in our opinion individual footing drains or below slab drains are not necessary.

4.3.3. Bearing Resistance of Existing Footings

We understand that the existing footings for the boiler plant, restroom building, and bulkhead walls will be evaluated considering current building codes and may be relied upon to resist loads from new improvements. Based on review of provided as-built drawings the existing structures are supported on shallow spread footings. It is unclear what bearing pressures were assumed for design of the footings and what methods were used for preparing foundation bearing surfaces. At this time, we recommend that the existing footings be evaluated using an allowable bearing resistance of 3,500 psf. Existing footings can be evaluated using the lateral resistance values provided above.

If more information on design and construction of the existing footings is obtained, or if can be confirmed that the existing foundations are bearing directly on intact glacial till, we expect that a higher bearing resistance bearing could be considered. Depending on structural demands it could be necessary to retrofit existing footings using deep foundations. For this site we expect that drilled micropiles are the most feasible solution for reinforcing existing footings. Recommendations for design and construction of micropiles are included in Section 4.2.5 of this report.

4.3.4. Pier Foundations

4.3.4.1. General

We expect that pier foundations will consist of a precast or cast in place concrete foundation installed into a predrilled/or excavated hole. The sections below provide recommendations for design and construction of pier foundations.

4.3.4.2. Axial Resistance

Pier foundations will achieve axial downward resistance through end bearing resistance at the toe of the pier and through skin friction along the length of the foundation. Uplift resistance will be achieved through skin friction only.

We recommend that end bearing resistance of pier foundations be estimated assuming an allowable soil bearing pressure of 5,000 psf. Downward skin friction resistance can be estimated using an allowable unit skin resistance of 350 psf per linear foot of embedded foundation. Uplift skin friction resistance can be estimated using an allowable unit skin resistance of 300 psf per linear foot of embedded foundation. These values are appropriate for foundation embedment depths up to about 15 feet. If foundation embedment depths are expected to exceed, we should be contacted to consider a revised estimate of pier axial resistance based on the proposed structure.

For example, a 2 foot diameter pier footing embedded 10 feet below grade would achieve the following **allowable** resistances:

$$End\ Bearing\ Resistance = \mathrm{B}earing\ pressure\ (psf) \times Toe\ Area\ (sf)$$

$$= 5{,}000 psf\ \times\ \pi(\frac{2\ ft.}{2})^2 \cong 15{,}700\ lbs.$$

$$Downward\ Skin\ Resistance = Unit\ Skin\ Resistance \times Pier\ Perimeter\ (ft) \times Pier\ Embedment(ft)$$

$$= 350\ psf\ \ \times \pi\ (2\ ft) \times 10\ ft. \cong 22{,}000\ lbs.$$

$$Upward\ Skin\ Resistance = Unit\ Uplift\ Resistance \times Pier\ Perimeter\ (ft) \times Pier\ Embedment(ft)$$

$$= 300\ psf\ \ \times \pi(2\ ft) \times 10\ ft. \cong 18{,}850\ lbs.$$

4.3.4.3. Lateral Resistance

The tables below provide recommendations for evaluating lateral resistance of pier foundations. Table 3 provides allowable lateral bearing resistance values for the soils encountered in our borings. Lateral bearing resistances are based on correlations presented in Table 17-2 of the WSDOT *Geotechnical Design Manual*.

TABLE 3. LATERAL SOIL BEARING RESISTANCE

Depth Range (feet)	Allowable Lateral Bearing Resistance (psf)
0 to 5	2,000
5 and below	4,500

Table 4 provides recommended soil parameters for lateral pier foundation analyses using the software program LPILE (Ensoft Inc. 2016).

TABLE 4. RECOMMENDED LPILE PARAMETERS

Depth Range (feet)	p-y Curve Type	Eff. Unit Wt. (pcf)	Friction Angle (deg)	K (pci)
0 to 5	Sand (Reese)	125	34	200
5 and below	Sand (Reese)	125	38	225

If lateral pier foundation analyses are completed using LPILE, we recommend that we be allowed to review the results of the analyses to confirm that the results are consistent with our experience designing foundations and our understanding of soil conditions at the site.

4.3.4.4. Construction Considerations

We present two conditions to consider when constructing pier foundations.

- Condition 1, an excavation the same dimension of the designed foundation is created, and the precast foundation is placed in the excavation or the foundation is cast directly against undisturbed earth; or
- Condition 2, an excavation larger than the designed dimension of the foundation is created, a casing is placed into the excavation and the foundation concrete is cast inside the casing. The casing could be left in place permanently or removed from the excavation as the foundation is constructed. If the casing is left in place any overexcavated area outside of the casing would need to be backfilled with controlled density fill (CDF).

Construction of Condition 1 requires the sidewalls of the excavation to stay stable during construction of the foundation. Construction of Condition 2 does not require the sidewalls of the excavation to remain stable. Based on the soil and groundwater conditions at the site, in our opinion it is feasible to complete excavations for drilled pier foundations without the use of temporary casing (Condition 1). The use of temporary casing could still be desirable in areas of sloping ground, if groundwater seepage is encountered in excavations, or if the excavations will be left open for an extended period of time. If a sacrificial or permanent casing is used, this practice should be coordinated with the structural engineer.

Excavations for drilled pier foundations discussed above are typically completed with augers attached to tracked excavator type equipment. The size of excavator needed to complete the excavation will depend on the foundation diameter and depth. Selection of this foundation alternative should consider equipment access restrictions to the foundation locations.

We recommend that the base of the pier footing excavations be free of loose or disturbed soils prior to construction of the foundation. If loose or disturbed soils are present at the base of the excavation and cannot be adequately compacted or removed, we recommend that quarry spalls be pushed into the excavation subgrade until a stable base is established. If water accumulates in the excavation, the water should be removed from the excavation prior to pouring concrete.

4.3.5. Micropiles

4.3.5.1. General

Micropiles are small-diameter drilled piles (typically less than 12 inches in diameter) that are constructed by drilling a hole, placing reinforcement and then grouting the hole. Various methods can be used to drill the holes for micropiles. In our opinion, any drilling method can be considered provided it can form a stable hole at the required dimensions and within specified tolerances. Temporary casings are often used to help maintain stability of the excavation sidewalls during micropile drilling. In some cases, the steel casing is left in place, especially within the upper portions of the pile to increase the structural capacity of the micropiles.

Reinforcement generally consists of a large steel reinforcing bar installed down the center of the hole. The grouting method used to construct the micropiles has a significant impact on capacity. Micropiles installed by gravity grouting have lower capacities, and micropiles installed by pressure grouting or post-grouting (two-stage grouting process) can achieve much higher capacities. We typically recommend that micropiles be installed using pressure grouting or post-grouting methods.

Micropiles develop their resistance to axial loads primarily within the “bonded length” of the micropile (portion of the pile where grout is in direct contact with the soil and no outer casing is present). Axial resistance of micropiles is primarily derived from side friction within the bonded length. Because of their small diameters, end bearing resistance of micropiles is typically low compared to the side resistance. In our opinion, it is conservate to ignore the contribution of end bearing resistance when evaluating the axial capacity of micropiles.

4.3.5.2. Design Recommendations

We recommend that micropiles be designed using the procedures and recommendations outlined in the 2005 Federal Highway Administration (FHWA) *NHI-05-039, Micropile Design and Construction Manual*. We recommend that micropiles have a minimum embedment depth of 10 feet and have a minimum dimeter of 6 inches.

In lieu of micropile resistance charts we have provided estimates of the soil-grout bond stress values for the various strata of the design soil profile. These values are summarized in Table 5. These unit values can be used to estimate resistances of micropiles of various diameters and lengths. In our opinion, the provided values are conservative with respect to micropile design. A sacrificial test micropile could be installed at the site and a load test completed to measure the achieved soil -grout bond strength and serve as a basis for designing the production micropiles.

TABLE 5. MICROPILE DESIGN VALUES

Depth Range[1]	Layer Ultimate[2] Soil Grout Bond Stress (psi)	Layer Ultimate[2] End Bearing Stress (psi)	Layer Ultimate[2] Uplift Soil Grout Bond Stress (psi)
0 to 5	120	N/A[4]	120
5 and below	200	N/A[4]	200

Notes: [1]Depths are referenced to existing ground surface

[2]These values assume the micropiles are installed using pressure grout or post grouting installation methods. The following factors of safety should be considered when evaluating allowable resistance. Static Conditions: Skin Friction = 2.0, Uplift = 2.0. Seismic Conditions: Skin Friction = 1.5, Uplift = 1.75

4.3.5.3. Micropile Lateral Design

Because micropiles are relatively slender, single micropiles often have a relatively low lateral capacity. It is often necessary to install micropiles in groups or use battered micropiles to resist lateral loads. Permanent steel casings are also used to help increase the lateral stiffness of micropiles.

In our opinion the geotechnical properties previously provided for lateral analysis of drilled pier foundations are also suitable for evaluating micropiles. Group effects can be considered negligible for groups of micropiles spaced greater than 3 diameters apart. If micropiles will be spaced closer than what is recommended above, we should be notified and can provide additional recommendations for evaluation group effects. If micropiles are included in this project we recommend that GeoEngineers review the results of the lateral analyses to confirm that the analysis was completed in accordance with the intent of our recommendations.

4.3.5.4. Micropile Settlement

Provided micropiles are designed as recommended, we estimate that the settlement of micropiles under static loads will generally be on the order of ½-inch or less, exclusive of the elastic micropile compression. Most of this settlement should occur rapidly as loads are applied. Differential settlement between adjacent micropiles is expected to be negligible.

4.3.5.5. Micropile Testing

Micropiles should be tested to verify the installed capacity. We recommend that a minimum of one sacrificial micropile be tested to at least 2 times the design load. The sacrificial micropile should be in the same general location as production micropiles and be installed using the same means and methods as the production piles. We recommend that a minimum of 10 percent of the production piles, but at least 2, be proof-tested to 1.67 times the design load. The structural engineer may require additional or alternative testing requirements.

Micropile load testing should be completed using a load frame capable of distributing large test loads into the near surface soils without damaging existing structural elements or below ground utilities. The location of the micropile pile load tests should be reviewed during the design phase to minimize impacts to existing improvements.

4.3.5.6. Construction Considerations

The contractor should be prepared to install micropiles below the groundwater table and through soils that contain gravel, cobbles and boulders. The contractor should be prepared to use casing and/or drilling fluid to maintain drill hole stability.

Micropile layout should consider the location of existing below grade improvements. If an obstacle is encountered during micropile installation, it may be necessary to adjust the micropile location. Typically adjusting micropile locations by up to 1 to 2 pile diameters can be accommodated without significant change to the foundation design. Adjustments to the locations of micropiles during construction should be reviewed by the structural engineer.

No direct information regarding capacity (e.g., driving resistance data) of the micropiles is obtained during installation. Therefore, we recommend the installation and testing of micropiles be carefully monitored by a member from our firm who can observe and document conditions encountered.

4.4. Earth Pressures for Conventional Below-Grade Structures

4.4.1. Design Parameters

We recommend the following lateral earth pressures be used for design of conventional retaining walls and below-grade structures. These values are also appropriate for evaluating the existing shoreline bulkhead and existing building walls which we understand are retaining soils at the toe of the slope. We recommend that the undrained parameters be used for evaluating earth pressures of the existing bulkhead. Undrained pressures should also be used for evaluating the existing building walls unless a perimeter drain is installed behind the structure. For other walls, if drained design parameters are used, drainage systems must be included in the design in accordance with the recommendations presented in Section 4.3.2 below.

- Active soil pressure may be estimated using an equivalent fluid density of 35 pcf for the drained condition.
- Active soil pressure may be estimated using an equivalent fluid density of 85 pcf for the undrained condition; this value includes hydrostatic pressures.
- At-rest soil pressure may be estimated using an equivalent fluid density of 55 pcf for the drained condition.
- At-rest soil pressure may be estimated using an equivalent fluid density of 95 pcf for the undrained condition; this value includes hydrostatic pressures.
- For backfill sloping conditions up to 2H:1V, the soil pressures presented above should be increased by 15 percent.
- For seismic considerations, a uniform lateral pressure of 10H psf (where H is the height of the retaining structure or the depth of a structure below ground surface) should be added to the lateral earth pressure.
- A traffic surcharge should be included if vehicles are allowed to operate within ½ the height of the retaining walls. A typical traffic surcharge of 250 psf can be estimated by assuming an additional 2 feet of fill as part of the wall height. Other surcharge loads should be considered on a case-by-case basis. We can provide additional surcharge loads for specific loading conditions once known.

The active soil pressure condition assumes the wall is free to move laterally 0.001 H, where H is the wall height). The at-rest condition is applicable where walls are restrained from movement. The above-recommended lateral soil pressures do not include surcharge loads than those described.

Over-compaction of fill placed directly behind retaining walls or below-grade structures must be avoided. We recommend use of hand-operated compaction equipment and maximum 6-inch loose lift thickness when compacting fill within about 5 feet of retaining walls and below-grade structures.

Retaining wall foundation bearing surfaces should be prepared following Section 4.2 of this report. Provided bearing surfaces are prepared as recommended retaining wall foundations may be designed using the allowable soil bearing values and lateral resistance values presented previously.

4.4.2. Drainage

If retaining walls or below-grade structures are designed using drained parameters, a drainage system behind the structure must be constructed to collect water and prevent the buildup of hydrostatic pressure against the structure. We recommend the drainage system include a zone of free-draining backfill a minimum of 18 inches in width against the back of the wall. The drainage material should consist of coarse sand and gravel containing less that 5 percent fines based on the fraction of material passing the ¾-inch sieve. Material similar to "Gravel Backfill for Drains" per WSDOT Standard Specifications Section 9-03.12(4) is also suitable. Waffle board-type drainage mats may be considered instead of gravel provided they are protected from accumulating silt and discharge appropriately.

A perforated, rigid, smooth-walled drainpipe with a minimum diameter of 4 inches should be placed along the base of the structure within the free-draining backfill and extend for the entire wall length. The drain pipe should be metal or rigid PVC pipe and be sloped to drain by gravity. Discharge should be routed to appropriate discharge areas and designed to reduce erosion potential. Cleanouts should be provided to allow routine maintenance. We recommend roof downspouts or other types of drainage systems not be connected to retaining wall drain systems.

4.5. Stormwater Management

Stormwater infiltration facilities are not currently envisioned for this project, however use of porous surfacing or pavement systems that designed to store and transport collected water (e.g. Silva Cells) are being considered.

The site has a very low potential for stormwater infiltration. Existing soils at the site are comprised of very compact, hard, fine grained glacially consolidated soils that have very slow infiltration rates and based on the proximity to the lake, anticipated groundwater levels in level portions of the site are expected within a few feet of the ground surface. Based on these conditions we do not recommend that traditional stormwater infiltration facilities such as bioswales, infiltration trenches or permeable pavements be considered for use at this site. Infiltration in specific areas of the site where historical grading has taken place or where fill is present could be feasible, however additional studies would need to be completed to further evaluate infiltration potential.

Silva Cells are described as a modular suspended pavement system. The cells consist of square or rectangular units that include a roof and bottom supported by four "posts" at the corners. The units have opens sides and hollow interior. The cell interiors are typically filled with porous soil that allow for the storage and transportation of stormwater. While some infiltration through the base of the cells can occur, the cells can be designed assuming no infiltration and an underdrain system is typically included to discharge stormwater. Once installed the cell system can support different surfacing materials including pavers, gravel surfacing and in certain cases traditional pavements.

Silva Cells or other systems are often designed by the product manufacturer, and we recommend that they be consulted during design if these systems are being used.

To support design of stormwater collection and storage systems, the table below includes typical soil properties for common backfill materials and existing soils at the site.

TABLE 6. TYPICAL SOIL HYDRAULIC PROPERTIES

Soil Type	Referenced Gradation	Estimated Hydraulic Conductivity (inches per hour)	Porosity (n)	Void Ratio (e)
Glacial till	See Figure A-5 in Appendix A	<0.01	0.15	0.17
WSDOT Gravel Borrow	WSDOT Standard Specification 9-03.14(1)	29	0.29	0.41
WSDOT Select Borrow	WSDOT Standard Specification 9-03.14(2)	42	0.26	0.35
WSDOT Common Borrow	WSDOT Standard Specification 9-03.14(3)	20	0.24	0.32
Silty Sand with Occasional Gravel	Gravel = 4% Sand = 66% Silt = 30%	0.3	0.26	0.35
Silty Sand with Gravel	Gravel = 19% Sand = 51% Silt = 30%	0.75	0.22	0.28
Fine Sand	Sand = 99% Silt =1%	0.5	0.3	0.43

Notes:

Provided values are approximate and are based on WSDOT research report WA-RD 872.1 and our experience.

Estimates hydraulic conductivity, porosity and void ration values are based for compacted soils.

4.6. Site Development and Earthwork

We anticipate that site development and earthwork will include demolition of existing features, excavating for shallow foundations, utilities and other improvements, establishing subgrades for structures and hardscaping, and placing and compacting fill and backfill materials. We expect that site grading and earthwork can be accomplished with conventional earthmoving equipment. The following sections provide specific recommendations for site development and earthwork.

4.6.1. Clearing, Stripping and Demolition

Clearing and stripping depths will likely be on the order of 2 inches in areas currently surfaced with sod or other surface vegetation. Greater stripping depths could be required within structural areas or areas of unsuitable soils, if observed during construction. Stripped grass and sod material must not be re-used as fill.

Coarse gravel, cobbles and boulders should be expected within the glacial till soils present at the site. Accordingly, the contractor should be prepared to remove boulders and cobbles, if encountered during grading or excavation. Boulders may be removed from the site or used in landscape areas. Voids caused by boulder removal should be backfilled with structural fill.

We recommend that existing pavements and hardscaping be completely removed from areas that will be developed. During removal of these features, disturbance of surficial soils may occur, especially if left exposed to wet conditions. Disturbed soils may require additional remediation during construction and grading. If utilities exist beneath planned structures, they should be removed and backfilled or abandoned in place.

4.6.2. Erosion and Sedimentation Control

Erosion and sedimentation rates and quantities can be influenced by construction methods, slope length and gradient, amount of soil exposed and/or disturbed, soil type, construction sequencing and weather. Implementing an Erosion and Sedimentation Control Plan will reduce the project impact on erosion-prone areas. The plan should be designed in accordance with applicable city, county and/or state standards. The plan should incorporate basic planning principles, including:

- Scheduling grading and construction to reduce soil exposure;
- Re-vegetating or mulching denuded areas;
- Directing runoff away from exposed soils;
- Reducing the length and steepness of slopes with exposed soils;
- Decreasing runoff velocities;
- Preparing drainage ways and outlets to handle concentrated or increased runoff;
- Confining sediment to the project site; and
- Inspecting and maintaining control measures frequently.

Some sloughing and raveling of exposed or disturbed soil on slopes should be expected. We recommend that disturbed soil be restored promptly so that surface runoff does not become channeled.

Temporary erosion protection should be used and maintained in areas with exposed or disturbed soils to help reduce erosion and reduce transport of sediment to adjacent areas and receiving waters. Permanent erosion protection should be provided by paving, structure construction or landscape planting.

Until the permanent erosion protection is established, and the site is stabilized, site monitoring may be required by qualified personnel to evaluate the effectiveness of the erosion control measures and to repair and/or modify them as appropriate. Provisions for modifications to the erosion control system based on monitoring observations should be included in the Erosion and Sedimentation Control Plan.

4.6.3. Temporary Excavation

Excavations deeper than 4 feet must be shored or laid back at a stable slope if workers are required to enter. Shoring and temporary slope inclinations must conform to the provisions of Title 296 Washington Administrative Code (WAC), Part N, “Excavation, Trenching and Shoring.” Regardless of the soil type encountered in the excavation, shoring, trench boxes or sloped sidewalls will be required under Washington Industrial Safety and Health Act (WISHA). The contract documents should specify that the contractor is responsible for selecting excavation and dewatering methods, monitoring the excavations for safety and providing shoring, as required, to protect personnel and structures.

The glacial till soils are hard and have some amount of cohesion that can allow them to stand vertical or near vertical for a limited amount of time. These soils can also slough unexpectedly. In general, temporary cut slopes at this site should be planned to be inclined no steeper than about 1½H to 1V (horizontal to vertical). Steeper slopes, up to about 1H to 1V can be considered within the intact glacial till deposits provided the contractor's competent person concurs with this assessment and monitors excavations in accordance with applicable regulations. This guideline assumes that all surface loads are kept at a minimum distance of at least one-half the depth of the cut away from the top of the slope and that seepage is not present on the slope face. Flatter cut slopes will be necessary where seepage occurs or if surcharge loads are anticipated. Temporary covering with heavy plastic sheeting should be used to protect slopes during periods of wet weather.

4.6.4. Permanent Slopes

If permanent slopes are necessary, we recommend they be constructed at a maximum inclination of 2H:1V. Where 2H:1V permanent slopes are not feasible, protective facings and/or retaining structures should be considered.

To achieve uniform compaction, we recommend that fill slopes be overbuilt slightly and subsequently cut back to expose well-compacted fill. Fill placement on slopes steeper than about 5H:1V should be benched into the slope face. The configuration of benches depends on the equipment being used. Bench excavations should be level and extend into the slope face.

Exposed areas should be re-vegetated as soon as practical to reduce the surface erosion and sloughing. Temporary protection should be used until permanent protection is established.

4.6.5. Groundwater Handling Considerations

In shoreline areas, groundwater should be expected in excavations that extend more than a few feet below the ground surface. Groundwater levels near the lake are expected to match water levels in Lake Washington. The glacial till soils have a very low permeability, therefore the quantity of water seeping into the excavation is expected to be low through these native soils and is expected to be manageable with isolated sumps and pumps. In areas where fill is present, groundwater handling could be more extensive. Groundwater could be especially challenging in areas where old utility trenches or pipe bedding are located and connect or otherwise provide a conduit to the shoreline of Lake Washington. If these conditions exist, the contractor might need to construct trench dams or other measures to slow groundwater flow.

Within the hillside area west of the existing buildings, we expect that perched groundwater could be encountered in shallow excavations. Perched groundwater can likley be handled adequately with sumps, pumps, and/or diversion ditches, as necessary. Groundwater seepage handling needs will typically be lower during the late summer and early fall months. Ultimately, we recommend that the contractor performing the work be made responsible for controlling and collecting groundwater encountered.

4.6.6. Surface Drainage

Surface water from roofs, pavements and landscape areas should be collected and controlled. Curbs or other appropriate measures such as sloping pavements, sidewalks and landscape areas should be used to direct surface flow away from buildings, erosion sensitive areas and from behind retaining structures. Roof and catchment drains should not be connected to wall or foundation drains.

4.6.7. Subgrade Preparation

Subgrades that will support slab-on-grade floors, pavements, and other site features bearing on final grade should be thoroughly compacted to a uniformly firm and unyielding condition on completion of stripping/excavation and before placing structural fill. We recommend that subgrades for structures, pavements and other bearing surfaces be evaluated, as appropriate, to identify areas of yielding or soft soil. Probing with a steel probe rod or proof-rolling with a heavy piece of wheeled construction equipment are appropriate methods of evaluation.

If soft or otherwise unsuitable subgrade areas are revealed during evaluation that cannot be compacted to a stable and uniformly firm condition, we recommend that: (1) the unsuitable soils be scarified (e.g., with a ripper or farmer's disc), aerated and recompacted, if practical; or (2) the unsuitable soils be removed and replaced with compacted structural fill, as needed.

4.6.8. Subgrade Protection and Wet Weather Considerations

The wet weather season generally begins in October and continues through May in Western Washington; however, periods of wet weather can occur during any month of the year. The soils encountered in our explorations contain a significant amount of fines. Soil with high fines content is very sensitive to small changes in moisture and is susceptible to disturbance from construction traffic when wet or if earthwork is performed during wet weather. If wet weather earthwork is unavoidable, we recommend that the following steps be taken.

- The ground surface in and around the work area should be sloped so that surface water is directed away from the work area. The ground surface should be graded so that areas of ponded water do not develop. Measures should be taken by the contractor to prevent surface water from collecting in excavations and trenches. Measures should be implemented to remove surface water from the work area.
- Earthwork activities should not take place during periods of heavy precipitation.
- Slopes with exposed soils should be covered with plastic sheeting.
- The contractor should take necessary measures to prevent on-site soils and other soils to be used as fill from becoming wet or unstable. These measures may include the use of plastic sheeting and controlling surface water with ditches, sumps with pumps and by grading. The site soils should not be left uncompacted and exposed to moisture. Sealing the exposed soils by rolling with a smooth-drum roller prior to periods of precipitation will help reduce the extent to which these soils become wet or unstable.
- Construction traffic should be restricted to specific areas of the site, preferably areas that are surfaced with working pad materials not susceptible to wet weather disturbance.
- Construction activities should be scheduled so that the length of time that soils are left exposed to moisture is reduced to the extent practical.
- During periods of wet weather, concrete should be placed as soon as practical after preparation of the footing excavations. Foundation bearing surfaces should not be exposed to standing water. If

water pools in the base of the excavation, it should be removed before placing structural fill or reinforcing steel.

- If footing excavations are exposed to extended wet weather conditions, a lean concrete mat or a layer of clean crushed rock can be considered for foundation bearing surface protection.

4.7. Fill Materials

4.7.1. Structural Fill

The workability of material for use as structural fill will depend on the gradation and moisture content of the soil. We recommend that washed crushed rock or select granular fill, as described below, be used for structural fill during the rainy season. If prolonged dry weather prevails during the earthwork phase of construction, materials with a somewhat higher fines content may be acceptable. Weather, material use, schedule, duration exposed, and site conditions should be considered when determining the type of import fill materials purchased and brought to the site for use as structural fill.

Material used for structural fill should be free of debris, organic material, and rock fragments larger than 6 inches. For most applications, we recommend that structural fill material consist of material similar to “Select Borrow” or “Gravel Borrow” as described in Section 9-03.14 of the Washington State Department of Transportation (WSDOT) Standard Specifications.

4.7.2. Select Granular Fill/Wet Weather Fill

Select granular fill should consist of well-graded sand and gravel or crushed rock with a maximum particle size of 6 inches and less than 5 percent fines by weight based on the minus ¾-inch fraction. Organic matter, debris or other deleterious material should not be present. In our opinion, material with gradation characteristics similar to WSDOT Specification 9-03.9 (Aggregates for Ballast and Crushed Surfacing), “Gravel Backfill for Walls” as described in Section 9-03.12(2) of the WSDOT Standard Specifications, or 9-03.14 (Borrow) is suitable for use as select granular fill, provided that the fines content is less than 5 percent (based on the minus ¾-inch fraction) and the maximum particle size is 6 inches.

4.7.3. Pipe Bedding

Trench backfill for the bedding and pipe zone should consist of well-graded granular material similar to “gravel backfill for pipe zone bedding” described in Section 9-03.12(3) of the WSDOT Standard Specifications. The material must be free of roots, debris, organic matter and other deleterious material. Other materials may be appropriate depending on manufacturer specifications and/or local jurisdiction requirements.

4.7.4. Trench Backfill

Trench backfill must be free of debris, organic material and rock fragments larger than 6 inches. We recommend that import trench backfill material consist of material similar to “Select Borrow” or “Gravel Borrow” as described in Section 9-03.14 of the WSDOT Standard Specifications. Where water is present, alternative materials may need to be considered.

4.7.5. Gravel Backfill for Walls

Backfill material used within 5 feet behind retaining walls should consist of free-draining material similar to “Gravel Backfill for Walls” as described in Section 9-03.12(2) of the WSDOT Standard Specifications.

4.7.6. Capillary Break Material

Structural fill placed as capillary break material below on-grade floor slabs should consist of ¾-inch coarse aggregate with negligible sand or silt as described in Section 9-03.1(4)C Grading No. 67 of the WSDOT Standard Specifications. WSDOT Specification 9-03.9 (Aggregates for Ballast and Crushed Surfacing, Crushed Surfacing Base Course [CSBC]) may also be considered.

4.7.7. Crushed Surfacing for Pavements and Sidewalks

Structural fill placed as CSBC below pavements and sidewalks should meet the requirements for Crushed Surfacing Base Course, Section 9-03.9(3) of the WSDOT Standard Specifications.

4.7.8. On-Site Soil

Based on our subsurface explorations and experience, it is our opinion that existing site soils will likely only be suitable for fill in non-structural areas and during periods of extended dry weather. The on-site soils may be considered for use as structural fill and trench backfill, provided they can be adequately moisture conditioned, placed and compacted as recommended and do not contain organic or other deleterious material.

The native glacial till soils at the site are primarily comprised of sandy silt and are extremely moisture sensitive. These soils will be very difficult or impossible to properly compact when wet and we do not recommend they be reused as structural fill during periods of wet weather. In addition, it is possible that existing soils will be generated at moisture contents above what is optimum for compaction. In this case, the soils would need to be moisture conditioned prior to re-use. Space for drying out material during dryer weather or covering on-site materials generated during wet weather should be considered. During wetter or even slightly colder times of year, such as when temperatures get below about 60 degrees, accommodations to cover stockpiled material generated on site that will be used as structural fill should be planned.

If earthwork occurs during a typical wet season, or if the soils are persistently wet and cannot be dried back due to prevailing wet weather conditions, we recommend the use of imported select granular fill, as described above.

4.7.9. Fill Placement and Compaction

To obtain proper compaction, fill soil should be compacted near optimum moisture content and in uniform horizontal lifts. Lift thickness and compaction procedures will depend on the moisture content and gradation characteristics of the soil and the type of equipment used. The maximum allowable moisture content varies with the soil gradation and should be evaluated during construction. Generally, 12-inch loose lifts are appropriate for steel-drum vibratory roller compaction equipment. Compaction should be achieved by mechanical means. During fill and backfill placement, sufficient testing of in-place density should be conducted by a representative of GeoEngineers to check that adequate compaction is being achieved.

4.7.9.1. Area Fills and Pavement Bases

Fill placed to raise site grades and materials under pavements and structural areas should be placed on subgrades prepared as previously recommended. Fill material placed below structures and footings should be compacted to at least 95 percent of the theoretical maximum dry density (MDD) per ASTM International (ASTM) D 1557. Fill material placed shallower than 2 feet below pavement sections should be compacted to at least 95 percent of the MDD. Fill placed deeper than 2 feet below pavement sections should be compacted to at least 90 percent of the MDD. Fill material placed in landscaping areas should be compacted to a firm condition that will support construction equipment, as necessary, typically around 85 to 90 percent of the MDD.

4.7.9.2. Backfill Behind Below-Grade Structures

Backfill behind retaining walls or below-grade structures should be compacted to between 90 and 92 percent of the MDD. Overcompaction of fill placed directly behind below-grade structures should be avoided. We recommend use of hand-operated compaction equipment and maximum 6-inch loose lift thickness when compacting fill within about 5 feet behind below-grade structures.

4.7.9.3. Trench Backfill

For utility excavations, we recommend that the initial lift of fill over the pipe be thick enough to reduce the potential for damage during compaction, but generally should not be greater than about 18 inches above the pipe. In addition, rock fragments greater than about 1 inch in maximum dimension should be excluded from this lift.

Trench backfill material placed below structures and footings should be compacted to at least 95 percent of the MDD. In paved areas, trench backfill should be uniformly compacted in horizontal lifts to at least 95 percent of the MDD in the upper 2 feet below subgrade. Fill placed below a depth of 2 feet from subgrade in paved areas must be compacted to at least 90 percent of the MDD. In non-structural areas, trench backfill should be compacted to a firm condition that will support construction equipment, as necessary.

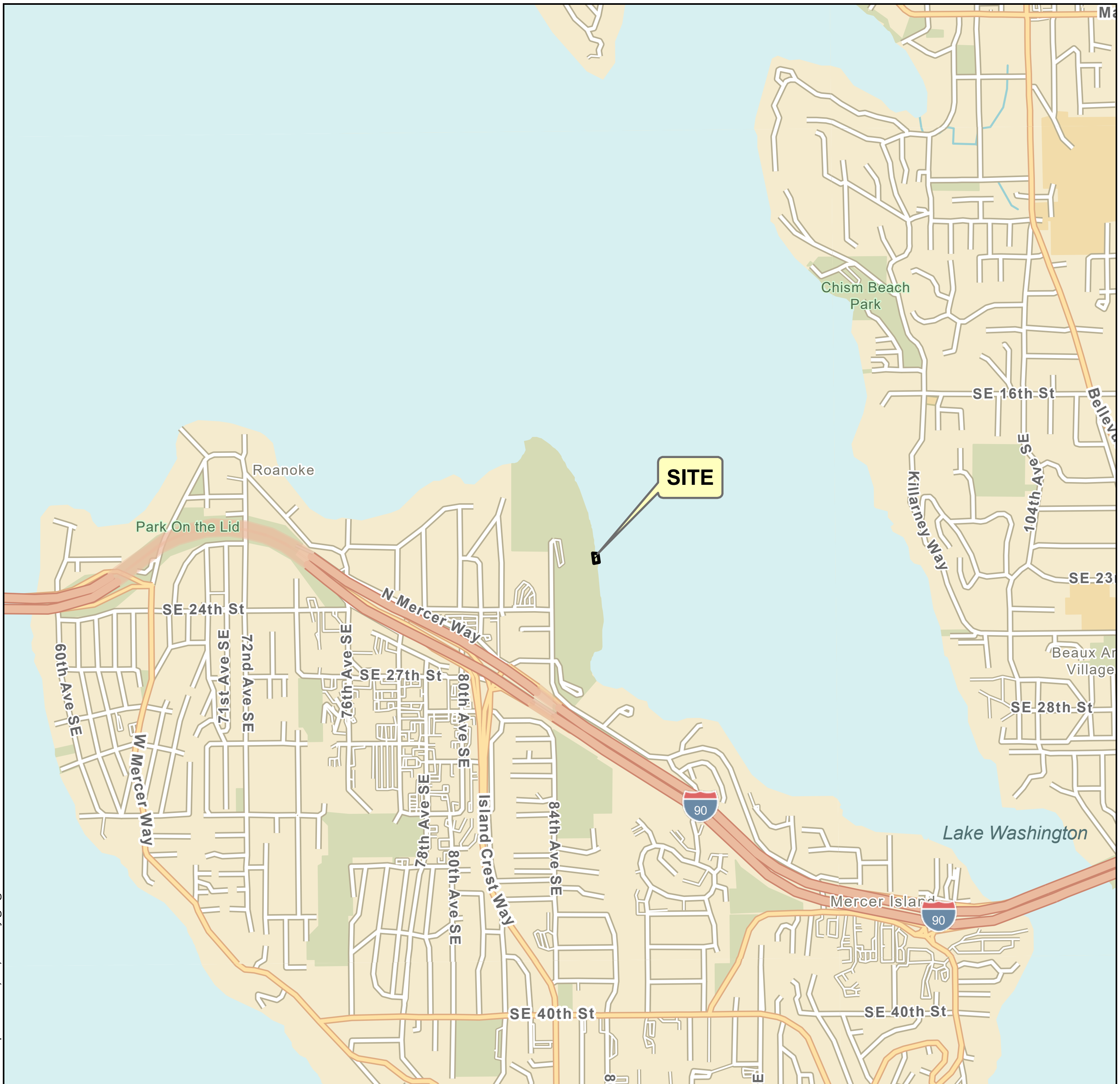
5.0 LIMITATIONS

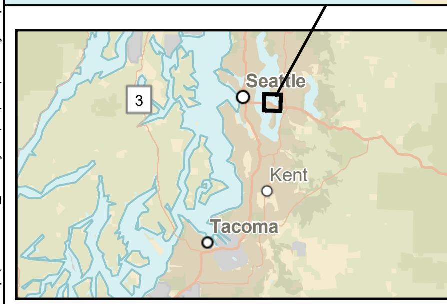
We have prepared this report for City of Mercer Island Public Works, for the Luther Burbank Park Upland Improvement Project. City of Mercer Island Public Works may distribute copies of this report to owner and owner's authorized agents and regulatory agencies as may be required for the Project.

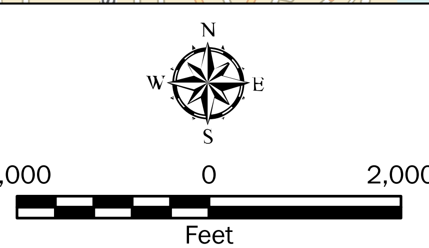
Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices for geotechnical engineering in this area at the time this report was prepared. The conclusions, recommendations, and opinions presented in this report are based on our professional knowledge, judgment and experience. No warranty, express or implied, applies to the services or this report.

Please refer to Appendix B titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.

FIGURES







Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: ESRI

Projection: NAD 1983 UTM Zone 10N

Vicinity Map

Luther Burbank Park Upland Improvements
Mercer Island Washington

GeoEngineers

Figure 1

P:\0\0817024\GIS\0817024_VicinityMap\0817024_VicinityMap.aprx\VicinityMap Date Exported: 04/25/22 by gregister

Legend

B-1 ⌖ Boring by GeoEngineers, Inc., 2022

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 08/14/2020.

Projection: Washington State Plane, North Zone, NAD83, US Foot

N
W E
S

60 0 60
Feet

Site Plan

Luther Burbank Park Upland Improvements
Mercer Island Washington

GEOENGINEERS

Figure 2

P:\0\0817024\CAD\01\Geotech Report\081702401_F02_Site Plan.dwg TAB:F02 Date Exported: 04/25/22 - 10:08 by gregister

APPENDICES

APPENDIX A
Subsurface Explorations and Laboratory Testing

APPENDIX A
SUBSURFACE EXPLORATIONS AND LABORATORY TESTING

Subsurface Explorations

General

Soil conditions at the project site were explored by advancing three borings on April 1, 2022. The approximate locations of our explorations and shown on Figure 2. The explorations were located in the field using a GPS device. The locations of the explorations shown on the Site Plan (Figure 2) should be considered approximate.

Soil Borings

Soil borings were advanced to between 11 feet and 13.5 feet below ground surface (bgs) using a track-mounted hollow-stem auger drill rig equipment and operators under subcontract to GeoEngineers. The explorations were continuously monitored by a representative from our firm who examined and classified the soil encountered, obtained representative soil samples, and maintained a detailed log of the explorations. Soil encountered in the borings was classified in general accordance with ASTM International (ASTM) D 2488 and the classification chart listed in Key to Exploration Logs, Figure A-1. Logs of the borings are presented in Figures A-2 through A-4. The logs are based on interpretation of the field and laboratory data and indicate the depth at which we interpret subsurface materials or their characteristics to change, although these changes might actually be gradual.

Soil samples were obtained from the borings at approximate 2.5- to 5-foot-depth intervals using either a 2-inch, outside-diameter, standard split-spoon sampler (Standard Penetration Test [SPT]) in general accordance with ASTM D 1586 or using a larger 2.4-inch-diameter sampler. The samplers were driven into the soil using a 140-pound rope and cathead hammer, free-falling 30 inches. The number of blows required to drive the samplers each of three, 6-inch increments of penetration were recorded in the field. The sum of the blow counts for the final 12 inches of penetration, unless otherwise noted, is reported on the boring logs.

Laboratory Testing

Soil samples obtained from the borings and test pits were returned to our laboratory for further examination and testing. The testing completed on each sample is presented in the corresponding boring log or test pit log.

Grain-size analyses were performed on selected soil samples in general accordance with ASTM Test Method D 6913. This test provides a quantitative determination of the distribution of particle sizes in soils. Figure A-5 presents the results of the grain-size analyses.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

Sampler Symbol Descriptions

- 2.4-inch I.D. split barrel / Dames & Moore (D&M)
- Standard Penetration Test (SPT)
- Shelby tube
- Piston
- Direct-Push
- Bulk or grab
- Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	SOD	Sod/Forest Duff
	TS	Topsoil

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PL	Point lead test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
UU	Unconsolidated undrained triaxial compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

Key to Exploration Logs

GEOENGINEERS

Figure A-1

Drilled	Start 4/1/2022	End 4/1/2022	Total Depth (ft) 13.5	Logged By LSP / Checked By BEL	Driller Geologic Drill Technologies	Drilling Method Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	23 / NAVD88	Hammer Data	Rope & Cathead / 140 (lbs) / 30 (in) Drop	Drilling Equipment	Mini Track Rig
Easting (X) / Northing (Y)	1297163 / 218603	System Datum	WA State Plane South / NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0							ML	Dark brown sandy silt with organics (stiff, moist) (sod)			
								ML	Gray sandy silt with occasional oxidation staining (hard, moist) (glacial till)			
			18	34		1 / SA				13	67	
20												
	5		18	55		2						
			11	50/5"		3						
15												
								SM	Gray silty fine sand (very dense, moist)			
	10		6	50/6"		4						
			18	71		5 / SA		ML	Gray silt with sand (hard, moist)	16	74	
			18	86		6						
10												

Practical drilling refusal at 13½ feet

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Esri Survey. Vertical approximated based on Project Survey.

Log of Boring B-1

GeoEngineers

Project: Luther Burbank Park Upland Improvements
Project Location: Mercer Island, Washington
Project Number: 0817-024-01

Figure A-2
Sheet 1 of 1

Drilled	Start 4/1/2022	End 4/1/2022	Total Depth (ft) 11	Logged By LSP / Checked By BEL	Driller Geologic Drill Technologies	Drilling Method Hollow-stem Auger

Surface Elevation (ft) 20 / Vertical Datum NAVD88	Hammer Data: Rope & Cathead 140 (lbs) / 30 (in) Drop	Drilling Equipment: Mini Track Rig
Easting (X) 1297149 / Northing (Y) 218583	System Datum: WA State Plane South NAD83 (feet)	Groundwater not observed at time of exploration

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0							ML	Dark brown sandy silt with organics (stiff, moist) (sod)			
								ML	Gray silt with sand and occasional gravel (hard, moist) (glacial till)			
			18	65		1 / SA				14	71	
15	5		18	58		2						
			17	75/11"		3						
10	10			50/6"		4						

Practical drilling refusal at 11 feet

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Esri Survey. Vertical approximated based on Project Survey.

Date:4/21/22 Path:P:\0\0817024\GINT\081702401.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI8_GEOTECH_STANDARD_%F_NO_GW

Log of Boring B-2

GEOENGINEERS

Project: Luther Burbank Park Upland Improvements
Project Location: Mercer Island, Washington
Project Number: 0817-024-01

Figure A-3
Sheet 1 of 1

Drilled	Start 4/1/2022	End 4/1/2022	Total Depth (ft) 11.5	Logged By LSP / Checked By BEL	Driller Geologic Drill Technologies	Drilling Method Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum: 20 / NAVD88	Hammer Data: Rope & Cathead 140 (lbs) / 30 (in) Drop	Drilling Equipment: Mini Track Rig
Easting (X) / Northing (Y): 1297142 / 218689	System Datum: WA State Plane South NAD83 (feet)	See "Remarks" section for groundwater observed

Notes:

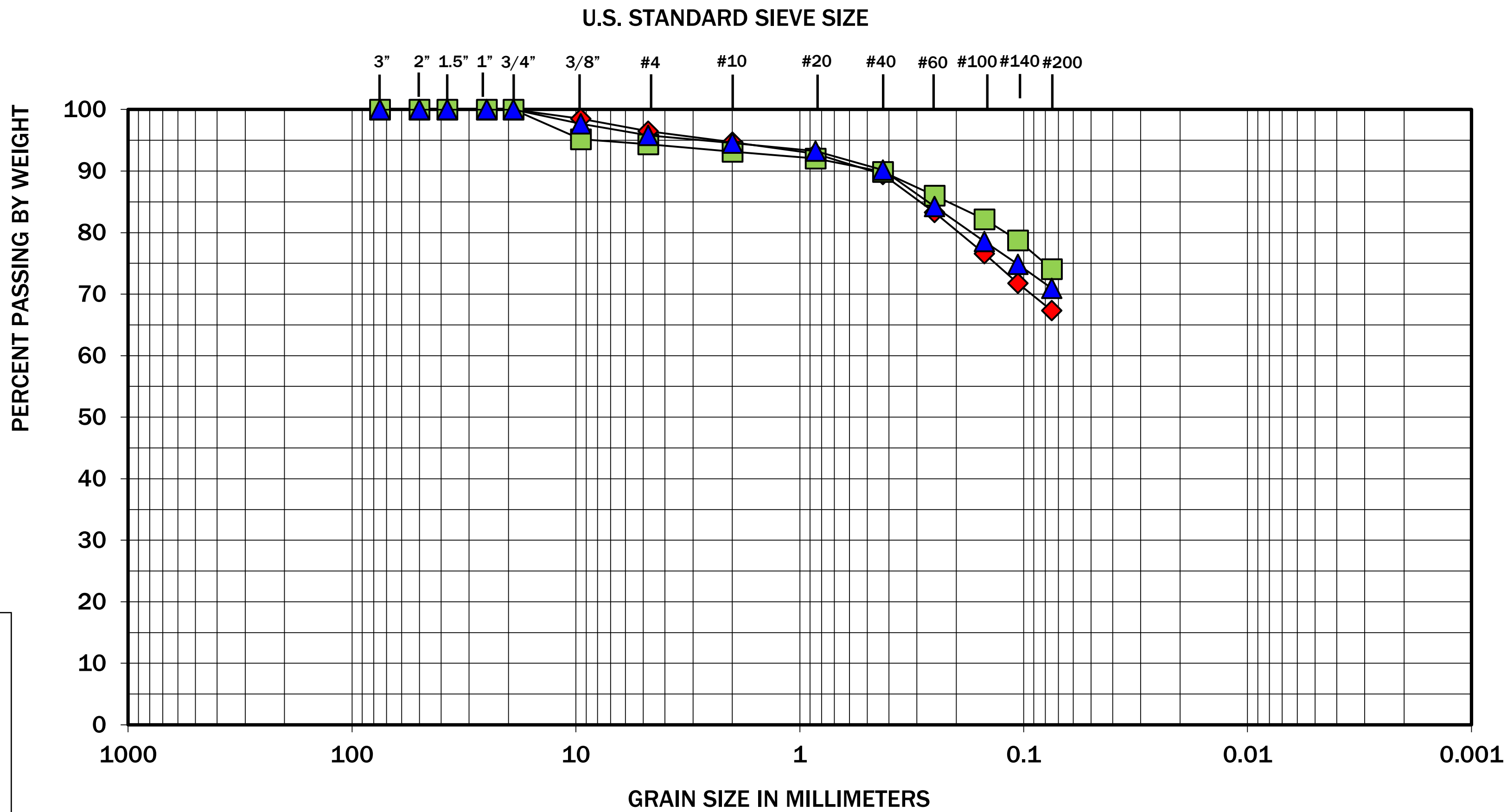
Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0							CC	Approximately 6 inches concrete			
			12	14		1		SP-SM	Approximately 4 inches gray fine to coarse sand with silt (medium dense, moist) (base course)			
								ML	Gray sandy silt with gravel (stiff, moist) (fill)			
			15	WOH		2						No sheen, slight odor
									Becomes wet			Perched groundwater observed at approxiamtely 3 feet during drilling
15	5		16	46		3						Slight sheen, slight odor
								ML	Light brown sandy silt (hard, moist) (glacial till)			
			18	60		4						No sheen, no odor
10	10		16	60		5						No sheen, no odor

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Esri Survey. Vertical approximated based on Project Survey.

Log of Boring B-3

GEOENGINEERS

Project: Luther Burbank Park Upland Improvements
Project Location: Mercer Island, Washington
Project Number: 0817-024-01



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆ (red diamond)	B-1	2.5	13	Sandy silt (ML)
■ (green square)	B-1	10.5	16	Silt with sand (ML)
▲ (blue triangle)	B-2	2.5	14	Silt with sand (ML)

Note: This report may not be reproduced, except in full, without written approval of GeoEngineers, Inc. Test results are applicable only to the specific sample on which they were performed, and should not be interpreted as representative of any other samples obtained at other times, depths or locations, or generated by separate operations or processes.

The grain size analysis results were obtained in general accordance with ASTM C 136. GeoEngineers 17425 NE Union Hill Road Ste 250, Redmond, WA 98052

AASHTO ACCREDITED

GEOENGINEERS

Luther Burbank Park Upland Improvements
Mercer Island, Washington

Sieve Analysis Results

Figure-A-5

APPENDIX B
Report Limitations and Guidelines for Use

APPENDIX B
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

Read These Provisions Closely

It is important to recognize that the geoscience practices (geotechnical engineering, geology and environmental science) rely on professional judgment and opinion to a greater extent than other engineering and natural science disciplines, where more precise and/or readily observable data may exist. To help clients better understand how this difference pertains to our services, GeoEngineers includes the following explanatory "limitations" provisions in its reports. Please confer with GeoEngineers if you need to know more how these "Report Limitations and Guidelines for Use" apply to your project or site.

Geotechnical Services are Performed for Specific Purposes, Persons and Projects

This report has been prepared for City of Mercer Island Public Works and for the Project(s) specifically identified in the report. The information contained herein is not applicable to other sites or projects.

GeoEngineers structures its services to meet the specific needs of its clients. No party other than the party to whom this report is addressed may rely on the product of our services unless we agree to such reliance in advance and in writing. Within the limitations of the agreed scope of services for the Project, and its schedule and budget, our services have been executed in accordance with our Agreement with City of Mercer Island Public Works dated January 4, 2022 and generally accepted geotechnical practices in this area at the time this report was prepared. We do not authorize, and will not be responsible for, the use of this report for any purposes or projects other than those identified in the report.

A Geotechnical Engineering or Geologic Report is based on a Unique Set of Project-Specific Factors

This report has been prepared for the Luther Burbank Upland Improvements Project in Mercer Island, Washington. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, it is important not to rely on this report if it was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

For example, changes that can affect the applicability of this report include those that affect:

- the function of the proposed structure;

---

1 Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org.

- elevation, configuration, location, orientation or weight of the proposed structure;
- composition of the design team; or
- project ownership.

If changes occur after the date of this report, GeoEngineers cannot be responsible for any consequences of such changes in relation to this report unless we have been given the opportunity to review our interpretations and recommendations. Based on that review, we can provide written modifications or confirmation, as appropriate.

Environmental Concerns are Not Covered

Unless environmental services were specifically included in our scope of services, this report does not provide any environmental findings, conclusions, or recommendations, including but not limited to, the likelihood of encountering underground storage tanks or regulated contaminants.

Information Provided by Others

GeoEngineers has relied upon certain data or information provided or compiled by others in the performance of our services. Although we use sources that we reasonably believe to be trustworthy, GeoEngineers cannot warrant or guarantee the accuracy or completeness of information provided or compiled by others.

Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by man-made events such as construction on or adjacent to the site, new information or technology that becomes available subsequent to the report date, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. If more than a few months have passed since issuance of our report or work product, or if any of the described events may have occurred, please contact GeoEngineers before applying this report for its intended purpose so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

Geotechnical and Geologic Findings are Professional Opinions

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies the specific subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied its professional judgment to render an informed opinion about subsurface conditions at other locations. Actual subsurface conditions may differ, sometimes significantly, from the opinions presented in this report. Our report, conclusions and interpretations are not a warranty of the actual subsurface conditions.

Geotechnical Engineering Report Recommendations are Not Final

We have developed the following recommendations based on data gathered from subsurface investigation(s). These investigations sample just a small percentage of a site to create a snapshot of the subsurface conditions elsewhere on the site. Such sampling on its own cannot provide a complete and accurate view of subsurface conditions for the entire site. Therefore, the recommendations included in this report are preliminary and should not be considered final. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers cannot assume responsibility or liability for the recommendations in this report if we do not perform construction observation.

We recommend that you allow sufficient monitoring, testing and consultation during construction by GeoEngineers to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes if the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective means of managing the risks associated with unanticipated conditions. If another party performs field observation and confirms our expectations, the other party must take full responsibility for both the observations and recommendations. Please note, however, that another party would lack our project-specific knowledge and resources.

A Geotechnical Engineering or Geologic Report Could Be Subject to Misinterpretation

Misinterpretation of this report by members of the design team or by contractors can result in costly problems. GeoEngineers can help reduce the risks of misinterpretation by conferring with appropriate members of the design team after submitting the report, reviewing pertinent elements of the design team's plans and specifications, participating in pre-bid and preconstruction conferences, and providing construction observation.

Do Not Redraw the Exploration Logs

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. The logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Photographic or electronic reproduction is acceptable, but separating logs from the report can create a risk of misinterpretation.

Give Contractors a Complete Report and Guidance

To help reduce the risk of problems associated with unanticipated subsurface conditions, GeoEngineers recommends giving contractors the complete geotechnical engineering or geologic report, including these "Report Limitations and Guidelines for Use." When providing the report, you should preface it with a clearly written letter of transmittal that:

- advises contractors that the report was not prepared for purposes of bid development and that its accuracy is limited; and
- encourages contractors to confer with GeoEngineers and/or to conduct additional study to obtain the specific types of information they need or prefer.

Contractors are Responsible for Site Safety on Their Own Construction Projects

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and adjacent properties.

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants, and no conclusions or inferences should be drawn regarding Biological Pollutants as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria and viruses, and/or any of their byproducts.

A Client that desires these specialized services is advised to obtain them from a consultant who offers services in this specialized field

GeoEngineers

Appendix D
Geotechnical Report for Dock Improvements

Geotechnical Engineering Services

Luther Burbank Park Dock Repair
Mercer Island, Washington

for
KPFF Consulting Engineers

June 30, 2022

GeoEngineers
Earth Science + Technology

Geotechnical Engineering Services

Luther Burbank Park Dock Repair
Mercer Island, Washington

for
KPFF Consulting Engineers

June 30, 2022

GeoEngineers

1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

Geotechnical Engineering Services

Luther Burbank Park Dock Repair
Mercer Island, Washington

File No. 0817-024-02

June 30, 2022

Prepared for:

KPFF Consulting Engineers
1601 Fifth Avenue, Suite 1600
Seattle, Washington 98101

Attention: Andrew Bennett, PE

Prepared by:

GeoEngineers, Inc.
1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

Brett E. Larabee, PE
Senior Geotechnical Engineer

LYLE JOSEPH STONE
STATE OF WASHINGTON
45765
REGISTERED
PROFESSIONAL ENGINEER
6/30/22

Lyle J. Stone, PE
Associate Geotechnical Engineer

BEL:LJS:leh

Table of Contents

LIST OF FIGURES

APPENDICES

1.0 INTRODUCTION AND PROJECT UNDERSTANDING

This report presents the results of our geotechnical engineering services for the Luther Burbank Park Dock Repair project. The project site is located at 2040 84th Avenue SE in Mercer Island, Washington. Our understanding of the project is based on our communications with Andrew Bennett (KPFF Consulting Engineers [KPFF]) and information provided including the 60 percent dock improvement plans dated June 13, 2022 and the plans for the original dock dated April 26, 1973 (1973 Plans).

We understand that portions of the existing moorage pier and floating docks at the park will be removed, and new floating dock segments secured in place using driven piles will be installed. We understand that 24-inch and 16-inch diameter steel pipe piles will be used to secure the docks. In additional to the dock improvements, a new overwater staircase is proposed along the existing shoreline bulkhead. We understand that the existing bulkhead will not be substantially modified as part of installing the overwater stairs and new docks. We understand that the staircase will be supported on either 6- to 8-inch diameter steel pipe piles.

Onshore improvements around the existing boiler plant building are also proposed at the site. GeoEngineers prepared a draft geotechnical report (dated April 26, 2022) to support the onshore improvements. These services are being provided under a separate contract with the City of Mercer Island.

2.0 SCOPE OF SERVICES

The purpose of our services was to review available existing subsurface information and complete hand-tool explorations at the site as a basis for providing geotechnical recommendations for design and construction. Our services were completed in accordance with our signed agreement dated May 26, 2020 and amended on June 1, 2022. Our specific scope of services is summarized in our proposal dated March 23, 2020.

3.0 SITE CONDITIONS

3.1. Surface Conditions

The project site is located on the shoreline of Lake Washington approximately in the geographical center of the parks' shoreline frontage. In the area of the dock the upland shoreline is developed with a concrete and brick sidewalk and a historic brick boiler plant building that has been converted into a restroom and park equipment storage area. An approximately 200-foot-long concrete bulkhead is located along the shoreline in front of the boiler plant.

The existing floating docks and moorage pier are accessed via the bulkhead area and extend approximately 250 feet out from the shoreline. The pier is supported on timber piles with top diameters on the order of 12 inches and butt diameters on the order of 8 inches as indicated in the 1973 plans.

3.2. Subsurface Conditions

3.2.1. Literature Review

We reviewed the Geologic Map of King County (2007). According to the map the project site is underlain by glacial till (Qvt). Glacial till is typically comprised of a mixture of sand, gravel, and cobbles in a silt matrix. Glacial till soils were consolidated by the weight of the overriding glacier and are typically dense to very dense.

The 1973 plans included data from four test piles driven as part of the pier construction. The test piles were embedded between 15 and 17 feet below mudline using a 3,450 pound drop hammer. End of drive blow counts for the test piles ranged between 10 and 16 blows per foot. The 1973 plans indicate that the soils encountered during the test pile program were interpreted to be "blue clay and cemented glacial till…"

We also reviewed the subsurface exploration logs completed to support the onshore improvements project. The locations of these explorations are shown on the Site Plan, Figure 1 and the exploration logs are included in Appendix A for reference. In these explorations very dense glacial till was encountered starting within about 1 foot of the ground surface with the exception of B-3, which was advanced in the vicinity of a relic underground storage tank. In B-3 about 7 feet of fill associated with the tank was observed on top of very dense glacially consolidated soils.

3.2.2. Subsurface Explorations

As part of our study, we advanced three dynamic cone penetrometer (DCP) test explorations from the existing pier. The locations of the DCP explorations are shown on the Site Plan, Figure 2. The DCP explorations extended between 2 and 2½ feet below mudline. No soil samples are obtained during DCP testing, therefore, our understanding of subsurface conditions in the offshore area of the site is based on the measured DCP penetration rates, reviewed information, and our experience.

3.2.3. Subsurface Conditions

Measured water depths ranged from about 14 feet to 24 feet at the locations of our DCP explorations.

The DCP explorations extended 2 to 2½ feet below mudline. Plots of the estimated Standard Penetration Test (SPT) "N" value versus depths for each DCP exploration is shown on Figure 3. The SPT values presented are based on published correlations between DCP pentation rate and SPT N values.

Based on the measured driving resistance, our observations, and our understanding of the site geology we encountered what we interpret to be lake sediments underlain by weathered glacially consolidated soil in our DCPs. The thickness of the lake sediments at the DCP locations appears to be on the order of 1 to 2 feet. The lake sediments were penetrated with the tip of the DCP under the weight of the rods (zero blow counts) or with a few blows of the DCP drop hammer. We expect the lake soils likely consist of a mixture of soft organic material, loose sand, and soft silt. The thickness of the lake sediments are expected to vary across the site. Due to the relative steepness of the lakebed in the project area, it appears unlikely that thick layers of lake sediments would collect with the project boundaries, however small depressions in the lakebed could locally collect more loose sediments than other steeper areas. To account for the uncertainty in the thickness of this layer, we recommend assuming that there is at least a 5-foot layer of lake sediments when designing the piles. In our opinion this is conservative with regards to piles design and prudent, given then limited explorations completed for this study.

DCP penetration resistance generally increased with depth when the weathered glacially consolidated soils were encountered. We expect that these soils are comprised of medium dense to dense soil similar to the glacially consolidated soils observe in the upland areas. We expect that the weathered zone of the glacially consolidated soils is on the order of 5 to 10 feet thick and is underlain by intact glacially consolidated soil.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1. Seismic Design

4.1.1. Seismic Design Parameters

The table below provides seismic design parameters developed in accordance the 2018 International Building Code (IBC) which references American Society of Civil Engineers (ASCE) 7-16. The project site is underlain by dense to very dense glacially consolidated soils and we recommend using a response spectrum for Site Class C for this site.

TABLE 1. SEISMIC DESIGN PARAMETERS 2018 IBC

2018 IBC Seismic Design Parameters	
Spectral Response Acceleration at Short Periods (S_S)	1.388g
Spectral Response Acceleration at 1-Second Periods (S_1)	0.482g
Site Class	C
Site Modified Peak Ground Acceleration (PGA_M)	0.712g
Design Spectral Response Acceleration at Short Periods (SD_S)	1.11g
Design Spectral Response Acceleration at 1-Second Periods (SD_1)	0.483g

4.1.2. Liquefaction, Lateral Spreading and Surface Rupture

Liquefaction refers to a condition where vibration or shaking of the ground, usually from earthquake forces, results in development of excess pore pressures and subsequent loss of strength in the affected soil deposit. In general, soils that are susceptible to liquefaction include loose to medium dense “clean” to silty sands that are below the water table.

Based on the soil conditions observed in our explorations and our understanding of the site geology, in our opinion it is unlikely that there are potentially liquefiable soils present at the project site and there is a low risk of significant liquefaction occurring during the seismic design event.

Lateral spreading related to seismic activity typically involves lateral displacement of large, surficial blocks of non-liquefied soil when an underlying soil layer loses strength during seismic shaking. Lateral spreading usually develops in areas where sloping ground or large grade changes (including retaining walls) are present. Due to the low liquefaction risk at the site, in our opinion there is also a low risk of lateral spreading occurring at this site.

According to the Department of Natural Resources Seismic Hazards Map, the project site is in the vicinity of the Seattle Fault zone. However, because bedrock in this area is covered by hundreds of feet of glacial soils, it is unlikely that movement of the fault would result in significant surface rupture at the ground surface.

4.2. Dock Piles

4.2.1. General

Based on information provided by KPFF, 24-inch diameter by 0.625 inch wall (24 x 0.625 -inch) and 16 x 0.625-inch wall open ended steel pipe piles will be installed to secure the new docks. We understand that the 24-inch diameter piles will be embedded around 28 feet below mudline and the 16-inch diameter piles will be installed around 20 feet below mudline. Design and construction recommendations for the dock piles are provided in the sections below.

4.2.2. Soil Properties for Lateral Pile Analysis

We understand that KPFF will be evaluating lateral pile performance using the software program LPILE (Ensoft 2016). We recommend that the soil profile and properties in Table 2 be used for static evaluation of the piles. We expect that some strain softening of the site soils could occur during seismic shaking, however strain softening is expected to be negligible within the glacially consolidated soil units. In our opinion the static parameters presented below can also be used for evaluating pseudo-static conditions. If piles are spaced at least six pile diameters on center, no reduction of lateral capacity for group action is needed.

Due to the uncertainty of the subsurface profile at the site we recommend evaluating a range of contacts between the units to establish a critical or controlling case.

TABLE 2. SOIL PROPERTIES FOR LATERAL PILE ANALYSES

Soil Unit	Anticipated Top of Unit (feet below mudline)	Anticipated Bottom of Unit (feet below mudline)	LPile Soil Type	Effective Unit Weight (pcf)	Friction Angle (Ø) or Cohesion (c)	Stiffness (K) or Strain Factor (E50)
Lake Sediments	Mudline	5	Soft Clay (Matlock)	58	c = 200 psf	E50 =20
Weathered Glacially Consolidated Soils	5	10	Sand (Reese)	63	Ø = 32°	K= 100 pci
Glacially Consolidated Soil	10	Extent of analysis	Sand (Reese)	68	Ø = 38°	K= 125 pci

4.2.3. Axial Pile Resistance

Figure 4 and Figure 5 present our estimate of ultimate and allowable pile axial pile resistance for the 16-inch and 24-inch diameter open ended pipe piles, respectively. The provided axial resistances are based on unplugged soil conditions, which in our opinion, is conservative with regards to pile design. The allowable resistances include a minimum factor of safety of about 1.5 for side friction and end bearing, and 2.0 for uplift. The allowable resistances apply to single piles. If piles are spaced at least three pile diameters on center, no reduction of axial capacity for group action is needed.

We expect that axial loads on the dock piles will be relatively modest and that the piles will achieve the needed allowable resistances at shallow embedment depths into the glacially consolidated soils. Additional embedment into the glacially consolidated soils beyond what is needed for axial resistance will likley be required for lateral fixity. This will necessitate overdriving the piles to achieve the minimum pile tip elevations. The additional driving could produce a soil plug in the tip of the pile, further increasing the driving resistance. Table 3 provides an estimate of pile overdrive resistance at the anticipated pile embedment depths provided by KPFF. The reported overdrive resistances in Table 3 are ultimate resistances that could occur and are provided for reference and evaluating pile installation. The overdrive resistances should not be used for design of the piles.

TABLE 3: ESTIMATED PILE OVERDRIVE RESISTANCE

Pile Size	Pile Embedment Depth (feet below mudline)	Anticipated Total Overdrive Resistance
24'' x 0.625''	28	Unplugged: 160 kips Plugged: 850 kips
16'' x 0.625''	20	Unplugged: 70 kips Plugged: 330 kips

4.2.4. Pile Installation Considerations

4.2.4.1. Anticipated Driving Conditions and Hammer Selection

We expect that soft or loose lake deposit soils will be present near the mudline at the start of driving and that driving resistance will rapidly increase as the piles encounter and are driven into the glacially consolidated soils. Zones of coarse gravels and cobbles should be expected. Boulders, if encountered, may obstruct the installation of piles in the planned location. If a boulder is encountered at depth, it may be necessary to use a sacrificial reinforced H-pile or other pile as a “spud” in an attempt to move or break up the boulder before advancing the production pile. Alternatively, relocating the proposed pile may need to be considered. The contractor performing the work should be made aware of the anticipated driving conditions and should be prepared to deal with these conditions during construction.

We anticipate that a vibratory hammer will be the preferred installation method for the piles. However, based on the soil conditions at the site and our experience we anticipate that a combination of vibratory and impact driving could be required to achieve required embedment depths. Alternatively, the pile could be driven using an impact hammer only.

Advancing piles into glacially consolidated soils with a vibratory hammer can be difficult. Based on our experience we expect that a vibratory hammer could be capable of installing the open-ended steel pipe piles about 10 to 20 feet into glacially consolidated soils. The actual embedment depth that can be achieved with a vibratory hammer will depend on the size of the hammer used, the length of the pile and the subsurface conditions encountered at the installation location.

The size of vibratory hammer required to install the pile will depend on the length of the pile and the conditions encountered. To advance the pile, vibratory hammers must mobilize or “excite” the mass of the hammer-pile combination. The heavier the hammer-pile combination, the more energy required to excite the system. A rough estimate of the minimum vibratory hammer size required to vibrate the pile-hammer combination can be made using the American Pile Driving Equipment (APE) Amplitude Equation. The amplitude equation is a relatively simple calculation and does not consider embedment depth, soil conditions or pile type (i.e., open ended or closed ended). Based on our calculations using the amplitude equation we expect that at least an APE 50 (eccentric moment = 1,300 in-lbs.) would be necessary to vibrate a 50-foot-long, 24- x 0.625-inch pipe pile. However, given anticipated soil conditions, a larger vibratory hammer would likley be necessary to advance the piles a significant distance into the glacially consolidated soils. The APE 200 hammer (eccentric moment = 4,400 in-lbs) is commonly used in the region to install steel pipe piles into glacially consolidated soils. We expect that a hammer of this size is more appropriately sized for driving the 24-inch diameter piles, but may be oversized, and could damage, the 16-inch diameter piles during driving. Pile damage during vibratory installation typically occurs at the top of the pile and can be remedied by removing or “fresh heading” the damaged section after installation.

If a vibratory hammer is not capable of installing the pile to the design embedment depth, use of an impact hammer will likely be necessary. Similarly, if a soil plug were to form during installation, we expect that a vibratory hammer may not be capable of installing the pile. In our experience the 16- and 24- inch-diameter are at a relatively high risk of plugging, especially during impact driving.

We completed a preliminary pile drivability analysis using the software program GRLWEAP to evaluate minimum impact hammer sizes that will likley be necessary to install the envisioned piles. Considering the range of overdrive resistances presented in Table 3, we anticipate that an impact hammer with a minimum rated energy between 60 and 80 kip-feet will likely be suitable for installing the 24-inch diameter piles and an impact hammer with a minimum rated energy between 30 and 50 kip-feet will likely be suitable for installing the 16-inch diameter piles. Note that these are minimum hammer energy ranges. Larger hammers than what are estimated for each piles’ size could also be acceptable, however pile driving stresses will need to be evaluated to determine if larger hammers will damage the piles during installation. Two different sized hammers, or a single hammer with variable energy settings, could be required for pile installation on the project.

Ultimately, the hammers used to install the piles should be evaluated and selected by the contractor performing the work. We recommend that the contractor performing the work submit a pile installation plan, which at a minimum should include:

- A proposed vibratory hammer size.
- A proposed impact hammer size and a pile drivability analysis considering the hammer-pile driving configuration. The pile drivability analysis should evaluate the driving stresses that could occur during installation and the calculated driving stresses from the drivability analysis should be compared to the allowable driving stresses for the pile. Typically, driving stresses in steel piles should be limited to 90 percent of the steel yield strength. Ultimately, anticipated pile driving stresses should be reviewed by a structural engineer.
- A contingency plan for advancing the pile to the design embedment depth if refusal with a vibratory hammer is encountered.
- A plan for advancing piles through zones of coarse gravels and cobbles, and a proposed plan for dealing with boulders, should they be encountered.

4.2.4.2. Additional Considerations

An approximation of axial pile capacity can be made during impact driving by monitoring hammer blows versus penetration distance and observing hammer stroke height. It is not possible to accurately correlate pile capacity to penetration rate when piles are installed using vibratory hammers. Often, piles installed using a vibratory hammer will be “proofed” using an impact hammer once the pile is near or at the design tip elevation in order to approximate pile capacity. In our opinion this pile proofing is not necessary if the minimum pile embedment depth is controlled by lateral loading. We recommend that we be allowed to review the design pile embedment depth and loads once they are finalized so we can provide a final recommendation on the need for pile axial capacity verification.

4.3. Overwater Staircase Piles

4.3.1. Axial Resistance

We understand that 6-inch to 8-inch diameter steel pipe piles will be used to support the proposed overwater staircase. Smaller diameter piles are often installed using pneumatic impact hammers that can mounted to excavators.

Table 4 below provides recommended allowable pile resistances for 6- and 8-inch-diameter piles. The allowable resistances include a factor of safety of around 2. Typically, small diameter piles driven to a specified penetration rate that corresponds to an estimated allowable pile resistance. The estimated penetration rates that correspond to the provided pile resistances are also provided in Table 3.

TABLE 4. PILE AXIAL RESISTANCE

Pile Diameter (D) and Wall Thickness (T)	Allowable Pile Resistance (kips)	Pile Penetration Rate at Allowable Pile Resistance 2,000 lb. hammer	Pile Penetration Rate at Allowable Pile Resistance 3,000 lb. hammer	Pile Penetration Rate at Allowable Pile Resistance 5,000 lb. hammer
D = 6 inches T = 0.28 inches	15	10	6 sec/in	4 sec/in
D = 8 inches T = 0.322 inches	25	Larger hammer recommended	10 sec/in	8 sec/in

4.3.2. Lateral Pile Analysis

In our opinion the LPILE parameters provided previously for the dock piles are also appropriate for evaluating the overwater staircase piles. For 6-inch and 8-inch diameter piles, lateral group effects do not need to be considered for piles spaced more than six diameters apart (center-to-center) in the direction of loading. We should be notified if piles will be spaced closer than six diameters apart and can provide recommendations for appropriate P-Multipliers, if requested.

4.3.3. Pile Installation Considerations

We recommend that the piles be embedded at least 5 feet into intact glacially consolidated soils. Ultimately, the target pile embedment depth should be determined based on the results of the lateral pile analysis and the penetration rates observed during pile installation.

We expect that soft or loose lake deposit soils will be present near the mudline at the start of driving and that driving resistance will rapidly increase as the piles encounter and are driven into the glacially consolidated soils. Zones of coarse gravels and cobbles should be expected within the glacially consolidated soils. Boulders, if encountered, may obstruct the installation of piles in the planned location. If a boulder is encountered at depth, it may be necessary to use a sacrificial pile to move or break up the boulder before advancing the production pile. Alternatively, relocating the proposed pile may need to be considered. The contractor performing the work should be made aware of the anticipated driving conditions and should be prepared to deal with these conditions during construction.

The contractor performing the work should be made responsible for selecting the hammer and equipment necessary to install the piles. We recommend that the contractor submit a pile installation plan, which at a minimum should include:

- Proposed hammer type and size;
- Pile driving refusal criteria; and
- A plan for advancing piles through zones of coarse gravels and cobbles, and a proposed plan for dealing with boulders, should they be encountered.

In our experience, to make material transportation and handling easier, smaller diameter piles are typically installed in 20-foot sections that are connected using a compression coupler. If a compression coupler system is used, the connection points should also be welded.

Because the piles will be installed into soils that contain gravels and cobbles, we recommend that the piles be constructed using high strength steel. Even if the piles are constructed of high strength steel, the small diameter piles will have relatively thin walls that can be damaged when driven into coarse-grained soils. In our opinion piles with a wall thickness less than about ¼ inch have a relatively high risk of damage during installation and piles with a wall thickness greater than ⅜ inch have a lower risk of damage during installation.

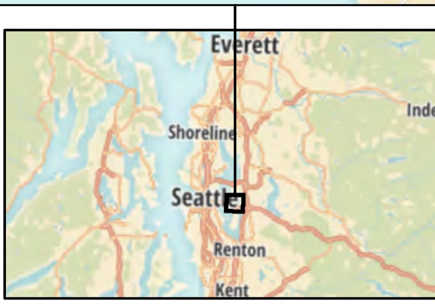
5.0 LIMITATIONS

We have prepared this report for KPFF Consulting Engineers, for the Luther Burbank Park Dock Repair Project. KPFF may distribute copies of this report to owner and owner's authorized agents and regulatory agencies as may be required for the Project.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices for geotechnical engineering in this area at the time this report was prepared. The conclusions, recommendations, and opinions presented in this report are based on our professional knowledge, judgment and experience. No warranty, express or implied, applies to the services or this report.

Please refer to Appendix B titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.

FIGURES



N
W E
S

2,000 0 2,000
Feet

Vicinity Map

Luther Burbank Park Dock Repair
Mercer Island, Washington

GEOENGINEERS

Figure 1

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Mapbox Open Street Map, 2016

Projection: NAD 1983 UTM Zone 10N

P:\0\0817024\GIS\MXD\081702400_F01_VicinityMap.mxd Date Exported: 06/25/20 by ccabrera

Legend

B-1 Boring by GeoEngineers, Inc., 2022

DCP-1 DCP Location by GeoEngineers, Inc., 2020

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 08/14/2020.

Projection: Washington State Plane, North Zone, NAD83, US Foot

N
W E
S

60 0 60
Feet

Site Plan

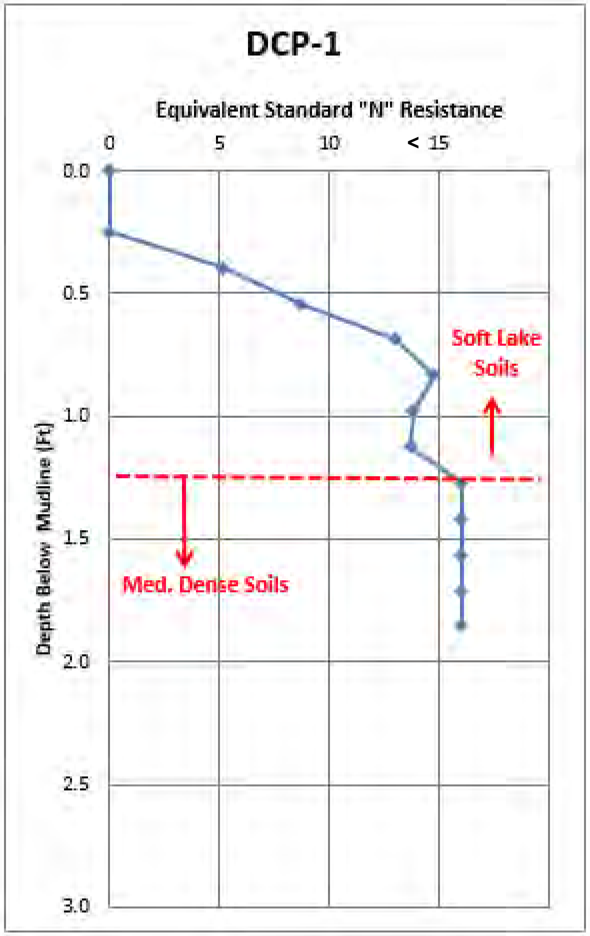
Luther Burbank Park Upland Improvements
Mercer Island Washington

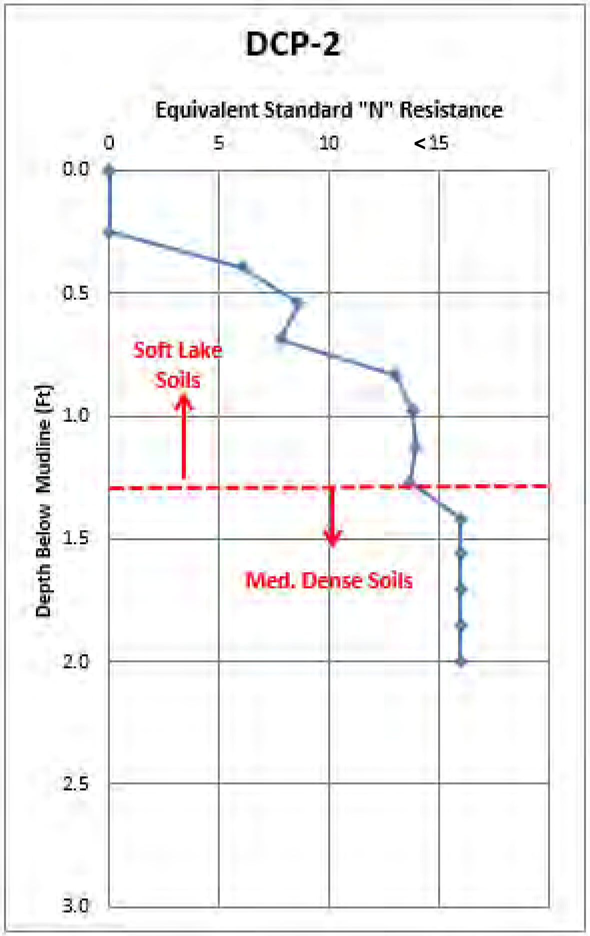
GeoEngineers

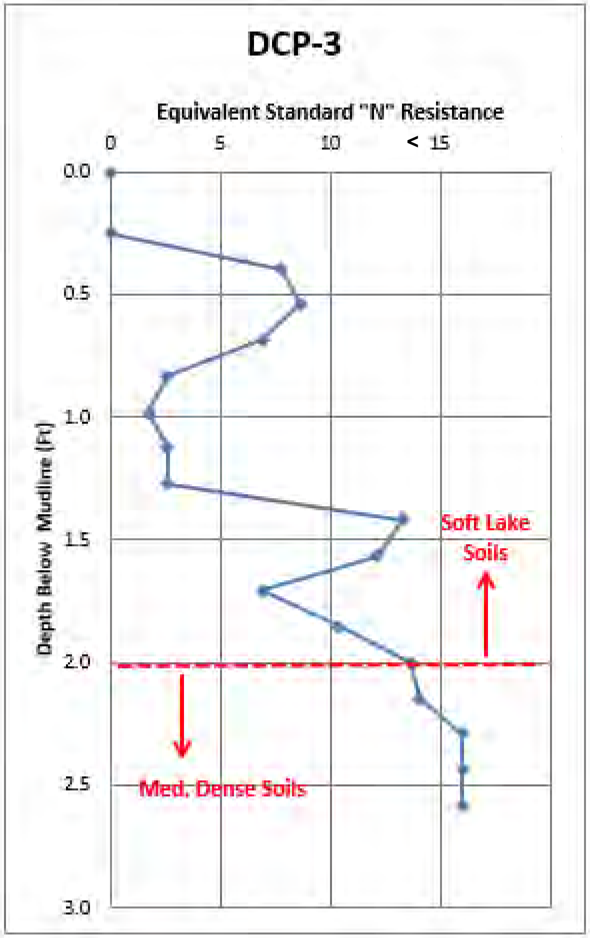
Figure 2

\\geoengineers.com\WAN\Projects\0\0817024\CAD\00\Geotech Report\081702400_F02_Site Plan.dwg TAB:F02 Date Exported: 06/09/22 - 13:58 by tbyrd

00817-024-02 Date Exported: 06/30/22







DCP Logs

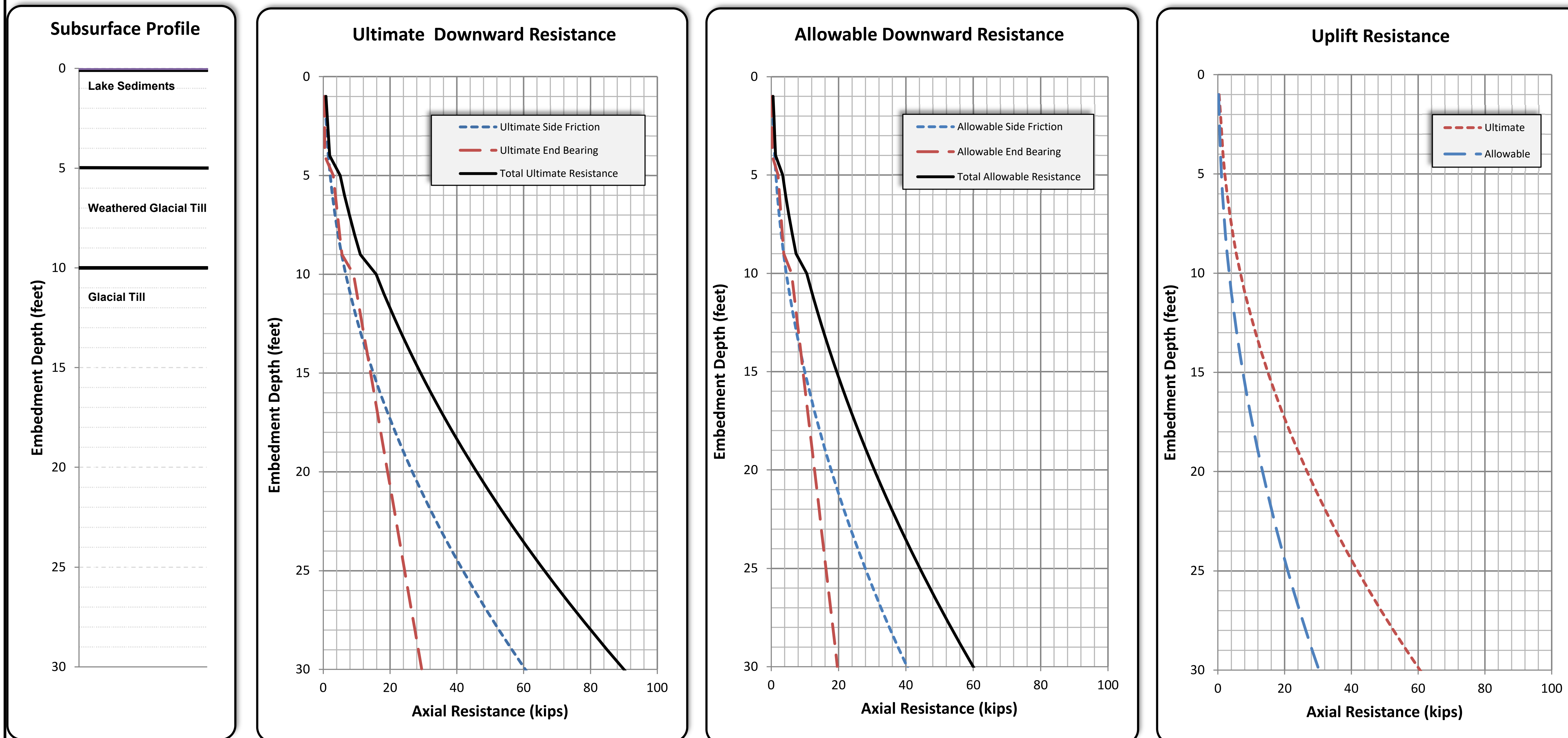
Luther Burbank Park Dock Repair
Mercer Island, Washington

GeoEngineers

Figure 3

AXIAL PILE RESISTANCE

16 x 0.625-inch Open-End Steel Pipe Pile

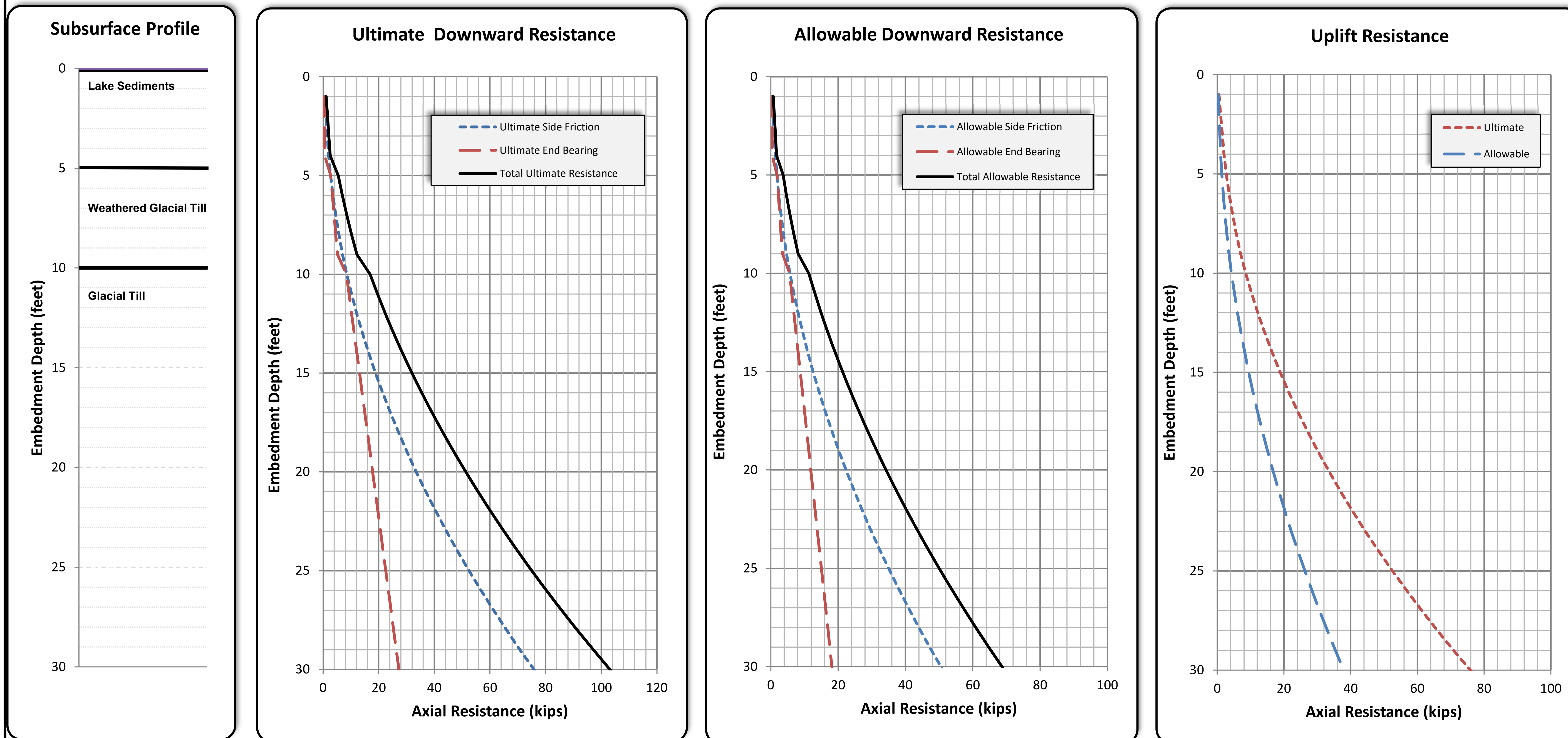


Axial Pile Resistance	
Luther Burbank Park Dock Repair Mercer Island, Washington	
GeoEngineers	**Figure 4**

0817-024-02

AXIAL PILE RESISTANCE

24 x 0.625-inch Open-End Steel Pipe Pile



Axial Pile Resistance

Luther Burbank Park Dock Repair
Mercer Island, Washington

GeoEngineers

Figure 5

0817-024-02

APPENDICES

APPENDIX A
References Exploration Logs

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

Sampler Symbol Descriptions

- 2.4-inch I.D. split barrel / Dames & Moore (D&M)
- Standard Penetration Test (SPT)
- Shelby tube
- Piston
- Direct-Push
- Bulk or grab
- Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	SOD	Sod/Forest Duff
	TS	Topsoil

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PL	Point lead test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
UU	Unconsolidated undrained triaxial compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

Key to Exploration Logs

GEOENGINEERS

Figure A-1

Drilled	Start 4/1/2022	End 4/1/2022	Total Depth (ft)	13.5	Logged By LSP Checked By BEL	Driller Geologic Drill Technologies	Drilling Method	Hollow-stem Auger

Surface Elevation (ft) Vertical Datum	23 NAVD88	Hammer Data	Rope & Cathead 140 (lbs) / 30 (in) Drop	Drilling Equipment	Mini Track Rig
Easting (X) Northing (Y)	1297163 218603	System Datum	WA State Plane South NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0							ML	Dark brown sandy silt with organics (stiff, moist) (sod)			
								ML	Gray sandy silt with occasional oxidation staining (hard, moist) (glacial till)			
20			18	34		1 / SA				13	67	
	5		18	55		2						
15			11	50/5"		3						
								SM	Gray silty fine sand (very dense, moist)			
	10		6	50/6"		4						
			18	71		5 / SA		ML	Gray silt with sand (hard, moist)	16	74	
10			18	86		6						

Practical drilling refusal at 13½ feet

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Esri Survey. Vertical approximated based on Project Survey.

Log of Boring B-1

GeoEngineers

Project: Luther Burbank Park Upland Improvements
Project Location: Mercer Island, Washington
Project Number: 0817-024-01

Figure A-2
Sheet 1 of 1

Drilled	Start 4/1/2022	End 4/1/2022	Total Depth (ft)	11	Logged By LSP	Checked By BEL	Driller	Geologic Drill Technologies	Drilling Method	Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	20 / NAVD88	Hammer Data	Rope & Cathead 140 (lbs) / 30 (in) Drop	Drilling Equipment	Mini Track Rig
Easting (X) / Northing (Y)	1297149 / 218583	System Datum	WA State Plane South NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0							ML	Dark brown sandy silt with organics (stiff, moist) (sod)			
								ML	Gray silt with sand and occasional gravel (hard, moist) (glacial till)			
			18	65		1 SA				14	71	
15	5		18	58		2						
			17	75/11"		3						
10	10			50/6"		4						
												Practical drilling refusal at 11 feet

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Esri Survey. Vertical approximated based on Project Survey.

Log of Boring B-2

GEOENGINEERS

Project: Luther Burbank Park Upland Improvements
Project Location: Mercer Island, Washington
Project Number: 0817-024-01

Figure A-3
Sheet 1 of 1

Drilled	Start 4/1/2022	End 4/1/2022	Total Depth (ft)	11.5	Logged By LSP	Checked By BEL	Driller	Geologic Drill Technologies	Drilling Method	Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	20 / NAVD88	Hammer Data	Rope & Cathead 140 (lbs) / 30 (in) Drop	Drilling Equipment	Mini Track Rig
Easting (X) / Northing (Y)	1297142 / 218689	System Datum	WA State Plane South NAD83 (feet)	See "Remarks" section for groundwater observed	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0							CC	Approximately 6 inches concrete			
			12	14		1		SP-SM	Approximately 4 inches gray fine to coarse sand with silt (medium dense, moist) (base course)			
								ML	Gray sandy silt with gravel (stiff, moist) (fill)			
			15	WOH		2						No sheen, slight odor
									Becomes wet			Perched groundwater observed at approxiamtely 3 feet during drilling
15	5		16	46		3						Slight sheen, slight odor
								ML	Light brown sandy silt (hard, moist) (glacial till)			
			18	60		4						No sheen, no odor
10	10		16	60		5						No sheen, no odor

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Esri Survey. Vertical approximated based on Project Survey.

Log of Boring B-3

GeoEngineers

Project: Luther Burbank Park Upland Improvements
Project Location: Mercer Island, Washington
Project Number: 0817-024-01

APPENDIX B
Report Limitations and Guidelines for Use

APPENDIX B
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

Read These Provisions Closely

It is important to recognize that the geoscience practices (geotechnical engineering, geology and environmental science) rely on professional judgment and opinion to a greater extent than other engineering and natural science disciplines, where more precise and/or readily observable data may exist. To help clients better understand how this difference pertains to our services, GeoEngineers includes the following explanatory “limitations” provisions in its reports. Please confer with GeoEngineers if you need to know more how these “Report Limitations and Guidelines for Use” apply to your project or site.

Geotechnical Services are Performed for Specific Purposes, Persons and Projects

This report has been prepared for KPFF Consulting Engineers and for the Project(s) specifically identified in the report. The information contained herein is not applicable to other sites or projects.

GeoEngineers structures its services to meet the specific needs of its clients. No party other than the party to whom this report is addressed may rely on the product of our services unless we agree to such reliance in advance and in writing. Within the limitations of the agreed scope of services for the Project, and its schedule and budget, our services have been executed in accordance with our Agreement with KPFF Consulting Engineers dated May 26, 2020 and amended on June 1, 2022 and generally accepted geotechnical practices in this area at the time this report was prepared. We do not authorize, and will not be responsible for, the use of this report for any purposes or projects other than those identified in the report.

A Geotechnical Engineering or Geologic Report is based on a Unique Set of Project-Specific Factors

This report has been prepared for the Luther Burbank Park Dock Repair project located at 2040 84th Avenue SE in Mercer Island, Washington. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, it is important not to rely on this report if it was:

- Not prepared for you,
- Not prepared for your project,
- Not prepared for the specific site explored, or
- Completed before important project changes were made.

1 Developed based on material provided by GBA, GeoProfessional Business Association; www.geoprofessional.org.

For example, changes that can affect the applicability of this report include those that affect:

- The function of the proposed structure;
- Elevation, configuration, location, orientation or weight of the proposed structure;
- Composition of the design team; or
- Project ownership.

If changes occur after the date of this report, GeoEngineers cannot be responsible for any consequences of such changes in relation to this report unless we have been given the opportunity to review our interpretations and recommendations. Based on that review, we can provide written modifications or confirmation, as appropriate.

Environmental Concerns are Not Covered

Unless environmental services were specifically included in our scope of services, this report does not provide any environmental findings, conclusions, or recommendations, including but not limited to, the likelihood of encountering underground storage tanks or regulated contaminants.

Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by man-made events such as construction on or adjacent to the site, new information or technology that becomes available subsequent to the report date, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. If more than a few months have passed since issuance of our report or work product, or if any of the described events may have occurred, please contact GeoEngineers before applying this report for its intended purpose so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

Geotechnical and Geologic Findings are Professional Opinions

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies the specific subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied its professional judgment to render an informed opinion about subsurface conditions at other locations. Actual subsurface conditions may differ, sometimes significantly, from the opinions presented in this report. Our report, conclusions and interpretations are not a warranty of the actual subsurface conditions.

Geotechnical Engineering Report Recommendations are Not Final

We have developed the following recommendations based on data gathered from subsurface investigation(s). These investigations sample just a small percentage of a site to create a snapshot of the subsurface conditions elsewhere on the site. Such sampling on its own cannot provide a complete and accurate view of subsurface conditions for the entire site. Therefore, the recommendations included in this report are preliminary and should not be considered final. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers cannot assume responsibility or liability for the recommendations in this report if we do not perform construction observation.

We recommend that you allow sufficient monitoring, testing and consultation during construction by GeoEngineers to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes if the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective means of managing the risks associated with unanticipated conditions. If another party performs field observation and confirms our expectations, the other party must take full responsibility for both the observations and recommendations. Please note, however, that another party would lack our project-specific knowledge and resources.

A Geotechnical Engineering or Geologic Report Could Be Subject to Misinterpretation

Misinterpretation of this report by members of the design team or by contractors can result in costly problems. GeoEngineers can help reduce the risks of misinterpretation by conferring with appropriate members of the design team after submitting the report, reviewing pertinent elements of the design team's plans and specifications, participating in pre-bid and preconstruction conferences, and providing construction observation.

Do Not Redraw the Exploration Logs

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. The logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Photographic or electronic reproduction is acceptable, but separating logs from the report can create a risk of misinterpretation.

Give Contractors a Complete Report and Guidance

To help reduce the risk of problems associated with unanticipated subsurface conditions, GeoEngineers recommends giving contractors the complete geotechnical engineering or geologic report, including these "Report Limitations and Guidelines for Use." When providing the report, you should preface it with a clearly written letter of transmittal that:

- Advises contractors that the report was not prepared for purposes of bid development and that its accuracy is limited; and
- Encourages contractors to conduct additional study to obtain the specific types of information they need or prefer.

Contractors are Responsible for Site Safety on Their Own Construction Projects

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and adjacent properties.

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants, and no conclusions or inferences should be drawn regarding Biological Pollutants as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria and viruses, and/or any of their byproducts.

A Client that desires these specialized services is advised to obtain them from a consultant who offers services in this specialized field.

Information Provided by Others

GeoEngineers has relied upon certain data or information provided or compiled by others in the performance of our services. Although we use sources that we reasonably believe to be trustworthy, GeoEngineers cannot warrant or guarantee the accuracy or completeness of information provided or compiled by others.

Appendix E
Wave and Wake Modeling Report

DRAFT

MEMORANDUM

To: Andy Bennett, P.E. (KPFF) and Will Cyrier, P.E.

From: Eduardo Sierra and Kathy Ketteridge, P.E., PhD

Date: January 9, 2022

Re: Luther Burnbank Marina Design: Wave and Wake Modeling

This technical memorandum summarizes the coastal engineering analysis completed by Blue Coast Engineering, LLC (Blue Coast) in support of the Luther Burnbank Marina design project. This evaluation developed empirical estimates of wind waves and wakes offshore of the Luther Burbank Marina and model predictions of wave/wake characteristics inside the marina based on proposed float layouts provided to Blue Coast by KPFF.

1. Extreme Winds

Wind data at Lake Washington were obtained from two sources: WDOT 520 Bridge (Latitude: 47.64 N, - Longitude: 122.26 W), and Renton Municipal Airport (Latitude: 47.49 N, Longitude: -122.21 W). Figure 1 shows a vicinity map as well as the wind station locations considered in this study. The data from these two sources were reviewed, statistically processed, and analyzed to develop an extremal analysis following the method of Goda (1984). Wind roses generated from the results of this analysis for both wind stations considered are also shown in Figure 1.

The shoreline in this area runs north to south along the northeastern corner of Mercer Island. The site is exposed to wind waves from the north-northeast (northerly) or south-southeast (southerly). Waves from the west and southwest are not expected to be significant at the site due to the small fetch distance across Lake Washington at the site from those directions. Due to the topography and project location with respect to the two wind stations, WDOT 520 Bridge station analysis was used for modeling wind waves from the northerly direction and wind from Renton Airport was considered for modeling wind waves approaching from the southerly direction. The 100-year (yr) wind speeds for these directions are provided in Table 1.

Table 1: 100-year Wind Speeds and Directions

Return Period Wind Year	Southerly – Renton Airport meters per second (mph)	Northerly – 520 Bridge meters per second (mph)
100-yr	24 (54)	18 (40)

2. Bathymetry Information

The coastal engineering evaluation conducted by Blue Coast utilized coastal bathymetry available to from a Lake Washington digital elevation model (DEM) NOS-NOAA bathymetry dataset. Additionally, site specific bathymetry, shown in Figure 2, was provided to Blue Coast by KPFF and was used to refine the bathymetry data set within the marina site.

3. Floating Breakwater Wave Transmission

The transmission of wave energy through the proposed floating wave attenuator dock units were estimated empirically outside the model using standard methods available in literature. This calculated transmission coefficient (ratio of transmitted wave over incoming wave height) was used as input to the wave model.

The method used to calculate the transmission coefficient was the relation proposed by Macagno referenced in Ruol et al (2013), shown in Equation 1. Different floating attenuator geometry combinations were used as input to Equation 1: widths of 8 feet (ft) and 10 ft and a drafts of 2 ft and 4 ft. Table 2 shows the calculated wave transmission coefficients for the different wave attenuator geometries evaluated.

$$k_{tM} = \frac{1}{\sqrt{1+\left[kw\frac{\sinh kh}{2\cosh\,(kh-kd)}\right]^2}} \qquad \text{Equation 1}$$

where, k is the wave number, w is the width, h is the depth and d is the draft.

Table 2: Calculated Transmission Coefficients for Different Wave Attenuator Geometries

Attenuator Draft (ft)	Attenuator Width (ft)	Calculated Wave Transmission ($\%k_{tM}$)	Dock Configuration (See Figures 3-5)
2	8 ft	35 %	Option 6
4	8 ft	28 %	Option 3
2	10 ft	28 %	Option 5
4	10 ft	23 %	Option 1 / Option 2 / Option 4

4. Proposed Alternatives: Marina Dock Configurations

KPFF provided Blue Coast with six different dock configurations (listed below) that were evaluated as part of this analysis. These dock configurations are shown in the Figures 3-5.

Description of Marina Configurations:

- Option 1: Current design: 193' x 10' x 4' draft main float
- Option 2: Current design extended (no dog leg): 210.5' x 10' x 4' draft main float
- Option 3: Narrower: 193' x 8' x 4' draft main float
- Option 4: Shorter: 173' x 10' x 4' draft main float (inner float +25’)
- Option 5: Lighter: 193' x 10' x 2' draft main float
- Option 6: Minimum: 173' x 8' x 2' draft main float (inner float +25')

5. Wind Wave Modeling

Wave numerical modeling using northerly and southerly 100-year wind speeds provided in Table 1 to develop predictions of wave characteristics within the Luther Burbank Marina site for proposed dock configurations shown in Figures 3 through 5. The model SWAN (Simulating WAves Nearshore), a third-generation spectral finite difference wave model, was utilized to for this work (Holthuijsen et al., 2006). SWAN utilizes lake bathymetry, incident wave spectra, and local wind conditions to generate and transform waves into the nearshore environment.

The model grid utilized bathymetry data described in Section 2 of this Memorandum. The entire modeling domain is shown in Figure 2. A higher resolved nested grid was used during the modeling in order to accurately transform the waves within the marina vicinity. The largest grid has a grid cell size of 50 ft, and the grid at the project site has a grid cell spacing of 3 ft.

Due to the lack of local wave data no SWAN model calibration for the Luther Burbank project conditions was conducted. Therefore, appropriate factors of safety should be applied to structural calculations conducted using results of the wave modeling provided in this memorandum.

Results for these 100-year wind-wave model simulations for the larger model domain are provided in Figure 6. Results in the vicinity of the Project Site, where the modeling grid had greater resolution with the different dock configurations described in Section 4 are shown in Figures 7-12. Higher waves are represented in red color, and blue color represents smaller or no waves.

Table 3 shows predicted waves at three extraction points inside the marina and one point outside the marine (see Figure 19) for the 6 marina options proposed by KPFF.

Table 3: Predicted Wind-Wave Heights at Specific Points Inside and Outside the Marina

		Sig Wave Height (Hs, ft)			
	Scenario	**P1**	**P2**	**P3**	**P4**
Option 1	100-yr Northerly Wind Waves	1.1	1.3	0.5	1.7
	100-yr Southerly Wind Waves	1.5	1.3	1.1	2.1
Option 2	100-yr Northerly Wind Waves	1.1	1.3	0.5	1.7
	100-yr Southerly Wind Waves	1.6	1.3	1.4	2.1
Option 3	100-yr Northerly Wind Waves	1.1	1.3	0.6	1.7
	100-yr Southerly Wind Waves	1.5	1.3	1.1	2.1
Option 4	100-yr Northerly Wind Waves	1.1	1.3	0.5	1.7
	100-yr Southerly Wind Waves	1.5	1.3	1.2	2.1
Option 5	100-yr Northerly Wind Waves	1.1	1.3	0.6	1.7
	100-yr Southerly Wind Waves	1.5	1.3	1.1	2.1
Option 6	100-yr Northerly Wind Waves	1.1	1.3	0.7	1.7
	100-yr Southerly Wind Waves	1.5	1.4	1.3	2.1

Wave modeling results show that 100-yr southerly winds produced higher wave heights than northerly winds outside and inside the marina. The open entrance at the south side of the marina allows intrusion of southerly waves. Wave extraction in the vicinity of Point 1 presented higher waves indicating that this area is less sheltered from southerly wind-waves. The north side of the marina also allows some wave energy penetration, (near extraction Point 2) however wave energy from northerly winds is less severe than from southerly wind directions. Dock Options 1 and 4 showed the lowest wave height values inside the marina whereas the highest wave height values were observed for Option 6.

The dog leg shown in Option 1 at the south end of the wave attenuator provides additional protection to the finger piers located at the southern end of the wave attenuator dock compared to the extended (no dog leg) Option 2. Wave heights at those finger piers is reduced by 30% for the dog leg Option 1 (see Figure 7) compared to only 10% reduction for the extended (no dog leg) Option 2 (see Figure 8).

6. Boat Wake Modeling

In addition to wind-waves, the project site is also impacted by boat wakes due to vessels traversing past the site, sometimes at high rates of speed. Therefore, additional wave modeling was conducted to evaluate boat wake heights inside the marina for the same 6 Dock Options evaluated for wind-waves (Section 5).

A specific vessel survey identifying types and frequencies of vessels passing the project site was not available for use in this evaluation. Therefore, typical vessels and operational criteria for these vessels were used to inform this evaluation.

Typical wakeboard and waterski boats vary in length from 16 to 24 ft. Based on observed boats on the lake and research conducted by Glamore (2009) on waves generated by waterski and wakeboard boats, a vessel length of 20 ft and an 8 ft beam will produce a wave height of approximately 3 ft and a wave period of 2 seconds. This wake height is expected to decrease exponentially from the sailing line to approximately 1.6 ft outside the marina (Rupretch, J. et al, 2015).

These wake parameters were input in the wave propagation model and tested for the two different traveling direction for the vessel (travelling sound and travelling north) and six different alternatives shown in Figures 3 through 5. The wake model results for these alternatives are shown in Figures 13 through 18, where higher wakes are represented in red color, and blue color represents smaller or no wakes. Table 4 summarizes wave heights for these model simulations at the same four extraction points as the wind-wave modeling results (see Figure 19).

Review of the modeling completed for boat wakes show that boats traveling from the north to the south produce smaller wakes inside the marine than boat travelling from the south to the north for all dock options evaluated. Predicted wake heights inside the marina were similar for all dock options evaluated for the same direction of boat travel.

Similarly, there is little difference in predicted boat wake heights within the marina between the dog leg used in Option 1 compared to the extended (no dog leg) Option 2.

Table 4: Predicted Boat Wake Heights at Specific Points Inside and Outside the Marina

		Wake Height (H, ft)			
	Scenario	**P1**	**P2**	**P3**	**P4**
Option 1	N → S Boat Wake	0.6	0.8	0.3	1.5
	S → N Boat Wake	0.7	0.7	0.5	1.5
Option 2	N → S Boat Wake	0.6	0.8	0.4	1.5
	S → N Boat Wake	0.7	0.7	0.7	1.5
Option 3	N → S Boat Wake	0.6	0.8	0.4	1.5
	S → N Boat Wake	0.7	0.7	0.6	1.5
Option 4	N → S Boat Wake	0.6	0.8	0.3	1.5
	S → N Boat Wake	0.7	0.7	0.6	1.5
Option 5	N → S Boat Wake	0.6	0.8	0.4	1.5
	S → N Boat Wake	0.7	0.7	0.6	1.5
Option 6	N → S Boat Wake	0.7	0.9	0.5	1.5
	S → N Boat Wake	0.8	0.7	0.7	1.5

7. Summary

A coastal engineering analysis was completed to develop winds and wave parameters sufficient for the design and for developing design criteria. Winds applicable to the project area are predominantly from the north-northwest (northerly) and south-southeast (southerly).

100-year southerly winds produced higher waves outside and inside the marina than northerly winds. Southerly wind-waves enter from the south end to the marina producing the higher wave energy inside the marina.

Wind-wave model using Options 1 and 4 predicted the lowest wave height values inside the marina. Option 6 presented the highest waves observed inside the marina due to the lowest draft and shortest width considered.

The dog leg located at the south end of the wave attenuator for Option 1 provides additional protection to the marina compared to the extended (no dog leg) Option 2 by reducing the wind wave heights from 10% to 30% at the finger floats located on the lee side of the wave attenuator dock. This benefit is not seen in the boat wake modeling results.

The highest boat-wake height values were observed when evaluating Option 6 due to the lowest draft (2 ft) and shortest width (8 ft) considered for this alternative. However, the wake model predicted similar wake heights inside the marina for all marina dock configurations.

The 100-year wind-wave produce longer wave periods than boat wake periods and, therefore, higher wave transmission is expected during a large extreme wind event.

8. Closure

This document has been prepared by Blue Coast Engineering LLC. in accordance with generally accepted engineering practices and is intended for the exclusive use and benefit of KPFF and their authorized representatives for specific application to the Luther Burbank project in Lake Washington. The contents of this document are not to be relied upon or used, in whole or in part, by or for the benefit of others without specific written authorization from Blue Coast Engineering LLC. No other warranty, expressed or implied, is made. Blue Coast Engineering LLC and its officers, directors, employees, and agents assume no responsibility for the reliance upon this document or any of its contents by any parties other than KPFF.

9. References

Adapted from the theoretical predictor of J. Cox (1988) to account for angle of wave incidence and to reflect experimental results in 3-D wave fields using irregular waves.

Glamore, W.C. 2009. "A Decision Support Tool for Assessing the Impact of Boat Wake Waves on Inland Waterways." http://www.pianc.org/downloads/dwa/Wglamore_DPWApaper.pdf.

Holthuijsen, L.H., Booij, N., Ris, R.C., Haagsma, IJ.G., Kieftenburg, A.T.M.M., and Kriezi, E.E. 2006. SWAN Cycle III version 40.51 User Manual. Delft University of Technology, Netherlands.

National Oceanographic and Atmospheric Administration. 2020. National Oceanographic and Atmospheric Administration Bathymetry & Digital Elevation Models, http://maps.ngdc.noaa.gov/viewers/bathymetry/.

NOAA bathymetry (2005) Combined bathymetry and topography of the Puget Lowlands, Washington State (tile: g1225480 and g1225475). Data originator; David Finlayson, School of Oceanography, University of Washington [accessed September 2, 2020 at http://www.ocean.washington.edu/data/pugetsound/]

Ruol, Piero & Martinelli, Luca & Pezzutto, Paolo. (2013). Formula to Predict Transmission for -Type Floating Breakwaters. Journal of waterway, port, coastal, and ocean engineering. 139. 1-8. 10.1061/(ASCE)ww.1943-5460.0000153.

Ruprecht, J. E., Glamore, W.X., Coglan, I.R., & Flocard, F. 2015. Wakesurfing. Some wakes are more equal than others. In Australasian Coasts & Ports Conference 2015: 22nd Australasian Coastal and Ocean Engineering Conference and the 15th Australasian Port and Harbour Conference (. 779). Engineers Australia and IPENZ.

FIGURES

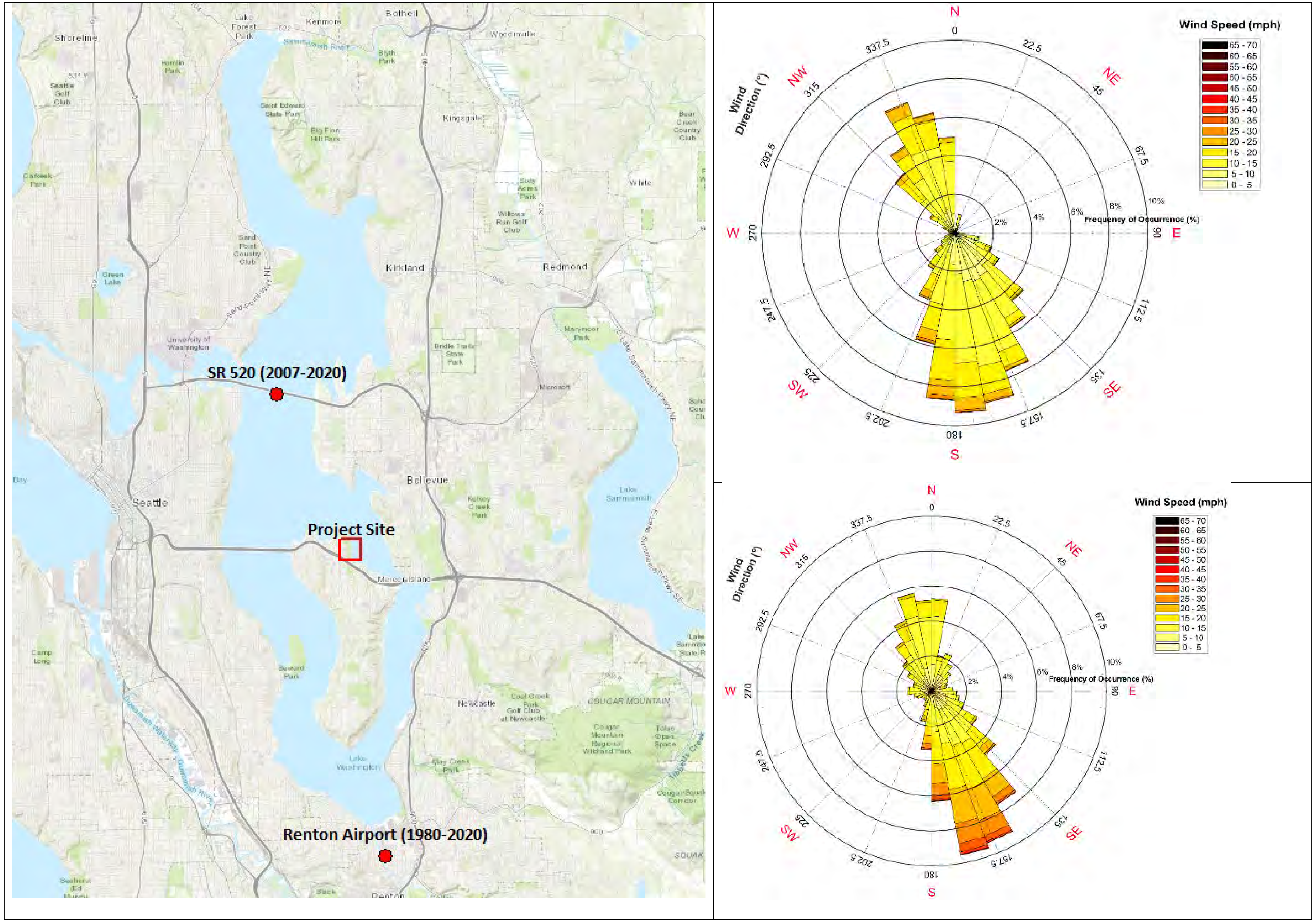


Figure 1. Left: Location of Project Site and Wind Stations used in the Evaluation. Upper Right: Wind Rose for 520 Bridge Station (2007-2020) and Bottom Right: Wind Rose for Renton Municipal Airport (1980-2020)

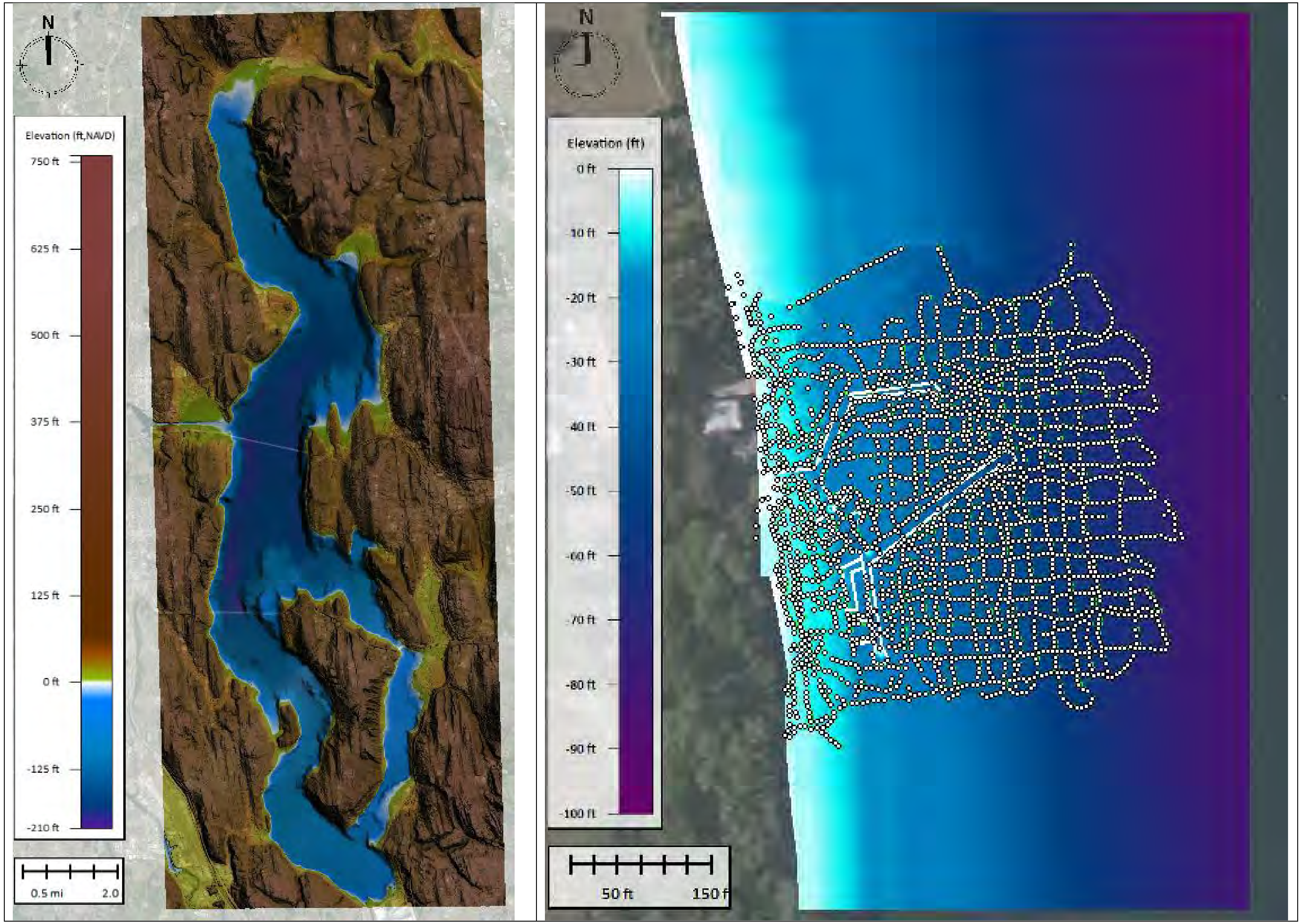
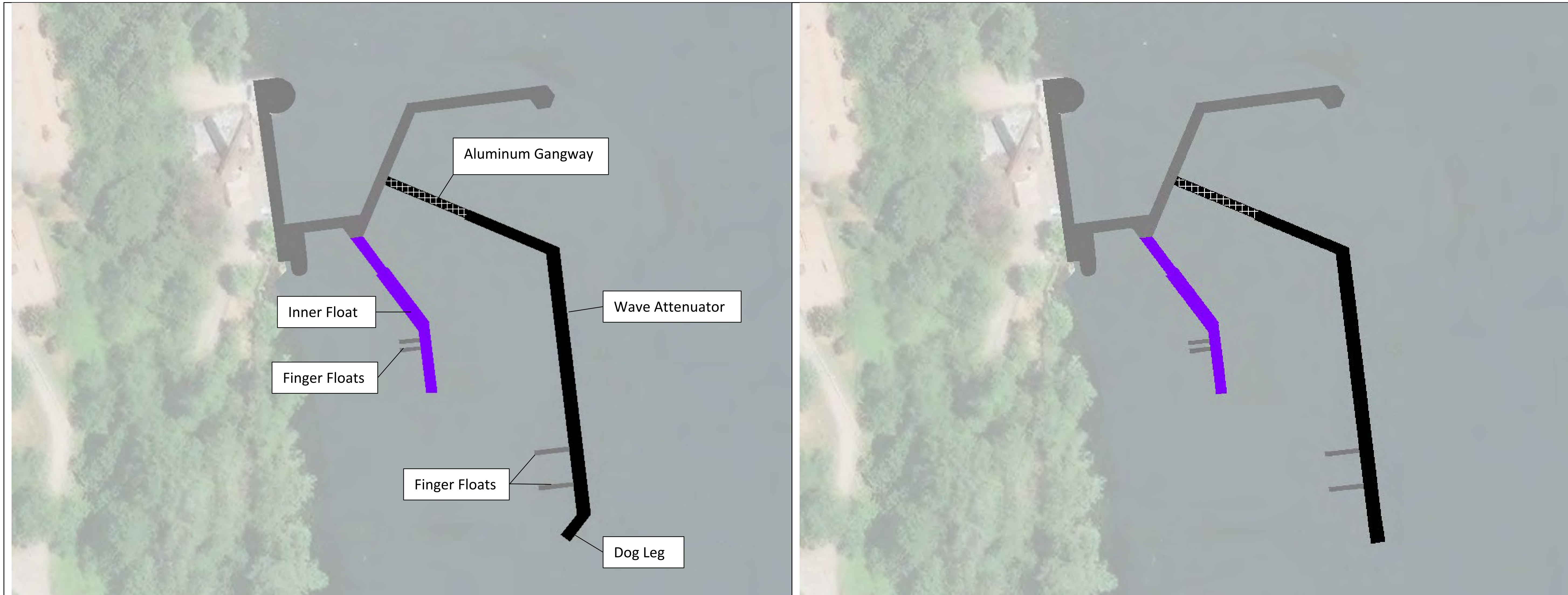


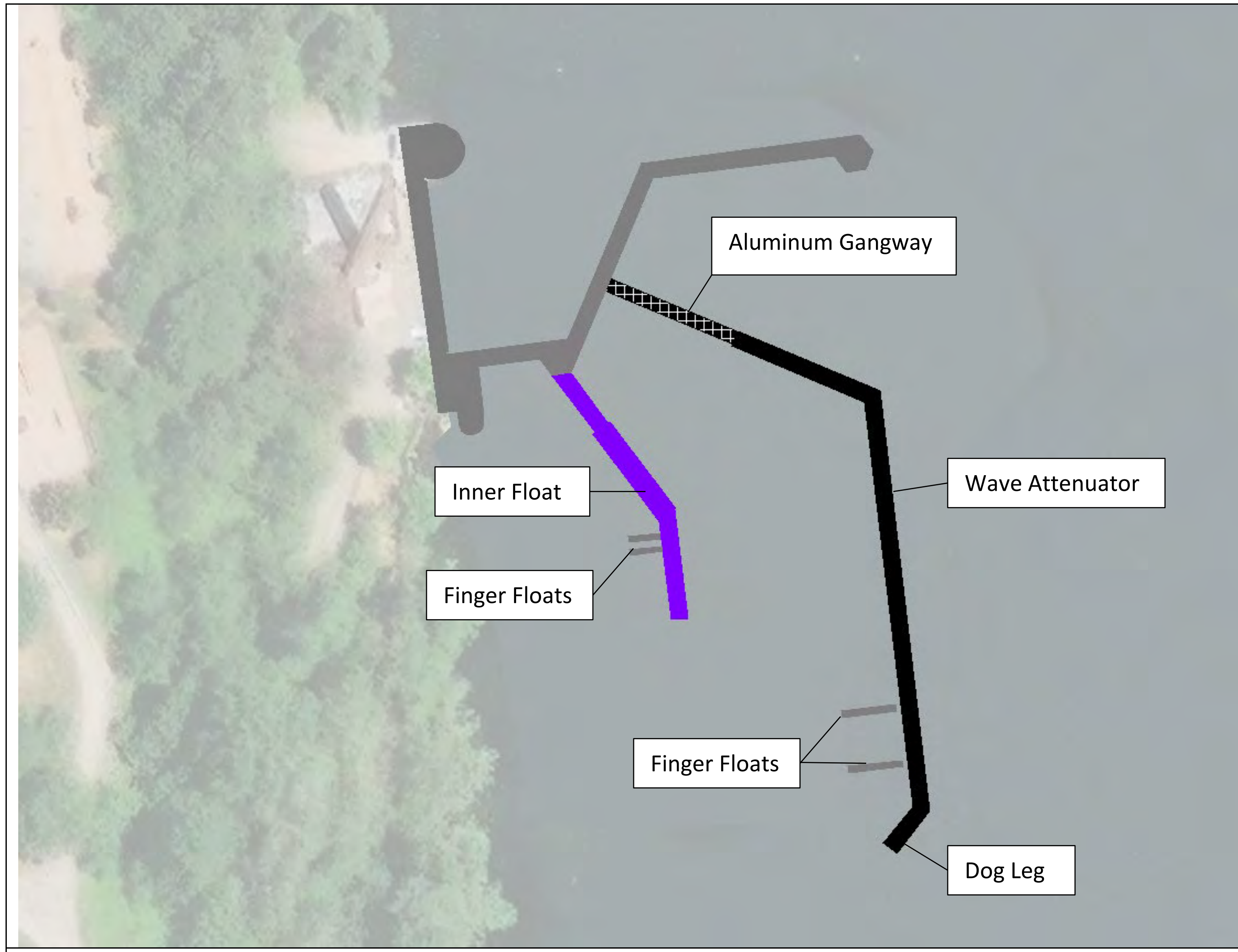
Figure 2. Left: Combined Bathymetry and Topography cropped to Lake Washington and NOAA NOS hydrographic data H11810 (2008) and H11376 (2005). Right: Bathymetric Survey (white dots) merged with NOAA NOS hydrographic data H11376 (2005) at the project site.



Option 1: Current design: 193' x 10' x 4' draft main float – KT = 23 %

Option 1.1: Current design with extension (no dog leg): 210.5' x 10' x 4' draft main float – KT = 23 %

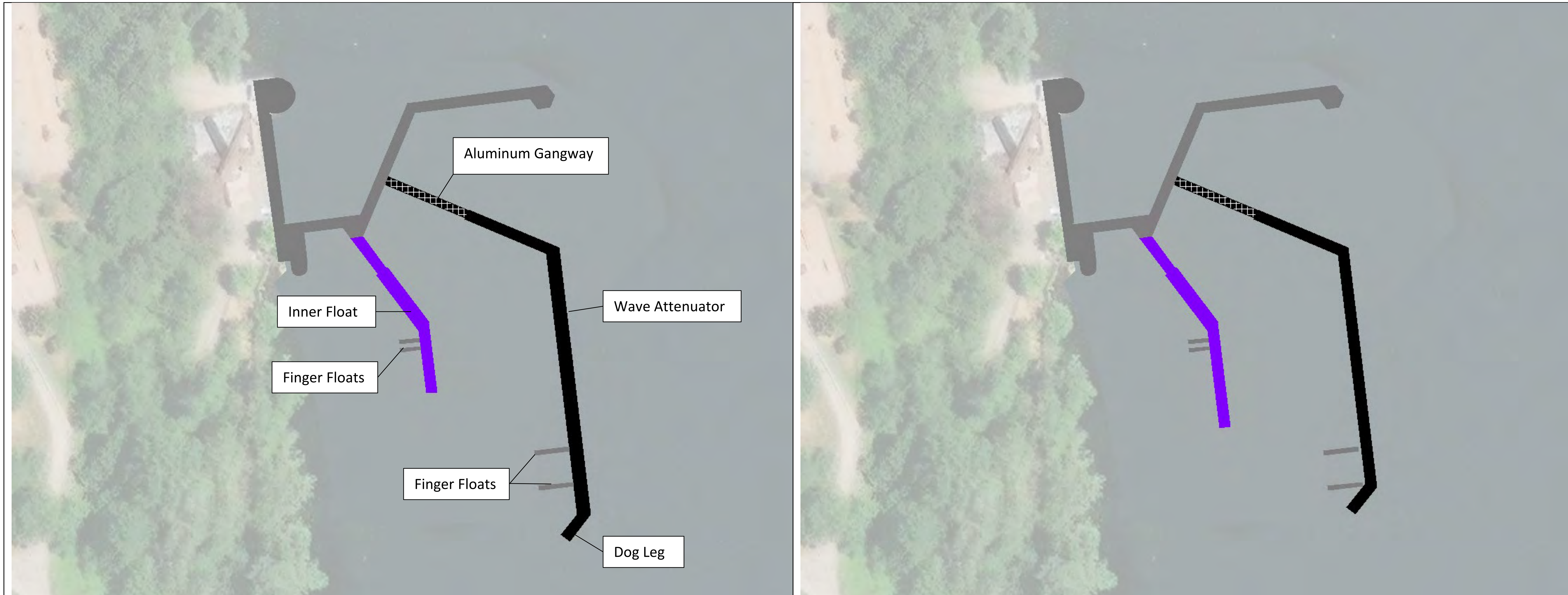
Figure 3: Dock Configurations used in the Wave and Boat Wake Numerical Modeling Evaluation.



Option 2: Narrower: 193' x 8' x 4' draft main float – KT = 28 %

Option 3: Shorter: 173' x 10' x 4' draft main float (inner float +25') – KT = 23 %

Figure 4: Dock Configurations used in the Wave and Boat Wake Numerical Modeling Evaluation.



Option 4: Lighter: 193' x 10' x 2' draft main float – KT = 28 %

Option 5: Minimum: 173' x 8' x 2' draft main float (inner float +25') – KT = 35 %

Figure 5: Dock Configurations used in the Wave and Boat Wake Numerical Modeling Evaluation.

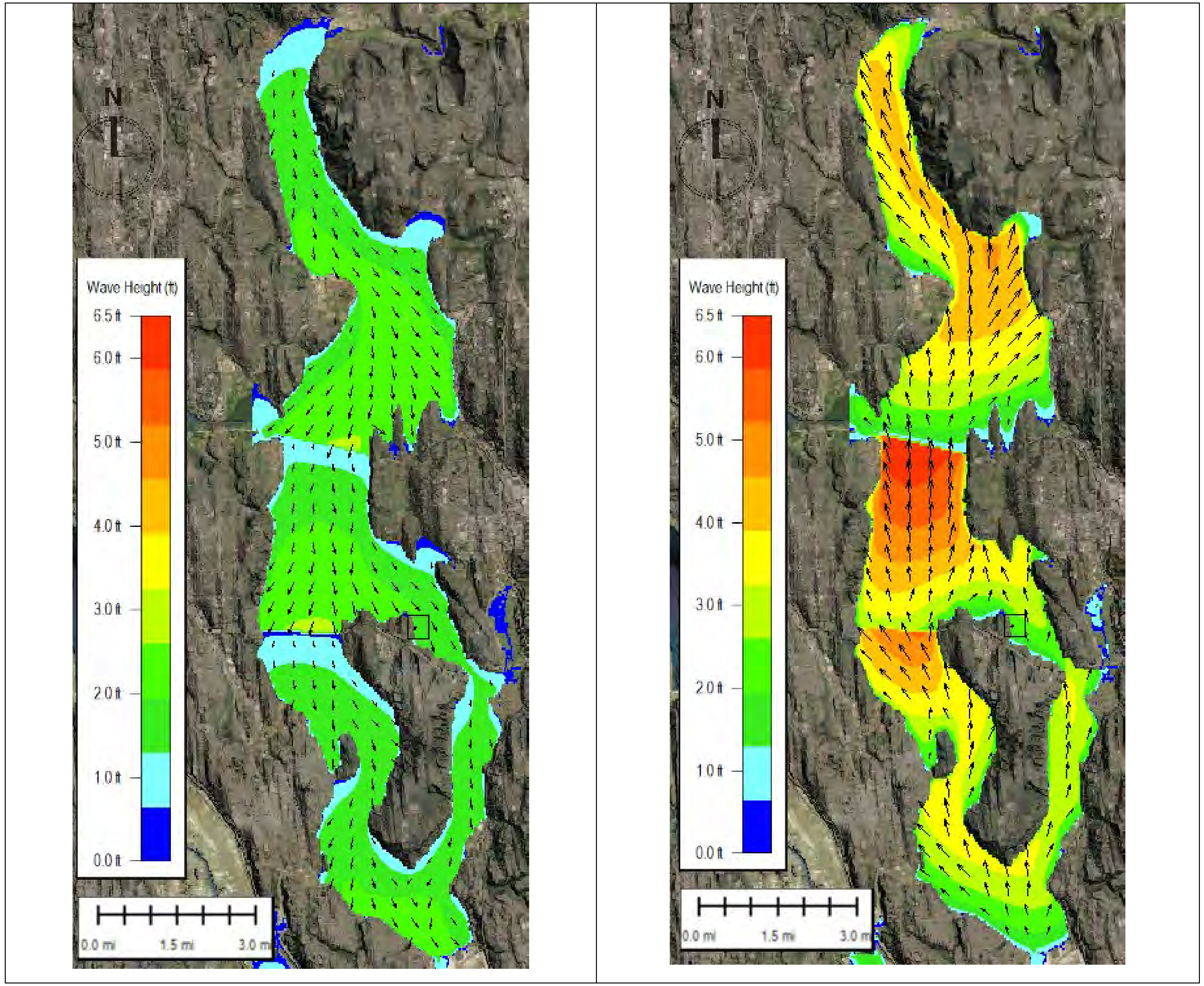


Figure 6. Simulated results for Lake Washington Northerly 100-yr return period wind (left) and 100-yr return period southerly wind (right).

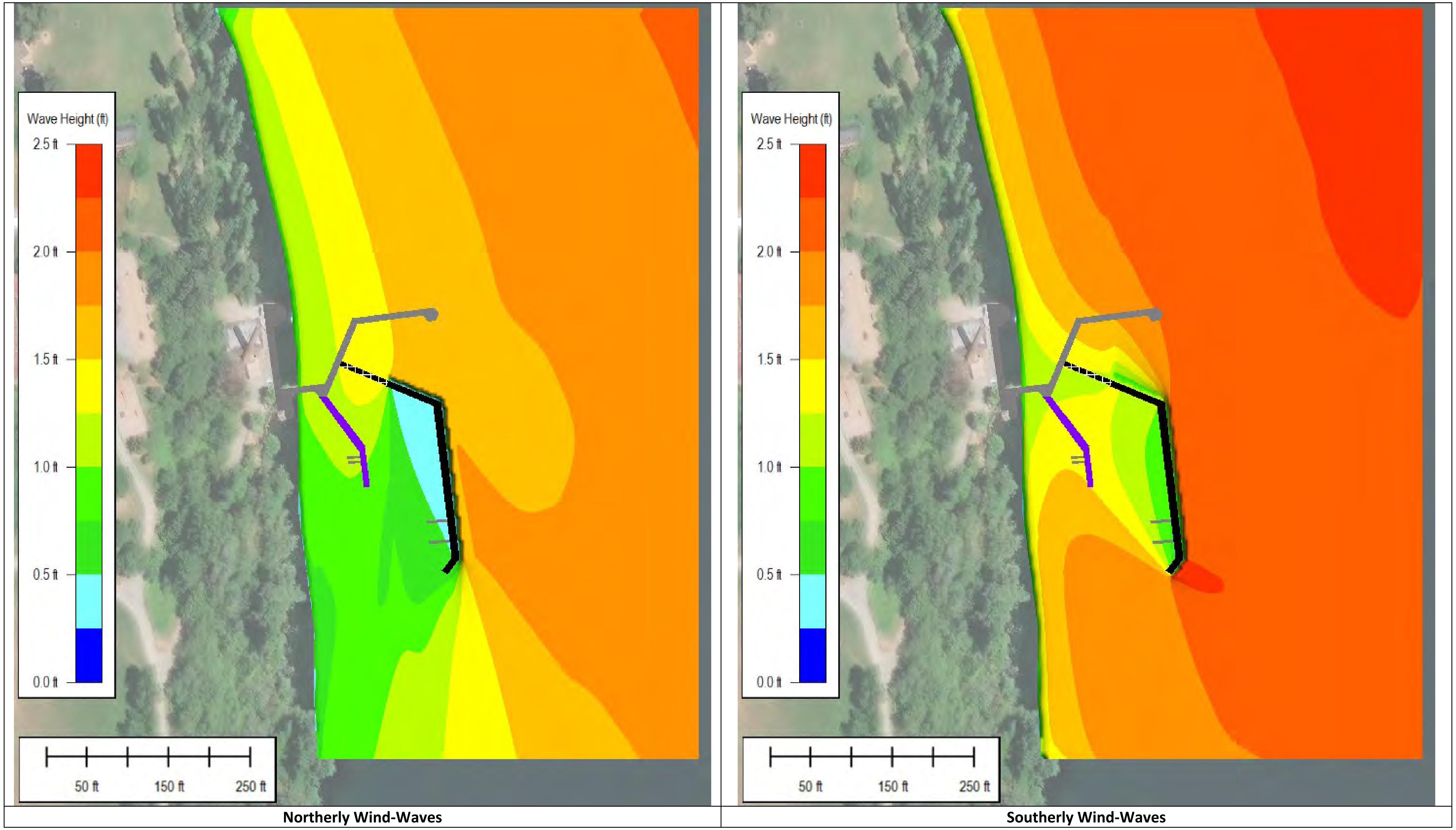


Figure 7: Plan View of Resulting 100-year Significant Wind-Wave Heights for Option 1: Current design: 193' x 10' x 4' draft main float – KT = 23 %

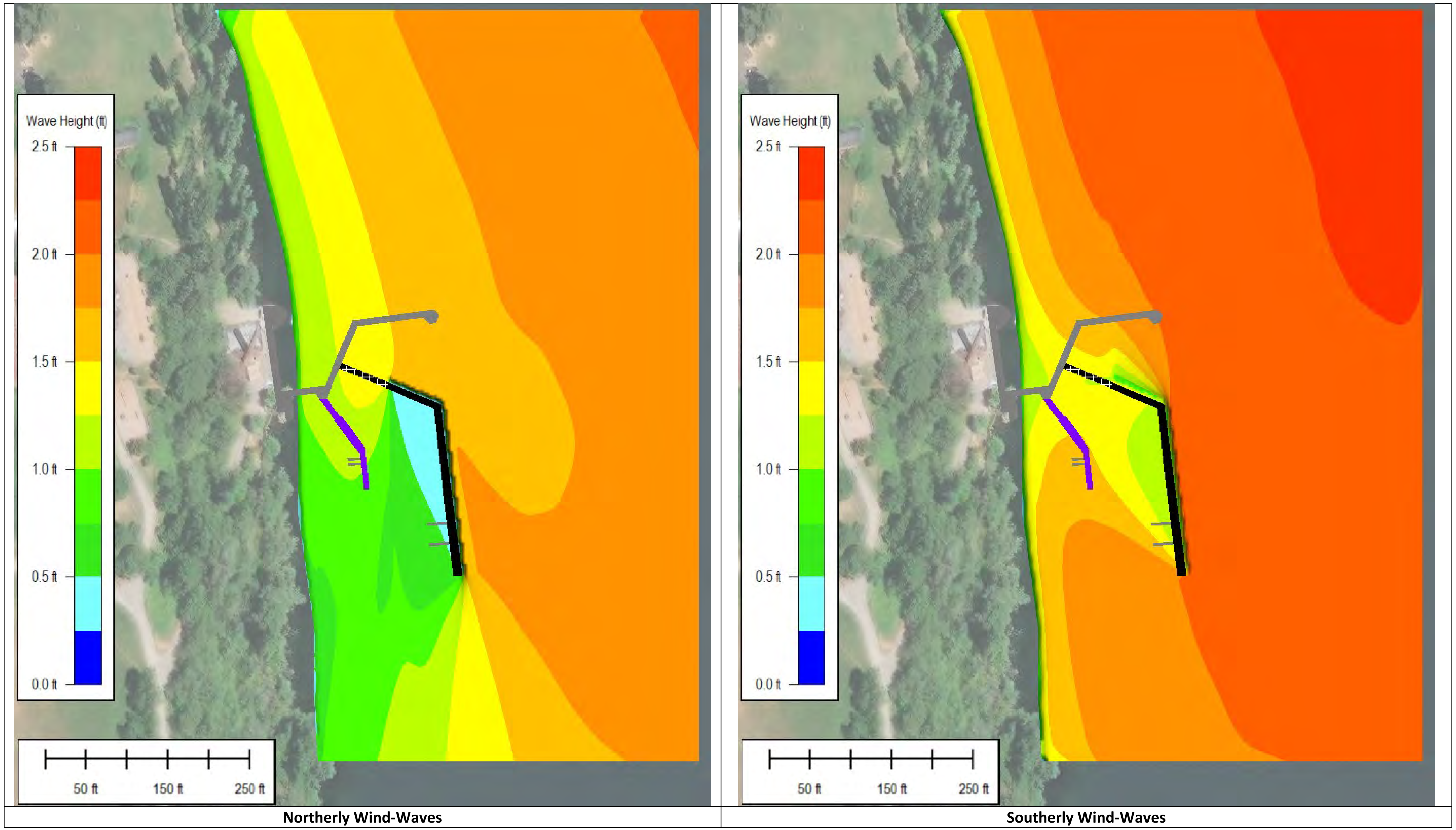
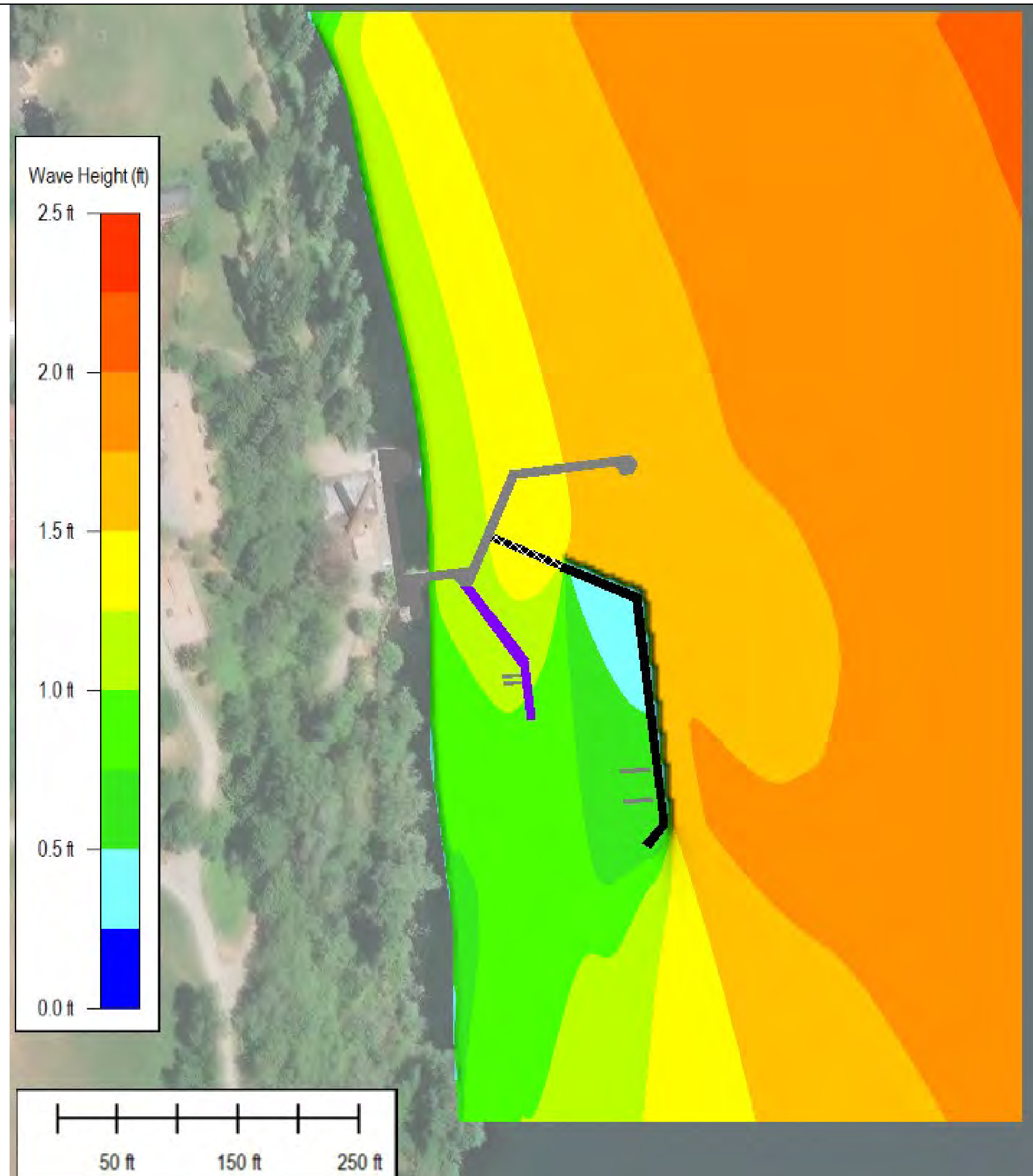
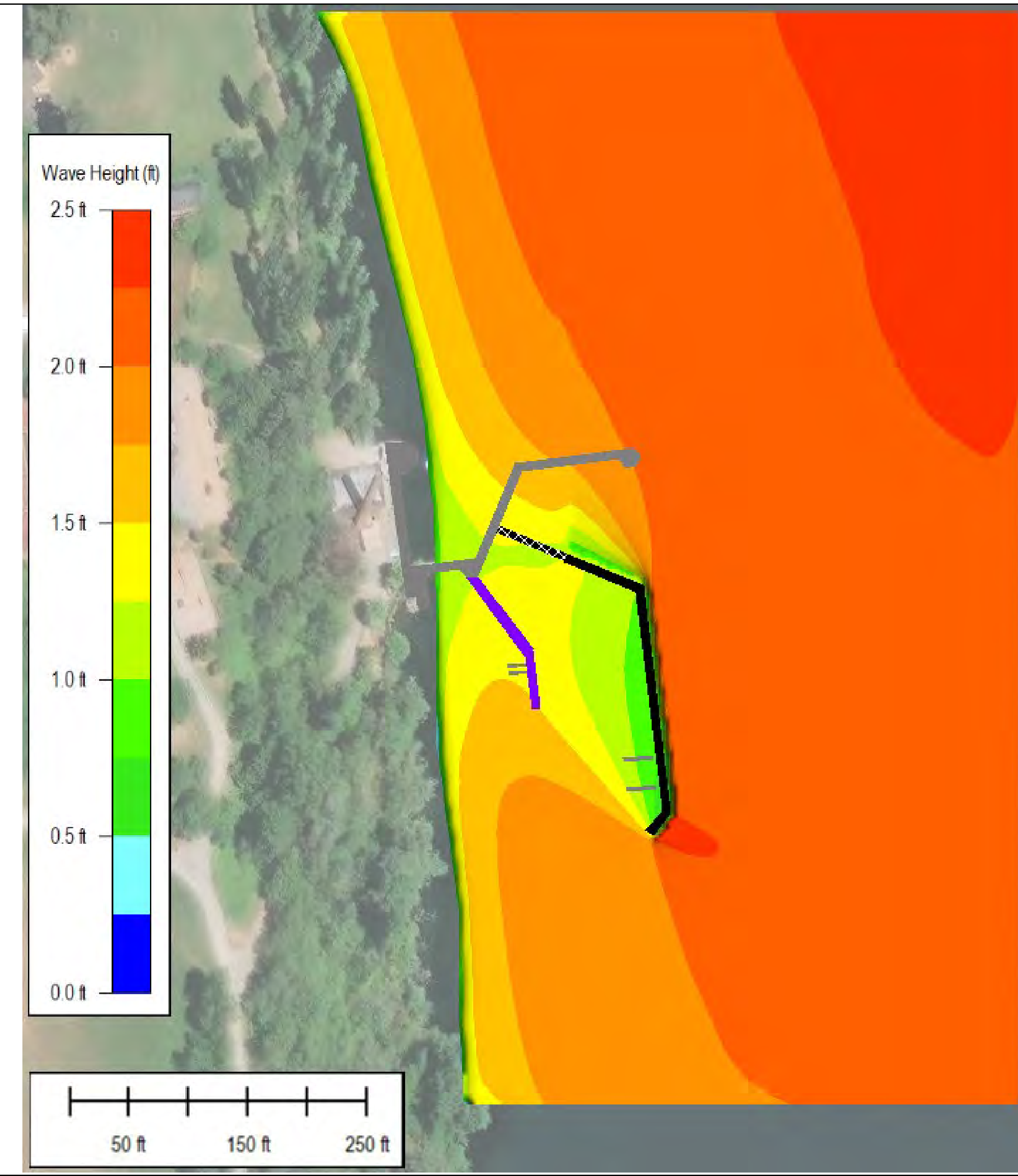


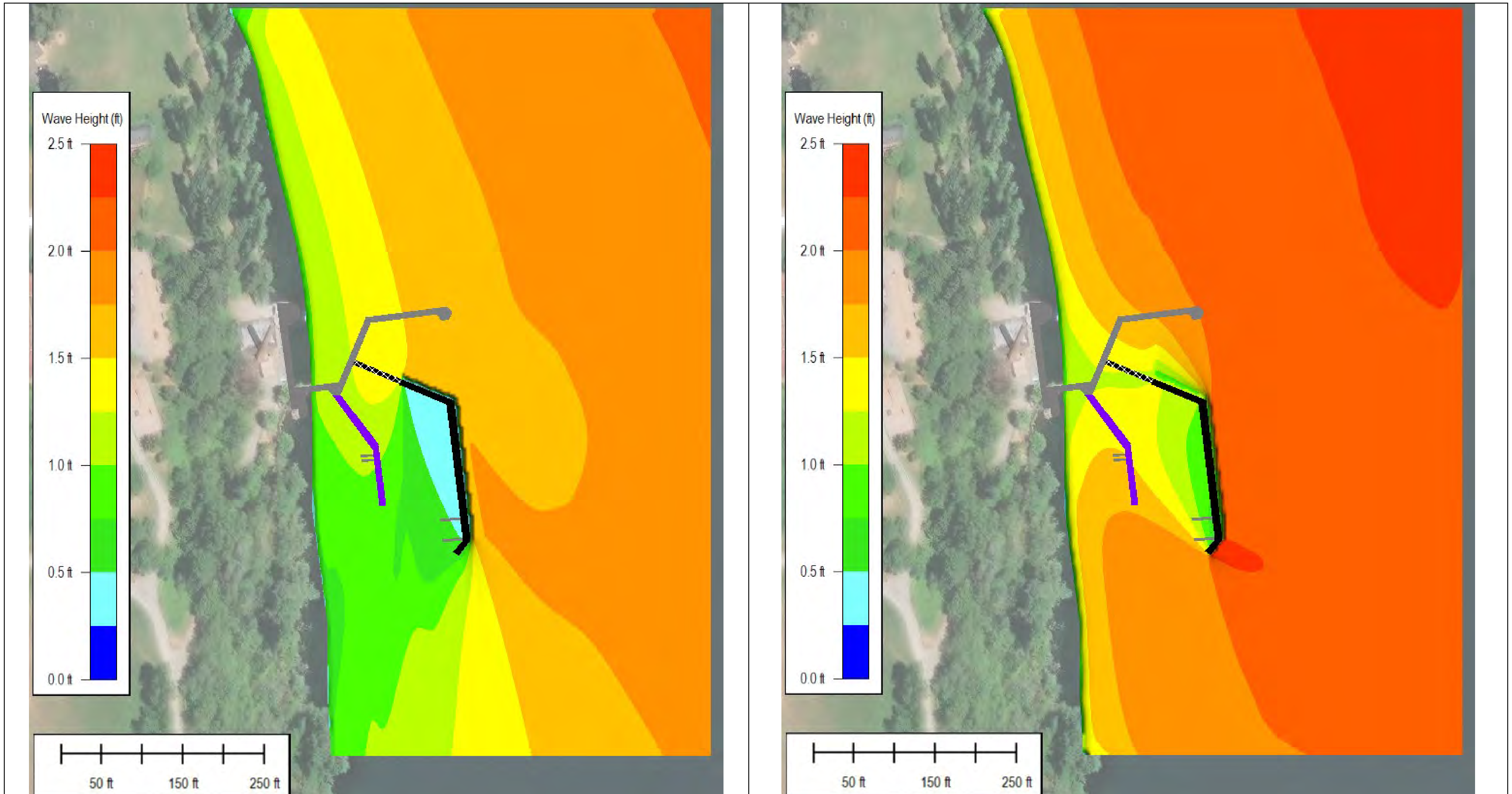
Figure 8: Plan View of Resulting 100-year Significant Wind-Wave Heights for Option 2: Current design extended (no dog leg): 210.5' x 10' x 4' draft main float – KT = 23 %





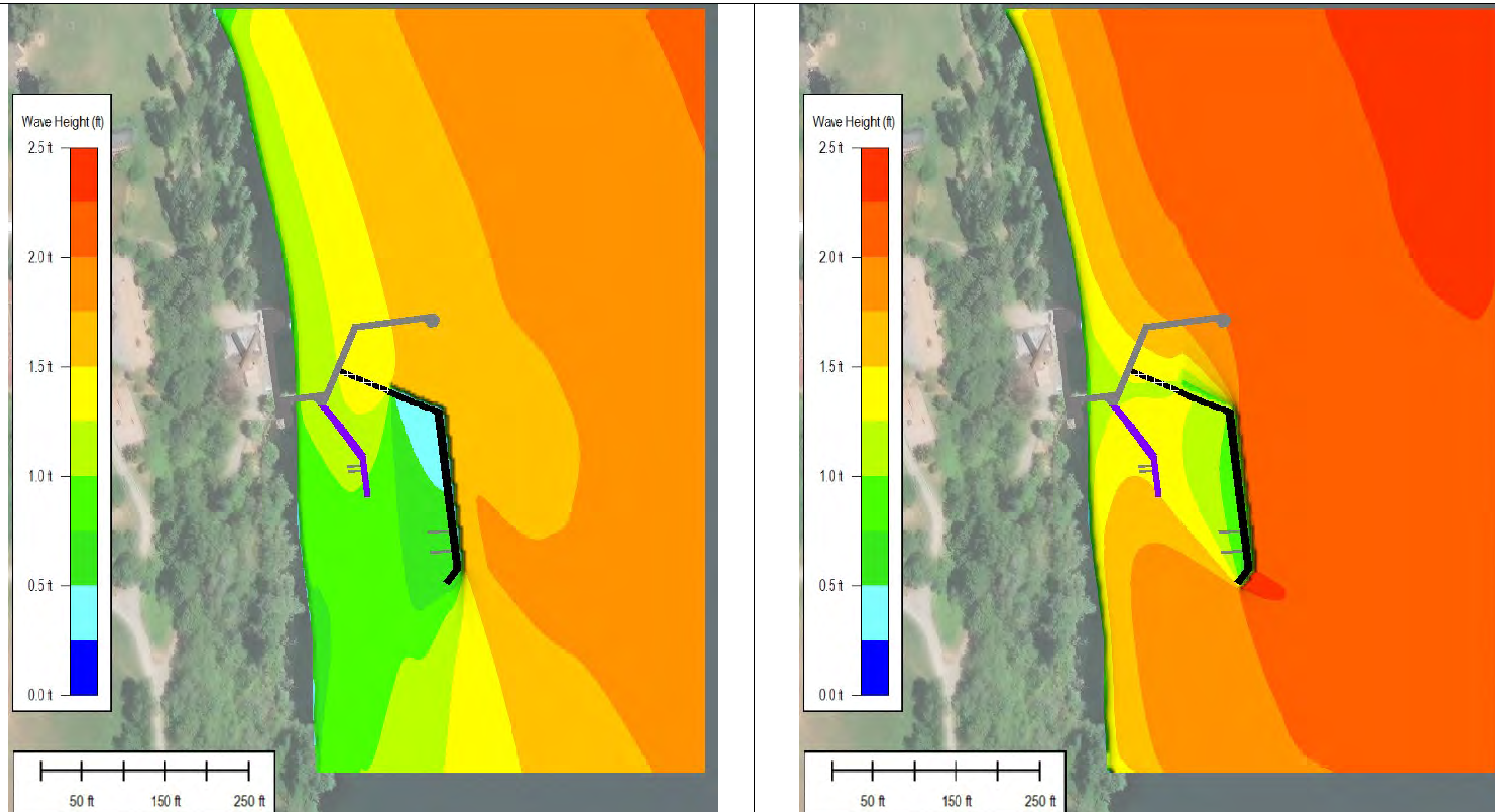
Northerly Wind-Waves	Southerly Wind-Waves

Figure 9: Plan View of Resulting 100-year Significant Wind-Wave Heights for Option 3: Narrower: 193' x 8' x 4' draft main float – KT = 28 %



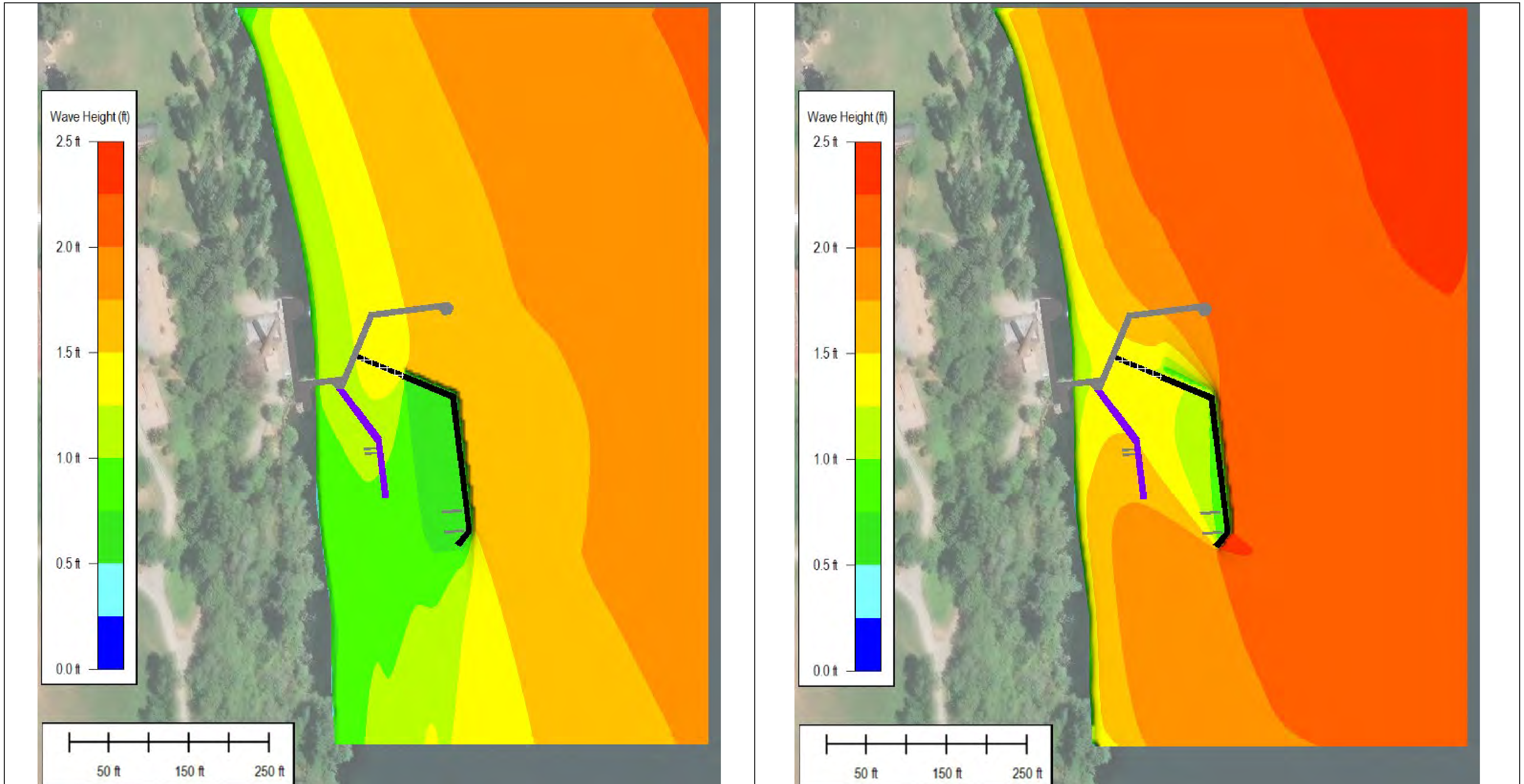
Northerly Wind-Waves	Southerly Wind-Waves

Figure 10: Plan View of Resulting 100-year Significant Wind-Wave Heights for Option 4: Shorter: 173' x 10' x 4' draft main float (inner float +25') – KT = 23 %



Northerly Wind-Waves	Southerly Wind-Waves

Figure 11: Plan View of Resulting 100-year Significant Wind-Wave Heights for Option 5: Lighter: 193' x 10' x 2' draft main float – KT = 28 %



Northerly Wind-Waves	Southerly Wind-Waves

Figure 12: Plan View of Resulting 100-year Significant Wind-Wave Heights for Option 6: Minimum: 173' x 8' x 2' draft main float (inner float +25') – KT = 35 %

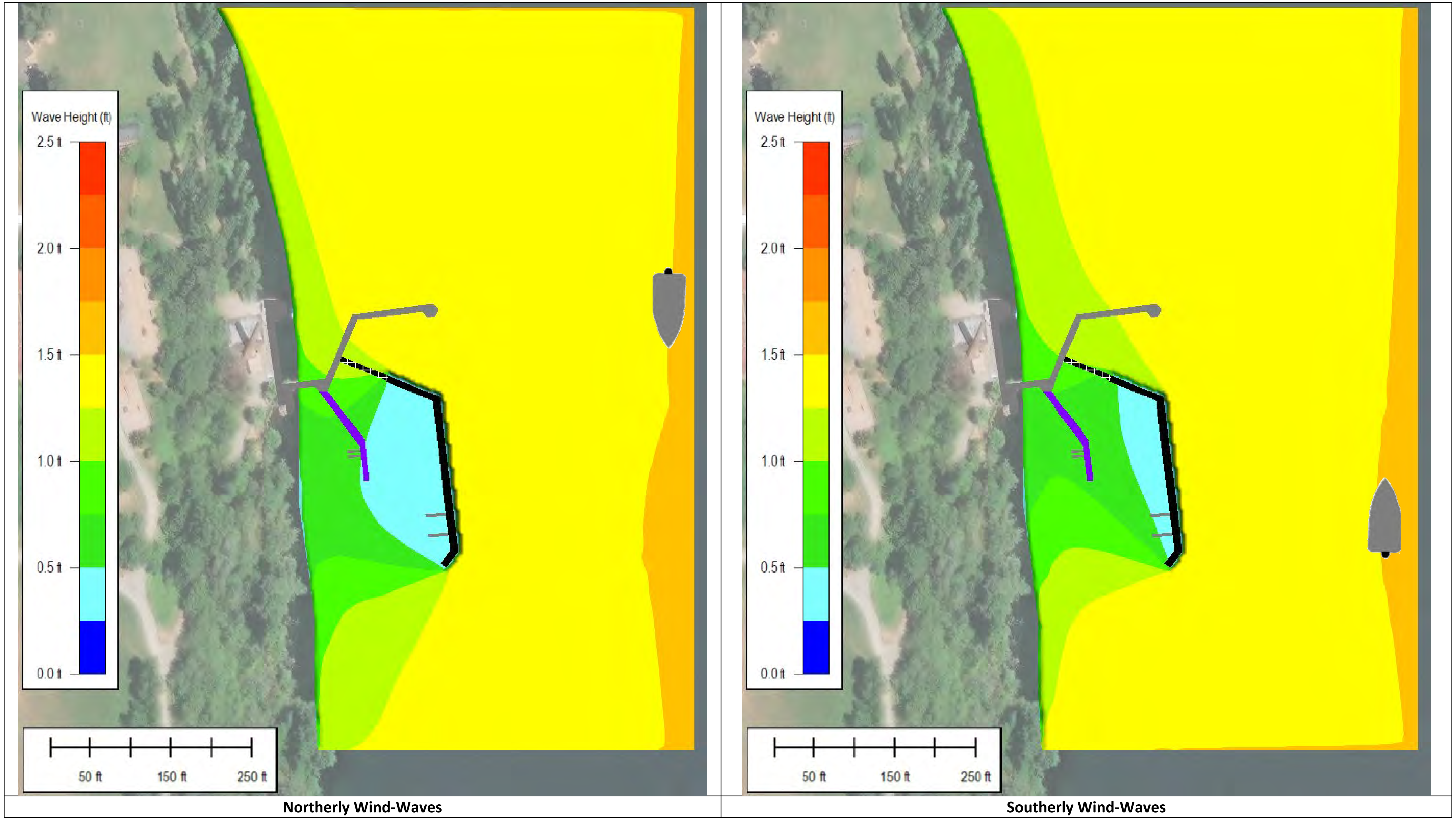


Figure 13: Plan View of Resulting Boat Wake Heights for Option 1: Current design: 193' x 10' x 4' draft main float – KT = 23 %

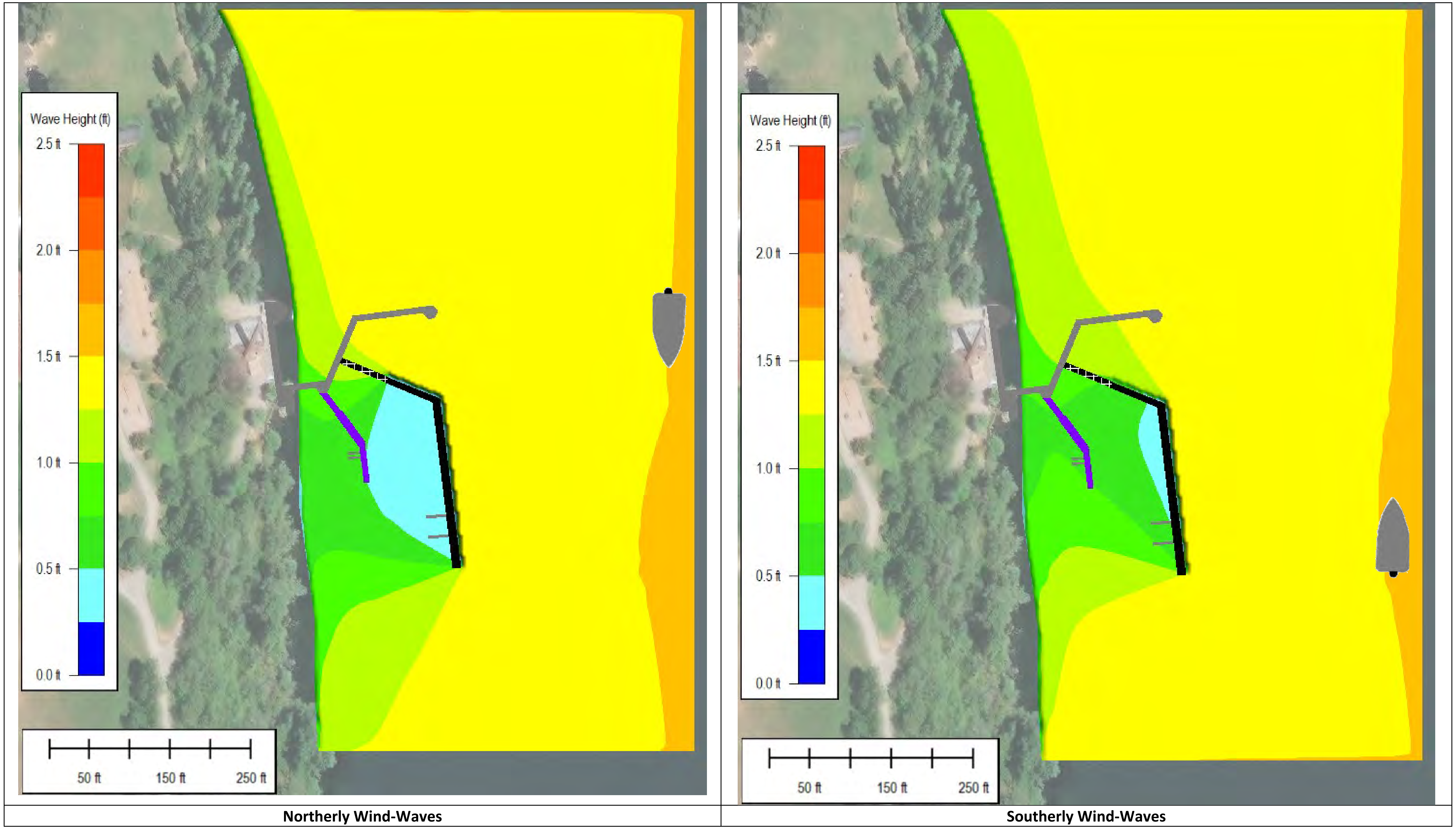


Figure 14: Plan View of Resulting Boat Wake Heights for Option 2: Current design: 210.5' x 10' x 4' draft main float – KT = 23 %

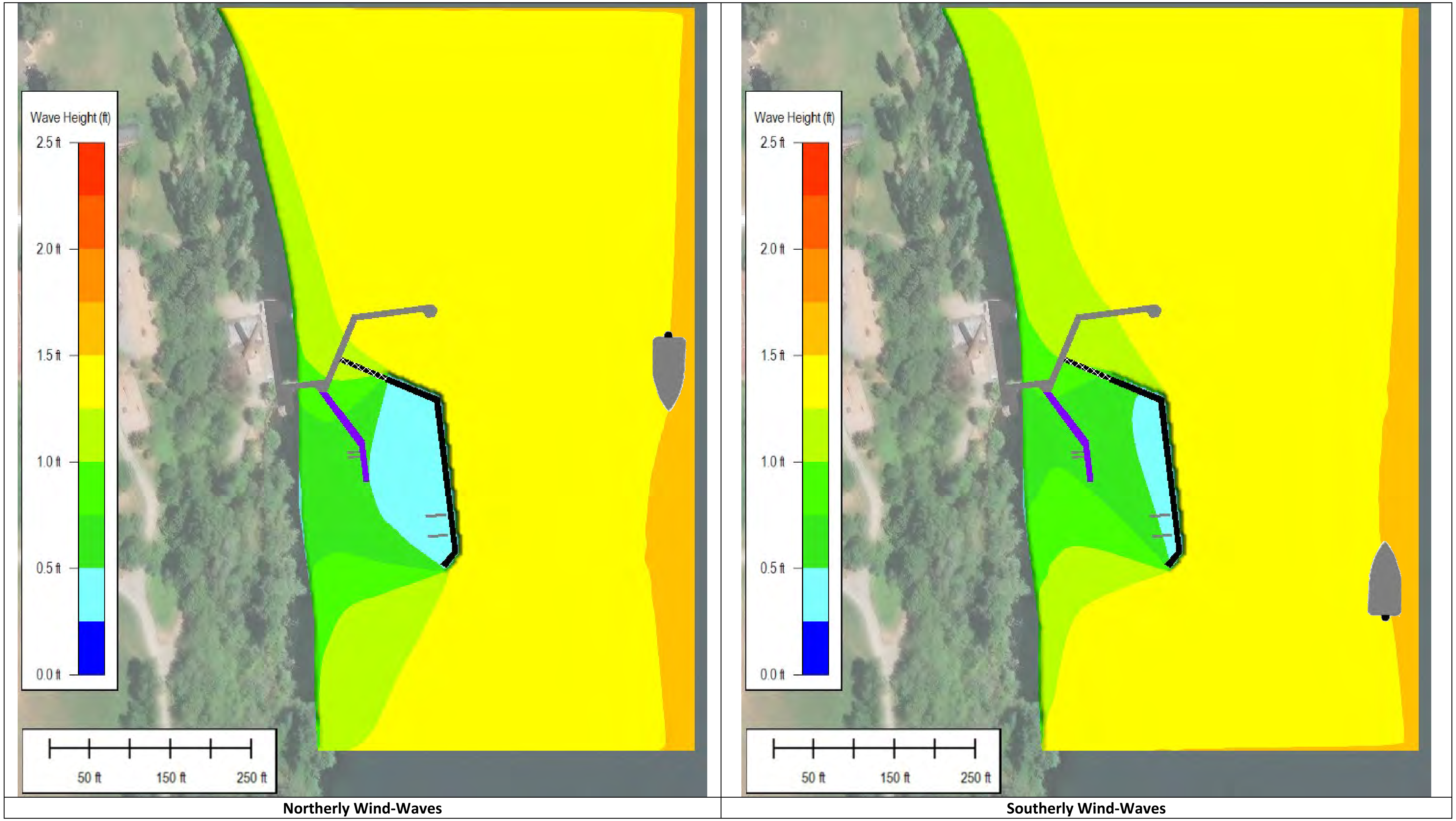
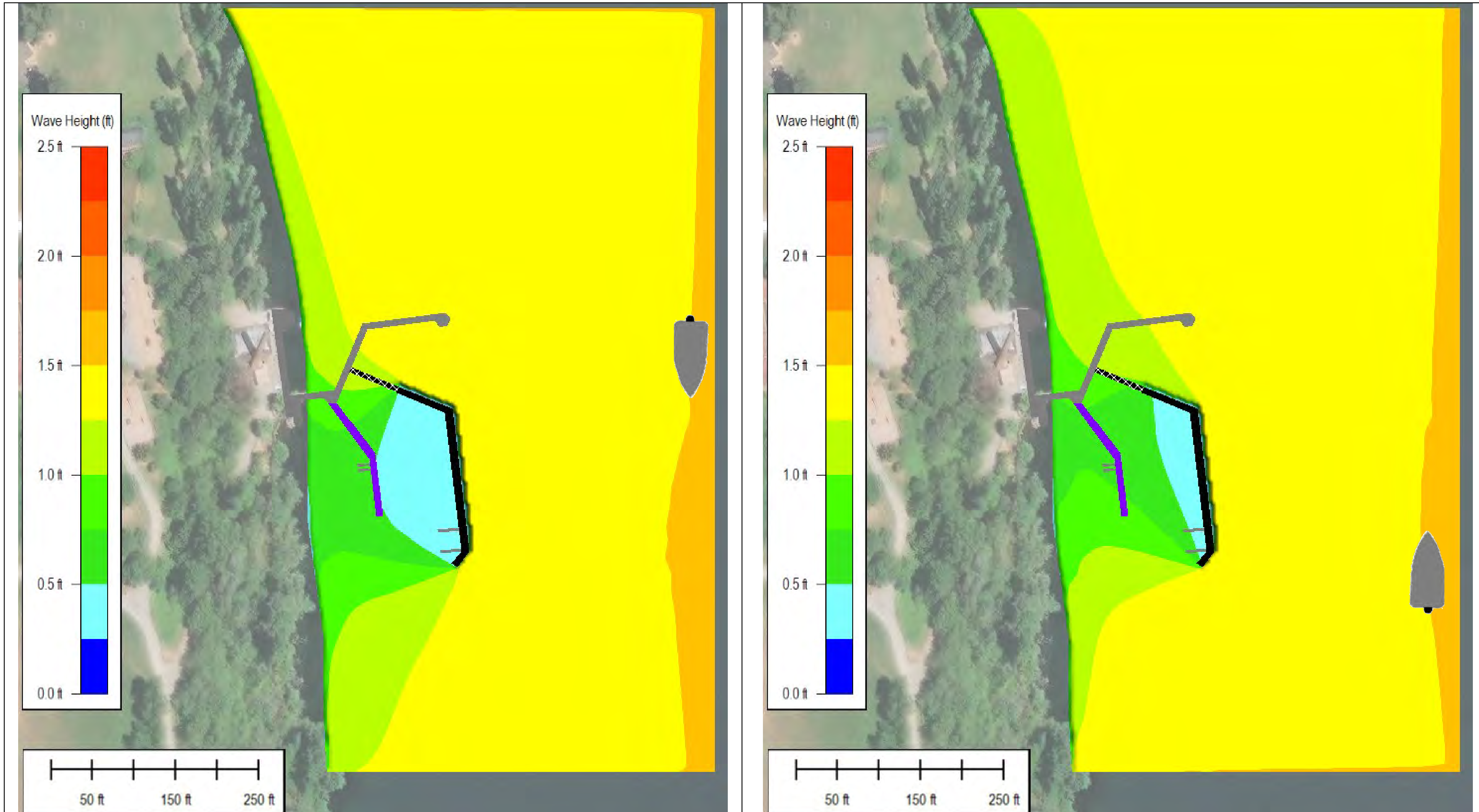


Figure 15: Plan View of Resulting Boat Wake Heights for Option 3: Narrower: 193' x 8' x 4' draft main float – KT = 28 %



Northerly Wind-Waves	Southerly Wind-Waves

Figure 16: Plan View of Resulting Boat Wake Heights for Option 4: Shorter: 173' x 10' x 4' draft main float (inner float +25') – KT = 23 %

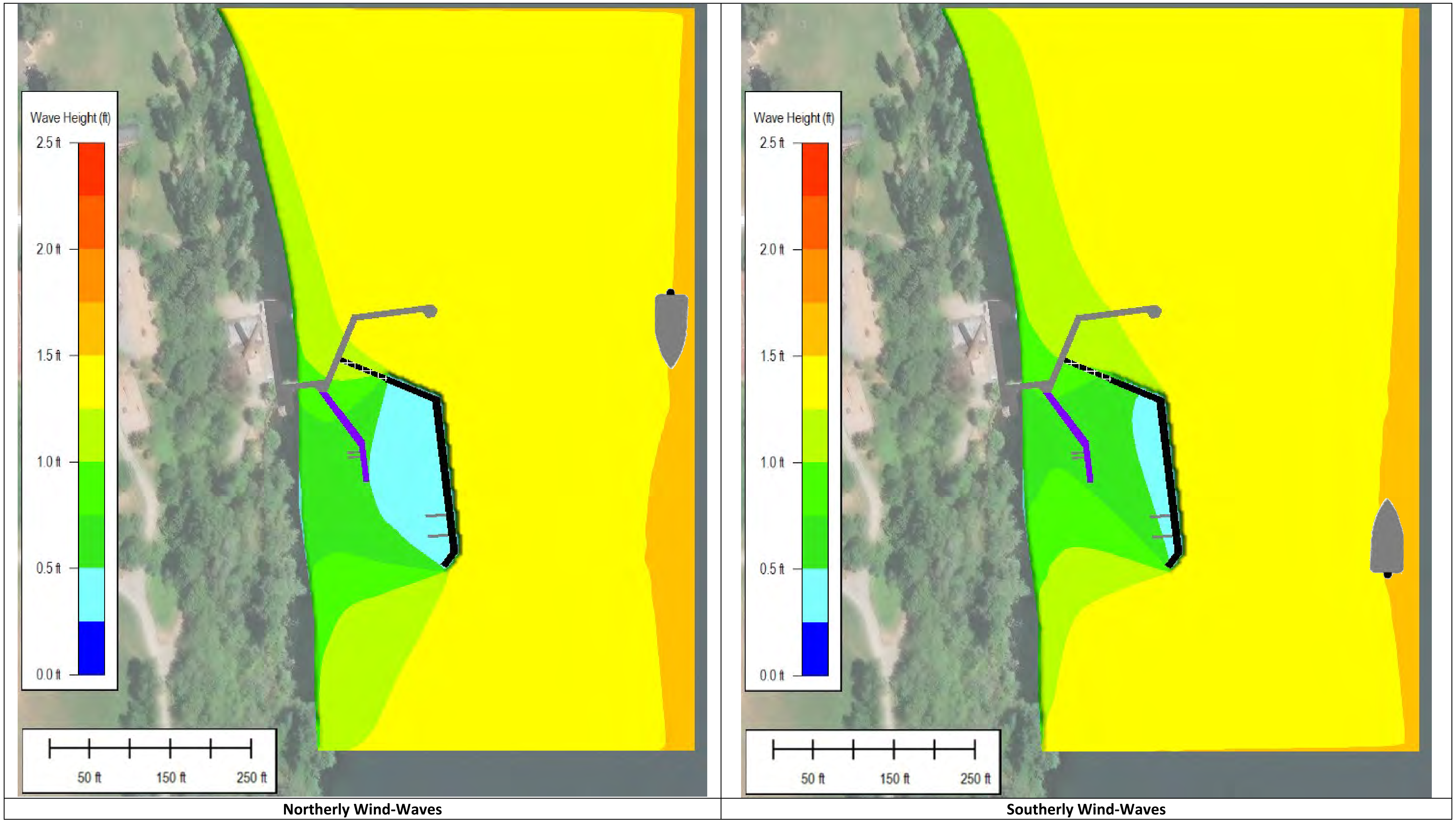
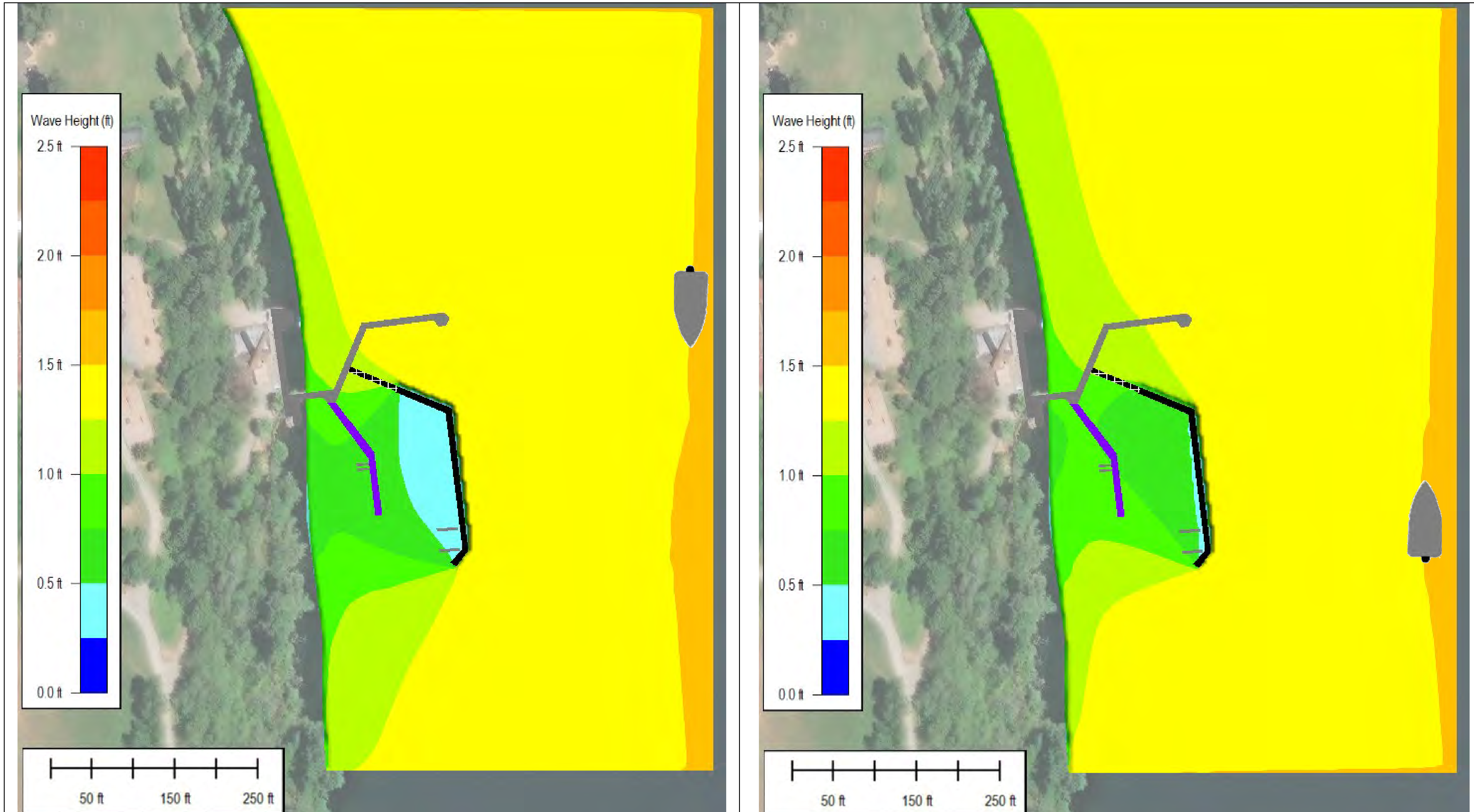


Figure 17: Plan View of Resulting Boat Wake Heights for Option 5: Lighter: 193' x 10' x 2' draft main float – KT = 28 %



Northerly Wind-Waves | Southerly Wind-Waves

Figure 18: Plan View of Resulting Boat Wake Heights for Option 6: Minimum: 173' x 8' x 2' draft main float (inner float +25') – KT = 35 %

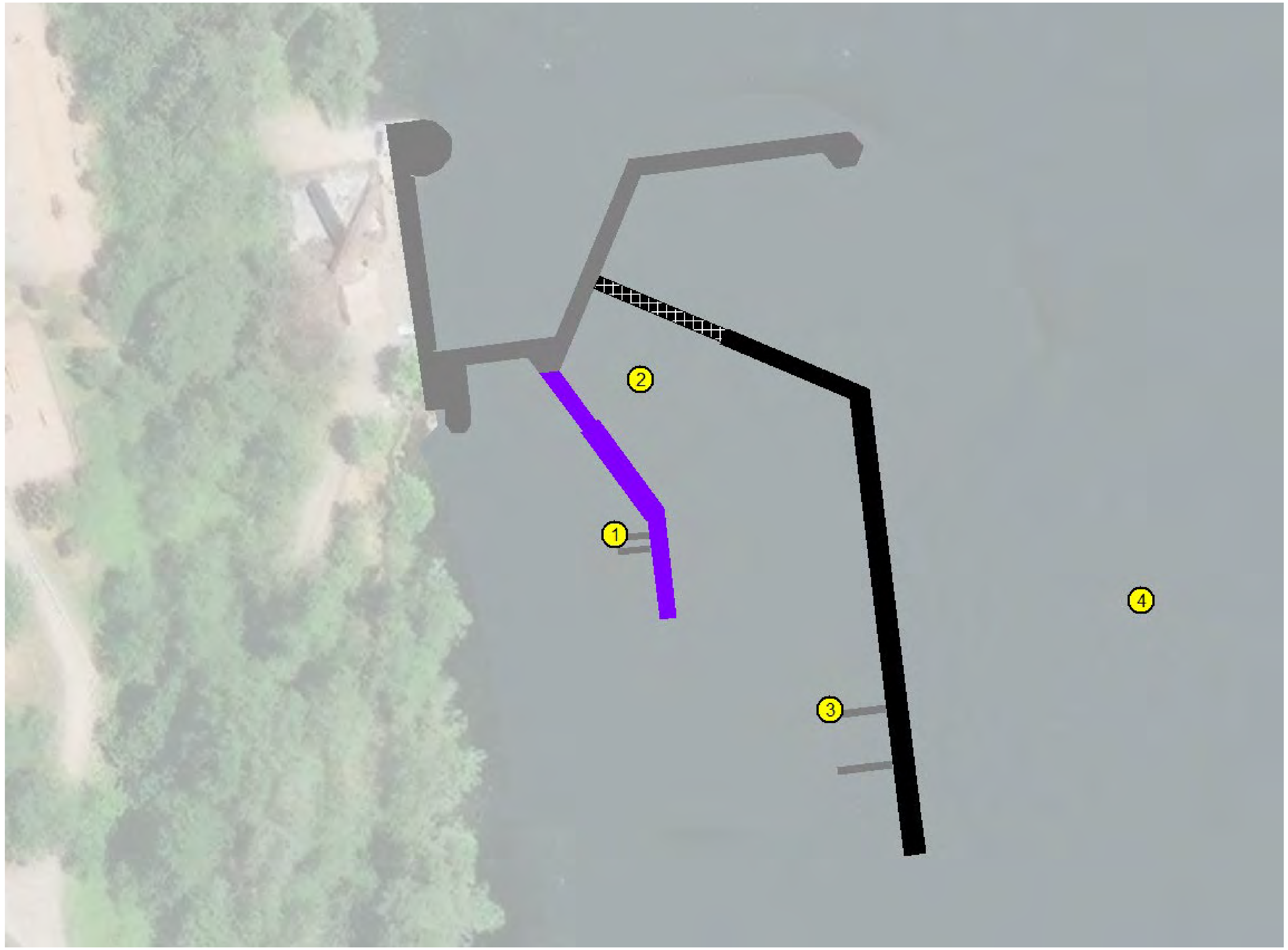


Figure 19: Location of Wave Height Extraction Points Inside the Marina

Appendix F
Tree Report

PUBLIC WORKS DEPARTMENT
CITY OF MERCER ISLAND, WASHINGTON
9611 S.E. 36th St. • Mercer Island, WA 98040-3732
(206) 275-7608 • FAX: (206) 275-7814
www.mercerisland.gov

Luther Burbank Park Waterfront Improvements Tree Report – Revised 3/31/2023

1. Arborists' Qualification

a. Andrew Prince: Andrew Prince has 17 years of experience in restoration and landscape horticulture, and is the Urban Forestry Project Manager for the City of Mercer Island. He holds a Municipal Arborist Specialist Certification from the International Society of Arboriculture. He maintains TRAQ certification through the same agency.
b. Paul West, MFR: Paul D. West has 40 years of experience in the field of landscape horticulture. He holds a Masters of Forest Resources in Urban Horticulture from the University of Washington. He was an ISA Certified Arborist for fifteen years. He held both TRACE and TRAQ qualifications. He has managed numerous capital projects that involve tree retention and protection, including paving, utility and building projects. He was previously the Senior Urban Forester for the City of Seattle Parks and Recreation Department.

2. Site, Project Purpose and Permit Approach

Luther Burbank Park is a 55 acre public park on the north end of Mercer Island. The address is 2040 84th Avenue SE. It slopes to Lake Washington along its eastern and northern boundaries. The site contains ¾ mile of shoreline. The purpose of this project is to increase capacity and accessibility for public shoreline recreation by renovating and improving a fifty year-old outdoor facility. This goal aligns with the Washington State Shoreline Management Act.

Mercer Island City Code 19.10.090 requires a tree plan that encompasses the entire property under permit application. This requirement is reasonable for private development, but would be onerous to execute for a 55 acre park. Furthermore, accepted urban forest management practices in a large public park are markedly different from those in a private development. The applicant plants and removes many trees every year to maintain or improve the long-term public benefit of the tree canopy in the park. Trees are managed as stands and populations as well as individuals. It is for this reason that this work is covered under annual tree permit provision found in MICC 19.10.100 A. To provide a complete understanding of the environmental impacts of the proposed action, this tree report focuses its study on those trees in proximity to the project such that they are likely to be impacted by the development proposal.

3. Tree Descriptions

The attached Tree Inventory (Item #10) provides data on each tree. Trees that are to be removed are described as follows:

Number	dbh (in.)	spp	description	health/ viability
1226	24	Acer macrophyllum	shoreline bank location; historic loss of the top has resulted in a short tree with a deep central cavity	fair
1227	22	Populus nigra (Lombardy Poplar)	Shoreline bank location; typical Lombardy poplar clone with codominant stem, dieback and basal cavities	poor
1228	7.5	Populus nigra (Lombardy Poplar)	Shoreline bank location; Lombardy poplar stump sprout with basal cavity; suppressed	poor
1229	28	Populus nigra (Lombardy Poplar)	Shoreline bank location; typical Lombardy poplar clone with deadwood	fair
1230	9.6	Acer rubra (red maple)	Paved plaza location; nursery-grown transplant has been very suppressed; dieback	poor
1231	7.6	Acer rubra (red maple)	Paved plaza location; nursery-grown transplant has been very suppressed; codominant main stem; dieback	poor
1232	11	Acer rubra (red maple)	Paved plaza location; nursery-grown transplant has been very suppressed; dieback	poor
1233	11	Fraxinus latifolia	Development edge location on the toe of the slope; included bark in subordinant stem	good
1234	47.5	Arbutus menziesii	Steep slope location; codominant trunks, north trunk is dead, south trunk has leaves on two lower scaffolds	poor
1235	14	Salix scouleriana	Steep slope location; extensive basal cavity, decay in basal crotch, extensive deadwood, upper scaffolds resprouted from topping incident	failing
1601	6	Populus nigra (Lombardy Poplar)	multiple subordinant stems; poor rooting on east side	fair
1602	7	Populus nigra (Lombardy Poplar)	multiple subordinant stems; poor rooting on east side	fair

4. Limits of Allowable Disturbance

Construction that may impact trees to be retained includes:

- Trenching operation north of the Boiler Building
- Geogrid installation along the pathways at the Fire Department Connection (FDC)

For those trees that are to be retained inside or in proximity to the limits of work, limits of allowable disturbance have been determined by the experience of the consulting arborist using the following criteria:

- Dripline diameter, trunk diameter and height of the tree
- Tree canopy form (e.g. excurrent, decurrent, columnar, etc.)
- Visual inspection of the ground level around the tree for its potential as rooting habitat (e.g. barriers to root growth like pavement, compaction)
- Visual evidence of tree root presence in the surface of the soil (e.g. surface roots, condition of competing vegetation)
- Root characteristics of subject species
- Soil composition
- Local topography
- Local hydrology including irrigation
- Maintenance practices

The limits set by the consulting arborist have been defined for groups of trees where possible. They have been visually represented in the plan set on sheet __________ (Item #12).

5. Special Instructions for Limits of Disturbance

Standard instructions are detailed in Section 329310 – Tree and Shrub Protection of the Specifications in the project manual and on plan sheet ___________ (Item #12). Additional instructions for one green ash tree (*Fraxinus pennsylvanica*) are shown on the plan sheet and listed here as follows:

1. Surround with tree protection fencing per specification
2. Excavate in this area only when daytime temperatures remain below 70 degrees F.
3. Soil shall be moist to a depth of 10 inches before excavation begins.
4. Excavation shall start closest to the tree and be accomplished by air spade.
5. Excavation shall be continuously observed by the project's consulting arborist.
6. Arborist will determine when excavation has reached the outer limits of significant structural roots.
7. Arborist will direct which roots are to be cut and which roots are to remain and be protected.
8. Remaining excavation may then be allowed by heavy equipment.
9. Exposed roots will be watered and covered until the specified fill material is place on top of them.
10. Fill shall occur within 24 hours following excavation.

6. Removals: Justification

The removals proposed are the minimum required to be able to execute the development proposal. Only one of them (1233) is in good or excellent condition. Three of the removals (1226, 1233 and 1235) are in locations needed for wheelchair accessibility routes. The proposed beach expansion and fire suppression system require the removal of five Lombardy poplars. They are not native and are likely root clones from older trees nearby. The three red maples in the plaza (1230, 1231 and 1232) are nursery cultivars that were planted 50 years ago. They exhibit weak growth and are not expected to grow significantly more or live significantly longer. Two of the trees (1234 and 1235) are in decline and are likely to become a hazard to the buildings.

Twenty new trees will replace the twelve being removed. They will increase the native composition of the shoreline canopy, including six new conifer trees. With maintenance, these trees are likely to exceed the habitat functions of the trees that are being removed.

7. Impacts of Removals on remaining trees

Most of the trees inventoried are not part of larger stands. The exceptions are the large madrona and the native willow on the hillside west of the project (1234 and 1235). The willow is a suppressed edge tree and its removal will have little effect on the trees upslope. The removal of the large madrona will have an effect on the surrounding trees by releasing them. In particular a smaller madrona to the west may benefit from this madrona's removal, not only from increased solar access, but also from the reduction in production of disease inoculum. The madrona is not providing significant wind shelter to other trees and the removal is not expected to increase the risk of windthrow for other trees.

8. Timing and Installation of Tree Protection

Tree protection measures shall be installed by the contractor during the first phase of mobilization onto the site and prior to operation of construction equipment on the site. Measures are typically installed along with TESC measures and are the first inspection item.

9. Locations and Species for Replacement

The Mercer Island Tree Inventory and Replacement Submittal worksheet (Item #11) is provided below. It demonstrates that MICC 19.10.070 A would require the 12 trees proposed for removal be replaced with 28 trees. However, MICC 19.10.070 B4 allows for the city arborist to reduce the number of replacement trees based on hazard, undesired or short-lived specimens, restoration of critical tree areas with native vegetation, or protection of small trees for canopy restoration. Therefore, the Tree Inventory (Item #10) indicates a reduction for specific trees based on these criteria. In total, we are proposing that the city arborist require 18 replacement trees.

The landscape plan proposes the planting of 20 new trees, two in excess of the proposed permit requirement. Replacement tree locations are as shown on Sheet L-010, below.

Common Name	Scientific Name	Min. size at transplant	Quantity
GRAND FIR	ABIES GRANDIS	5-6' HT	3
WESTERN RED CEDAR	THUJA PLICATA	5-6' HT	3
BIG LEAF MAPLE	ACER MACROPHYLLUM	1.5"CAL	4
SWAMP OAK	QUERCUS BICOLOR 'American Dream'	2" CAL	1
VINE MAPLE	ACER CIRCINATUM	5 GAL	9

10. **Tree Inventory**

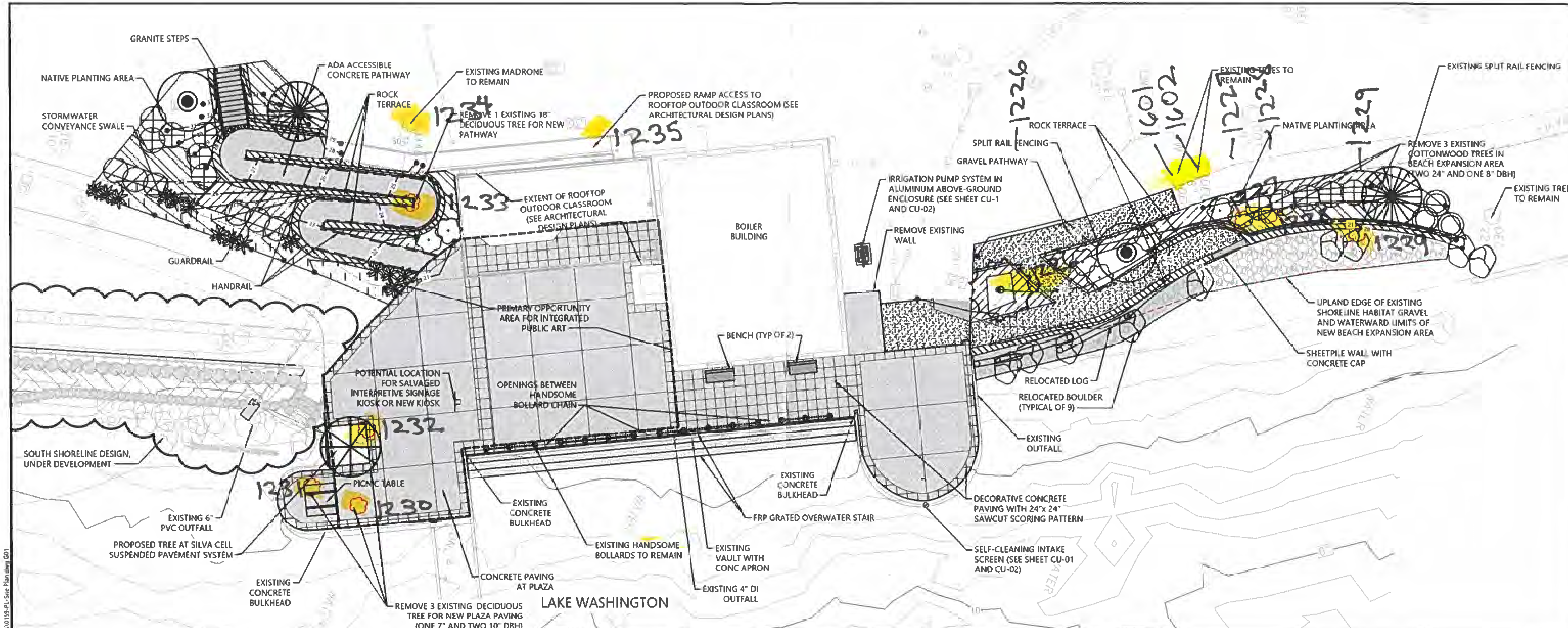
11. **Mercer Island Tree Inventory worksheet**

12. **Tree Protection plan sheet and sample Tree Protection Specification**

13. **Sheet L-010 Landscape Plan**

LUTHER BURBANK WATERFRONT IMPROVEMENT PROJECT **TREE INVENTORY** **September 1, 2021** **Paul West, MFR** **Andrew Prince, CAMS, TRAQ**

Number	dbh (in.)	status	spp	large regulated tree	exceptional	health/ viability	health notes	critical root zone	notes	updated condition February 2023	required replacement	reduced replace	19.10.070 B4 reason
1226	24	remove	ACMA	yes	no	fair	large cavity in central trunk; shortened terminal growth, dieback	not applicable	south trunk likely to fail; target beach and trail		3	2	restoration with native vegetation
1227	22	remove	PONI (Lombardy Poplar)	yes	no	poor	codominant stem, dieback, basal cavities	not applicable			2	1	restoration with native vegetation
1228	7.5	remove	PONI (Lombardy Poplar)	no	no	poor	main stem is a stump sprout, basal cavity, suppressed	not applicable			1	1	restoration with native vegetation
1229	28	remove	PONI (Lombardy Poplar)	yes	no	fair	lots of deadwood	not applicable			3	2	restoration with native vegetation
1230	9.6	remove	ACRU (red maple)	no	no	poor	stunted, lots of dieback	not applicable	tree planted in 1974; has not grown to mature size		1	1	short lived
1231	7.6	remove	ACRU (red maple)	no	no	poor	stunted, codominant main stem, dieback	not applicable	tree planted in 1974; has not grown to mature size		1	1	short lived
1232	11	remove	ACRU (red maple)	yes	no	poor	stunted, dieback	not applicable	tree planted in 1974; has not grown to mature size		2	1	short lived
1233	11	remove	FRLA	yes	no	good	included bark in subordinant stem	not applicable			2	2	
1234	47.5	remove	ARME	yes	yes	poor	codominant main stems; north trunk canopy mostly dead, decline is recent	not applicable	this tree may be dead by the 2024 construction, could be cut to a low (20') snag	north trunk is dead, only two lower scaffolds of south trunk have leaves	6	3	short lived
1235	14	remove	SASC	yes	yes	failing	extensive basal cavity, decay in basal crotch, extensive deadwood, upper scaffolds resprouted from topping incident	not applicable	this tree targets the restroom annex and is likely to fail		6	2	hazardous
1601	6	remove	PONI (Lombardy Poplar)	no	no	fair	multiple subordinant stems; poor rooting on east side	not applicable	root sucker from trail construction in 2008	added 2/23 for fire suppression system	1	1	
1602	7	remove	PONI (Lombardy Poplar)	no	no	fair	multiple subordinant stems; poor rooting on east side	not applicable	root sucker from trail construction in 2008	added 2/23 for fire suppression system	1	1	
											29	18	



LEGEND:

- EXISTING CONTOUR
- EXISTING TREE TO RETAIN
- EXISTING TREE TO REMOVE
- EXISTING UPLAND EDGE OF SHORELINE HABITAT GRAVEL
- EXISTING BOULDER TO RETAIN
- PROPOSED CONTOUR
- DECORATIVE CONCRETE PAVING WITH 24"x 24" SAWCUT SCORING PATTERN
- CONCRETE PAVING WITH SAWCUT JOINT SCORING
- GRAVEL PATHWAY
- EXISTING BOLLARD AND CHAIN TO REMAIN
- HABITAT GRAVEL
- GRAVEL OF COBBLE
- ROCK TERRACE
- GRATED WATER ACCESS STEPS
- GUARDRAIL
- HANDRAIL
- SPLIT RAIL FENCING
- PICNIC TABLE
- BENCH
- EXISTING LARGE WOODY DEBRIS RELOCATED
- PROPOSED TREE
- PROPOSED SHRUBS/GROUNDCOVERS
- RIPARIAN SHRUBS
- GROUNDCOVER
- STORMWATER CONVEYANCE PLANTING
- SALVAGED INTERPRETIVE SIGNAGE KIOSK/NEW KIOSK

NORTH

0 10 20
SCALE IN FEET

NOTES:

1. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD83 (2011), U.S. SURVEY FEET
2. VERTICAL DATUM: NAVD88

PLAN INTENDED TO BE VIEWED IN COLOR. ADJACENT BLOCK IS "BLUE"

ONE INCH AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

30% DESIGN SUBMITTAL - NOT FOR CONSTRUCTION

ANCHOR QEA

CITY OF MERCER ISLAND WASHINGTON

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: A. SPOONER
DRAWN BY: T. GRIGA/C WEE
CHECKED BY: P. HUMMEL
APPROVED BY: A. SPOONER
SCALE: AS NOTED
DATE: MONTH YYYY

MERCER ISLAND LUTHER BURBANK DOCK REPAIR

COMPOSITE SITE PLAN

G-02

SHEET # 2 OF #

Aug 18, 2021 5:29pm cwee K:\Projects\0159-KPFF Consulting Engineers\Mercer Island Luther Burbank Dock Repair\Construction Plans\0159-PL-Site Plan.dwg G01

CITY OF MERCER ISLAND

COMMUNITY PLANNING & DEVELOPMENT
9611 SE 36TH STREET | MERCER ISLAND, WA 98040
PHONE: 206.275.7605 | www.mercergov.org

MERCER ISLAND TREE INVENTORY & REPLACEMENT SUBMITTAL INFORMATION

EXCEPTIONAL TREES

Exceptional Trees- means a tree or group of trees that because of its unique historical, ecological or aesthetic value constitutes an important community resource. A tree that is rare or exceptional by virtue of its size, species, condition, cultural/historical importance, age, and/or contribution as part of a tree grove. Trees with a diameter of more than 36 inches, or with a diameter that is equal to or greater than the diameter listed in the Exceptional Tree Table shown in MICC 19.16 under Tree, Exceptional.

List the total number of trees for each category and the tree identification numbers from the arborist report.

Number of trees 36" or greater: 1
List tree numbers: 1234

Number of trees 24" or greater (including 36" or greater): 1
List tree numbers: 1234

Number of trees from Exceptional Tree Table (MICC 19.16): 2
List tree numbers: 1234, 1235

LARGE REGULATED TREES

Large Regulated Trees- means any tree with a diameter of 10 inches or more, and any tree that meets the definition of an Exceptional Tree.

Number of Large Regulated Trees on site: 7 (A)
List tree numbers: 1226, 1227, 1229, 1232, 1233, 1234, 1235

Number of Large Regulated Trees on site proposed for removal: 7 (B)
List tree numbers: 1226, 1227, 1229, 1232, 1233, 1234, 1235

Percentage of trees to be retained ((A-B)/Ax100) note: must be at least 30% >95 %

RIGHT OF WAY TREES

Right of Way Trees- means a tree that is located in the street right of way adjacent to the project property.

Number of Large Regulated Trees in right of way: 0
List tree numbers:

Number of Large Regulated Trees in right of way proposed for removal: 0

List tree numbers: ______________________________

Reason for removal: ______________________________

TREE REPLACEMENT

Tree replacement- removed trees must be replaced based on the ratio in the table below. Replacement trees shall be conifers at least six feet tall and or deciduous at least one and one-half inches in diameter at base.

Diameter of Removed Tree (measured 4.5' above ground)	Tree replacement Ratio	Number of Trees Proposed for Removal	Number of Tree Required for Replacement Based on Size/Type
Less than 10"*****	1	5	5
10" up to 24"	2	4	8
Greater than 24" up to 36"	3	1	3
Greater than 36" and any Exceptional Tree	6	2	12
		TOTAL TREE REPLACEMENTS	28

no replacement tree is needed if the tree fits all of the following;
Less than 10 inches in diameter, not an exceptional tree, and not a replacement tree from another tree permit. *

CAD USER: rluiten PLOT DATE: Mar 09, 2023-03:25pm
PATH: N:\2020\20000291 Luther Burbank Park\Drawings\Current (DWG2018)\C-030-034 UTILITY PLAN.dwg

kpff
1601 5th Avenue, Suite 1600
Seattle, WA 98101
206.622.5822
www.kpff.com

NO.	DATE	BY	REVISION

CITY OF MERCER ISLAND WASHINGTON

LUTHER BURBANK PARK
WATERFRONT IMPROVEMENTS
UTILITY PLAN - OVERALL

DRAWN: DCG	PROJECT NO.: 2200248
DESIGN: SS	SCALE: AS SHOWN
CHECKED: NAW	DATE: 10/07/2022
DRAWING NO.	C-030
SHEET NO.	X OF 44

60% SUBMITTAL

LEGEND:

- EXISTING CONTOUR
- EXISTING TREE TO RETAIN
- EXISTING LARGE WOODY DEBRIS RELOCATED
- PROPOSED TREE
- PROPOSED SHRUBS/GROUNDCOVERS
- RIPARIAN SHRUBS
- GROUNDCOVER
- STORMWATER CONVEYANCE PLANTING

NOTES:

1. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD83 (2011), U.S. SURVEY FEET
2. VERTICAL DATUM: NAVD88
3. SEE SHEET L02 FOR PLANT SCHEDULE

60% SUBMITTAL

kpff
1601 5th Avenue, Suite 1600
Seattle, WA 98101
206.622.5822
www.kpff.com

ANCHOR QEA

NO.	DATE	BY	REVISION

CITY OF MERCER ISLAND WASHINGTON

LUTHER BURBANK PARK
WATERFRONT IMPROVEMENTS

PLANTING PLAN

DRAWN: CW/RF	PROJECT NO.: 2200248
DESIGN: AS	SCALE: AS NOTED
CHECKED: AS/DR	DATE: 10/07/2022
DRAWING NO. L-010	
SHEET NO. 25	OF 44

PLANT SCHEDULE					
COMMON NAME	SCIENTIFIC NAME	SIZE	SPACING	QUANTITY	NOTES
TREES					
GRAND FIR	ABIES GRANDIS	5-6' HT	AS SHOWN	3	1 L-012, 2 L-012, 3 L-012
WESTERN RED CEDAR	THUJA PLICATA	5-6' HT	AS SHOWN	3	
BIG LEAF MAPLE	ACER MACROPHYLLUM	1.5" CAL	AS SHOWN	4	
SWAMP OAK	QUERCUS PALUSTRIS	2" CAL	AS SHOWN	1	
VINE MAPLE	ACER CIRCINATUM	5 GAL	AS SHOWN	9	
HIGH SHRUBS					
INDIAN PLUM	OEMLERIA CERASIFORMIS	2 GAL	AS SHOWN		5 L-012, 6 L-012
MOCK ORANGE	PHILADELPHUS LEWISII	2 GAL	AS SHOWN		
SHRUBS - RIPARIAN					
SWORD FERN	POLYSTICHUM MUNITUM	1 GAL	3' O.C.		5 L-012, 6 L-012
RED FLOWERING CURRANT	RIBES SANGUINEUM	1 GAL	3' O.C.		
NOOTKA ROSE	ROSA NUTKANA	1 GAL	3' O.C.		
THIMBLEBERRY	RUBUS PARVIFLORUS	1 GAL	3' O.C.		
SNOWBERRY	SYMPHORICARPOS ALBUS	1 GAL	3' O.C.		
GROUNDCOVERS					
SWORD FERN	POLYSTICHUM MUNITUM	1 GAL	3' O.C.		4 L-012, 6 L-012
OREGON GRAPE	MAHONIA NERVOSA	1 GAL	3' O.C.		
SHRUBS/GROUNDCOVERS - STORMWATER CONVEYANCE AREA					
RED OSIER DOGWOOD	CORNUS SERICEA	1 GAL	AS SHOWN		4 L-012, 5 L-012, 6 L-012
LADY FERN	ATHYRIUM FELIX FEMINA	1 GAL	AS SHOWN		
SEED MIX - STORMWATER CONVEYANCE AREA					

PLANT QUANTITIES WILL BE PROVIDED AT 90%

kpff
1601 5th Avenue, Suite 1600
Seattle, WA 98101
206.622.5822
www.kpff.com

ANCHOR QEA

NO.	DATE	BY	REVISION

CITY OF MERCER ISLAND WASHINGTON

LUTHER BURBANK PARK
WATERFRONT IMPROVEMENTS

PLANT SCHEDULE

DRAWN: CW/RF
PROJECT NO.: 2200248
DESIGN: AS
SCALE: AS NOTED
CHECKED: AS/DR
DATE: 10/07/2022
DRAWING NO. L-011

60% SUBMITTAL

Appendix G
Pre-Construction Subsurface Investigation Results Summary

2101 Fourth Avenue, Suite 950
Seattle, Washington 98121
206.728.2674

April 16, 2024

City of Mercer Island Public Works
9601 SE 36th Street
Mercer Island, Washington 98040

Attention: Paul West, CIP Project Manager

Subject: Pre-Construction Subsurface Investigation Results Summary
Luther Burbank Park
Mercer Island, Washington
File No. 0817-025-00

INTRODUCTION AND PROJECT BACKGROUND

GeoEngineers is pleased to present this letter summarizing the results of the pre-construction subsurface investigation field activities conducted at the City of Mercer Island (City) Luther Burbank Park located at 2040 84th Avenue SE in Mercer Island, Washington (project site). This work supports the proposed upland improvement project (project) for Luther Burbank Park that includes replacement of existing pavement with low impact surfacing, such as permeable pavers, intended to limit stormwater runoff, construction of a new Americans with Disability Act (ADA) accessible pedestrian ramp leading from existing trails to a second-story rooftop classroom area, and a seismic retrofit of the existing boiler plant building. A schematic of the proposed improvements is presented in Appendix A.

A previous remedial/cleanup action was conducted at the project site in 2003 to clean the unused underground storage tanks (USTs) located beneath the plaza, remove diesel-range total petroleum hydrocarbon (TPH-D) containing soil from around the tanks, and remove shallow soil containing select metals, polyaromatic hydrocarbons (PAHs), and TPH-D from beneath the steam plant building. The independent cleanup action resulted in a No Further Action (NFA) determination from the Washington State Department of Ecology (Ecology). Environmental investigations by Hart Crowser in 2002 and by GeoEngineers in 2022 did not identify evidence of area-wide petroleum hydrocarbon-containing soil or groundwater at the project site.

In August 2023, during an early phase of the project, soil containing diesel- and oil-range TPH was encountered along the waterfront during construction of stairs along the south shoreline of Lake Washington (Figure 1). GeoEngineers collected soil samples and a water sample from within the construction excavation for laboratory analyses and identified petroleum hydrocarbons at concentrations greater than the applicable Washington Department of Ecology (Ecology) Cleanup Levels (GeoEngineers, 2023).

The purpose of the pre-construction subsurface investigation was to collect additional soil and groundwater data near the UST area, along the waterfront, and in the stairway excavation area. This data will be used to evaluate and document the nature and extent of petroleum hydrocarbon impacts within the project area and to assess the need for further action, as part of project construction, to properly manage and dispose of the TPH-containing media and mitigate the potential for impacts to human health and the environment, including the shoreline of Lake Washington. Project site features and exploration locations are shown on Figure 1.

INVESTIGATION ACTIVITIES

Based on the information available from the previous investigations, contaminants of concern were identified and samples were collected and submitted for laboratory chemical analyses from selected boring locations, based on field screening results, to evaluate the nature and extent of contaminant containing soil and groundwater near the USTs, along the waterfront, and by the stairway excavation. Applicable soil screening levels include Ecology Model Toxics Control Act (MTCA) Method A cleanup levels based on unrestricted land use and the MTCA Method B cleanup level protective of surface water. Applicable cleanup levels for groundwater include the MTCA Method A and MTCA Method B surface water cleanup levels that are protective of human and aquatic receptors. Analytical results and screening levels for soil and groundwater are presented in Tables 1 and 2, respectively.

Subsurface conditions were evaluated by obtaining environmental soil samples from 28 direct-push soil borings (B-1 through B-28, Figure 2). The borings were generally drilled to a depth of 10.0 feet below ground surface (bgs). Three borings along the waterfront encountered shallow refusal at 0.5 feet bgs (B11 and B23) and 5 feet bgs (B13), and boring B15, located south of the abandoned UST area, also encountered refusal at 5 feet bgs.

Grab groundwater samples were collected from temporary well screens placed in select borings as shown on Figure 3. Slow groundwater recharge limited the number and location of groundwater samples that could be collected. Temporary well screens were installed in several borings that did not produce enough groundwater to sample. The borings and temporary wells were completed by Cascade Drilling on December 12 through 14, 2023. Descriptions of the field exploration program, field screening methods, and the boring logs are presented in Appendix B.

Exploration drilling activities were monitored by a representative of GeoEngineers, who visually classified and performed field screening tests on soil samples collected from the borings for indications of petroleum hydrocarbons and volatile organic compounds (VOCs) using water sheen screening and headspace vapor screening using a photo-ionization detector (PID).

INVESTIGATION FINDINGS

Soil field screening identified several samples with slight to heavy sheen in the vicinity of the USTs, and a slight to moderate sheen was observed on soil samples collected from scattered areas along the waterfront and to the southeast. Soil encountered in the borings beneath the gravel surface base course primarily consisted of moist, gray to brown silt with variable amounts of sand and gravel, over consolidated native silty sand with gravel, which is consistent with previous geotechnical explorations for the larger redevelopment. Groundwater was generally encountered at 3 to 5 feet bgs.

Multiple samples were collected from each boring and 34 discrete soil samples were selected for chemical analysis. Soil and water samples were analyzed for diesel- and oil-range TPH and select soil samples were analyzed for TPH Identification and for PAHs based on field observations and the results of field screening. Soil sample analytical results are presented in Table 1 and on Figure 2. Groundwater analytical results are presented in Table 2 and on Figure 3. The laboratory data report is included in Appendix C.

A summary of the investigation findings for each area of the project site is presented below.

- **UST Area.** Petroleum hydrocarbon-like odors and staining were observed in several samples adjacent to the abandoned USTs. Diesel- and oil-range TPH were detected at concentrations greater than the laboratory reporting limits in several samples collected from borings surrounding the abandoned UST area (Figure 2). Soil samples from three borings near the UST area (B2, B3, and B4) contained combined diesel- and oil-range petroleum hydrocarbon concentrations greater than the Ecology MTCA Method A cleanup level of 2,000 milligrams per kilogram (mg/kg). Several PAHs were detected at concentrations greater than the laboratory reporting limits. Only acenaphthene, benzo(a)anthracene, and fluorene concentrations in soil are greater than their respective MTCA Method B cleanup levels protective of surface water.
- **Waterfront.** Oil-range and/or diesel-range TPH were detected at concentrations greater than the laboratory reporting limits but not greater than the MTCA Method A cleanup levels in soil samples from borings B12, B20, B24, B25, and B28. Several PAHs were detected in boring B24 at concentrations greater than the laboratory reporting limits but not greater than the MTCA Method A cleanup levels.

  Grab groundwater samples were collected from four locations along the waterfront (borings B12, B14, and B26, and previously installed monitoring well P-5) to characterize groundwater adjacent to Lake Washington. TPH-D was detected at concentrations greater than the laboratory reporting limits in groundwater from all four locations; concentrations in samples collected from B12 (540 micrograms per liter [µg/L]) and B14 (694 µg/L) are greater than the MTCA Method A unrestricted groundwater cleanup level of 500 µg/L, but were less than the concentration protective of fresh surface water for "weathered" TPH-D (3,000 µg/L) based on the MTCA Method B requirements for surface water cleanup levels that are protective of aquatic receptors under Washington Administrative Code (WAC) 173-340-730 (3)(b)(ii) or 173-340-730(4)(b)(ii) using the NWTPH-Dx methods (Ecology, 2021). The laboratory report for this analysis notes that the chromatographic pattern for groundwater samples B12, B26, and P-5 indicates that the diesel-range TPH may be a weathered product and/or organic material. Due to the releases likely being over two decades old and the laboratory interpretation of the chromatographs, the TPH-D detected in groundwater at the project site is considered to be weathered.

  Several PAHs were detected at concentrations greater than the laboratory reporting limits in groundwater. Only benzo(a)anthracene concentrations in groundwater are greater than the applicable MTCA Method B cleanup level. Benzo(a)anthracene concentrations in all five groundwater samples are greater than the MTCA Method B surface water cleanup level protective of human health (consumption of water and organisms).
- **South Stairway Area.** Diesel- and oil-range TPH was not detected at a concentration greater than the laboratory reporting limits in the soil samples collected in the vicinity of the August 2023

stairway excavation. Diesel-range petroleum hydrocarbons were detected in a grab groundwater sample collected from a temporary well installed in boring B27 at a concentration of 96.4 µg/L, which is less than the MTCA Method A unrestricted cleanup level (500 µg/L) and MTCA Method B surface water cleanup level for weathered TPH-D protective of aquatic receptors (3,000 µg/L).

Several PAHs were detected at concentrations greater than the laboratory reporting limits in groundwater collected from a temporary well screen installed in B27. Only benzo(a)anthracene concentrations in groundwater were detected at concentrations greater than the MTCA Method B surface water cleanup level protective of human health (consumption of water and organisms).

SUMMARY

Diesel- and oil-range TPH concentrations in soil are greater than the MTCA Method A cleanup level of 2,000 mg/kg in the vicinity of the abandoned USTs (Figure 2). Diesel- and/or oil-range TPH were detected at concentrations less than the MTCA Method A cleanup levels along the waterfront and near the stairway excavation area. Acenaphthene, benzo(a)anthracene, and fluorene concentrations in soil are greater than their respective MTCA Method B cleanup levels protective of surface water in soil near the abandoned USTs.

Diesel-range petroleum hydrocarbons are present in groundwater at concentrations greater than the MTCA Method A unrestricted cleanup level (500 µg/L) at two locations along the waterfront (Figure 3). The detected TPH-D in groundwater is considered weathered based on the presumed age of the release and chromatograph results. All TPH-D concentrations in groundwater samples are less than the MTCA Method B surface water cleanup level protective of aquatic receptors of 3,000 µg/L. Benzo(a)anthracene concentrations in all five groundwater samples are greater than the MTCA Method B surface water cleanup level.

The primary source of petroleum is likely residual contamination associated with the USTs and associated piping. Some of the shallow detections along the waterfront and near the stairway excavation may be the result of the historical placement of petroleum-contaminated fill material or spills associated with operation of the former USTs and boiler. The low-density of the petroleum constituents in groundwater (i.e., petroleum floats) and presence of the concrete bulkhead located between the upland area and Lake Washington appears to be restricting the lateral movement of the petroleum hydrocarbons in groundwater, making the groundwater to surface water pathway incomplete near the bulkhead. Furthermore, we understand that there have not been reported observations of sheen along the waterfront, which would be expected (even at low levels below MTCA cleanup levels) if petroleum hydrocarbons were migrating to the lake.

NEXT STEPS

Removal of the PAH and petroleum hydrocarbon-containing soil adjacent to the decommissioned USTs is warranted as a source control measure. The soil and fill material adjacent to the abandoned USTs contain diesel and oil-range TPH concentrations greater than the MTCA Method A cleanup levels and the material is a potential on-going source for groundwater contamination and could present a direct-contact risk to construction workers during the planned waterfront improvement project.

Removal of PAH and petroleum-containing soil along the waterfront during construction for renovation of the waterfront and prior to installation of planned drainage infrastructure is also warranted. Diesel- and oil-range petroleum hydrocarbon concentrations in soil along the waterfront are not greater than the applicable MTCA cleanup levels. However, due to the proximity to Lake Washington, the TPH-D and PAH concentrations detected in groundwater, the current and planned future public use of the waterfront, and the proposed stormwater infrastructure along the waterfront, the removal of the soil along the waterfront is warranted. Removal of the soil will be a source control measure to mitigate the PAH and TPH-D concentrations in groundwater along the waterfront.

Removal of petroleum-impacted soil around the USTs will likely be sufficient to lower the diesel-range TPH concentrations in groundwater to below MTCA Method A unrestricted cleanup levels. However, removal of the abandoned USTs should be considered to maximize the amount of petroleum-impacted soil that can be removed. If the abandoned USTs are left in place, placement of oxygen releasing compounds such as magnesium or sodium peroxide soil amendments to enhance degradation of residual TPH would be an alternative mitigation measure.

REFERENCES

GeoEngineers, 2023. Letter regarding Subsurface Investigation Results Summary, Field Support—Stair Construction, Luther Burbank Park Mercer Island, from James Kohn and Tim Syverson, GeoEngineers, to Paul West, City of Mercer Island Public Works. Dated October 24, 2023.

Washington State Department of Ecology, 2007. “Model Toxics Control Act Cleanup Regulation, Chapter 173-340 WAC” Washington State Department of Ecology Toxics Cleanup Program. Publication No. 94-06. Issued April 1990, Revised October 12, 2007.

Washington State Department of Ecology, 2021. “Concentrations of Gasoline and Diesel Range Organics Predicted to be Protective of Aquatic Receptors in Surface Waters Implementation Memorandum No. 23 dated August 25, 2021.

Washington State Department of Ecology, 2023. Cleanup Levels and Risk Calculation (CLARC) Tables. Updated August 2023. https://fortress.wa.gov/ecy/ezshare/tcp/CLARC/CLARC_Master.xlsx.

LIMITATIONS

We have prepared this report for the City of Mercer Island. The City may distribute copies of this report to their authorized agents and regulatory agencies as may be required for the project.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted environmental science practices in this area at the time this report was prepared. The conclusions, recommendations, and opinions presented in this report are based on our professional knowledge, judgment, and experience. No warranty or other conditions, express or implied, should be understood.

Please refer to Appendix D titled “Report Limitations and Guidelines for Use” for additional information pertaining to the use of this report.

We appreciate the opportunity to assist the City of Mercer Island with this project. Please call if you have questions or require additional information.

Sincerely,
GeoEngineers, Inc.

Phil Cordell, LG
Senior Environmental Geologist

Tim L. Syverson, LG, LHG
Associate

PC:TLS:jm

Attachments:

Table 1. Chemical Analytical Data—Soil
Table 2. Chemical Analytical Data—Water
Figure 1. Site Plan
Figure 2. Diesel- and Oil-Range Petroleum Hydrocarbons in Soil
Figure 3. Diesel- and Oil-Range Petroleum Hydrocarbons in Water
Appendix A. Construction Schematics
Appendix B. Field Procedures and Boring Logs
Appendix C. Laboratory Analytical Report
Appendix D. Report Limitations and Guidelines for Use

TABLES

GeoEngineers

Table 1

Chemical Analytical Data—Soil

Luther Burbank Park

Mercer Island, Washington

Sample Identification[1]	MTCA Cleanup Levels (Soil)[2]	MTCA Cleanup Levels Protective of Surface Water[3] (Vadose Zone/Saturated)	B1-1.5	B1-6	B2-2	B2-6	B3-2	B3-7	B4-10	B4-5	B5-6	B6-6
Sample Location			B1	B1	B2	B2	B3	B3	B4	B4	B5	B6
Date Sampled			12/12/2023	12/12/2023	12/12/2023	12/12/2023	12/12/2023	12/12/2023	12/12/2023	12/12/2023	12/12/2023	12/12/2023
Petroleum Hydrocarbons by NWTPH-Dx/Dx Ext.(mg/kg)												
Diesel-range hydrocarbons	2,000	NE	**364**	14.3 U	**3,440**	**206**	**3,280**	**538**	**422**	**1,180**	–	–
Heavy oil-range hydrocarbons	2,000	NE	**42.3**	**50.8 J**	**2,000**	20.7 U	**641**	**90.0 J**	**131**	**962**	25.2 U	24.6 U
Total Petroleum Hydrocarbons	2,000	NE	**407**	**50.8 J**	**5,440**	**206**	**3,920**	**628**	**554**	**2,140**	–	–
Hydrocarbon Identification by NWTPH-HCID (mg/kg)												
Kerosene	NE	NE	–	–	–	–	–	–	14.0 U	14.9 U	15.2 U	14.9 U
Mineral Spirits	NE	NE	–	–	–	–	–	–	14.0 U	14.9 U	15.2 U	14.9 U
Gasoline	NE	NE	–	–	–	–	–	–	14.0 U	14.9 U	15.2 U	14.9 U
Diesel (Fuel Oil)	NE	NE	–	–	–	–	–	–	**DETECT**	**DETECT**	15.2 U	14.9 U
Mineral Oil	NE	NE	–	–	–	–	–	–	14.0 U	14.9 U	15.2 U	14.9 U
Detected Polyaromatic Hydrocarbons (PAHs) by EPA 8270 (mg/kg)												
Anthracene	24,000	47/2.4	–	–	–	–	**1.21**	**0.201**	**0.173**	**0.368**	–	0.00306 U
Pyrene	2,400	11/0.55	–	–	–	–	0.105 U	**0.164**	**0.199**	0.104 U	–	0.0104 U
Fluoranthene	3,200	5.9/0.3	–	–	–	–	**0.290**	**0.0479**	**0.0562**	**0.132 J**	–	0.0083 U
Chrysene	NE	NE	–	–	–	–	**0.225 J**	**0.0394**	**0.0584**	**0.134 J**	–	0.00398 U
Benzo(*a*)pyrene	0.1	0.00031/0.000016	–	–	–	–	*0.105 U*	**0.0128 J**	**0.0204 J**	*0.104 U*	–	0.0104 U
Benzo(*a*)anthracene	NE	NE	–	–	–	–	**0.187 J**	**0.0255 J**	**0.0330**	**0.116 J**	–	0.00809 U
Acenaphthene	4,800	3.1/0.16	–	–	–	–	**3.26**	**0.473**	**0.349**	**0.947**	–	0.00419 U
Phenanthrene	NE	NE	–	–	–	–	**7.73**	**1.47**	**1.28**	**3.01**	–	0.00636 U
Fluorene	3,200	1.6/0.08	–	–	–	–	**2.54**	**0.450**	**0.326**	**0.887**	–	0.00285 U
1-Methylnaphthalene	34	NE	–	–	–	–	**9.61**	**1.23**	**1.17**	**5.14**	–	0.00350 U
Naphthalene	2,400	140/7.3	–	–	–	–	**0.132 J**	**0.0129 J**	**0.0213**	**0.621**	–	0.00486 U
2-Methylnaphthalene	320	NE	–	–	–	–	**0.102 J**	**0.00563 J**	**0.437**	**5.78**	–	0.00429 U

Notes:

[1] Sample locations are shown on Figure 1.

[2] Based on the MTCA Method A Unrestricted or Method B Direct Contact cleanup levels for soil.

[3] Based on MTCA Method B cleanup levels protective of surface water.

EPA = United States Environmental Protection Agency

mg/kg = milligrams per kilogram

MTCA = Model Toxics Control Act

NE = Not Established

NWTPH-Dx = Northwest Total Petroleum Hydrocarbon–Diesel Extended

NWTPH-HCID = Northwest Total Petroleum Hydrocarbon–Hydrocarbon Identification

U = Not detected above the method detection limit.

J = Estimated value.

Shading indicates that the identified concentration is greater than the MTCA cleanup level.

Bold font type indicates the analyte was detected at the reported concentration.

Italic font type indicates the analyte was not detected but that the method detection limit is greater than the MTCA cleanup level.

Sample Identification[1]	MTCA Cleanup Levels (Soil)[2]	MTCA Cleanup Levels Protective of Surface Water[3] (Vadose Zone/Saturated)	B6-8	B9-4	B9-6	B12-1	B12-2	B12-8	B14-3	B14-6	B17-2	B17-7.5
Sample Location			B6	B9	B9	B12	B12	B12	B14	B14	B17	B17
Date Sampled			12/12/2023	12/12/2023	12/12/2023	12/12/2023	12/13/2023	12/13/2023	12/13/2023	12/13/2023	12/13/2023	12/13/2023
Petroleum Hydrocarbons by NWTPH-Dx/Dx Ext.(mg/kg)												
Diesel-range hydrocarbons	2,000	NE	–	14.9 U	15.4 U	14.6 U	13.8 U	14.1 U	14.5 U	14.7 U	13.1 U	–
Heavy oil-range hydrocarbons	2,000	NE	26.9 U	**64.5 J**	**37.7 J**	**34.0 J**	19.2 U	19.5 U	20.1 U	20.4 U	18.2 U	25.3 U
Total Petroleum Hydrocarbons	2,000	NE	–	**64.5 J**	**37.7 J**	34.9 U	33 U	33.6 U	34.6 U	35.2 U	31.2 U	–
Hydrocarbon Identification by NWTPH-HCID (mg/kg)												
Kerosene	NE	NE	16.2 U	–	–	–	–	–	–	–	–	15.3 U
Mineral Spirits	NE	NE	16.2 U	–	–	–	–	–	–	–	–	15.3 U
Gasoline	NE	NE	16.2 U	–	–	–	–	–	–	–	–	15.3 U
Diesel (Fuel Oil)	NE	NE	16.2 U	–	–	–	–	–	–	–	–	15.3 U
Mineral Oil	NE	NE	16.2 U	–	–	–	–	–	–	–	–	15.3 U
Detected Polyaromatic Hydrocarbons (PAHs) by EPA 8270 (mg/kg)												
Anthracene	24,000	47/2.4	–	–	0.00311 U	0.00307 U	–	–	–	0.00324 U	–	–
Pyrene	2,400	11/0.55	–	–	0.0106 U	0.0105 U	–	–	–	0.0110 U	–	–
Fluoranthene	3,200	5.9/0.3	–	–	0.00844 U	0.00835 U	–	–	–	0.00880 U	–	–
Chrysene	NE	NE	–	–	0.00405 U	0.00400 U	–	–	–	0.00422 U	–	–
Benzo(*a*)pyrene	0.1	0.00031/0.000016	–	–	0.0106 U	0.0105 U	–	–	–	0.0111 U	–	–
Benzo(*a*)anthracene	NE	NE	–	–	0.00822 U	0.00813 U	–	–	–	0.00857 U	–	–
Acenaphthene	4,800	3.1/0.16	–	–	0.00426 U	0.00421 U	–	–	–	0.00444 U	–	–
Phenanthrene	NE	NE	–	–	0.00647 U	0.00640 U	–	–	–	0.00674 U	–	–
Fluorene	3,200	1.6/0.08	–	–	0.00289 U	0.00286 U	–	–	–	0.00302 U	–	–
1-Methylnaphthalene	34	NE	–	–	0.00356 U	0.00352 U	–	–	–	0.00371 U	–	–
Naphthalene	2,400	140/7.3	–	–	0.00494 U	0.00489 U	–	–	–	0.00515 U	–	–
2-Methylnaphthalene	320	NE	–	–	0.00436 U	0.00431 U	–	–	–	0.00454 U	–	–

Notes:

[1] Sample locations are shown on Figure 1.

[2] Based on the MTCA Method A Unrestricted or Method B Direct Contact cleanup levels for soil.

3 Based on MTCA Method B cleanup levels protective of surface water.

EPA = United States Environmental Protection Agency

mg/kg = milligrams per kilogram

MTCA = Model Toxics Control Act

NE = Not Established

NWTPH-Dx = Northwest Total Petroleum Hydrocarbon–Diesel Extended

NWTPH-HCID = Northwest Total Petroleum Hydrocarbon–Hydrocarbon Identification

U = Not detected above the method detection limit.

J = Estimated value.

Shading indicates that the identified concentration is greater than the MTCA cleanup level.

Bold font type indicates the analyte was detected at the reported concentration.

Italic font type indicates the analyte was not detected but that the method detection limit is greater than the MTCA cleanup level.

Sample Identification[1]	MTCA Cleanup Levels (Soil)[2]	MTCA Cleanup Levels Protective of Surface Water[3] (Vadose Zone/Saturated)	B18-2	B18-8	B19-3.5	B19-6.5	B20-1	B20-3	B22-3	B24-2.5	B24-6	B25-2.5
Sample Location			B18	B18	B19	B19	B20	B20	B22	B24	B24	B25
Date Sampled			12/13/2023	12/13/2023	12/13/2023	12/13/2023	12/13/2023	12/13/2023	12/14/2023	12/14/2023	12/14/2023	12/14/2023
Petroleum Hydrocarbons by NWTPH-Dx/Dx Ext.(mg/kg)												
Diesel-range hydrocarbons	2,000	NE	–	14.1 U	14.9 U	15.4 U	**157**	14.1 U	14.7 U	**468**	14.8 U	15.7 U
Heavy oil-range hydrocarbons	2,000	NE	23.9 U	19.5 U	20.6 U	21.4 U	**352**	19.6 U	20.4 U	**386**	20.6 U	**27.0 J**
Total Petroleum Hydrocarbons	2,000	NE	–	33.6 U	35.5 U	36.9 U	**509**	33.8 U	35.0 U	**854**	35.4 U	37.4 U
Hydrocarbon Identification by NWTPH-HCID (mg/kg)												
Kerosene	NE	NE	14.4 U	–	14.9 U	–	14.7 U	–	–	–	–	–
Mineral Spirits	NE	NE	14.4 U	–	14.9 U	–	14.7 U	–	–	–	–	–
Gasoline	NE	NE	14.4 U	–	14.9 U	–	14.7 U	–	–	–	–	–
Diesel (Fuel Oil)	NE	NE	14.4 U	–	14.9 U	–	**DETECT**	–	–	–	–	–
Mineral Oil	NE	NE	14.4 U	–	14.9 U	–	14.7 U	–	–	–	–	–
Detected Polyaromatic Hydrocarbons (PAHs) by EPA 8270 (mg/kg)												
Anthracene	24,000	47/2.4	–	–	0.00290 U	–	–	–	–	**0.00857 J**	0.00290 U	–
Pyrene	2,400	11/0.55	–	–	0.00987 U	–	–	–	–	0.0102 U	0.00987 U	–
Fluoranthene	3,200	5.9/0.3	–	–	0.00788 U	–	–	–	–	**0.00970 J**	0.00788 U	–
Chrysene	NE	NE	–	–	0.00378 U	–	–	–	–	**0.0208 J**	0.00378 U	–
Benzo(*a*)pyrene	0.1	0.00031/0.000016	–	–	0.00990 U	–	–	–	–	0.0102 U	0.00990 U	–
Benzo(*a*)anthracene	NE	NE	–	–	0.00767 U	–	–	–	–	0.00792 U	0.00767 U	–
Acenaphthene	4,800	3.1/0.16	–	–	0.00397 U	–	–	–	–	0.00410 U	0.00397 U	–
Phenanthrene	NE	NE	–	–	0.00603 U	–	–	–	–	**0.154**	0.00604 U	–
Fluorene	3,200	1.6/0.08	–	–	0.00270 U	–	–	–	–	**0.0581**	0.00270 U	–
1-Methylnaphthalene	34	NE	–	–	0.00332 U	–	–	–	–	0.00343 U	0.00332 U	–
Naphthalene	2,400	140/7.3	–	–	0.00461 U	–	–	–	–	0.00477 U	0.00461 U	–
2-Methylnaphthalene	320	NE	–	–	0.00407 U	–	–	–	–	0.0042 U	0.00407 U	–

Notes:

[1] Sample locations are shown on Figure 1.

[2] Based on the MTCA Method A Unrestricted or Method B Direct Contact cleanup levels for soil.

3 Based on MTCA Method B cleanup levels protective of surface water.

EPA = United States Environmental Protection Agency

mg/kg = milligrams per kilogram

MTCA = Model Toxics Control Act

NE = Not Established

NWTPH-Dx = Northwest Total Petroleum Hydrocarbon–Diesel Extended

NWTPH-HCID = Northwest Total Petroleum Hydrocarbon–Hydrocarbon Identification

U = Not detected above the method detection limit.

J = Estimated value.

Shading indicates that the identified concentration is greater than the MTCA cleanup level.

Bold font type indicates the analyte was detected at the reported concentration.

Italic font type indicates the analyte was not detected but that the method detection limit is greater than the MTCA cleanup level.

Sample Identification[1]	MTCA Cleanup Levels (Soil)[2]	MTCA Cleanup Levels Protective of Surface Water[3] (Vadose Zone/Saturated)	B26-6	B27-3.5	B28-1.5	B28-6
Sample Location			B26	B27	B28	B28
Date Sampled			12/14/2023	12/14/2023	12/14/2023	12/14/2023
Petroleum Hydrocarbons by NWTPH-Dx/Dx Ext.(mg/kg)						
Diesel-range hydrocarbons	2,000	NE	14.1 U	15.9 U	15.2 U	13.8 U
Heavy oil-range hydrocarbons	2,000	NE	19.6 U	22.0 U	296	19.1 U
Total Petroleum Hydrocarbons	2,000	NE	33.8 U	37.9 U	296	32.8 U
Hydrocarbon Identification by NWTPH-HCID (mg/kg)						
Kerosene	NE	NE	--	--	--	--
Mineral Spirits	NE	NE	--	--	--	--
Gasoline	NE	NE	--	--	--	--
Diesel (Fuel Oil)	NE	NE	--	--	--	--
Mineral Oil	NE	NE	--	--	--	--
Detected Polyaromatic Hydrocarbons (PAHs) by EPA 8270 (mg/kg)						
Anthracene	24,000	47/2.4	--	--	--	--
Pyrene	2,400	11/0.55	--	--	--	--
Fluoranthene	3,200	5.9/0.3	--	--	--	--
Chrysene	NE	NE	--	--	--	--
Benzo(*a*)pyrene	0.1	0.00031/0.000016	--	--	--	--
Benzo(*a*)anthracene	NE	NE	--	--	--	--
Acenaphthene	4,800	3.1/0.16	--	--	--	--
Phenanthrene	NE	NE	--	--	--	--
Fluorene	3,200	1.6/0.08	--	--	--	--
1-Methylnaphthalene	34	NE	--	--	--	--
Naphthalene	2,400	140/7.3	--	--	--	--
2-Methylnaphthalene	320	NE	--	--	--	--

Notes:

[1] Sample locations are shown on Figure 1.

[2] Based on the MTCA Method A Unrestricted or Method B Direct Contact cleanup levels for soil.

3 Based on MTCA Method B cleanup levels protective of surface water.

EPA = United States Environmental Protection Agency

mg/kg = milligrams per kilogram

MTCA = Model Toxics Control Act

NE = Not Established

NWTPH-Dx = Northwest Total Petroleum Hydrocarbon–Diesel Extended

NWTPH-HCID = Northwest Total Petroleum Hydrocarbon–Hydrocarbon Identification

U = Not detected above the method detection limit.

J = Estimated value.

Shading indicates that the identified concentration is greater than the MTCA cleanup leve

Bold font type indicates the analyte was detected at the reported concentration.

Italic font type indicates the analyte was not detected but that the method detection

Table 2

Chemical Analytical Data—Water

Luther Burbank Park

Mercer Island, Washington

Sample Identification	MTCA Cleanup Levels (Water)[2]	B12-W	B14-W	B26-W	B27-W	P-5
Sample Location		B12	B14	B26	B27	P-5
Date Sampled		12/13/2023	12/13/2023	12/14/2023	12/14/2023	12/14/2023
Petroleum Hydrocarbons by NWTPH-Dx (µg/L)						
Diesel-range hydrocarbons	500[3] /3,000[4]	**540**	**694**	**310**	**94.4**	**95.9 J**
Heavy oil-range hydrocarbons	NE	26.7 U	27.6 U	26.8 U	26.7 U	33.6 U
Detected Polyaromatic Hydrocarbons (PAHs) by EPA 8270 (µg/L)						
Anthracene	100	**0.0580 J**	0.00702 U	0.00683 U	0.00739 U	0.00705 U
Pyrene	8	0.0572 U	0.0586 U	0.0571 U	0.0617 U	0.0589 U
Benzo(*g,h,i*)perylene	NE	0.0374 U	0.0384 U	0.0374 U	0.0404 U	0.0386 U
Indeno(*1,2,3-cd*)pyrene	0.00016	*0.00614 U*	*0.00630 U*	*0.00613 U*	*0.00663 U*	*0.00633 U*
Benzo(*b*)fluoranthene	0.00016	*0.00774 U*	*0.00793 U*	*0.00773 U*	*0.00836 U*	*0.00797 U*
Fluoranthene	6	0.0327 U	0.0335 U	0.0327 U	0.0353 U	0.0337 U
Benzo(*k*)fluoranthene	0.0016	*0.00968 U*	*0.00992 U*	*0.00966 U*	*0.0105 U*	*0.00997 U*
Acenaphthylene	30	0.00565 U	0.00579 U	0.00564 U	0.00610 U	0.00582 U
Chrysene	0.016	0.00854 U	0.00876 U	0.00853 U	0.00923 U	0.00880 U
Benzo(*a*)pyrene	0.000016	*0.00787 U*	*0.00807 U*	*0.00786 U*	*0.00850 U*	*0.00811 U*
Dibenz(*a,h*)anthracene	0.000016	*0.00644 U*	*0.00660 U*	*0.00643 U*	*0.00695 U*	*0.00663 U*
Benzo(*a*)anthracene	0.00016	**0.0128 J**	**0.0158 J**	**0.0130 J**	**0.0129 J**	**0.0112 J**
Acenaphthene	30	**1.30**	0.0191 U	0.0186 U	0.0201 U	0.0192 U
Phenanthrene	NE	**0.0458 J**	**0.0720 J**	**0.0211 J**	**0.0221 J**	0.0109 U
Fluorene	10	**0.494**	**0.0126 J**	0.00509 U	**0.00585 J**	0.00525 U
1-Methylnaphthalene	1.5[2]	**0.540**	**0.0640 J**	**0.00755 J**	**0.0166 J**	0.00777 U
Naphthalene	4,938	0.0221 U	**0.0531 J**	**0.0305 J**	**0.0388 J**	**0.0376 J**
2-Methylnaphthalene	32[2]	**0.0337 J**	**0.104**	**0.00982 J**	**0.0186 J**	**0.00813 J**

Notes:

[1] Sample LBP-W1 was collected from water accumulated in the bottom of the excavation (area outlined in red on Figure 1).

[2] Based on the MTCA Method B cleanup levels protective of surface water (lowest level).

[3] MTCA Method A Groundwater Cleanup Level.

[4] The cleanup level is 150 µg/L for "unweathered" diesel-range organics and 3,000 µg/L for "weathered" diesel-range organics. (Ecology, 2021).

NWTPH-Dx = Northwest Total Petroleum Hydrocarbon - Diesel Extended

MTCA = Model Toxics Control Act

µg/L = microgram per liter

NE = Not Established

U = Not detected above the practical quantification limit.

Shading indicates that the identified concentration is greater than the MTCA cleanup level.

Bold font type indicates the analyte was detected at the reported concentration.

FIGURES

GeoEngineers

P:\0\0817024\GIS\0817024_VicnityMap\0817024_VicnityMap.aprx\0817024_VicnityMap Date Exported: 01/25/24 by estrandhagen

Legend

- Boring Number and Approximate Loca on
- Exis ng Well
- Approximate Loca on of Abandoned USTs
- Approximate Loca on of August 2023 Stairway Excava on

N

0 15

Feet

Source(s):
- King County 2021 imagery

Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Disclaimer: This figure was created for a specific purpose and project. Any use of this figure for any other project or purpose shall be at the user's sole risk and without liability to GeoEngineers. The locations of features shown may be approximate. GeoEngineers makes no warranty or representation as to the accuracy, completeness, or suitability of the figure, or data contained therein. The file containing this figure is a copy of a master document, the original of which is retained by GeoEngineers and is the official document of record.

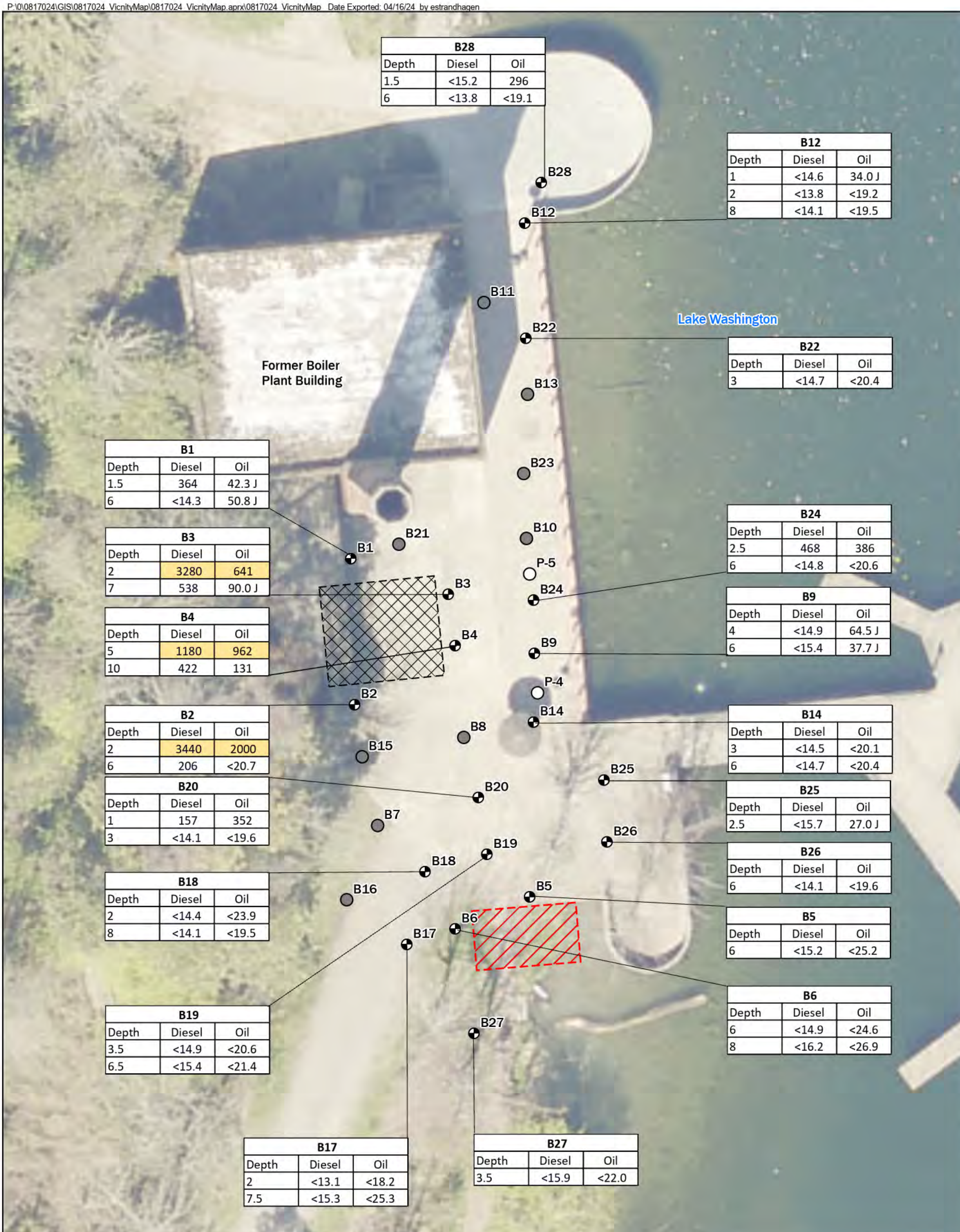
Site Plan

Luther Burbank Park Upland Improvements
Mercer Island Washington

GeoEngineers

Figure 1

P:\0\0817024\GIS\0817024_VicnityMap\0817024_VicnityMap.aprx\0817024_VicnityMap Date Exported: 04/16/24 by estrandhagen



B28

Depth	Diesel	Oil
1.5	<15.2	296
6	<13.8	<19.1

B12

Depth	Diesel	Oil
1	<14.6	34.0 J
2	<13.8	<19.2
8	<14.1	<19.5

B22

Depth	Diesel	Oil
3	<14.7	<20.4

B1

Depth	Diesel	Oil
1.5	364	42.3 J
6	<14.3	50.8 J

B24

Depth	Diesel	Oil
2.5	468	386
6	<14.8	<20.6

B3

Depth	Diesel	Oil
2	3280	641
7	538	90.0 J

B9

Depth	Diesel	Oil
4	<14.9	64.5 J
6	<15.4	37.7 J

B4

Depth	Diesel	Oil
5	1180	962
10	422	131

B2

Depth	Diesel	Oil
2	3440	2000
6	206	<20.7

B14

Depth	Diesel	Oil
3	<14.5	<20.1
6	<14.7	<20.4

B20

Depth	Diesel	Oil
1	157	352
3	<14.1	<19.6

B25

Depth	Diesel	Oil
2.5	<15.7	27.0 J

B26

Depth	Diesel	Oil
6	<14.1	<19.6

B18

Depth	Diesel	Oil
2	<14.4	<23.9
8	<14.1	<19.5

B5

Depth	Diesel	Oil
6	<15.2	<25.2

B6

Depth	Diesel	Oil
6	<14.9	<24.6
8	<16.2	<26.9

B19

Depth	Diesel	Oil
3.5	<14.9	<20.6
6.5	<15.4	<21.4

B17

Depth	Diesel	Oil
2	<13.1	<18.2
7.5	<15.3	<25.3

B27

Depth	Diesel	Oil
3.5	<15.9	<22.0

Legend

- Boring Location
- Boring Location with No Chemical Data
- Existing Well
- Approximate Location of Abandoned USTs
- Approximate Location of August 2023 Stairway Excavation

N

0 15
Feet

Notes:
1. Orange color denotes exceedance of MTCA CUL.
2. MTCA Method A Unrestricted - 2,000 for oil, 2,000 for diesel, and 2,000 for total combined oil- and diesel-range petroleum hydrocarbons.
3. Depths are feet.
4. Soil Results are milligrams per kilogram.

Source(s):
- King County 2021 imagery

Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Diesel- and Oil-Range Petroleum Hydrocarbon Results in Soil

Luther Burbank Park Upland Improvements
Mercer Island Washington

GeoEngineers

Figure 2

P:\0\0817024\GIS\0817024_VicnityMap\0817024_VicnityMap.aprx\0817024_VicnityMap   Date Exported: 01/25/24   by estrandhagen

Legend

- Boring Loca on
- Water Sample Not Taken at Boring Loca on
- Exis ng Well
- Approximate Loca on of Abandoned USTs
- Approximate Loca on of August 2023 Stairway Excava on

N

0 15

Feet

Notes:
1. Orange color denotes exceedance of MTCA CUL.
2. MTCA Method A Groundwater Cleanup Level - 500 ug/L.
3. Depths are feet.
4. Soil Results are milligrams per kilogram.

Source(s):
- King County 2021 imagery

Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Disclaimer: This figure was created for a specific purpose and project. Any use of this figure for any other project or purpose shall be at the user's sole risk and without liability to GeoEngineers. The locations of features shown may be approximate. GeoEngineers makes no warranty or representation as to the accuracy, completeness, or suitability of the figure, or data contained therein. The file containing this figure is a copy of a master document, the original of which is retained by GeoEngineers and is the official document of record.

Diesel- and Oil-Range Petroleum Hydrocarbon Results in Water

Luther Burbank Park Upland Improvements
Mercer Island Washington

GEOENGINEERS

Figure 3

APPENDICES

GeoEngineers

APPENDIX A
Construction Schematics

LEGEND:

- EXISTING CONTOUR
- EXISTING TREE TO RETAIN
- EXISTING TREE TO REMOVE
- EXISTING UPLAND EDGE OF SHORELINE HABITAT GRAVEL
- EXISTING BOULDER TO RETAIN
- PROPOSED CONTOUR
- PERVIOUS PAVERS
- CONCRETE PAVING WITH SAWCUT JOINT SCORING
- GRAVEL PATHWAY
- GRAVEL DRIVEWAY PAVING
- EXISTING BOLLARD AND CHAIN TO REMAIN
- HABITAT GRAVEL
- GRAVEL OVER COBBLE
- ROCK TERRACE
- GRATED WATER ACCESS STEPS
- HANDRAIL
- SPLIT RAIL FENCING
- PICNIC TABLE
- BENCH
- EXISTING LARGE WOODY DEBRIS RELOCATED
- PROPOSED TREE
- PROPOSED SHRUBS/GROUNDCOVERS
- RIPARIAN SHRUBS
- NATIVE UPLAND PLANTING/GROUNDCOVER
- STORMWATER CONVEYANCE PLANTING

NOTES:

1. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD83 (2011), U.S. SURVEY FEET
2. VERTICAL DATUM: NAVD88

CAD USER: cwee PLOT DATE: Oct 22, 2021–03:12pm
PATH: K:\Projects\0159-KPFF Consulting Engineers\Mercer Island Luther Burbank Dock Repair\Construction Plans\0159-PL-Site Plan.dwg

kpff
1601 5th Avenue, Suite 1600
Seattle, WA 98101
206.622.5822
www.kpff.com

ANCHOR QEA

NO.	DATE	BY	REVISION

CITY OF MERCER ISLAND WASHINGTON

LUTHER BURBANK PARK PIER REPAIR
CITY OF MERCER ISLAND

COMPOSITE SITE PLAN

DRAWN: TG/CW	PROJECT NO.: 2000291
DESIGN: AS	SCALE: AS NOTED
CHECKED: PH	DATE: 09/08/2021
DRAWING NO.	G-021
SHEET NO. 5	OF 52

30% SUBMITTAL

Appendix B
Field Procedures and Boring Logs

APPENDIX B
FIELD PROCEDURES AND BORING LOGS

As part of this pre-demolition investigation, environmental soil samples were obtained from 28 borings (B-1 through B-28). These borings were completed to depths of approximately 0.5 and 10.0 feet below the existing ground surface (bgs). The borings were completed by Cascade Drilling on December 12 through 14, 2023.

Soil Sampling

The borings were completed using a limited access direct-push track rig. The borings were monitored by a geologist from our firm who examined and classified the soils encountered, obtained representative soil samples, and prepared a detailed log of each exploration. The soils encountered in the borings were generally sampled at 2½- and 5-foot vertical intervals with clean plastic 1.5-inch diameter disposable liners.

The sampling equipment was decontaminated before each sampling attempt with a Liquinox® solution wash and a distilled water rinse. Soil samples were obtained for field screening and possible chemical analysis. Soil samples obtained during the exploration activities were collected from the sampler with a stainless-steel knife or new gloves. A portion of each sample was placed in laboratory-prepared sample jars for possible chemical analysis. The remaining portion of each sample was used for field screening.

Soil samples collected for potential chemical analysis were placed in a cooler with ice for transport to the laboratory. Standard chain-of-custody procedures were followed in transporting the soil samples to the laboratory.

Soils encountered in the borings were visually classified in general accordance with the classification system described in Figure B-1. A key to the boring log symbols is also presented in Figure A-1. The logs of the borings are presented in Figures B-2 through B-29.

Field Screening of Soil Samples

Soil samples obtained from the borings were screened in the field for evidence of contamination using: (1) visual examination; (2) sheen screening; and/or (3) or photoionization detector (PID). The results of headspace and sheen screening are included in the boring logs for soil samples tested by chemical analysis.

Visual screening consists of inspecting the soil for stains indicative of petroleum-related contamination. Visual screening is generally more effective when contamination is related to heavy petroleum hydrocarbons, such as motor oil or hydraulic oil, or when hydrocarbon concentrations are high. Sheen screening and headspace vapor screening are more sensitive methods that have been effective in detecting contamination at concentrations less than regulatory cleanup guidelines. Sheen screening involves placing soil in a pan of water and observing the water surface for signs of sheen. Sheen classifications are as follows:

No Sheen (NS)	No visible sheen on water surface.
Slight Sheen (SS)	Light, colorless, dull sheen; spread is irregular, not rapid; sheen dissipates rapidly.

Moderate Sheen (MS)	Light to heavy sheen, may have some color/iridescence; spread is irregular to flowing; few remaining areas of no sheen on water surface.
Heavy Sheen (HS)	Heavy sheen with color/iridescence; spread is rapid; entire water surface may be covered with sheen.

Headspace vapor screening involves placing a soil sample in a plastic sample bag. Air is captured in the bag and the bag is shaken to expose the soil to the air trapped in the bag. The probe of a PID is inserted in the bag and the instrument measures the concentration of combustible vapor in the air removed from the sample headspace. The PID measures concentrations in ppm (parts per million) and is calibrated to isobutylene. The PID is designed to quantify combustible gas and organic vapor concentrations up to 2,500 ppm. Field screening results are site-specific and vary with soil type, soil moisture content, temperature, and type of contaminant.

Groundwater Sample Collection and Handling

Groundwater samples were obtained from selected borings from a temporary polyvinyl chloride (PVC) well screen using a peristaltic pump with high-density polyethylene tubing at low-flow sampling rates. The groundwater was pumped at approximately 0.5 liter per minute at a flow rate of approximately 0.5 liter per minute (low-flow). Due to slow groundwater recharge, only a small amount of water was purged prior to sampling and the groundwater samples were generally turbid. Purging generated wastewater, which was drummed and temporarily stored on the property pending off-site disposal.

The groundwater samples were transferred directly from the tubing outlet to laboratory-prepared sample containers. New nitrile gloves were worn when collecting the groundwater sample. The sample containers were filled completely and placed in a cooler with ice pending transport to the analytical laboratory. Sample labels were completed and chain-of-custody procedures were followed in transporting the sample to the laboratory.

Investigation-Derived Waste

Investigation-derived waste (soil, groundwater and decontamination water) generated during the subsurface assessment was placed into four appropriately labeled 55-gallon drums. Disposal is pending.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

Sampler Symbol Descriptions

- 2.4-inch I.D. split barrel / Dames & Moore (D&M)
- Standard Penetration Test (SPT)
- Shelby tube
- Piston
- Direct-Push
- Bulk or grab
- Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	SOD	Sod/Forest Duff
	TS	Topsoil

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PL	Point load test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
UU	Unconsolidated undrained triaxial compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

Key to Exploration Logs

GeoEngineers

Figure B-1

Drilled	Start 12/12/2023	End 12/12/2023	Total Depth (ft) 10	Logged By KCJ / Checked By JAK	Driller Cascade Environmental	Drilling Method Direct-Push

Surface Elevation (ft) / Vertical Datum: Undetermined	Hammer Data: NA	Drilling Equipment: 7822DT
Easting (X) / Northing (Y)	System / Datum	See "Remarks" section for groundwater observed

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		42					CC	Portland concrete cement			
						CA		ML	Gray/brown silt with occasional sand and gravel (moist)	HS	48.7	
						B1-1.5						Petroleum hydrocarbon-like odor
						CA				NS		
						B1-3.5						Petroleum hydrocarbon-like odor
	5		48			CA			Becomes wet	NS		Groundwater observed at approximately 5 feet below ground surface during drilling
						B1-6						No odor
										NS		
										NS		
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B1

GEOENGINEERS

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Figure B-2
Sheet 1 of 1

Drilled — Start: 12/12/2023, End: 12/12/2023	Total Depth (ft): 10	Logged By: KCJ Checked By: JAK	Driller: Cascade Environmental
Drilling Method: Direct-Push	Surface Elevation (ft) / Vertical Datum: Undetermined	Hammer Data: NA	Drilling Equipment: 7822DT
Easting (X) / Northing (Y):	System / Datum:	See "Remarks" section for groundwater observed	

Notes:

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		24					CC	Portland concrete cement			
						CA		ML	Gray silt with clay (moist) (fill at top 6 inches)	NS		
						B2-1 / CA				SS	19.1	No odor
						B2-2				SS	12.4	
	5		30					ML	Gray silt (wet)			Groundwater observed at approximately 5 feet below ground surface during drilling
						B2-6 / CA				NS	<1	Petroleum hydrocarbon-like odor from 5 to 7.5 feet below ground surface
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B2

GEOENGINEERS

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Figure B-3
Sheet 1 of 1

Drilled	Start 12/12/2023	End 12/12/2023	Total Depth (ft)	10	Logged By KCJ / Checked By JAK	Driller: Cascade Environmental	Drilling Method: Direct-Push

Surface Elevation (ft) / Vertical Datum	Undetermined	Hammer Data	NA	Drilling Equipment	7822DT
Easting (X) / Northing (Y)		System / Datum		See "Remarks" section for groundwater observed	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		48					CC	Portland concrete cement			
								ML	Brown silt with trace sand, heavy staining (moist)			
						B3-2 / CA				HS	93.7	Strong petroleum hydrocarbon-like odor
						B3-4				NS	18.1	No odor
	5		48						Becomes wet with occasional gravel, heavy staining			Groundwater observed at approximately 5 feet below ground surface during drilling
						B3-7 / CA				HS	34.8	Petroleum hydrocarbon-like odor
						B3-9 / CA				NS	<1	No odor
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B3

GEOENGINEERS

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Figure B-4
Sheet 1 of 1

Drilled	Start 12/12/2023	End 12/12/2023	Total Depth (ft)	10	Logged By KCJ / Checked By JAK	Driller	Cascade Environmental	Drilling Method	Direct-Push

Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data	NA	Drilling Equipment	7822DT
Easting (X) Northing (Y)		System Datum		See "Remarks" section for groundwater observed	
Notes:					

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		12					CC	Portland concrete cement			
									Gray silt with occasional gravel (_______)			
	5		12			B4-5 / CA				HS		Petroleum hydrocarbon-like odor Groundwater observed at approximately 5 feet below ground surface during drilling
								SM	Brown-gray sand with silt and gravel (_______)			
						B4-10 / CA				HS		
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B4

GEOENGINEERS

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Figure B-5
Sheet 1 of 1

Drilled	Start 12/12/2023	End 12/12/2023	Total Depth (ft) 10	Logged By KCJ / Checked By JAK	Driller Cascade Environmental	Drilling Method Direct-Push
Surface Elevation (ft) / Vertical Datum	Undetermined		Hammer Data	NA	Drilling Equipment	7822DT
Easting (X) / Northing (Y)			System Datum		See "Remarks" section for groundwater observed	
Notes:						

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		36					CC	Portland concrete cement			
								ML	Brown silt with occasional gravel (moist)			
						B5-1.5 / CA				NS	1.3	
								ML	Gray silt (moist)			Groundwater observed at approximately 2 feet below ground surface during drilling
						B5-3 / CA				NS	1.1	
	5		54					ML	Brown-gray sandy silt with gravel (wet)			
						B5-6 / CA				SS	1.8	
								ML	Brown silt with occasional gravel (wet)	NS	<1	
										NS	<1	
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Date:1/25/24 Path:P:\0\0817024\GINT\081702403.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI8_ENVIRONMENTAL_STANDARD_NO_GW

Log of Boring B5

GEOENGINEERS

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Figure B-6
Sheet 1 of 1

Drilled	Start 12/12/2023	End 12/12/2023	Total Depth (ft) 10	Logged By KCJ / Checked By JAK	Driller Cascade Environmental	Drilling Method Direct-Push
Surface Elevation (ft) / Vertical Datum	Undetermined		Hammer Data	NA	Drilling Equipment	7822DT
Easting (X) / Northing (Y)			System Datum		Groundwater not observed at time of exploration	
Notes:						

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		30					ML	Brown-gray silt with gravel and occasional sand (wet)	NS	<1	No odor
									With occasional gravel, becomes moist			
						B6-2.5 / CA				NS	<1	No odor
	5		48						With sand and gravel, becomes wet			
						B6-6 / CA				SS	<1	No odor
						B6-8 / CA				SS	<1	No odor
									With occasional gravel	NS	<1	
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B6

GeoEngineers

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Figure B-7
Sheet 1 of 1

Drilled	Start 12/12/2023	End 12/12/2023	Total Depth (ft)	10	Logged By KCJ / Checked By JAK	Driller Cascade Environmental	Drilling Method Direct-Push

Surface Elevation (ft) / Vertical Datum: Undetermined	Hammer Data: NA	Drilling Equipment: 7822DT	
Easting (X) / Northing (Y)	System Datum	Groundwater not observed at time of exploration	
Notes:			

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		60					ML	Brown silt with occasional gravel and trace sand (moist)			
						B7-1 / CA				NS	<1	No odor
						B7-3.5 / CA				NS	<1	No odor
										NS	<1	
	5		60									
										NS	<1	
								ML	Gray silt with trace gravel (moist)			
						B7-8 / CA				NS	<1	No odor
										NS	<1	
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B7

GeoEngineers

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Drilled	Start 12/12/2023	End 12/12/2023	Total Depth (ft)	10	Logged By KCJ Checked By JAK	Driller Cascade Environmental	Drilling Method Direct-Push

Surface Elevation (ft) Vertical Datum: Undetermined	Hammer Data: NA	Drilling Equipment: 7822DT
Easting (X) Northing (Y)	System Datum	See "Remarks" section for groundwater observed

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		48					SM	Brown-gray silty sand with gravel (moist)	NS	<1	No odor
								ML	Gray silt with trace sand and gravel (moist)			
						B8-3 CA				NS	<1	
										NS	<1	No odor
	5		60					ML	Brown-gray silt with trace sand (moist to wet)			Groundwater observed at approximately 5 feet below ground surface during drilling
						B8-6 CA				NS	<1	
										NS	<1	No odor
						B8-10 CA				NS	<1	
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B8

GeoEngineers

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Date:1/25/24 Path:P:\0\0817024\GINT\081702403.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI8_ENVIRONMENTAL_STANDARD_NO_GW

Drilled	Start 12/12/2023	End 12/12/2023	Total Depth (ft) 10	Logged By KCJ / Checked By JAK	Driller Cascade Environmental	Drilling Method Direct-Push

Surface Elevation (ft) / Vertical Datum	Undetermined	Hammer Data	NA	Drilling Equipment	7822DT
Easting (X) / Northing (Y)		System / Datum		See "Remarks" section for groundwater observed	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		48					ML	Gray silt with occasional gravel (moist)	NS	<1	No odor
								ML	Gray silt with sand and occasional gravel (moist)			
												Groundwater observed at approximately 3½ feet below ground surface during drilling
						B9-4 / CA				NS	<1	No odor
	5		36									
						B9-6 / CA				SS	<1	No odor
						B9-7.5 / CA				NS	<1	No odor
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B9

GeoEngineers

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Figure B-10
Sheet 1 of 1

Drilled	Start 12/13/2023	End 12/13/2023	Total Depth (ft) 10	Logged By KCJ / Checked By JAK	Driller Cascade Environmental	Drilling Method Direct-Push

Surface Elevation (ft) / Vertical Datum: Undetermined	Hammer Data: NA	Drilling Equipment: 7822DT
Easting (X) / Northing (Y)	System / Datum	See "Remarks" section for groundwater observed

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		24					ML	Brown-gray sandy silt with gravel (damp)	NS	<1	No odor
								ML	Gray sandy silt with occasional gravel (moist)			
						B10-2 / CA				NS	<1	
												Groundwater observed at approximately 3½ feet below ground surface during drilling
	5		60					ML	Gray-brown silt with sand and occasional gravel (moist)			
						B10-6 / CA				NS	<1	
										NS	<1	No odor
										NS	<1	No odor
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B10

GEOENGINEERS

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Drilled	Start 12/13/2023	End 12/13/2023	Total Depth (ft)	0.5	Logged By KCJ Checked By JAK	Driller Cascade Environmental	Drilling Method Direct-Push

Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data	NA	Drilling Equipment	7822DT
Easting (X) Northing (Y)		System Datum		Groundwater not observed at time of exploration	
Notes:					

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	FIELD DATA: Recovered (in)	FIELD DATA: Blows/foot	FIELD DATA: Collected Sample	FIELD DATA: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0								Boring terminated at approximately 6 inches due to refusal			

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B11

GeoEngineers

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Drilled	Start 12/13/2023	End 12/13/2023	Total Depth (ft) 10	Logged By KCJ / Checked By JAK	Driller Cascade Environmental	Drilling Method Direct-Push

Surface Elevation (ft) / Vertical Datum: Undetermined	Hammer Data: NA	Drilling Equipment: 7822DT
Easting (X) / Northing (Y)	System / Datum	See "Remarks" section for groundwater observed

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		24					ML	Gray brown sandy silt with gravel (moist)			Very weak petroleum hydrocarbon-like odor
								ML	Gray silt with clay, occasional gravel and trace sand (moist)			
						B12-1 / CA				SS	<1	
						B12-2 / CA				NS	<1	No odor
												Groundwater observed at approximately 3½ feet below ground surface during drilling
	5		60					ML	Brown silt with occasional gravel and trace sand (wet)	NS	<1	No odor
						B12-8 / CA				NS	<1	No odor
										NS	<1	No odor
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Date:1/25/24 Path:P:\0\0817024\GINT\081702403.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI8_ENVIRONMENTAL_STANDARD_NO_GW

Log of Boring B12

GEOENGINEERS

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Drilled	Start 12/13/2023	End 12/13/2023	Total Depth (ft)	5	Logged By KCJ	Checked By JAK	Driller	Cascade Environmental	Drilling Method	Direct-Push

Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data	NA	Drilling Equipment	7822DT
Easting (X) Northing (Y)		System Datum		See "Remarks" section for groundwater observed	
Notes:					

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		12					ML	Gray-reddish brown silt with gravel (wet)			
						B13-0.5 CA				NS	<1	No odor
						B13-1 CA				NS	<1	
												Groundwater observed at approximately 2½ feet below ground surface during drilling
	5								Boring terminated at approximately 5 feet below ground surface due to refusal			

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B13

GeoEngineers

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Drilled	Start 12/13/2023	End 12/13/2023	Total Depth (ft) 10	Logged By KCJ / Checked By JAK	Driller Cascade Environmental	Drilling Method Direct-Push

Surface Elevation (ft) / Vertical Datum: Undetermined	Hammer Data: NA	Drilling Equipment: 7822DT
Easting (X) / Northing (Y)	System / Datum	See "Remarks" section for groundwater observed

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		36					CC	Portland concrete cement			
								ML	Gray-brown silt with occasional gravel and trace sand (moist)			
						B14-1 / CA				NS	<1	
								ML	Gray silt with occasional gravel (moist)	NS	<1	No odor
						B14-3 / CA				NS	<1	
												Groundwater observed at approximately 3½ feet below ground surface during drilling
	5		48					ML	Gray silt with sand and occasional gravel (wet)			
						B14-6 / CA		ML	Gray silt with occasional gravel and trace sand (wet)	SS	<1	No odor
										NS	<1	No odor
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B14

GeoEngineers

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Figure B-15
Sheet 1 of 1

Date:1/25/24 Path:P:\0\0817024\GINT\081702403.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI8_ENVIRONMENTAL_STANDARD_NO_GW

Drilled	Start 12/13/2023	End 12/13/2023	Total Depth (ft) 5	Logged By KCJ Checked By JAK	Driller Cascade Environmental	Drilling Method Direct-Push

Surface Elevation (ft) Vertical Datum: Undetermined	Hammer Data: NA	Drilling Equipment: 7822DT
Easting (X) Northing (Y)	System Datum	See "Remarks" section for groundwater observed

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	FIELD DATA: Recovered (in)	FIELD DATA: Blows/foot	FIELD DATA: Collected Sample	FIELD DATA: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		60					ML	Gray-brown silt with gravel and trace sand (moist)			
						B15-1 / CA				NS	<1	No odor
										NS	<1	
												Groundwater observed at approximately 3½ feet below ground surface during drilling
	5					B15-5				NS	<1	No odor

Boring terminated at approximately 5 feet below ground surface due to refusal

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B15

GEOENGINEERS

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Drilled	Start 12/13/2023	End 12/13/2023	Total Depth (ft) 10	Logged By KCJ / Checked By JAK	Driller Cascade Environmental	Drilling Method Direct-Push

Surface Elevation (ft) / Vertical Datum: Undetermined	Hammer Data: NA	Drilling Equipment: 7822DT
Easting (X) / Northing (Y)	System / Datum	See "Remarks" section for groundwater observed

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		54					ML	Gray-brown silt with gravel and trace sand (moist)			
										NS	<1	No odor
									Grades to occasional gravel			
						B16-3 CA				NS	<1	
										NS	<1	No odor
	5		60									
						B16-6 CA				NS	<1	
										NS	<1	No odor
									Becomes wet			Groundwater observed at approximately 7½ feet below ground surface during drilling
						B16-9 CA				NS	<1	
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B16

GeoEngineers

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Figure B-17
Sheet 1 of 1

Drilled	Start 12/13/2023	End 12/13/2023	Total Depth (ft)	10	Logged By KCJ / Checked By JAK	Driller Cascade Environmental	Drilling Method Direct-Push

Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data	NA	Drilling Equipment	7822DT
Easting (X) Northing (Y)		System Datum		See "Remarks" section for groundwater observed	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		60					ML	Gray-brown silt with occasional gravel and trace sand (moist)	NS	<1	No odor
						B17-2 / CA				NS	<1	No odor
										NS	<1	No odor
	5		60							NS	<1	No odor
						B17-7.5			Becomes wet	NS	<1	No odor Groundwater observed at approximately 7½ feet below ground surface during drilling
										NS	<1	No odor
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Date:1/25/24 Path:P:\0\0817024\GINT\081702403.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI8_ENVIRONMENTAL_STANDARD_NO_GW

Log of Boring B17

GEOENGINEERS

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Drilled	Start 12/13/2023	End 12/13/2023	Total Depth (ft) 10	Logged By KCJ / Checked By JAK	Driller Cascade Environmental	Drilling Method Direct-Push
Surface Elevation (ft) / Vertical Datum	Undetermined		Hammer Data NA		Drilling Equipment 7822DT	
Easting (X) / Northing (Y)			System / Datum		See "Remarks" section for groundwater observed	
Notes:						

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		30					ML	Brown sandy silt with gravel (moist)	NS	<1	No odor
								ML	Brown silt with gravel and trace sand (moist)			
						B18-2.5 / CA				NS	<1	No odor
	5		60							NS	<1	No odor
									Becomes wet			Groundwater observed at approximately 7½ feet below ground surface during drilling
						B18-8 / CA				NS	<1	No odor
										NS	<1	No odor
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B18

GeoEngineers

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Figure B-19
Sheet 1 of 1

Drilled	Start 12/13/2023	End 12/13/2023	Total Depth (ft)	10	Logged By KCJ	Checked By JAK	Driller	Cascade Environmental	Drilling Method	Direct-Push

Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data	NA	Drilling Equipment	7822DT
Easting (X) Northing (Y)		System Datum		See "Remarks" section for groundwater observed	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	FIELD DATA: Recovered (in)	FIELD DATA: Blows/foot	FIELD DATA: Collected Sample	FIELD DATA: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		48					ML	Brown-gray silt with gravel (moist)			
						B19-1 / CA		ML	Gray-brown silt with trace sand and occasional gravel (moist)	NS	<1	No odor
						B19-3.5 / CA				SS	<1	No odor Groundwater observed at approximately 3½ feet below ground surface during drilling
	5		24						Becomes wet			
						B19-6.5 / CA				NS	<1	No odor
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B19

GEOENGINEERS

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Figure B-20
Sheet 1 of 1

Drilled	Start 12/13/2023	End 12/13/2023	Total Depth (ft) 10	Logged By KCJ Checked By JAK	Driller Cascade Environmental	Drilling Method Direct-Push

Surface Elevation (ft) Vertical Datum: Undetermined	Hammer Data: NA	Drilling Equipment: 7822DT
Easting (X) Northing (Y)	System Datum	See "Remarks" section for groundwater observed

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		54					ML	Gray silt with sand and occasional gravel (moist)			
						B20-1 CA				SS	<1	No odor
						B20-3 CA				NS	<1	No odor
										NS	<1	
	5		54						Becomes wet			Groundwater observed at approximately 5 feet below ground surface during drilling
										NS	<1	No odor
						B20-8 CA				NS	<1	No odor
										NS	<1	No odor
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B20

GEOENGINEERS

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Figure B-21
Sheet 1 of 1

Drilled	Start 12/14/2023	End 12/14/2023	Total Depth (ft) 10	Logged By KCJ Checked By JAK	Driller Cascade Environmental	Drilling Method Direct-Push

Surface Elevation (ft) Vertical Datum: Undetermined	Hammer Data: NA	Drilling Equipment: 7822DT
Easting (X) Northing (Y)	System Datum	Groundwater not observed at time of exploration

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		36					ML	Brown sandy silt with gravel (moist)			
						B21-1 / CA		ML	Gray-brown silt with occasional gravel (moist)	SS	9.7	Slight petroleum hydrocarbon-like odor
						B21-3 / CA				NS	2.1	No odor
	5		60							NS	<1	No odor
						B21-8				NS	<1	No odor
										NS	<1	No odor
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B21

GEOENGINEERS

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Figure B-22
Sheet 1 of 1

Drilled	Start 12/14/2023	End 12/14/2023	Total Depth (ft)	10	Logged By KCJ / Checked By JAK	Driller Cascade Environmental	Drilling Method Direct-Push

Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data	NA	Drilling Equipment	7822DT
Easting (X) Northing (Y)		System Datum		See "Remarks" section for groundwater observed	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		36					SM	Brown sand with gravel (moist)			
								ML	Gray silt with sand and occasional gravel (moist)			
						B22-1 / CA		ML	Gray silt with occasional gravel and trace sand (moist)	NS	<1	No odor
						B22-3 / CA				NS	<1	No odor
									Becomes wet			Groundwater observed at approximately 3½ feet below ground surface during drilling
	5		48									
						B22-6 / CA				NS	<1	No odor
								ML	Gray-brown silt (moist)	NS	<1	No odor
										NS	<1	No odor
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B22

GEOENGINEERS

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Drilled	Start 12/14/2023	End 12/14/2023	Total Depth (ft)	0.5	Logged By KCJ / Checked By JAK	Driller Cascade Environmental	Drilling Method	Direct-Push

Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data	NA	Drilling Equipment	7822DT
Easting (X) Northing (Y)		System Datum		Groundwater not observed at time of exploration	
Notes:					

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	FIELD DATA: Recovered (in)	FIELD DATA: Blows/foot	FIELD DATA: Collected Sample	FIELD DATA: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0								Boring terminated at approximately 5 inches below ground surface due to refusal			

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B23

GeoEngineers

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Drilled	Start 12/14/2023	End 12/14/2023	Total Depth (ft) 10	Logged By KCJ / Checked By JAK	Driller Cascade Environmental	Drilling Method Direct-Push

Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data	NA	Drilling Equipment	7822DT
Easting (X) Northing (Y)		System Datum		See "Remarks" section for groundwater observed	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		30					SM	Gray gravelly sand (moist)			
								ML	Gray silt with sand and occasional gravel (wet)	NS	<1	No odor
						B24-2.5 CA				MS	12.8	Petroleum hydrocarbon-like odor Groundwater observed at approximately 2½ feet below ground surface during drilling
	5		60					ML	Brown-gray silt with occasional gravel and trace sand (moist)			
						B24-6				NS	<1	No odor
						B24-8				NS	<1	
										NS	<1	
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B24

GeoEngineers

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Figure B-25
Sheet 1 of 1

Drilled	Start 12/14/2023	End 12/14/2023	Total Depth (ft)	10	Logged By KCJ / Checked By JAK	Driller	Cascade Environmental	Drilling Method	Direct-Push

Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data	NA	Drilling Equipment	7822DT
Easting (X) Northing (Y)		System Datum		See "Remarks" section for groundwater observed	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		30					ML	Brown sandy silt with gravel (moist)	NS	1.4	No odor
								ML	Gray silt with sand and occasional gravel (moist)			Groundwater observed at approximately 2 feet below ground surface during drilling
						B25-2.5 / CA				NS	<1	No odor
	5		36					ML	Gray-brown silt with gravel and trace sand (wet)			
						B25-6 / CA				NS	<1	
										NS	<1	
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B25

GeoEngineers

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Figure B-26
Sheet 1 of 1

Drilled	Start 12/14/2023	End 12/14/2023	Total Depth (ft) 10	Logged By KCJ Checked By JAK	Driller Cascade Environmental	Drilling Method Direct-Push

Surface Elevation (ft) / Vertical Datum: Undetermined	Hammer Data: NA	Drilling Equipment: 7822DT
Easting (X) / Northing (Y)	System / Datum	See "Remarks" section for groundwater observed

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		12					CR	Crushed concrete rock at bottom of sampler	NS	<1	
												Groundwater observed at approximately 2½ feet below ground surface during drilling
	5		60					ML	Brown-gray silt with gravel and trace sand (moist)			
						B26-6 / CA				NS	<1	No odor
								ML	Gray silt with trace sand and trace gravel (wet)			
						B26-8				NS	<1	No odor
										NS	<1	
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Date:1/25/24 Path:P:\0\0817024\GINT\081702403.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI8_ENVIRONMENTAL_STANDARD_NO_GW

Log of Boring B26

GeoEngineers

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Figure B-27
Sheet 1 of 1

Drilled	Start 12/14/2023	End 12/14/2023	Total Depth (ft)	10	Logged By KCJ, Checked By JAK	Driller	Cascade Environmental	Drilling Method	Direct-Push

Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data	NA	Drilling Equipment	7822DT
Easting (X) Northing (Y)		System Datum		See "Remarks" section for groundwater observed	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		48					ML	Brown-gray mottled silt with sand (moist)			
						B27-1.5 CA				NS	<1	No odor
										NS	<1	No odor
						B27-3.5 CA				NS	<1	No odor
	5		60						Becomes wet			Groundwater observed at approximately 5 feet below ground surface during drilling
										NS	<1	No odor
						B27-7.5 CA				NS	<1	No odor
										NS	<1	No odor
										NS	<1	No odor
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B27

GEOENGINEERS

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

Figure B-28
Sheet 1 of 1

Drilled	Start 12/14/2023	End 12/14/2023	Total Depth (ft) 10	Logged By KCJ Checked By JAK	Driller Cascade Environmental	Drilling Method Direct-Push
Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data	NA	Drilling Equipment	7822DT
Easting (X) Northing (Y)		System Datum		See "Remarks" section for groundwater observed	
Notes:					

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		18					GP	2-inch gravel cap			
								Brick	Red brick			
								SM	Gray sand with silt and gravel (moist)			
						B28-1.5 / CA				NS	<1	No odor
												Groundwater observed at approximately 3½ feet below ground surface during drilling
	5		60					ML	Brown silt with sand (wet)			
						B28-6 / CA				NS	<1	No odor
						B28-8 / CA				NS	<1	No odor
										NS	<1	
	10											

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring B28

GEOENGINEERS

Project: Luther Burbank Park
Project Location: Mercer Island, Washington
Project Number: 0817-024-03

APPENDIX C
Laboratory Analytical Report

APPENDIX C
LABORATORY ANALYTICAL REPORT

Analytical Methods

Chain-of-custody procedures were followed during the transport of the field samples to the analytical laboratory. The samples were held in cold storage pending extraction and/or analysis. The analytical results, analytical methods reference and laboratory quality control (QC) records are included in this appendix. The analytical results are also summarized in the text and tables of this report.

Analytical Data Review

The laboratory maintains an internal quality assurance program as documented in its laboratory quality assurance manual. The laboratory uses a combination of blanks, surrogate recoveries, duplicates, matrix spike recoveries, matrix spike duplicate recoveries, blank spike recoveries and blank spike duplicate recoveries to evaluate the validity of the analytical results. The laboratory also uses data quality goals for individual chemicals or groups of chemicals based on the long- term performance of the test methods. The data quality goals were included in the laboratory reports. The laboratory compared each group of samples with the existing data quality goals and noted any exceptions in the laboratory report. Data quality exceptions documented by the accredited laboratory were reviewed by GeoEngineers and are addressed in the data quality exception section of this appendix.

Analytical Data Review Summary

Quality assurance and quality control flags were present for a limited number of samples (B9-4, B12-2, B12-8, B14-3, B17-2, B18-8, B19-6.5, B20-3, and B27-3.5) due to the samples being analyzed past the analytical method holding time. Holding times were exceeded by 1 day because additional samples were selected for analysis following an initial review of the sample results. The data quality exceptions were noted during our review of the analytical data reports provided to us by the laboratory. Based on review of the analytical data, and with these qualifiers, it is our opinion that the analytical data are of acceptable quality for their intended use.

3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

GeoEngineers
Phil Cordell
2101 4th Ave, Suite 950
Seattle, WA 98121

RE: **LBP**
Work Order Number: **2312358**

January 08, 2024

Attention Phil Cordell:

Fremont Analytical, Inc. received 76 sample(s) on 12/14/2023 for the analyses presented in the following report.

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.
Hydrocarbon Identification by NWTPH-HCID
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)
Sample Moisture (Percent Moisture)

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Brianna Barnes
Project Manager

DoD-ELAP Accreditation #79636 by PJLA, ISO/IEC 17025:2017 and QSM 5.3 for Environmental Testing
ORELAP Certification: WA 100009 (NELAP Recognized) for Environmental Testing
Washington State Department of Ecology Accredited for Environmental Testing, Lab ID C910

Date: *01/11/2024*

CLIENT:	GeoEngineers
Project:	LBP
Work Order:	2312358

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2312358-001	B1-1.5	12/12/2023 11:20 AM	12/14/2023 3:46 PM
2312358-002	B1-3.5	12/12/2023 11:25 AM	12/14/2023 3:46 PM
2312358-003	B1-6	12/12/2023 11:30 AM	12/14/2023 3:46 PM
2312358-004	B2-1	12/12/2023 10:55 AM	12/14/2023 3:46 PM
2312358-005	B2-2	12/12/2023 11:00 AM	12/14/2023 3:46 PM
2312358-006	B2-6	12/12/2023 11:10 AM	12/14/2023 3:46 PM
2312358-007	B3-2	12/12/2023 10:15 AM	12/14/2023 3:46 PM
2312358-008	B3-4	12/12/2023 10:20 AM	12/14/2023 3:46 PM
2312358-009	B3-7	12/12/2023 10:25 AM	12/14/2023 3:46 PM
2312358-010	B3-9	12/12/2023 10:30 AM	12/14/2023 3:46 PM
2312358-011	B4-5	12/12/2023 10:40 AM	12/14/2023 3:46 PM
2312358-012	B4-10	12/12/2023 10:45 AM	12/14/2023 3:46 PM
2312358-013	B5-1.5	12/12/2023 11:45 AM	12/14/2023 3:46 PM
2312358-014	B5-3	12/12/2023 11:50 AM	12/14/2023 3:46 PM
2312358-015	B5-6	12/12/2023 11:50 AM	12/14/2023 3:46 PM
2312358-016	B6-2.5	12/12/2023 12:55 PM	12/14/2023 3:46 PM
2312358-017	B6-6	12/12/2023 1:00 PM	12/14/2023 3:46 PM
2312358-018	B6-8	12/12/2023 1:05 PM	12/14/2023 3:46 PM
2312358-019	B7-1	12/12/2023 1:20 PM	12/14/2023 3:46 PM
2312358-020	B7-3.5	12/12/2023 1:25 PM	12/14/2023 3:46 PM
2312358-021	B7-8	12/12/2023 1:30 PM	12/14/2023 3:46 PM
2312358-022	B8-3	12/12/2023 1:40 PM	12/14/2023 3:46 PM
2312358-023	B8-6	12/12/2023 1:45 PM	12/14/2023 3:46 PM
2312358-024	B8-10	12/12/2023 1:50 PM	12/14/2023 3:46 PM
2312358-025	B9-4	12/12/2023 2:00 PM	12/14/2023 3:46 PM
2312358-026	B9-6	12/12/2023 2:05 PM	12/14/2023 3:46 PM
2312358-027	B9-7.5	12/12/2023 2:10 PM	12/14/2023 3:46 PM
2312358-028	B10-2	12/13/2023 9:00 AM	12/14/2023 3:46 PM
2312358-029	B10-6	12/13/2023 9:05 AM	12/14/2023 3:46 PM
2312358-030	B12-1	12/12/2023 9:35 AM	12/14/2023 3:46 PM
2312358-031	B12-2	12/13/2023 9:40 AM	12/14/2023 3:46 PM
2312358-032	B12-8	12/13/2023 9:45 AM	12/14/2023 3:46 PM
2312358-033	B13-0.5	12/13/2023 9:55 AM	12/14/2023 3:46 PM
2312358-034	B13-1	12/13/2023 10:00 AM	12/14/2023 3:46 PM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

CLIENT: GeoEngineers
Project: LBP
Work Order: 2312358

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2312358-035	B14-1	12/13/2023 10:30 AM	12/14/2023 3:46 PM
2312358-036	B14-3	12/13/2023 10:35 AM	12/14/2023 3:46 PM
2312358-037	B14-6	12/13/2023 10:40 AM	12/14/2023 3:46 PM
2312358-038	B15-1	12/13/2023 11:00 AM	12/14/2023 3:46 PM
2312358-039	B15-5	12/13/2023 11:05 AM	12/14/2023 3:46 PM
2312358-040	B16-3	12/13/2023 11:15 AM	12/14/2023 3:46 PM
2312358-041	B16-6	12/13/2023 11:20 AM	12/14/2023 3:46 PM
2312358-042	B16-9	12/13/2023 11:25 AM	12/14/2023 3:46 PM
2312358-043	B17-2	12/13/2023 11:30 AM	12/14/2023 3:46 PM
2312358-044	B17-7.5	12/13/2023 11:35 AM	12/14/2023 3:46 PM
2312358-045	B18-2	12/13/2023 12:20 PM	12/14/2023 3:46 PM
2312358-046	B18-8	12/13/2023 12:25 PM	12/14/2023 3:46 PM
2312358-047	B19-1	12/13/2023 12:30 PM	12/14/2023 3:46 PM
2312358-048	B19-3.5	12/13/2023 12:35 PM	12/14/2023 3:46 PM
2312358-049	B19-6.5	12/13/2023 12:40 PM	12/14/2023 3:46 PM
2312358-050	B20-1	12/13/2023 12:45 PM	12/14/2023 3:46 PM
2312358-051	B20-3	12/13/2023 12:50 PM	12/14/2023 3:46 PM
2312358-052	B20-8	12/13/2023 12:55 PM	12/14/2023 3:46 PM
2312358-053	B21-1	12/14/2023 9:20 AM	12/14/2023 3:46 PM
2312358-054	B21-3	12/14/2023 9:25 AM	12/14/2023 3:46 PM
2312358-055	B21-8	12/14/2023 9:30 AM	12/14/2023 3:46 PM
2312358-056	B22-1	12/14/2023 9:50 AM	12/14/2023 3:46 PM
2312358-057	B22-3	12/14/2023 9:55 AM	12/14/2023 3:46 PM
2312358-058	B22-6	12/14/2023 10:00 AM	12/14/2023 3:46 PM
2312358-059	B24-2.5	12/14/2023 10:05 AM	12/14/2023 3:46 PM
2312358-060	B24-6	12/14/2023 10:10 AM	12/14/2023 3:46 PM
2312358-061	B24-8	12/14/2023 10:15 AM	12/14/2023 3:46 PM
2312358-062	B25-2.5	12/14/2023 10:20 AM	12/14/2023 3:46 PM
2312358-063	B25-6	12/14/2023 10:25 AM	12/14/2023 3:46 PM
2312358-064	B26-6	12/14/2023 10:30 AM	12/14/2023 3:46 PM
2312358-065	B26-8	12/14/2023 10:35 AM	12/14/2023 3:46 PM
2312358-066	B27-1.5	12/14/2023 11:50 AM	12/14/2023 3:46 PM
2312358-067	B27-3.5	12/14/2023 11:55 AM	12/14/2023 3:46 PM
2312358-068	B27-7.5	12/14/2023 12:00 PM	12/14/2023 3:46 PM
2312358-069	B28-1.5	12/14/2023 12:15 PM	12/14/2023 3:46 PM
2312358-070	B28-6	12/14/2023 12:00 PM	12/14/2023 3:46 PM
2312358-071	B28-8	12/14/2023 12:15 PM	12/14/2023 3:46 PM
2312358-072	B12-W	12/13/2023 1:05 PM	12/14/2023 3:46 PM
2312358-073	B14-W	12/13/2023 12:45 PM	12/14/2023 3:46 PM
2312358-074	B27-W	12/14/2023 2:00 PM	12/14/2023 3:46 PM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

CLIENT: GeoEngineers
Project: LBP
Work Order: 2312358

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2312358-075	B26-W	12/14/2023 12:15 PM	12/14/2023 3:46 PM
2312358-076	P-5	12/14/2023 1:45 PM	12/14/2023 3:46 PM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **2312358**
Date: **1/8/2024**

CLIENT: GeoEngineers
Project: LBP

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

1/4/2024: Rev1 includes additional analysis per client request.
1/8/2024: Rev2 includes additional sample data per client request.
1/11/2024: Rev3 reports detections to the Method Detection Limit per client request.

Qualifiers:

* - Associated LCS is outside of control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Method Detection Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
DUP - Sample Duplicate
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MCL - Maximum Contaminant Level
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
REP - Sample Replicate
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Project: LBP
Lab ID: 2312358-001
Client Sample ID: **B1-1.5**

Collection Date: 12/12/2023 11:20:00 AM
Matrix: Soil

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42374			Analyst: SK
Diesel Range Organics	364	62.1	16.3		mg/Kg-dry	1	12/18/23 22:06:54
Heavy Oil	42.3	124	22.7	J	mg/Kg-dry	1	12/18/23 22:06:54
Total Petroleum Hydrocarbons	407	186	39.0		mg/Kg-dry	1	12/18/23 22:06:54
Surr: 2-Fluorobiphenyl	122	50 - 150			%Rec	1	12/18/23 22:06:54
Surr: o-Terphenyl	120	50 - 150			%Rec	1	12/18/23 22:06:54
Sample Moisture (Percent Moisture)				Batch ID: R88392			Analyst: MP
Percent Moisture	20.6	0.500	0.100		wt%	1	12/18/23 8:33:57

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Project: LBP
Lab ID: 2312358-003
Client Sample ID: **B1-6**

Collection Date: 12/12/2023 11:30:00 AM
Matrix: Soil

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42374			Analyst: SK
Diesel Range Organics	ND	54.2	14.3		mg/Kg-dry	1	12/18/23 22:17:48
Heavy Oil	50.8	108	19.8	J	mg/Kg-dry	1	12/18/23 22:17:48
Total Petroleum Hydrocarbons	50.8	163	34.0	J	mg/Kg-dry	1	12/18/23 22:17:48
Surr: 2-Fluorobiphenyl	104	50 - 150			%Rec	1	12/18/23 22:17:48
Surr: o-Terphenyl	105	50 - 150			%Rec	1	12/18/23 22:17:48
Sample Moisture (Percent Moisture)				Batch ID: R88392			Analyst: MP
Percent Moisture	12.2	0.500	0.100		wt%	1	12/18/23 8:33:57

Fremont Analytical
An Alliance Technical Group Company

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers **Collection Date:** 12/12/2023 11:00:00 AM
Project: LBP
Lab ID: 2312358-005 **Matrix:** Soil
Client Sample ID: **B2-2**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.					Batch ID: 42374		Analyst: SK
Diesel Range Organics	3,440	62.0	16.3		mg/Kg-dry	1	12/19/23 9:06:26
Heavy Oil	2,000	124	22.6		mg/Kg-dry	1	12/19/23 9:06:26
Total Petroleum Hydrocarbons	5,440	186	38.9		mg/Kg-dry	1	12/19/23 9:06:26
Surr: 2-Fluorobiphenyl	82.6	50 - 150			%Rec	1	12/19/23 9:06:26
Surr: o-Terphenyl	114	50 - 150			%Rec	1	12/19/23 9:06:26

NOTES:
Chromatographic pattern indicates a continuous distribution of material in the diesel and oil ranges. Pattern resembles a fuel oil

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Sample Moisture (Percent Moisture)					Batch ID: R88392		Analyst: MP
Percent Moisture	21.2	0.500	0.100		wt%	1	12/18/23 8:33:57

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/12/2023 11:10:00 AM
Project: LBP
Lab ID: 2312358-006
Matrix: Soil
Client Sample ID: **B2-6**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.					Batch ID: 42374		Analyst: SK
Diesel Range Organics	206	56.9	15.0		mg/Kg-dry	1	12/19/23 8:55:33
Heavy Oil	ND	114	20.7		mg/Kg-dry	1	12/19/23 8:55:33
Total Petroleum Hydrocarbons	206	171	35.7		mg/Kg-dry	1	12/19/23 8:55:33
Surr: 2-Fluorobiphenyl	107	50 - 150			%Rec	1	12/19/23 8:55:33
Surr: o-Terphenyl	111	50 - 150			%Rec	1	12/19/23 8:55:33

NOTES:
Chromatographic pattern indicates a continuous distribution of material in the diesel and oil ranges. Pattern resembles a fuel oil

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Sample Moisture (Percent Moisture)					Batch ID: R88392		Analyst: MP
Percent Moisture	16.8	0.500	0.100		wt%	1	12/18/23 8:33:57

Analytical Report

Fremont Analytical — An Alliance Technical Group Company

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Project: LBP
Lab ID: 2312358-007
Client Sample ID: **B3-2**

Collection Date: 12/12/2023 10:15:00 AM
Matrix: Soil

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42383			Analyst: AP
Diesel Range Organics	3,280	57.9	15.2		mg/Kg-dry	1	12/20/23 0:54:03
Heavy Oil	641	116	21.1		mg/Kg-dry	1	12/20/23 0:54:03
Total Petroleum Hydrocarbons	3,920	174	36.3		mg/Kg-dry	1	12/20/23 0:54:03
Surr: 2-Fluorobiphenyl	109	50 - 150			%Rec	1	12/20/23 0:54:03
Surr: o-Terphenyl	124	50 - 150			%Rec	1	12/20/23 0:54:03
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 42382			Analyst: RG
Naphthalene	0.132	0.229	0.0489	DJ	mg/Kg-dry	10	12/21/23 2:22:18
2-Methylnaphthalene	0.102	0.229	0.0431	DJ	mg/Kg-dry	10	12/21/23 2:22:18
1-Methylnaphthalene	9.61	0.229	0.0352	D	mg/Kg-dry	10	12/21/23 2:22:18
Acenaphthylene	ND	0.229	0.0336	D	mg/Kg-dry	10	12/21/23 2:22:18
Acenaphthene	3.26	0.229	0.0421	D	mg/Kg-dry	10	12/21/23 2:22:18
Fluorene	2.54	0.229	0.0286	D	mg/Kg-dry	10	12/21/23 2:22:18
Phenanthrene	7.73	0.229	0.0640	D	mg/Kg-dry	10	12/21/23 2:22:18
Anthracene	1.21	0.229	0.0307	D	mg/Kg-dry	10	12/21/23 2:22:18
Fluoranthene	0.290	0.229	0.0835	D	mg/Kg-dry	10	12/21/23 2:22:18
Pyrene	ND	0.458	0.105	D	mg/Kg-dry	10	12/21/23 2:22:18
Benz(a)anthracene	0.187	0.229	0.0813	DJ	mg/Kg-dry	10	12/21/23 2:22:18
Chrysene	0.225	0.229	0.0400	DJ	mg/Kg-dry	10	12/21/23 2:22:18
Benzo(b)fluoranthene	ND	0.286	0.0883	D	mg/Kg-dry	10	12/21/23 2:22:18
Benzo(k)fluoranthene	ND	0.286	0.100	D	mg/Kg-dry	10	12/21/23 2:22:18
Benzo(a)pyrene	ND	0.343	0.105	D	mg/Kg-dry	10	12/21/23 2:22:18
Indeno(1,2,3-cd)pyrene	ND	0.458	0.0817	D	mg/Kg-dry	10	12/21/23 2:22:18
Dibenz(a,h)anthracene	ND	0.572	0.259	D	mg/Kg-dry	10	12/21/23 2:22:18
Benzo(g,h,i)perylene	ND	0.572	0.248	D	mg/Kg-dry	10	12/21/23 2:22:18
Surr: 2-Fluorobiphenyl	114	29.3 - 159	0	D	%Rec	10	12/21/23 2:22:18
Surr: Terphenyl-d14 (surr)	107	28.4 - 159	0	D	%Rec	10	12/21/23 2:22:18

NOTES:
Diluted due to matrix.

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/12/2023 10:15:00 AM
Project: LBP
Lab ID: 2312358-007
Matrix: Soil
Client Sample ID: **B3-2**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Sample Moisture (Percent Moisture)				Batch ID: R88392			Analyst: MP
Percent Moisture	15.7	0.500	0.100		wt%	1	12/18/23 8:33:57

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Project: LBP
Lab ID: 2312358-009
Client Sample ID: **B3-7**

Collection Date: 12/12/2023 10:25:00 AM
Matrix: Soil

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42383			Analyst: AP
Diesel Range Organics	538	55.8	14.7		mg/Kg-dry	1	12/19/23 21:37:38
Heavy Oil	90.0	112	20.3	J	mg/Kg-dry	1	12/19/23 21:37:38
Total Petroleum Hydrocarbons	628	167	35.0		mg/Kg-dry	1	12/19/23 21:37:38
Surr: 2-Fluorobiphenyl	105	50 - 150			%Rec	1	12/19/23 21:37:38
Surr: o-Terphenyl	111	50 - 150			%Rec	1	12/19/23 21:37:38
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 42382			Analyst: RG
Naphthalene	0.0129	0.0221	0.00472	J	mg/Kg-dry	1	12/21/23 1:25:01
2-Methylnaphthalene	0.00563	0.0221	0.00416	J	mg/Kg-dry	1	12/21/23 1:25:01
1-Methylnaphthalene	1.23	0.0221	0.00340		mg/Kg-dry	1	12/21/23 1:25:01
Acenaphthylene	ND	0.0221	0.00324		mg/Kg-dry	1	12/21/23 1:25:01
Acenaphthene	0.473	0.0221	0.00406		mg/Kg-dry	1	12/21/23 1:25:01
Fluorene	0.450	0.0221	0.00276		mg/Kg-dry	1	12/21/23 1:25:01
Phenanthrene	1.47	0.0221	0.00618		mg/Kg-dry	1	12/21/23 1:25:01
Anthracene	0.201	0.0221	0.00297		mg/Kg-dry	1	12/21/23 1:25:01
Fluoranthene	0.0479	0.0221	0.00806		mg/Kg-dry	1	12/21/23 1:25:01
Pyrene	0.164	0.0442	0.0101		mg/Kg-dry	1	12/21/23 1:25:01
Benz(a)anthracene	0.0255	0.0221	0.00785		mg/Kg-dry	1	12/21/23 1:25:01
Chrysene	0.0394	0.0221	0.00386		mg/Kg-dry	1	12/21/23 1:25:01
Benzo(b)fluoranthene	ND	0.0276	0.00852		mg/Kg-dry	1	12/21/23 1:25:01
Benzo(k)fluoranthene	ND	0.0276	0.00970		mg/Kg-dry	1	12/21/23 1:25:01
Benzo(a)pyrene	0.0128	0.0331	0.0101	J	mg/Kg-dry	1	12/21/23 1:25:01
Indeno(1,2,3-cd)pyrene	ND	0.0442	0.00789		mg/Kg-dry	1	12/21/23 1:25:01
Dibenz(a,h)anthracene	ND	0.0552	0.0250		mg/Kg-dry	1	12/21/23 1:25:01
Benzo(g,h,i)perylene	ND	0.0552	0.0239		mg/Kg-dry	1	12/21/23 1:25:01
Surr: 2-Fluorobiphenyl	101	29.3 - 159	0		%Rec	1	12/21/23 1:25:01
Surr: Terphenyl-d14 (surr)	97.3	28.4 - 159	0		%Rec	1	12/21/23 1:25:01
Sample Moisture (Percent Moisture)				Batch ID: R88392			Analyst: MP
Percent Moisture	12.8	0.500	0.100		wt%	1	12/18/23 8:33:57

Fremont Analytical
An Alliance Technical Group Company

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/12/2023 10:40:00 AM
Project: LBP
Lab ID: 2312358-011
Matrix: Soil
Client Sample ID: B4-5

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42383			Analyst: AP
Diesel Range Organics	1,180	56.6	14.9		mg/Kg-dry	1	12/20/23 12:42:01
Heavy Oil	962	113	20.7		mg/Kg-dry	1	12/20/23 12:42:01
Total Petroleum Hydrocarbons	2,140	170	35.5		mg/Kg-dry	1	12/20/23 12:42:01
Surr: 2-Fluorobiphenyl	110	50 - 150			%Rec	1	12/20/23 12:42:01
Surr: o-Terphenyl	126	50 - 150			%Rec	1	12/20/23 12:42:01

NOTES:
Chromatographic pattern indicates a continuous distribution of material in the diesel and oil ranges. Pattern resembles a fuel oil (Bunker C)

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 42383			Analyst: AP
Gasoline	ND	34.0	14.9		mg/Kg-dry	1	12/20/23 12:42:01
Mineral Spirits	ND	56.6	14.9		mg/Kg-dry	1	12/20/23 12:42:01
Kerosene	ND	56.6	14.9		mg/Kg-dry	1	12/20/23 12:42:01
Diesel (Fuel Oil)	DETECT	56.6	14.9		mg/Kg-dry	1	12/20/23 12:42:01
Heavy Oil	DETECT	113	24.7		mg/Kg-dry	1	12/20/23 12:42:01
Mineral Oil	ND	113	14.9		mg/Kg-dry	1	12/20/23 12:42:01
Surr: 2-Fluorobiphenyl	110	50 - 150			%Rec	1	12/20/23 12:42:01
Surr: o-Terphenyl	126	50 - 150			%Rec	1	12/20/23 12:42:01

NOTES:
Chromatographic pattern indicates a continuous distribution of material in the diesel and oil ranges. Pattern resembles a fuel oil (Bunker C)

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 42382			Analyst: RG
Naphthalene	0.621	0.227	0.0485	D	mg/Kg-dry	10	12/21/23 2:50:50
2-Methylnaphthalene	5.78	0.227	0.0427	D	mg/Kg-dry	10	12/21/23 2:50:50
1-Methylnaphthalene	5.14	0.227	0.0349	D	mg/Kg-dry	10	12/21/23 2:50:50
Acenaphthylene	ND	0.227	0.0333	D	mg/Kg-dry	10	12/21/23 2:50:50
Acenaphthene	0.947	0.227	0.0417	D	mg/Kg-dry	10	12/21/23 2:50:50
Fluorene	0.887	0.227	0.0284	D	mg/Kg-dry	10	12/21/23 2:50:50
Phenanthrene	3.01	0.227	0.0634	D	mg/Kg-dry	10	12/21/23 2:50:50
Anthracene	0.368	0.227	0.0305	D	mg/Kg-dry	10	12/21/23 2:50:50
Fluoranthene	0.132	0.227	0.0828	DJ	mg/Kg-dry	10	12/21/23 2:50:50

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/12/2023 10:40:00 AM
Project: LBP
Lab ID: 2312358-011
Matrix: Soil
Client Sample ID: **B4-5**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 42382			Analyst: RG
Pyrene	ND	0.454	0.104	D	mg/Kg-dry	10	12/21/23 2:50:50
Benz(a)anthracene	0.116	0.227	0.0806	DJ	mg/Kg-dry	10	12/21/23 2:50:50
Chrysene	0.134	0.227	0.0397	DJ	mg/Kg-dry	10	12/21/23 2:50:50
Benzo(b)fluoranthene	ND	0.284	0.0875	D	mg/Kg-dry	10	12/21/23 2:50:50
Benzo(k)fluoranthene	ND	0.284	0.0997	D	mg/Kg-dry	10	12/21/23 2:50:50
Benzo(a)pyrene	ND	0.340	0.104	D	mg/Kg-dry	10	12/21/23 2:50:50
Indeno(1,2,3-cd)pyrene	ND	0.454	0.0810	D	mg/Kg-dry	10	12/21/23 2:50:50
Dibenz(a,h)anthracene	ND	0.567	0.257	D	mg/Kg-dry	10	12/21/23 2:50:50
Benzo(g,h,i)perylene	ND	0.567	0.246	D	mg/Kg-dry	10	12/21/23 2:50:50
Surr: 2-Fluorobiphenyl	106	29.3 - 159	0	D	%Rec	10	12/21/23 2:50:50
Surr: Terphenyl-d14 (surr)	104	28.4 - 159	0	D	%Rec	10	12/21/23 2:50:50

NOTES:
Diluted due to matrix.

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Sample Moisture (Percent Moisture)				Batch ID: R88392			Analyst: MP
Percent Moisture	14.8	0.500	0.100		wt%	1	12/18/23 8:33:57

Fremont Analytical
An Alliance Technical Group Company

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Project: LBP
Lab ID: 2312358-012
Client Sample ID: B4-10

Collection Date: 12/12/2023 10:45:00 AM
Matrix: Soil

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42383			Analyst: AP
Diesel Range Organics	422	53.3	14.0		mg/Kg-dry	1	12/20/23 13:25:46
Heavy Oil	131	107	19.4		mg/Kg-dry	1	12/20/23 13:25:46
Total Petroleum Hydrocarbons	554	160	33.5		mg/Kg-dry	1	12/20/23 13:25:46
Surr: 2-Fluorobiphenyl	100	50 - 150			%Rec	1	12/20/23 13:25:46
Surr: o-Terphenyl	112	50 - 150			%Rec	1	12/20/23 13:25:46

NOTES:
Chromatographic pattern indicates a continuous distribution of material in the diesel and oil ranges. Pattern resembles a fuel oil (Bunker C)

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 42383			Analyst: AP
Gasoline	ND	32.0	14.0		mg/Kg-dry	1	12/20/23 13:25:46
Mineral Spirits	ND	53.3	14.0		mg/Kg-dry	1	12/20/23 13:25:46
Kerosene	ND	53.3	14.0		mg/Kg-dry	1	12/20/23 13:25:46
Diesel (Fuel Oil)	DETECT	53.3	14.0		mg/Kg-dry	1	12/20/23 13:25:46
Heavy Oil	DETECT	107	23.2		mg/Kg-dry	1	12/20/23 13:25:46
Mineral Oil	ND	107	14.0		mg/Kg-dry	1	12/20/23 13:25:46
Surr: 2-Fluorobiphenyl	100	50 - 150			%Rec	1	12/20/23 13:25:46
Surr: o-Terphenyl	112	50 - 150			%Rec	1	12/20/23 13:25:46

NOTES:
Chromatographic pattern indicates a continuous distribution of material in the diesel and oil ranges. Pattern resembles a fuel oil (Bunker C)

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 42382			Analyst: RG
Naphthalene	0.0213	0.0210	0.00448		mg/Kg-dry	1	12/21/23 1:53:41
2-Methylnaphthalene	0.437	0.0210	0.00395		mg/Kg-dry	1	12/21/23 1:53:41
1-Methylnaphthalene	1.17	0.0210	0.00323		mg/Kg-dry	1	12/21/23 1:53:41
Acenaphthylene	ND	0.0210	0.00308		mg/Kg-dry	1	12/21/23 1:53:41
Acenaphthene	0.349	0.0210	0.00386		mg/Kg-dry	1	12/21/23 1:53:41
Fluorene	0.326	0.0210	0.00262		mg/Kg-dry	1	12/21/23 1:53:41
Phenanthrene	1.28	0.0210	0.00586		mg/Kg-dry	1	12/21/23 1:53:41
Anthracene	0.173	0.0210	0.00282		mg/Kg-dry	1	12/21/23 1:53:41
Fluoranthene	0.0562	0.0210	0.00765		mg/Kg-dry	1	12/21/23 1:53:41

Analytical Report

Fremont Analytical — An Alliance Technical Group Company

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/12/2023 10:45:00 AM
Project: LBP
Lab ID: 2312358-012
Matrix: Soil
Client Sample ID: **B4-10**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 42382			Analyst: RG
Pyrene	0.199	0.0420	0.00959		mg/Kg-dry	1	12/21/23 1:53:41
Benz(a)anthracene	0.0330	0.0210	0.00745		mg/Kg-dry	1	12/21/23 1:53:41
Chrysene	0.0584	0.0210	0.00367		mg/Kg-dry	1	12/21/23 1:53:41
Benzo(b)fluoranthene	ND	0.0262	0.00809		mg/Kg-dry	1	12/21/23 1:53:41
Benzo(k)fluoranthene	ND	0.0262	0.00922		mg/Kg-dry	1	12/21/23 1:53:41
Benzo(a)pyrene	0.0204	0.0315	0.00962	J	mg/Kg-dry	1	12/21/23 1:53:41
Indeno(1,2,3-cd)pyrene	ND	0.0420	0.00749		mg/Kg-dry	1	12/21/23 1:53:41
Dibenz(a,h)anthracene	ND	0.0525	0.0238		mg/Kg-dry	1	12/21/23 1:53:41
Benzo(g,h,i)perylene	ND	0.0525	0.0227		mg/Kg-dry	1	12/21/23 1:53:41
Surr: 2-Fluorobiphenyl	99.8	29.3 - 159	0		%Rec	1	12/21/23 1:53:41
Surr: Terphenyl-d14 (surr)	97.4	28.4 - 159	0		%Rec	1	12/21/23 1:53:41
Sample Moisture (Percent Moisture)				Batch ID: R88392			Analyst: MP
Percent Moisture	11.7	0.500	0.100		wt%	1	12/18/23 8:33:57

Analytical Report

Fremont Analytical — An Alliance Technical Group Company

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers **Collection Date:** 12/12/2023 11:50:00 AM
Project: LBP
Lab ID: 2312358-015 **Matrix:** Soil
Client Sample ID: B5-6

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 42383			Analyst: AP
Gasoline	ND	34.7	15.2		mg/Kg-dry	1	12/19/23 22:10:18
Mineral Spirits	ND	57.9	15.2		mg/Kg-dry	1	12/19/23 22:10:18
Kerosene	ND	57.9	15.2		mg/Kg-dry	1	12/19/23 22:10:18
Diesel (Fuel Oil)	ND	57.9	15.2		mg/Kg-dry	1	12/19/23 22:10:18
Heavy Oil	ND	116	25.2		mg/Kg-dry	1	12/19/23 22:10:18
Mineral Oil	ND	116	15.2		mg/Kg-dry	1	12/19/23 22:10:18
Surr: 2-Fluorobiphenyl	83.0	50 - 150			%Rec	1	12/19/23 22:10:18
Surr: o-Terphenyl	86.1	50 - 150			%Rec	1	12/19/23 22:10:18
Sample Moisture (Percent Moisture)				Batch ID: R88392			Analyst: MP
Percent Moisture	18.9	0.500	0.100		wt%	1	12/18/23 8:33:57

Analytical Report

Fremont Analytical — An Alliance Technical Group Company

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/12/2023 1:00:00 PM
Project: LBP
Lab ID: 2312358-017
Matrix: Soil
Client Sample ID: **B6-6**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 42383			Analyst: AP
Gasoline	ND	33.9	14.9		mg/Kg-dry	1	12/19/23 22:21:21
Mineral Spirits	ND	56.5	14.9		mg/Kg-dry	1	12/19/23 22:21:21
Kerosene	ND	56.5	14.9		mg/Kg-dry	1	12/19/23 22:21:21
Diesel (Fuel Oil)	ND	56.5	14.9		mg/Kg-dry	1	12/19/23 22:21:21
Heavy Oil	ND	113	24.6		mg/Kg-dry	1	12/19/23 22:21:21
Mineral Oil	ND	113	14.9		mg/Kg-dry	1	12/19/23 22:21:21
Surr: 2-Fluorobiphenyl	101	50 - 150			%Rec	1	12/19/23 22:21:21
Surr: o-Terphenyl	102	50 - 150			%Rec	1	12/19/23 22:21:21
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 42382			Analyst: RG
Naphthalene	ND	0.0228	0.00486		mg/Kg-dry	1	12/20/23 21:07:18
2-Methylnaphthalene	ND	0.0228	0.00429		mg/Kg-dry	1	12/20/23 21:07:18
1-Methylnaphthalene	ND	0.0228	0.00350		mg/Kg-dry	1	12/20/23 21:07:18
Acenaphthylene	ND	0.0228	0.00334		mg/Kg-dry	1	12/20/23 21:07:18
Acenaphthene	ND	0.0228	0.00419		mg/Kg-dry	1	12/20/23 21:07:18
Fluorene	ND	0.0228	0.00285		mg/Kg-dry	1	12/20/23 21:07:18
Phenanthrene	ND	0.0228	0.00636		mg/Kg-dry	1	12/20/23 21:07:18
Anthracene	ND	0.0228	0.00306		mg/Kg-dry	1	12/20/23 21:07:18
Fluoranthene	ND	0.0228	0.00830		mg/Kg-dry	1	12/20/23 21:07:18
Pyrene	ND	0.0455	0.0104		mg/Kg-dry	1	12/20/23 21:07:18
Benz(a)anthracene	ND	0.0228	0.00809		mg/Kg-dry	1	12/20/23 21:07:18
Chrysene	ND	0.0228	0.00398		mg/Kg-dry	1	12/20/23 21:07:18
Benzo(b)fluoranthene	ND	0.0285	0.00878		mg/Kg-dry	1	12/20/23 21:07:18
Benzo(k)fluoranthene	ND	0.0285	0.0100		mg/Kg-dry	1	12/20/23 21:07:18
Benzo(a)pyrene	ND	0.0341	0.0104		mg/Kg-dry	1	12/20/23 21:07:18
Indeno(1,2,3-cd)pyrene	ND	0.0455	0.00813		mg/Kg-dry	1	12/20/23 21:07:18
Dibenz(a,h)anthracene	ND	0.0569	0.0258		mg/Kg-dry	1	12/20/23 21:07:18
Benzo(g,h,i)perylene	ND	0.0569	0.0247		mg/Kg-dry	1	12/20/23 21:07:18
Surr: 2-Fluorobiphenyl	89.4	29.3 - 159	0		%Rec	1	12/20/23 21:07:18
Surr: Terphenyl-d14 (surr)	88.1	28.4 - 159	0		%Rec	1	12/20/23 21:07:18

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Project: LBP
Lab ID: 2312358-017
Client Sample ID: **B6-6**

Collection Date: 12/12/2023 1:00:00 PM
Matrix: Soil

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Sample Moisture (Percent Moisture)				Batch ID: R88392			Analyst: MP
Percent Moisture	14.3	0.500	0.100		wt%	1	12/18/23 8:33:57

Analytical Report

Fremont Analytical — An Alliance Technical Group Company

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/12/2023 1:05:00 PM
Project: LBP
Lab ID: 2312358-018
Matrix: Soil
Client Sample ID: **B6-8**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 42383			Analyst: AP
Gasoline	ND	37.0	16.2		mg/Kg-dry	1	12/19/23 22:32:14
Mineral Spirits	ND	61.7	16.2		mg/Kg-dry	1	12/19/23 22:32:14
Kerosene	ND	61.7	16.2		mg/Kg-dry	1	12/19/23 22:32:14
Diesel (Fuel Oil)	ND	61.7	16.2		mg/Kg-dry	1	12/19/23 22:32:14
Heavy Oil	ND	123	26.9		mg/Kg-dry	1	12/19/23 22:32:14
Mineral Oil	ND	123	16.2		mg/Kg-dry	1	12/19/23 22:32:14
Surr: 2-Fluorobiphenyl	90.0	50 - 150			%Rec	1	12/19/23 22:32:14
Surr: o-Terphenyl	93.2	50 - 150			%Rec	1	12/19/23 22:32:14
Sample Moisture (Percent Moisture)				Batch ID: R88392			Analyst: MP
Percent Moisture	22.5	0.500	0.100		wt%	1	12/18/23 8:33:57

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/12/2023 2:00:00 PM
Project: LBP
Lab ID: 2312358-025
Matrix: Soil
Client Sample ID: **B9-4**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42465			Analyst: SK
Diesel Range Organics	ND	56.7	14.9	H	mg/Kg-dry	1	12/30/23 4:12:18
Heavy Oil	64.5	113	20.7	JH	mg/Kg-dry	1	12/30/23 4:12:18
Total Petroleum Hydrocarbons	64.5	170	35.6	JH	mg/Kg-dry	1	12/30/23 4:12:18
Surr: 2-Fluorobiphenyl	70.9	50 - 150		H	%Rec	1	12/30/23 4:12:18
Surr: o-Terphenyl	82.2	50 - 150		H	%Rec	1	12/30/23 4:12:18
Sample Moisture (Percent Moisture)				Batch ID: R88590			Analyst: MP
Percent Moisture	17.0	0.500	0.100		wt%	1	12/28/23 8:20:34

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Project: LBP
Lab ID: 2312358-026
Client Sample ID: **B9-6**

Collection Date: 12/12/2023 2:05:00 PM
Matrix: Soil

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42383			Analyst: AP
Diesel Range Organics	ND	58.7	15.4		mg/Kg-dry	1	12/19/23 22:43:08
Heavy Oil	37.7	117	21.4	J	mg/Kg-dry	1	12/19/23 22:43:08
Total Petroleum Hydrocarbons	37.7	176	36.8	J	mg/Kg-dry	1	12/19/23 22:43:08
Surr: 2-Fluorobiphenyl	81.4	50 - 150			%Rec	1	12/19/23 22:43:08
Surr: o-Terphenyl	81.2	50 - 150			%Rec	1	12/19/23 22:43:08
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 42382			Analyst: RG
Naphthalene	ND	0.0231	0.00494		mg/Kg-dry	1	12/20/23 21:36:01
2-Methylnaphthalene	ND	0.0231	0.00436		mg/Kg-dry	1	12/20/23 21:36:01
1-Methylnaphthalene	ND	0.0231	0.00356		mg/Kg-dry	1	12/20/23 21:36:01
Acenaphthylene	ND	0.0231	0.00340		mg/Kg-dry	1	12/20/23 21:36:01
Acenaphthene	ND	0.0231	0.00426		mg/Kg-dry	1	12/20/23 21:36:01
Fluorene	ND	0.0231	0.00289		mg/Kg-dry	1	12/20/23 21:36:01
Phenanthrene	ND	0.0231	0.00647		mg/Kg-dry	1	12/20/23 21:36:01
Anthracene	ND	0.0231	0.00311		mg/Kg-dry	1	12/20/23 21:36:01
Fluoranthene	ND	0.0231	0.00844		mg/Kg-dry	1	12/20/23 21:36:01
Pyrene	ND	0.0463	0.0106		mg/Kg-dry	1	12/20/23 21:36:01
Benz(a)anthracene	ND	0.0231	0.00822		mg/Kg-dry	1	12/20/23 21:36:01
Chrysene	ND	0.0231	0.00405		mg/Kg-dry	1	12/20/23 21:36:01
Benzo(b)fluoranthene	ND	0.0289	0.00893		mg/Kg-dry	1	12/20/23 21:36:01
Benzo(k)fluoranthene	ND	0.0289	0.0102		mg/Kg-dry	1	12/20/23 21:36:01
Benzo(a)pyrene	ND	0.0347	0.0106		mg/Kg-dry	1	12/20/23 21:36:01
Indeno(1,2,3-cd)pyrene	ND	0.0463	0.00826		mg/Kg-dry	1	12/20/23 21:36:01
Dibenz(a,h)anthracene	ND	0.0578	0.0262		mg/Kg-dry	1	12/20/23 21:36:01
Benzo(g,h,i)perylene	ND	0.0578	0.0251		mg/Kg-dry	1	12/20/23 21:36:01
Surr: 2-Fluorobiphenyl	97.7	29.3 - 159	0		%Rec	1	12/20/23 21:36:01
Surr: Terphenyl-d14 (surr)	99.4	28.4 - 159	0		%Rec	1	12/20/23 21:36:01
Sample Moisture (Percent Moisture)				Batch ID: R88392			Analyst: MP
Percent Moisture	16.2	0.500	0.100		wt%	1	12/18/23 8:33:57

Analytical Report

Fremont Analytical — An Alliance Technical Group Company

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/12/2023 9:35:00 AM
Project: LBP
Lab ID: 2312358-030
Matrix: Soil
Client Sample ID: **B12-1**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42383			Analyst: AP
Diesel Range Organics	ND	55.7	14.6		mg/Kg-dry	1	12/19/23 22:54:02
Heavy Oil	34.0	111	20.3	J	mg/Kg-dry	1	12/19/23 22:54:02
Total Petroleum Hydrocarbons	ND	167	34.9		mg/Kg-dry	1	12/19/23 22:54:02
Surr: 2-Fluorobiphenyl	73.7	50 - 150			%Rec	1	12/19/23 22:54:02
Surr: o-Terphenyl	72.2	50 - 150			%Rec	1	12/19/23 22:54:02
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 42382			Analyst: RG
Naphthalene	ND	0.0229	0.00489		mg/Kg-dry	1	12/20/23 23:01:57
2-Methylnaphthalene	ND	0.0229	0.00431		mg/Kg-dry	1	12/20/23 23:01:57
1-Methylnaphthalene	ND	0.0229	0.00352		mg/Kg-dry	1	12/20/23 23:01:57
Acenaphthylene	ND	0.0229	0.00336		mg/Kg-dry	1	12/20/23 23:01:57
Acenaphthene	ND	0.0229	0.00421		mg/Kg-dry	1	12/20/23 23:01:57
Fluorene	ND	0.0229	0.00286		mg/Kg-dry	1	12/20/23 23:01:57
Phenanthrene	ND	0.0229	0.00640		mg/Kg-dry	1	12/20/23 23:01:57
Anthracene	ND	0.0229	0.00307		mg/Kg-dry	1	12/20/23 23:01:57
Fluoranthene	ND	0.0229	0.00835		mg/Kg-dry	1	12/20/23 23:01:57
Pyrene	ND	0.0458	0.0105		mg/Kg-dry	1	12/20/23 23:01:57
Benz(a)anthracene	ND	0.0229	0.00813		mg/Kg-dry	1	12/20/23 23:01:57
Chrysene	ND	0.0229	0.00400		mg/Kg-dry	1	12/20/23 23:01:57
Benzo(b)fluoranthene	ND	0.0286	0.00883		mg/Kg-dry	1	12/20/23 23:01:57
Benzo(k)fluoranthene	ND	0.0286	0.0101		mg/Kg-dry	1	12/20/23 23:01:57
Benzo(a)pyrene	ND	0.0343	0.0105		mg/Kg-dry	1	12/20/23 23:01:57
Indeno(1,2,3-cd)pyrene	ND	0.0458	0.00817		mg/Kg-dry	1	12/20/23 23:01:57
Dibenz(a,h)anthracene	ND	0.0572	0.0259		mg/Kg-dry	1	12/20/23 23:01:57
Benzo(g,h,i)perylene	ND	0.0572	0.0248		mg/Kg-dry	1	12/20/23 23:01:57
Surr: 2-Fluorobiphenyl	98.6	29.3 - 159	0		%Rec	1	12/20/23 23:01:57
Surr: Terphenyl-d14 (surr)	97.3	28.4 - 159	0		%Rec	1	12/20/23 23:01:57
Sample Moisture (Percent Moisture)				Batch ID: R88392			Analyst: MP
Percent Moisture	15.8	0.500	0.100		wt%	1	12/18/23 8:33:57

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Project: LBP
Lab ID: 2312358-031
Client Sample ID: **B12-2**
Collection Date: 12/13/2023 9:40:00 AM
Matrix: Soil

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42465			Analyst: SK
Diesel Range Organics	ND	52.5	13.8	H	mg/Kg-dry	1	12/30/23 4:33:58
Heavy Oil	ND	105	19.2	H	mg/Kg-dry	1	12/30/23 4:33:58
Total Petroleum Hydrocarbons	ND	158	33.0	H	mg/Kg-dry	1	12/30/23 4:33:58
Surr: 2-Fluorobiphenyl	108	50 - 150		H	%Rec	1	12/30/23 4:33:58
Surr: o-Terphenyl	112	50 - 150		H	%Rec	1	12/30/23 4:33:58
Sample Moisture (Percent Moisture)				Batch ID: R88590			Analyst: MP
Percent Moisture	11.6	0.500	0.100		wt%	1	12/28/23 8:20:34

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/13/2023 9:45:00 AM
Project: LBP
Lab ID: 2312358-032
Matrix: Soil
Client Sample ID: **B12-8**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42465			Analyst: SK
Diesel Range Organics	ND	53.5	14.1	H	mg/Kg-dry	1	12/30/23 5:06:17
Heavy Oil	ND	107	19.5	H	mg/Kg-dry	1	12/30/23 5:06:17
Total Petroleum Hydrocarbons	ND	161	33.6	H	mg/Kg-dry	1	12/30/23 5:06:17
Surr: 2-Fluorobiphenyl	96.1	50 - 150		H	%Rec	1	12/30/23 5:06:17
Surr: o-Terphenyl	99.9	50 - 150		H	%Rec	1	12/30/23 5:06:17
Sample Moisture (Percent Moisture)				Batch ID: R88590			Analyst: MP
Percent Moisture	12.5	0.500	0.100		wt%	1	12/28/23 8:20:34

Analytical Report

Fremont Analytical — An Alliance Technical Group Company

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/13/2023 10:35:00 AM
Project: LBP
Lab ID: 2312358-036
Matrix: Soil
Client Sample ID: **B14-3**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42465			Analyst: SK
Diesel Range Organics	ND	55.1	14.5	H	mg/Kg-dry	1	12/30/23 5:17:05
Heavy Oil	ND	110	20.1	H	mg/Kg-dry	1	12/30/23 5:17:05
Total Petroleum Hydrocarbons	ND	165	34.6	H	mg/Kg-dry	1	12/30/23 5:17:05
Surr: 2-Fluorobiphenyl	79.8	50 - 150		H	%Rec	1	12/30/23 5:17:05
Surr: o-Terphenyl	90.4	50 - 150		H	%Rec	1	12/30/23 5:17:05
Sample Moisture (Percent Moisture)				Batch ID: R88590			Analyst: MP
Percent Moisture	13.9	0.500	0.100		wt%	1	12/28/23 8:20:34

Fremont Analytical

An Alliance Technical Group Company

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/13/2023 10:40:00 AM
Project: LBP
Lab ID: 2312358-037
Matrix: Soil
Client Sample ID: B14-6

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42383			Analyst: AP
Diesel Range Organics	ND	56.1	14.7		mg/Kg-dry	1	12/19/23 23:04:54
Heavy Oil	ND	112	20.4		mg/Kg-dry	1	12/19/23 23:04:54
Total Petroleum Hydrocarbons	ND	168	35.2		mg/Kg-dry	1	12/19/23 23:04:54
Surr: 2-Fluorobiphenyl	102	50 - 150			%Rec	1	12/19/23 23:04:54
Surr: o-Terphenyl	104	50 - 150			%Rec	1	12/19/23 23:04:54
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 42382			Analyst: RG
Naphthalene	ND	0.0241	0.00515		mg/Kg-dry	1	12/20/23 23:30:34
2-Methylnaphthalene	ND	0.0241	0.00454		mg/Kg-dry	1	12/20/23 23:30:34
1-Methylnaphthalene	ND	0.0241	0.00371		mg/Kg-dry	1	12/20/23 23:30:34
Acenaphthylene	ND	0.0241	0.00354		mg/Kg-dry	1	12/20/23 23:30:34
Acenaphthene	ND	0.0241	0.00444		mg/Kg-dry	1	12/20/23 23:30:34
Fluorene	ND	0.0241	0.00302		mg/Kg-dry	1	12/20/23 23:30:34
Phenanthrene	ND	0.0241	0.00674		mg/Kg-dry	1	12/20/23 23:30:34
Anthracene	ND	0.0241	0.00324		mg/Kg-dry	1	12/20/23 23:30:34
Fluoranthene	ND	0.0241	0.00880		mg/Kg-dry	1	12/20/23 23:30:34
Pyrene	ND	0.0482	0.0110		mg/Kg-dry	1	12/20/23 23:30:34
Benz(a)anthracene	ND	0.0241	0.00857		mg/Kg-dry	1	12/20/23 23:30:34
Chrysene	ND	0.0241	0.00422		mg/Kg-dry	1	12/20/23 23:30:34
Benzo(b)fluoranthene	ND	0.0302	0.00930		mg/Kg-dry	1	12/20/23 23:30:34
Benzo(k)fluoranthene	ND	0.0302	0.0106		mg/Kg-dry	1	12/20/23 23:30:34
Benzo(a)pyrene	ND	0.0362	0.0111		mg/Kg-dry	1	12/20/23 23:30:34
Indeno(1,2,3-cd)pyrene	ND	0.0482	0.00861		mg/Kg-dry	1	12/20/23 23:30:34
Dibenz(a,h)anthracene	ND	0.0603	0.0273		mg/Kg-dry	1	12/20/23 23:30:34
Benzo(g,h,i)perylene	ND	0.0603	0.0261		mg/Kg-dry	1	12/20/23 23:30:34
Surr: 2-Fluorobiphenyl	98.1	29.3 - 159	0		%Rec	1	12/20/23 23:30:34
Surr: Terphenyl-d14 (surr)	96.6	28.4 - 159	0		%Rec	1	12/20/23 23:30:34
Sample Moisture (Percent Moisture)				Batch ID: R88392			Analyst: MP
Percent Moisture	18.8	0.500	0.100		wt%	1	12/18/23 8:33:57

Fremont Analytical
An Alliance Technical Group Company

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Project: LBP
Lab ID: 2312358-043
Client Sample ID: **B17-2**

Collection Date: 12/13/2023 11:30:00 AM
Matrix: Soil

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42465			Analyst: SK
Diesel Range Organics	ND	49.8	13.1	H	mg/Kg-dry	1	12/30/23 5:28:00
Heavy Oil	ND	99.5	18.2	H	mg/Kg-dry	1	12/30/23 5:28:00
Total Petroleum Hydrocarbons	ND	149	31.2	H	mg/Kg-dry	1	12/30/23 5:28:00
Surr: 2-Fluorobiphenyl	112	50 - 150		H	%Rec	1	12/30/23 5:28:00
Surr: o-Terphenyl	114	50 - 150		H	%Rec	1	12/30/23 5:28:00
Sample Moisture (Percent Moisture)				Batch ID: R88590			Analyst: MP
Percent Moisture	11.5	0.500	0.100		wt%	1	12/28/23 8:20:34

Analytical Report

Fremont Analytical — An Alliance Technical Group Company

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/13/2023 11:35:00 AM
Project: LBP
Lab ID: 2312358-044
Matrix: Soil
Client Sample ID: **B17-7.5**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 42383			Analyst: AP
Gasoline	ND	34.8	15.3		mg/Kg-dry	1	12/19/23 23:15:49
Mineral Spirits	ND	58.1	15.3		mg/Kg-dry	1	12/19/23 23:15:49
Kerosene	ND	58.1	15.3		mg/Kg-dry	1	12/19/23 23:15:49
Diesel (Fuel Oil)	ND	58.1	15.3		mg/Kg-dry	1	12/19/23 23:15:49
Heavy Oil	ND	116	25.3		mg/Kg-dry	1	12/19/23 23:15:49
Mineral Oil	ND	116	15.3		mg/Kg-dry	1	12/19/23 23:15:49
Surr: 2-Fluorobiphenyl	82.3	50 - 150			%Rec	1	12/19/23 23:15:49
Surr: o-Terphenyl	91.5	50 - 150			%Rec	1	12/19/23 23:15:49
Sample Moisture (Percent Moisture)				Batch ID: R88392			Analyst: MP
Percent Moisture	14.6	0.500	0.100		wt%	1	12/18/23 8:33:57

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/13/2023 12:20:00 PM
Project: LBP
Lab ID: 2312358-045
Matrix: Soil
Client Sample ID: B18-2

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 42383			Analyst: AP
Gasoline	ND	32.9	14.4		mg/Kg-dry	1	12/19/23 23:26:52
Mineral Spirits	ND	54.9	14.4		mg/Kg-dry	1	12/19/23 23:26:52
Kerosene	ND	54.9	14.4		mg/Kg-dry	1	12/19/23 23:26:52
Diesel (Fuel Oil)	ND	54.9	14.4		mg/Kg-dry	1	12/19/23 23:26:52
Heavy Oil	ND	110	23.9		mg/Kg-dry	1	12/19/23 23:26:52
Mineral Oil	ND	110	14.4		mg/Kg-dry	1	12/19/23 23:26:52
Surr: 2-Fluorobiphenyl	68.1	50 - 150			%Rec	1	12/19/23 23:26:52
Surr: o-Terphenyl	77.1	50 - 150			%Rec	1	12/19/23 23:26:52
Sample Moisture (Percent Moisture)				Batch ID: R88392			Analyst: MP
Percent Moisture	12.1	0.500	0.100		wt%	1	12/18/23 8:33:57

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/13/2023 12:25:00 PM
Project: LBP
Lab ID: 2312358-046
Matrix: Soil
Client Sample ID: **B18-8**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42465			Analyst: SK
Diesel Range Organics	ND	53.6	14.1	H	mg/Kg-dry	1	12/30/23 5:38:46
Heavy Oil	ND	107	19.5	H	mg/Kg-dry	1	12/30/23 5:38:46
Total Petroleum Hydrocarbons	ND	161	33.6	H	mg/Kg-dry	1	12/30/23 5:38:46
Surr: 2-Fluorobiphenyl	99.2	50 - 150		H	%Rec	1	12/30/23 5:38:46
Surr: o-Terphenyl	102	50 - 150		H	%Rec	1	12/30/23 5:38:46
Sample Moisture (Percent Moisture)				Batch ID: R88590			Analyst: MP
Percent Moisture	13.6	0.500	0.100		wt%	1	12/28/23 8:20:34

Analytical Report

Fremont Analytical — An Alliance Technical Group Company

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/13/2023 12:35:00 PM
Project: LBP
Lab ID: 2312358-048
Matrix: Soil
Client Sample ID: **B19-3.5**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42383			Analyst: AP
Diesel Range Organics	ND	56.5	14.9		mg/Kg-dry	1	12/20/23 0:32:16
Heavy Oil	ND	113	20.6		mg/Kg-dry	1	12/20/23 0:32:16
Total Petroleum Hydrocarbons	ND	170	35.5		mg/Kg-dry	1	12/20/23 0:32:16
Surr: 2-Fluorobiphenyl	107	50 - 150			%Rec	1	12/20/23 0:32:16
Surr: o-Terphenyl	110	50 - 150			%Rec	1	12/20/23 0:32:16
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 42383			Analyst: AP
Gasoline	ND	33.9	14.9		mg/Kg-dry	1	12/20/23 0:32:16
Mineral Spirits	ND	56.5	14.9		mg/Kg-dry	1	12/20/23 0:32:16
Kerosene	ND	56.5	14.9		mg/Kg-dry	1	12/20/23 0:32:16
Diesel (Fuel Oil)	ND	56.5	14.9		mg/Kg-dry	1	12/20/23 0:32:16
Heavy Oil	ND	113	24.6		mg/Kg-dry	1	12/20/23 0:32:16
Mineral Oil	ND	113	14.9		mg/Kg-dry	1	12/20/23 0:32:16
Surr: 2-Fluorobiphenyl	107	50 - 150			%Rec	1	12/20/23 0:32:16
Surr: o-Terphenyl	110	50 - 150			%Rec	1	12/20/23 0:32:16
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 42382			Analyst: RG
Naphthalene	ND	0.0216	0.00461		mg/Kg-dry	1	12/20/23 23:59:10
2-Methylnaphthalene	ND	0.0216	0.00407		mg/Kg-dry	1	12/20/23 23:59:10
1-Methylnaphthalene	ND	0.0216	0.00332		mg/Kg-dry	1	12/20/23 23:59:10
Acenaphthylene	ND	0.0216	0.00317		mg/Kg-dry	1	12/20/23 23:59:10
Acenaphthene	ND	0.0216	0.00397		mg/Kg-dry	1	12/20/23 23:59:10
Fluorene	ND	0.0216	0.00270		mg/Kg-dry	1	12/20/23 23:59:10
Phenanthrene	ND	0.0216	0.00603		mg/Kg-dry	1	12/20/23 23:59:10
Anthracene	ND	0.0216	0.00290		mg/Kg-dry	1	12/20/23 23:59:10
Fluoranthene	ND	0.0216	0.00788		mg/Kg-dry	1	12/20/23 23:59:10
Pyrene	ND	0.0432	0.00987		mg/Kg-dry	1	12/20/23 23:59:10
Benz(a)anthracene	ND	0.0216	0.00767		mg/Kg-dry	1	12/20/23 23:59:10
Chrysene	ND	0.0216	0.00378		mg/Kg-dry	1	12/20/23 23:59:10
Benzo(b)fluoranthene	ND	0.0270	0.00833		mg/Kg-dry	1	12/20/23 23:59:10

Analytical Report

Fremont Analytical — An Alliance Technical Group Company

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/13/2023 12:35:00 PM
Project: LBP
Lab ID: 2312358-048
Matrix: Soil
Client Sample ID: **B19-3.5**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 42382			Analyst: RG
Benzo(k)fluoranthene	ND	0.0270	0.00948		mg/Kg-dry	1	12/20/23 23:59:10
Benzo(a)pyrene	ND	0.0324	0.00990		mg/Kg-dry	1	12/20/23 23:59:10
Indeno(1,2,3-cd)pyrene	ND	0.0432	0.00771		mg/Kg-dry	1	12/20/23 23:59:10
Dibenz(a,h)anthracene	ND	0.0540	0.0245		mg/Kg-dry	1	12/20/23 23:59:10
Benzo(g,h,i)perylene	ND	0.0540	0.0234		mg/Kg-dry	1	12/20/23 23:59:10
Surr: 2-Fluorobiphenyl	92.8	29.3 - 159	0		%Rec	1	12/20/23 23:59:10
Surr: Terphenyl-d14 (surr)	89.9	28.4 - 159	0		%Rec	1	12/20/23 23:59:10
Sample Moisture (Percent Moisture)				Batch ID: R88392			Analyst: MP
Percent Moisture	13.2	0.500	0.100		wt%	1	12/18/23 8:33:57

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/13/2023 12:40:00 PM
Project: LBP
Lab ID: 2312358-049
Matrix: Soil
Client Sample ID: **B19-6.5**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42465			Analyst: SK
Diesel Range Organics	ND	58.7	15.4	H	mg/Kg-dry	1	12/30/23 5:49:36
Heavy Oil	ND	117	21.4	H	mg/Kg-dry	1	12/30/23 5:49:36
Total Petroleum Hydrocarbons	ND	176	36.9	H	mg/Kg-dry	1	12/30/23 5:49:36
Surr: 2-Fluorobiphenyl	75.3	50 - 150		H	%Rec	1	12/30/23 5:49:36
Surr: o-Terphenyl	82.9	50 - 150		H	%Rec	1	12/30/23 5:49:36
Sample Moisture (Percent Moisture)				Batch ID: R88590			Analyst: MP
Percent Moisture	15.6	0.500	0.100		wt%	1	12/28/23 8:20:34

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Project: LBP
Lab ID: 2312358-050
Client Sample ID: **B20-1**

Collection Date: 12/13/2023 12:45:00 PM
Matrix: Soil

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.					Batch ID: 42383		Analyst: AP
Diesel Range Organics	157	56.0	14.7		mg/Kg-dry	1	12/20/23 13:47:42
Heavy Oil	352	112	20.4		mg/Kg-dry	1	12/20/23 13:47:42
Total Petroleum Hydrocarbons	509	168	35.2		mg/Kg-dry	1	12/20/23 13:47:42
Surr: 2-Fluorobiphenyl	86.1	50 - 150			%Rec	1	12/20/23 13:47:42
Surr: o-Terphenyl	89.8	50 - 150			%Rec	1	12/20/23 13:47:42

NOTES:
Chromatographic pattern indicates a continuous distribution of material in the diesel and oil ranges. Pattern resembles a fuel oil (Bunker C)

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID					Batch ID: 42383		Analyst: AP
Gasoline	ND	33.6	14.7		mg/Kg-dry	1	12/20/23 13:47:42
Mineral Spirits	ND	56.0	14.7		mg/Kg-dry	1	12/20/23 13:47:42
Kerosene	ND	56.0	14.7		mg/Kg-dry	1	12/20/23 13:47:42
Diesel (Fuel Oil)	DETECT	56.0	14.7		mg/Kg-dry	1	12/20/23 13:47:42
Heavy Oil	DETECT	112	24.4		mg/Kg-dry	1	12/20/23 13:47:42
Mineral Oil	ND	112	14.7		mg/Kg-dry	1	12/20/23 13:47:42
Surr: 2-Fluorobiphenyl	86.1	50 - 150			%Rec	1	12/20/23 13:47:42
Surr: o-Terphenyl	89.8	50 - 150			%Rec	1	12/20/23 13:47:42

NOTES:
Chromatographic pattern indicates a continuous distribution of material in the diesel and oil ranges. Pattern resembles a fuel oil (Bunker C)

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Sample Moisture (Percent Moisture)					Batch ID: R88392		Analyst: MP
Percent Moisture	14.1	0.500	0.100		wt%	1	12/18/23 8:33:57

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Project: LBP
Lab ID: 2312358-051
Client Sample ID: **B20-3**

Collection Date: 12/13/2023 12:50:00 PM
Matrix: Soil

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42465			Analyst: SK
Diesel Range Organics	ND	53.8	14.1	H	mg/Kg-dry	1	12/30/23 6:00:21
Heavy Oil	ND	108	19.6	H	mg/Kg-dry	1	12/30/23 6:00:21
Total Petroleum Hydrocarbons	ND	161	33.8	H	mg/Kg-dry	1	12/30/23 6:00:21
Surr: 2-Fluorobiphenyl	117	50 - 150		H	%Rec	1	12/30/23 6:00:21
Surr: o-Terphenyl	124	50 - 150		H	%Rec	1	12/30/23 6:00:21
Sample Moisture (Percent Moisture)				Batch ID: R88590			Analyst: MP
Percent Moisture	15.6	0.500	0.100		wt%	1	12/28/23 8:20:34

Analytical Report

Fremont Analytical — An Alliance Technical Group Company

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Project: LBP
Lab ID: 2312358-057
Client Sample ID: **B22-3**

Collection Date: 12/14/2023 9:55:00 AM
Matrix: Soil

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42465			Analyst: SK
Diesel Range Organics	ND	55.8	14.7		mg/Kg-dry	1	12/30/23 6:11:07
Heavy Oil	ND	112	20.4		mg/Kg-dry	1	12/30/23 6:11:07
Total Petroleum Hydrocarbons	ND	168	35.0		mg/Kg-dry	1	12/30/23 6:11:07
Surr: 2-Fluorobiphenyl	85.7	50 - 150			%Rec	1	12/30/23 6:11:07
Surr: o-Terphenyl	92.0	50 - 150			%Rec	1	12/30/23 6:11:07
Sample Moisture (Percent Moisture)				Batch ID: R88590			Analyst: MP
Percent Moisture	11.3	0.500	0.100		wt%	1	12/28/23 8:20:34

Fremont Analytical
An Alliance Technical Group Company

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Project: LBP
Lab ID: 2312358-059
Client Sample ID: **B24-2.5**
Collection Date: 12/14/2023 10:05:00 AM
Matrix: Soil

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42383			Analyst: AP
Diesel Range Organics	468	60.4	15.9		mg/Kg-dry	1	12/20/23 14:31:46
Heavy Oil	386	121	22.0		mg/Kg-dry	1	12/20/23 14:31:46
Total Petroleum Hydrocarbons	854	181	37.9		mg/Kg-dry	1	12/20/23 14:31:46
Surr: 2-Fluorobiphenyl	104	50 - 150			%Rec	1	12/20/23 14:31:46
Surr: o-Terphenyl	113	50 - 150			%Rec	1	12/20/23 14:31:46
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 42382			Analyst: RG
Naphthalene	ND	0.0223	0.00477		mg/Kg-dry	1	12/21/23 0:27:49
2-Methylnaphthalene	ND	0.0223	0.00420		mg/Kg-dry	1	12/21/23 0:27:49
1-Methylnaphthalene	ND	0.0223	0.00343		mg/Kg-dry	1	12/21/23 0:27:49
Acenaphthylene	ND	0.0223	0.00327		mg/Kg-dry	1	12/21/23 0:27:49
Acenaphthene	ND	0.0223	0.00410		mg/Kg-dry	1	12/21/23 0:27:49
Fluorene	0.0581	0.0223	0.00279		mg/Kg-dry	1	12/21/23 0:27:49
Phenanthrene	0.154	0.0223	0.00624		mg/Kg-dry	1	12/21/23 0:27:49
Anthracene	0.00857	0.0223	0.00300	J	mg/Kg-dry	1	12/21/23 0:27:49
Fluoranthene	0.00970	0.0223	0.00814	J	mg/Kg-dry	1	12/21/23 0:27:49
Pyrene	ND	0.0446	0.0102		mg/Kg-dry	1	12/21/23 0:27:49
Benz(a)anthracene	ND	0.0223	0.00792		mg/Kg-dry	1	12/21/23 0:27:49
Chrysene	0.0208	0.0223	0.00390	J	mg/Kg-dry	1	12/21/23 0:27:49
Benzo(b)fluoranthene	ND	0.0279	0.00861		mg/Kg-dry	1	12/21/23 0:27:49
Benzo(k)fluoranthene	ND	0.0279	0.00980		mg/Kg-dry	1	12/21/23 0:27:49
Benzo(a)pyrene	ND	0.0335	0.0102		mg/Kg-dry	1	12/21/23 0:27:49
Indeno(1,2,3-cd)pyrene	ND	0.0446	0.00797		mg/Kg-dry	1	12/21/23 0:27:49
Dibenz(a,h)anthracene	ND	0.0558	0.0253		mg/Kg-dry	1	12/21/23 0:27:49
Benzo(g,h,i)perylene	ND	0.0558	0.0242		mg/Kg-dry	1	12/21/23 0:27:49
Surr: 2-Fluorobiphenyl	107	29.3 - 159	0		%Rec	1	12/21/23 0:27:49
Surr: Terphenyl-d14 (surr)	106	28.4 - 159	0		%Rec	1	12/21/23 0:27:49
Sample Moisture (Percent Moisture)				Batch ID: R88392			Analyst: MP
Percent Moisture	17.5	0.500	0.100		wt%	1	12/18/23 8:33:57

Fremont Analytical
An Alliance Technical Group Company

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/14/2023 10:10:00 AM
Project: LBP
Lab ID: 2312358-060
Matrix: Soil
Client Sample ID: B24-6

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42383			Analyst: AP
Diesel Range Organics	ND	56.4	14.8		mg/Kg-dry	1	12/20/23 0:43:11
Heavy Oil	ND	113	20.6		mg/Kg-dry	1	12/20/23 0:43:11
Total Petroleum Hydrocarbons	ND	169	35.4		mg/Kg-dry	1	12/20/23 0:43:11
Surr: 2-Fluorobiphenyl	104	50 - 150			%Rec	1	12/20/23 0:43:11
Surr: o-Terphenyl	105	50 - 150			%Rec	1	12/20/23 0:43:11
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 42382			Analyst: RG
Naphthalene	ND	0.0216	0.00461		mg/Kg-dry	1	12/21/23 0:56:23
2-Methylnaphthalene	ND	0.0216	0.00407		mg/Kg-dry	1	12/21/23 0:56:23
1-Methylnaphthalene	ND	0.0216	0.00332		mg/Kg-dry	1	12/21/23 0:56:23
Acenaphthylene	ND	0.0216	0.00317		mg/Kg-dry	1	12/21/23 0:56:23
Acenaphthene	ND	0.0216	0.00397		mg/Kg-dry	1	12/21/23 0:56:23
Fluorene	ND	0.0216	0.00270		mg/Kg-dry	1	12/21/23 0:56:23
Phenanthrene	ND	0.0216	0.00604		mg/Kg-dry	1	12/21/23 0:56:23
Anthracene	ND	0.0216	0.00290		mg/Kg-dry	1	12/21/23 0:56:23
Fluoranthene	ND	0.0216	0.00788		mg/Kg-dry	1	12/21/23 0:56:23
Pyrene	ND	0.0432	0.00987		mg/Kg-dry	1	12/21/23 0:56:23
Benz(a)anthracene	ND	0.0216	0.00767		mg/Kg-dry	1	12/21/23 0:56:23
Chrysene	ND	0.0216	0.00378		mg/Kg-dry	1	12/21/23 0:56:23
Benzo(b)fluoranthene	ND	0.0270	0.00833		mg/Kg-dry	1	12/21/23 0:56:23
Benzo(k)fluoranthene	ND	0.0270	0.00949		mg/Kg-dry	1	12/21/23 0:56:23
Benzo(a)pyrene	ND	0.0324	0.00990		mg/Kg-dry	1	12/21/23 0:56:23
Indeno(1,2,3-cd)pyrene	ND	0.0432	0.00771		mg/Kg-dry	1	12/21/23 0:56:23
Dibenz(a,h)anthracene	ND	0.0540	0.0245		mg/Kg-dry	1	12/21/23 0:56:23
Benzo(g,h,i)perylene	ND	0.0540	0.0234		mg/Kg-dry	1	12/21/23 0:56:23
Surr: 2-Fluorobiphenyl	105	29.3 - 159	0		%Rec	1	12/21/23 0:56:23
Surr: Terphenyl-d14 (surr)	103	28.4 - 159	0		%Rec	1	12/21/23 0:56:23
Sample Moisture (Percent Moisture)				Batch ID: R88392			Analyst: MP
Percent Moisture	13.1	0.500	0.100		wt%	1	12/18/23 8:33:57

Fremont Analytical
An Alliance Technical Group Company

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/14/2023 10:20:00 AM
Project: LBP
Lab ID: 2312358-062
Matrix: Soil
Client Sample ID: **B25-2.5**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42465			Analyst: SK
Diesel Range Organics	ND	59.5	15.7		mg/Kg-dry	1	12/30/23 6:21:57
Heavy Oil	27.0	119	21.7	J	mg/Kg-dry	1	12/30/23 6:21:57
Total Petroleum Hydrocarbons	ND	179	37.4		mg/Kg-dry	1	12/30/23 6:21:57
Surr: 2-Fluorobiphenyl	91.3	50 - 150			%Rec	1	12/30/23 6:21:57
Surr: o-Terphenyl	100	50 - 150			%Rec	1	12/30/23 6:21:57
Sample Moisture (Percent Moisture)				Batch ID: R88590			Analyst: MP
Percent Moisture	18.4	0.500	0.100		wt%	1	12/28/23 8:20:34

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/14/2023 10:30:00 AM
Project: LBP
Lab ID: 2312358-064
Matrix: Soil
Client Sample ID: **B26-6**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42465			Analyst: SK
Diesel Range Organics	ND	53.8	14.1		mg/Kg-dry	1	12/30/23 7:15:48
Heavy Oil	ND	108	19.6		mg/Kg-dry	1	12/30/23 7:15:48
Total Petroleum Hydrocarbons	ND	161	33.8		mg/Kg-dry	1	12/30/23 7:15:48
Surr: 2-Fluorobiphenyl	110	50 - 150			%Rec	1	12/30/23 7:15:48
Surr: o-Terphenyl	114	50 - 150			%Rec	1	12/30/23 7:15:48
Sample Moisture (Percent Moisture)				Batch ID: R88590			Analyst: MP
Percent Moisture	12.2	0.500	0.100		wt%	1	12/28/23 8:20:34

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Project: LBP
Lab ID: 2312358-067
Client Sample ID: **B27-3.5**

Collection Date: 12/14/2023 11:55:00 AM
Matrix: Soil

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42522			Analyst: SK
Diesel Range Organics	ND	60.3	15.9	H	mg/Kg-dry	1	01/05/24 17:16:14
Heavy Oil	ND	121	22.0	H	mg/Kg-dry	1	01/05/24 17:16:14
Total Petroleum Hydrocarbons	ND	181	37.9	H	mg/Kg-dry	1	01/05/24 17:16:14
Surr: 2-Fluorobiphenyl	116	50 - 150		H	%Rec	1	01/05/24 17:16:14
Surr: o-Terphenyl	118	50 - 150		H	%Rec	1	01/05/24 17:16:14
Sample Moisture (Percent Moisture)				Batch ID: R88798			Analyst: MP
Percent Moisture	20.3	0.500	0.100		wt%	1	01/08/24 8:34:53

Fremont Analytical
An Alliance Technical Group Company

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Project: LBP
Lab ID: 2312358-069
Client Sample ID: **B28-1.5**

Collection Date: 12/14/2023 12:15:00 PM
Matrix: Soil

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42465			Analyst: SK
Diesel Range Organics	ND	57.8	15.2		mg/Kg-dry	1	12/30/23 8:53:10
Heavy Oil	296	116	21.1		mg/Kg-dry	1	12/30/23 8:53:10
Total Petroleum Hydrocarbons	296	173	36.2		mg/Kg-dry	1	12/30/23 8:53:10
Surr: 2-Fluorobiphenyl	109	50 - 150			%Rec	1	12/30/23 8:53:10
Surr: o-Terphenyl	115	50 - 150			%Rec	1	12/30/23 8:53:10
Sample Moisture (Percent Moisture)				Batch ID: R88591			Analyst: MP
Percent Moisture	22.5	0.500	0.100		wt%	1	12/28/23 8:21:30

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/14/2023 12:00:00 PM
Project: LBP
Lab ID: 2312358-070
Matrix: Soil
Client Sample ID: **B28-6**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42465			Analyst: SK
Diesel Range Organics	ND	52.3	13.8		mg/Kg-dry	1	12/30/23 7:26:38
Heavy Oil	ND	105	19.1		mg/Kg-dry	1	12/30/23 7:26:38
Total Petroleum Hydrocarbons	ND	157	32.8		mg/Kg-dry	1	12/30/23 7:26:38
Surr: 2-Fluorobiphenyl	55.5	50 - 150			%Rec	1	12/30/23 7:26:38
Surr: o-Terphenyl	71.5	50 - 150			%Rec	1	12/30/23 7:26:38
Sample Moisture (Percent Moisture)				Batch ID: R88591			Analyst: MP
Percent Moisture	16.8	0.500	0.100		wt%	1	12/28/23 8:21:30

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/13/2023 1:05:00 PM
Project: LBP
Lab ID: 2312358-072
Matrix: Water
Client Sample ID: **B12-W**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.					Batch ID: 42366		Analyst: SK
Diesel Range Organics	540	93.7	35.0		µg/L	1	12/19/23 16:31:03
Heavy Oil	ND	93.7	26.7		µg/L	1	12/19/23 16:31:03
Total Petroleum Hydrocarbons	540	187	61.7		µg/L	1	12/19/23 16:31:03
Surr: 2-Fluorobiphenyl	104	50 - 150			%Rec	1	12/19/23 16:31:03
Surr: o-Terphenyl	96.1	50 - 150			%Rec	1	12/19/23 16:31:03

NOTES:
Chromatographic pattern indicates an unresolved complex mixture, which may be weathered and/or organic material

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)					Batch ID: 42388		Analyst: SH
Naphthalene	ND	0.0934	0.0221		µg/L	1	12/20/23 15:50:36
2-Methylnaphthalene	0.0337	0.0934	0.00670	J	µg/L	1	12/20/23 15:50:36
1-Methylnaphthalene	0.540	0.0934	0.00753		µg/L	1	12/20/23 15:50:36
Acenaphthene	1.30	0.0934	0.0186		µg/L	1	12/20/23 15:50:36
Acenaphthylene	ND	0.0934	0.00565		µg/L	1	12/20/23 15:50:36
Fluorene	0.494	0.0934	0.00509		µg/L	1	12/20/23 15:50:36
Phenanthrene	0.0458	0.0934	0.0106	J	µg/L	1	12/20/23 15:50:36
Anthracene	0.0580	0.0934	0.00684	J	µg/L	1	12/20/23 15:50:36
Fluoranthene	ND	0.0934	0.0327		µg/L	1	12/20/23 15:50:36
Pyrene	ND	0.187	0.0572		µg/L	1	12/20/23 15:50:36
Benz(a)anthracene	0.0128	0.0934	0.00828	J	µg/L	1	12/20/23 15:50:36
Chrysene	ND	0.0934	0.00854		µg/L	1	12/20/23 15:50:36
Benzo(b)fluoranthene	ND	0.0934	0.00774		µg/L	1	12/20/23 15:50:36
Benzo(k)fluoranthene	ND	0.0934	0.00968		µg/L	1	12/20/23 15:50:36
Benzo(a)pyrene	ND	0.0934	0.00787		µg/L	1	12/20/23 15:50:36
Indeno(1,2,3-cd)pyrene	ND	0.0934	0.00614		µg/L	1	12/20/23 15:50:36
Dibenz(a,h)anthracene	ND	0.0934	0.00644		µg/L	1	12/20/23 15:50:36
Benzo(g,h,i)perylene	ND	0.0934	0.0374		µg/L	1	12/20/23 15:50:36
Surr: 2-Fluorobiphenyl	102	29.7 - 124	0		%Rec	1	12/20/23 15:50:36
Surr: Terphenyl-d14	57.6	36.9 - 152	0		%Rec	1	12/20/23 15:50:36

Analytical Report

Fremont Analytical — An Alliance Technical Group Company

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Project: LBP
Lab ID: 2312358-073
Client Sample ID: **B14-W**

Collection Date: 12/13/2023 12:45:00 PM
Matrix: Water

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42366			Analyst: SK
Diesel Range Organics	694	96.9	36.2		µg/L	1	12/19/23 16:41:59
Heavy Oil	ND	96.9	27.6		µg/L	1	12/19/23 16:41:59
Total Petroleum Hydrocarbons	694	194	63.9		µg/L	1	12/19/23 16:41:59
Surr: 2-Fluorobiphenyl	95.4	50 - 150			%Rec	1	12/19/23 16:41:59
Surr: o-Terphenyl	92.4	50 - 150			%Rec	1	12/19/23 16:41:59

NOTES:
Chromatographic pattern is not consistent with a petroleum standard

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 42388			Analyst: SH
Naphthalene	0.0531	0.0957	0.0226	J	µg/L	1	12/20/23 17:17:14
2-Methylnaphthalene	0.104	0.0957	0.00687		µg/L	1	12/20/23 17:17:14
1-Methylnaphthalene	0.0640	0.0957	0.00773	J	µg/L	1	12/20/23 17:17:14
Acenaphthene	ND	0.0957	0.0191		µg/L	1	12/20/23 17:17:14
Acenaphthylene	ND	0.0957	0.00579		µg/L	1	12/20/23 17:17:14
Fluorene	0.0126	0.0957	0.00522	J	µg/L	1	12/20/23 17:17:14
Phenanthrene	0.0720	0.0957	0.0109	J	µg/L	1	12/20/23 17:17:14
Anthracene	ND	0.0957	0.00702		µg/L	1	12/20/23 17:17:14
Fluoranthene	ND	0.0957	0.0335		µg/L	1	12/20/23 17:17:14
Pyrene	ND	0.191	0.0586		µg/L	1	12/20/23 17:17:14
Benz(a)anthracene	0.0158	0.0957	0.00849	J	µg/L	1	12/20/23 17:17:14
Chrysene	ND	0.0957	0.00876		µg/L	1	12/20/23 17:17:14
Benzo(b)fluoranthene	ND	0.0957	0.00793		µg/L	1	12/20/23 17:17:14
Benzo(k)fluoranthene	ND	0.0957	0.00992		µg/L	1	12/20/23 17:17:14
Benzo(a)pyrene	ND	0.0957	0.00807		µg/L	1	12/20/23 17:17:14
Indeno(1,2,3-cd)pyrene	ND	0.0957	0.00630		µg/L	1	12/20/23 17:17:14
Dibenz(a,h)anthracene	ND	0.0957	0.00660		µg/L	1	12/20/23 17:17:14
Benzo(g,h,i)perylene	ND	0.0957	0.0384		µg/L	1	12/20/23 17:17:14
Surr: 2-Fluorobiphenyl	99.4	29.7 - 124	0		%Rec	1	12/20/23 17:17:14
Surr: Terphenyl-d14	34.7	36.9 - 152	0	S	%Rec	1	12/20/23 17:17:14

NOTES:
S - Outlying surrogate recovery(ies) observed. All other laboratory and field samples recovered within range.

Fremont Analytical
An Alliance Technical Group Company

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Project: LBP
Lab ID: 2312358-074
Client Sample ID: **B27-W**

Collection Date: 12/14/2023 2:00:00 PM
Matrix: Water

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42366			Analyst: SK
Diesel Range Organics	94.4	93.7	35.0		µg/L	1	12/19/23 16:53:02
Heavy Oil	ND	93.7	26.7		µg/L	1	12/19/23 16:53:02
Total Petroleum Hydrocarbons	94.4	187	61.7	J	µg/L	1	12/19/23 16:53:02
Surr: 2-Fluorobiphenyl	95.7	50 - 150			%Rec	1	12/19/23 16:53:02
Surr: o-Terphenyl	82.1	50 - 150			%Rec	1	12/19/23 16:53:02

NOTES:
Chromatographic pattern indicates an unresolved complex mixture, which may be weathered and/or organic material

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 42388			Analyst: SH
Naphthalene	0.0388	0.101	0.0238	J	µg/L	1	12/20/23 17:46:07
2-Methylnaphthalene	0.0186	0.101	0.00724	J	µg/L	1	12/20/23 17:46:07
1-Methylnaphthalene	0.0166	0.101	0.00814	J	µg/L	1	12/20/23 17:46:07
Acenaphthene	ND	0.101	0.0201		µg/L	1	12/20/23 17:46:07
Acenaphthylene	ND	0.101	0.00610		µg/L	1	12/20/23 17:46:07
Fluorene	0.00585	0.101	0.00550	J	µg/L	1	12/20/23 17:46:07
Phenanthrene	0.0221	0.101	0.0115	J	µg/L	1	12/20/23 17:46:07
Anthracene	ND	0.101	0.00739		µg/L	1	12/20/23 17:46:07
Fluoranthene	ND	0.101	0.0353		µg/L	1	12/20/23 17:46:07
Pyrene	ND	0.202	0.0617		µg/L	1	12/20/23 17:46:07
Benz(a)anthracene	0.0129	0.101	0.00894	J	µg/L	1	12/20/23 17:46:07
Chrysene	ND	0.101	0.00923		µg/L	1	12/20/23 17:46:07
Benzo(b)fluoranthene	ND	0.101	0.00836		µg/L	1	12/20/23 17:46:07
Benzo(k)fluoranthene	ND	0.101	0.0105		µg/L	1	12/20/23 17:46:07
Benzo(a)pyrene	ND	0.101	0.00850		µg/L	1	12/20/23 17:46:07
Indeno(1,2,3-cd)pyrene	ND	0.101	0.00663		µg/L	1	12/20/23 17:46:07
Dibenz(a,h)anthracene	ND	0.101	0.00695		µg/L	1	12/20/23 17:46:07
Benzo(g,h,i)perylene	ND	0.101	0.0404		µg/L	1	12/20/23 17:46:07
Surr: 2-Fluorobiphenyl	102	29.7 - 124	0		%Rec	1	12/20/23 17:46:07
Surr: Terphenyl-d14	48.4	36.9 - 152	0		%Rec	1	12/20/23 17:46:07

Analytical Report

Fremont Analytical — An Alliance Technical Group Company

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Collection Date: 12/14/2023 12:15:00 PM
Project: LBP
Lab ID: 2312358-075
Matrix: Water
Client Sample ID: **B26-W**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42366			Analyst: SK
Diesel Range Organics	310	94.0	35.1		µg/L	1	12/19/23 17:03:59
Heavy Oil	ND	94.0	26.8		µg/L	1	12/19/23 17:03:59
Total Petroleum Hydrocarbons	310	188	62.0		µg/L	1	12/19/23 17:03:59
Surr: 2-Fluorobiphenyl	99.0	50 - 150			%Rec	1	12/19/23 17:03:59
Surr: o-Terphenyl	77.2	50 - 150			%Rec	1	12/19/23 17:03:59

NOTES:
Chromatographic pattern indicates an unresolved complex mixture, which may be weathered and/or organic material

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 42388			Analyst: SH
Naphthalene	0.0305	0.0932	0.0220	J	µg/L	1	12/20/23 18:14:55
2-Methylnaphthalene	0.00982	0.0932	0.00669	J	µg/L	1	12/20/23 18:14:55
1-Methylnaphthalene	0.00755	0.0932	0.00753	J	µg/L	1	12/20/23 18:14:55
Acenaphthene	ND	0.0932	0.0186		µg/L	1	12/20/23 18:14:55
Acenaphthylene	ND	0.0932	0.00564		µg/L	1	12/20/23 18:14:55
Fluorene	ND	0.0932	0.00509		µg/L	1	12/20/23 18:14:55
Phenanthrene	0.0211	0.0932	0.0106	J	µg/L	1	12/20/23 18:14:55
Anthracene	ND	0.0932	0.00683		µg/L	1	12/20/23 18:14:55
Fluoranthene	ND	0.0932	0.0327		µg/L	1	12/20/23 18:14:55
Pyrene	ND	0.186	0.0571		µg/L	1	12/20/23 18:14:55
Benz(a)anthracene	0.0130	0.0932	0.00827	J	µg/L	1	12/20/23 18:14:55
Chrysene	ND	0.0932	0.00853		µg/L	1	12/20/23 18:14:55
Benzo(b)fluoranthene	ND	0.0932	0.00773		µg/L	1	12/20/23 18:14:55
Benzo(k)fluoranthene	ND	0.0932	0.00966		µg/L	1	12/20/23 18:14:55
Benzo(a)pyrene	ND	0.0932	0.00786		µg/L	1	12/20/23 18:14:55
Indeno(1,2,3-cd)pyrene	ND	0.0932	0.00613		µg/L	1	12/20/23 18:14:55
Dibenz(a,h)anthracene	ND	0.0932	0.00643		µg/L	1	12/20/23 18:14:55
Benzo(g,h,i)perylene	ND	0.0932	0.0374		µg/L	1	12/20/23 18:14:55
Surr: 2-Fluorobiphenyl	112	29.7 - 124	0		%Rec	1	12/20/23 18:14:55
Surr: Terphenyl-d14	57.8	36.9 - 152	0		%Rec	1	12/20/23 18:14:55

Analytical Report

Work Order: **2312358**
Date Reported: **1/8/2024**

Client: GeoEngineers
Project: LBP
Lab ID: 2312358-076
Client Sample ID: **P-5**

Collection Date: 12/14/2023 1:45:00 PM
Matrix: Water

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 42366			Analyst: SK
Diesel Range Organics	95.9	118	44.0	J	µg/L	1	12/19/23 17:14:53
Heavy Oil	ND	118	33.6		µg/L	1	12/19/23 17:14:53
Total Petroleum Hydrocarbons	95.9	235	77.6	J	µg/L	1	12/19/23 17:14:53
Surr: 2-Fluorobiphenyl	99.0	50 - 150			%Rec	1	12/19/23 17:14:53
Surr: o-Terphenyl	109	50 - 150			%Rec	1	12/19/23 17:14:53
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 42388			Analyst: SH
Naphthalene	0.0376	0.0962	0.0227	J	µg/L	1	12/20/23 18:43:43
2-Methylnaphthalene	0.00813	0.0962	0.00690	J	µg/L	1	12/20/23 18:43:43
1-Methylnaphthalene	ND	0.0962	0.00777		µg/L	1	12/20/23 18:43:43
Acenaphthene	ND	0.0962	0.0192		µg/L	1	12/20/23 18:43:43
Acenaphthylene	ND	0.0962	0.00582		µg/L	1	12/20/23 18:43:43
Fluorene	ND	0.0962	0.00525		µg/L	1	12/20/23 18:43:43
Phenanthrene	ND	0.0962	0.0109		µg/L	1	12/20/23 18:43:43
Anthracene	ND	0.0962	0.00705		µg/L	1	12/20/23 18:43:43
Fluoranthene	ND	0.0962	0.0337		µg/L	1	12/20/23 18:43:43
Pyrene	ND	0.192	0.0589		µg/L	1	12/20/23 18:43:43
Benz(a)anthracene	0.0112	0.0962	0.00853	J	µg/L	1	12/20/23 18:43:43
Chrysene	ND	0.0962	0.00880		µg/L	1	12/20/23 18:43:43
Benzo(b)fluoranthene	ND	0.0962	0.00797		µg/L	1	12/20/23 18:43:43
Benzo(k)fluoranthene	ND	0.0962	0.00997		µg/L	1	12/20/23 18:43:43
Benzo(a)pyrene	ND	0.0962	0.00811		µg/L	1	12/20/23 18:43:43
Indeno(1,2,3-cd)pyrene	ND	0.0962	0.00633		µg/L	1	12/20/23 18:43:43
Dibenz(a,h)anthracene	ND	0.0962	0.00663		µg/L	1	12/20/23 18:43:43
Benzo(g,h,i)perylene	ND	0.0962	0.0386		µg/L	1	12/20/23 18:43:43
Surr: 2-Fluorobiphenyl	101	29.7 - 124	0		%Rec	1	12/20/23 18:43:43
Surr: Terphenyl-d14	92.3	36.9 - 152	0		%Rec	1	12/20/23 18:43:43

Date: *1/8/2024*

Work Order: 2312358
CLIENT: GeoEngineers
Project: LBP

QC SUMMARY REPORT

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Sample ID: **MB-42374**	SampType: **MBLK**			Units: **mg/Kg**		Prep Date: **12/18/2023**		RunNo: **88431**			
Client ID: **MBLKS**	Batch ID: **42374**					Analysis Date: **12/18/2023**		SeqNo: **1846652**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel Range Organics	ND	50.0									
Heavy Oil	ND	100									
Total Petroleum Hydrocarbons	ND	150									
Surr: 2-Fluorobiphenyl	13.5		10.00		135	50	150				
Surr: o-Terphenyl	13.9		10.00		139	50	150				

Sample ID: **LCS-42374**	SampType: **LCS**			Units: **mg/Kg**		Prep Date: **12/18/2023**		RunNo: **88431**			
Client ID: **LCSS**	Batch ID: **42374**					Analysis Date: **12/18/2023**		SeqNo: **1846653**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Petroleum Hydrocarbons	557	150	500.0	0	111	80.8	118				
Surr: 2-Fluorobiphenyl	11.9		10.00		119	50	150				
Surr: o-Terphenyl	13.7		10.00		137	50	150				

Sample ID: **2312286-001AMS**	SampType: **MS**			Units: **mg/Kg-dry**		Prep Date: **12/18/2023**		RunNo: **88431**			
Client ID: **BATCH**	Batch ID: **42374**					Analysis Date: **12/18/2023**		SeqNo: **1846655**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Petroleum Hydrocarbons	772	163	543.3	0	142	43.5	147				
Surr: 2-Fluorobiphenyl	10.8		10.87		99.7	50	150				
Surr: o-Terphenyl	19.6		10.87		181	50	150				S

NOTES:
S - Outlying surrogate recovery attributed to TPH interference.

Sample ID: **2312286-001AMSD**	SampType: **MSD**			Units: **mg/Kg-dry**		Prep Date: **12/18/2023**		RunNo: **88431**			
Client ID: **BATCH**	Batch ID: **42374**					Analysis Date: **12/18/2023**		SeqNo: **1846656**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Petroleum Hydrocarbons	787	164	547.6	0	144	43.5	147	771.7	1.93	30	
Surr: 2-Fluorobiphenyl	10.7		10.95		97.9	50	150		0		
Surr: o-Terphenyl	21.4		10.95		196	50	150		0		S

Fremont Analytical
An Alliance Technical Group Company

Date: *1/8/2024*

Work Order: 2312358
CLIENT: GeoEngineers
Project: LBP

QC SUMMARY REPORT

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Sample ID: **2312286-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **12/18/2023** RunNo: **88431**
Client ID: **BATCH** Batch ID: **42374** Analysis Date: **12/18/2023** SeqNo: **1846656**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

NOTES:
S - Outlying surrogate recovery attributed to TPH interference.

Sample ID: **2312286-002ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **12/18/2023** RunNo: **88431**
Client ID: **BATCH** Batch ID: **42374** Analysis Date: **12/18/2023** SeqNo: **1846658**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel Range Organics	ND	52.5						0	0	30	
Heavy Oil	ND	105						0	0	30	
Total Petroleum Hydrocarbons	ND	158						0	0	30	
Surr: 2-Fluorobiphenyl	13.6		10.51		130	50	150		0		
Surr: o-Terphenyl	14.0		10.51		133	50	150		0		

Sample ID: **MB-42383** SampType: **MBLK** Units: **mg/Kg** Prep Date: **12/19/2023** RunNo: **88539**
Client ID: **MBLKS** Batch ID: **42383** Analysis Date: **12/19/2023** SeqNo: **1848940**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel Range Organics	ND	50.0									
Heavy Oil	ND	100									
Total Petroleum Hydrocarbons	ND	150									
Surr: 2-Fluorobiphenyl	11.4		10.00		114	50	150				
Surr: o-Terphenyl	11.7		10.00		117	50	150				

Sample ID: **LCS-42383** SampType: **LCS** Units: **mg/Kg** Prep Date: **12/19/2023** RunNo: **88539**
Client ID: **LCSS** Batch ID: **42383** Analysis Date: **12/19/2023** SeqNo: **1848941**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Petroleum Hydrocarbons	524	150	500.0	0	105	80.8	118				
Surr: 2-Fluorobiphenyl	10.4		10.00		104	50	150				
Surr: o-Terphenyl	13.6		10.00		136	50	150				

Date: *1/8/2024*

Work Order: 2312358
CLIENT: GeoEngineers
Project: LBP

QC SUMMARY REPORT

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Sample ID: **2312358-009AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **12/19/2023** RunNo: **88539**
Client ID: **B3-7** Batch ID: **42383** Analysis Date: **12/19/2023** SeqNo: **1848943**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Petroleum Hydrocarbons	831	167	557.8	627.9	36.5	43.5	147				S
Surr: 2-Fluorobiphenyl	10.5		11.16		93.7	50	150				
Surr: o-Terphenyl	13.2		11.16		119	50	150				

NOTES:
S - Outlying spike recovery(ies) observed. A duplicate analysis was performed with similar results indicating a possible matrix effect.

Sample ID: **2312358-009AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **12/19/2023** RunNo: **88539**
Client ID: **B3-7** Batch ID: **42383** Analysis Date: **12/19/2023** SeqNo: **1848945**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Petroleum Hydrocarbons	759	167	557.8	627.9	23.5	43.5	147	831.5	9.10	30	S
Surr: 2-Fluorobiphenyl	10.2		11.16		91.7	50	150		0		
Surr: o-Terphenyl	13.0		11.16		117	50	150		0		

NOTES:
S - Outlying spike recovery(ies) observed. A duplicate analysis was performed with similar results indicating a possible matrix effect.

Sample ID: **MB-42465** SampType: **MBLK** Units: **mg/Kg** Prep Date: **12/28/2023** RunNo: **88757**
Client ID: **MBLKS** Batch ID: **42465** Analysis Date: **12/30/2023** SeqNo: **1854143**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel Range Organics	ND	50.0									
Heavy Oil	30.8	100									J
Total Petroleum Hydrocarbons	ND	150									
Surr: 2-Fluorobiphenyl	11.4		10.00		114	50	150				
Surr: o-Terphenyl	12.1		10.00		121	50	150				

Sample ID: **LCS-42465** SampType: **LCS** Units: **mg/Kg** Prep Date: **12/28/2023** RunNo: **88757**
Client ID: **LCSS** Batch ID: **42465** Analysis Date: **12/30/2023** SeqNo: **1854144**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Petroleum Hydrocarbons	561	150	500.0	0	112	80.8	118				
Surr: 2-Fluorobiphenyl	10.8		10.00		108	50	150				

Fremont Analytical
An Alliance Technical Group Company

Date: 1/8/2024

Work Order: 2312358
CLIENT: GeoEngineers
Project: LBP

QC SUMMARY REPORT

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Sample ID: **LCS-42465** SampType: **LCS** Units: **mg/Kg** Prep Date: **12/28/2023** RunNo: **88757**
Client ID: **LCSS** Batch ID: **42465** Analysis Date: **12/30/2023** SeqNo: **1854144**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: o-Terphenyl	14.4		10.00		144	50	150				

Sample ID: **2312358-025ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **12/28/2023** RunNo: **88757**
Client ID: **B9-4** Batch ID: **42465** Analysis Date: **12/30/2023** SeqNo: **1854146**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel Range Organics	ND	54.4						0	0	30	H
Heavy Oil	78.1	109						64.48	19.2	30	JH
Total Petroleum Hydrocarbons	78.1	163						64.48	19.2	30	JH
Surr: 2-Fluorobiphenyl	9.31		10.88		85.6	50	150		0		H
Surr: o-Terphenyl	10.3		10.88		95.1	50	150		0		H

Sample ID: **2312358-031AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **12/28/2023** RunNo: **88757**
Client ID: **B12-2** Batch ID: **42465** Analysis Date: **12/30/2023** SeqNo: **1854148**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Petroleum Hydrocarbons	574	163	542.0	0	106	43.5	147				H
Surr: 2-Fluorobiphenyl	9.04		10.84		83.4	50	150				H
Surr: o-Terphenyl	12.6		10.84		116	50	150				H

Sample ID: **2312358-031AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **12/28/2023** RunNo: **88757**
Client ID: **B12-2** Batch ID: **42465** Analysis Date: **12/30/2023** SeqNo: **1854149**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Petroleum Hydrocarbons	538	162	538.9	0	99.9	43.5	147	573.8	6.36	30	H
Surr: 2-Fluorobiphenyl	8.73		10.78		81.0	50	150		0		H
Surr: o-Terphenyl	12.4		10.78		115	50	150		0		H

Date: *1/8/2024*

Work Order: 2312358
CLIENT: GeoEngineers
Project: LBP

QC SUMMARY REPORT

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Sample ID: **MB-42522** SampType: **MBLK** Units: **mg/Kg** Prep Date: **1/4/2024** RunNo: **88775**
Client ID: **MBLKS** Batch ID: **42522** Analysis Date: **1/4/2024** SeqNo: **1854570**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel Range Organics	ND	50.0									
Heavy Oil	ND	100									
Total Petroleum Hydrocarbons	ND	150									
Surr: 2-Fluorobiphenyl	10.7		10.00		107	50	150				
Surr: o-Terphenyl	11.0		10.00		110	50	150				

Sample ID: **LCS-42522** SampType: **LCS** Units: **mg/Kg** Prep Date: **1/4/2024** RunNo: **88775**
Client ID: **LCSS** Batch ID: **42522** Analysis Date: **1/4/2024** SeqNo: **1854571**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Petroleum Hydrocarbons	507	150	500.0	0	101	80.8	118				
Surr: 2-Fluorobiphenyl	10.7		10.00		107	50	150				
Surr: o-Terphenyl	12.7		10.00		127	50	150				

Sample ID: **2401037-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **1/4/2024** RunNo: **88775**
Client ID: **BATCH** Batch ID: **42522** Analysis Date: **1/4/2024** SeqNo: **1854573**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Petroleum Hydrocarbons	1,090	232	772.3	0	142	43.5	147				
Surr: 2-Fluorobiphenyl	16.6		15.45		107	50	150				
Surr: o-Terphenyl	20.6		15.45		133	50	150				

Sample ID: **2401037-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **1/4/2024** RunNo: **88775**
Client ID: **BATCH** Batch ID: **42522** Analysis Date: **1/4/2024** SeqNo: **1854574**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Petroleum Hydrocarbons	1,430	231	771.6	0	185	43.5	147	1,094	26.7	30	S
Surr: 2-Fluorobiphenyl	21.6		15.43		140	50	150		0		
Surr: o-Terphenyl	33.3		15.43		215	50	150		0		S

Work Order: 2312358
CLIENT: GeoEngineers
Project: LBP

QC SUMMARY REPORT

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Sample ID: **2401037-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **1/4/2024** RunNo: **88775**
Client ID: **BATCH** Batch ID: **42522** Analysis Date: **1/4/2024** SeqNo: **1854574**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

NOTES:
S - Outlying spike recovery(ies) observed. A duplicate analysis was performed and recovered within range.
S - Outlying surrogate recovery(ies) observed. A duplicate analysis was performed and recovered within range.

Sample ID: **2401060-009ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **1/4/2024** RunNo: **88775**
Client ID: **BATCH** Batch ID: **42522** Analysis Date: **1/4/2024** SeqNo: **1854588**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel Range Organics	ND	51.8						0	0	30	
Heavy Oil	ND	104						0	0	30	
Total Petroleum Hydrocarbons	ND	155						0	0	30	
Surr: 2-Fluorobiphenyl	13.1		10.36		126	50	150		0		
Surr: o-Terphenyl	13.7		10.36		132	50	150		0		

Work Order: 2312358
CLIENT: GeoEngineers
Project: LBP

QC SUMMARY REPORT

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Sample ID: **MB-42366** SampType: **MBLK** Units: **µg/L** Prep Date: **12/18/2023** RunNo: **88433**
Client ID: **MBLKW** Batch ID: **42366** Analysis Date: **12/18/2023** SeqNo: **1846705**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel Range Organics	ND	95.3									
Heavy Oil	30.7	95.3									J
Total Petroleum Hydrocarbons	ND	191									
Surr: 2-Fluorobiphenyl	8.84		23.82		37.1	50	150				S
Surr: o-Terphenyl	9.72		23.82		40.8	50	150				S

NOTES:
S - Outlying surrogate recovery(ies) observed.

Sample ID: **LCS-42366** SampType: **LCS** Units: **µg/L** Prep Date: **12/18/2023** RunNo: **88433**
Client ID: **LCSW** Batch ID: **42366** Analysis Date: **12/18/2023** SeqNo: **1846706**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Petroleum Hydrocarbons	935	188	1,177	0	79.4	35.1	118				
Surr: 2-Fluorobiphenyl	21.0		23.55		89.0	50	150				
Surr: o-Terphenyl	26.2		23.55		111	50	150				

Sample ID: **LCSD-42366** SampType: **LCSD** Units: **µg/L** Prep Date: **12/18/2023** RunNo: **88433**
Client ID: **LCSW02** Batch ID: **42366** Analysis Date: **12/18/2023** SeqNo: **1846707**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Petroleum Hydrocarbons	1,040	189	1,182	0	88.3	35.1	118	934.5	11.1	30	
Surr: 2-Fluorobiphenyl	23.2		23.64		98.2	50	150		0		
Surr: o-Terphenyl	27.9		23.64		118	50	150		0		

Work Order: 2312358
CLIENT: GeoEngineers
Project: LBP

QC SUMMARY REPORT

Hydrocarbon Identification by NWTPH-HCID

Sample ID: **MB-42383** SampType: **MBLK** Units: **mg/Kg** Prep Date: **12/19/2023** RunNo: **88540**
Client ID: **MBLKS** Batch ID: **42383** Analysis Date: **12/19/2023** SeqNo: **1848996**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Gasoline	ND	30.0									
Mineral Spirits	ND	50.0									
Kerosene	ND	50.0									
Diesel (Fuel Oil)	ND	50.0									
Heavy Oil	ND	100									
Mineral Oil	ND	100									
Surr: 2-Fluorobiphenyl	11.4		10.00		114	50	150				
Surr: o-Terphenyl	11.7		10.00		117	50	150				

Sample ID: **LCS-42383** SampType: **LCS** Units: **mg/Kg** Prep Date: **12/19/2023** RunNo: **88540**
Client ID: **LCSS** Batch ID: **42383** Analysis Date: **12/19/2023** SeqNo: **1848997**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Petroleum Hydrocarbons	524	50.0	500.0	0	105	74.5	125				
Surr: 2-Fluorobiphenyl	10.4		10.00		104	50	150				
Surr: o-Terphenyl	13.6		10.00		136	50	150				

Sample ID: **2312358-045ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **12/19/2023** RunNo: **88540**
Client ID: **B18-2** Batch ID: **42383** Analysis Date: **12/19/2023** SeqNo: **1849003**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Gasoline	ND	32.9						0	0	30	
Mineral Spirits	ND	54.9						0	0	30	
Kerosene	ND	54.9						0	0	30	
Diesel (Fuel Oil)	ND	54.9						0	0	30	
Heavy Oil	ND	110						0	0	30	
Mineral Oil	ND	110						0	0	30	
Surr: 2-Fluorobiphenyl	10.0		10.98		91.1	50	150		0		
Surr: o-Terphenyl	10.6		10.98		96.8	50	150		0		

Fremont Analytical
An Alliance Technical Group Company

Date: *1/8/2024*

Work Order: 2312358
CLIENT: GeoEngineers
Project: LBP

QC SUMMARY REPORT

Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)

Sample ID: **MB-42382** SampType: **MBLK** Units: **mg/Kg** Prep Date: **12/19/2023** RunNo: **88499**
Client ID: **MBLKS** Batch ID: **42382** Analysis Date: **12/20/2023** SeqNo: **1848188**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Naphthalene	ND	0.0200									
2-Methylnaphthalene	ND	0.0200									
1-Methylnaphthalene	ND	0.0200									
Acenaphthylene	ND	0.0200									
Acenaphthene	ND	0.0200									
Fluorene	ND	0.0200									
Phenanthrene	ND	0.0200									
Anthracene	ND	0.0200									
Fluoranthene	ND	0.0200									
Pyrene	ND	0.0400									
Benz(a)anthracene	ND	0.0200									
Chrysene	ND	0.0200									
Benzo(b)fluoranthene	ND	0.0250									
Benzo(k)fluoranthene	ND	0.0250									
Benzo(a)pyrene	ND	0.0300									
Indeno(1,2,3-cd)pyrene	ND	0.0400									
Dibenz(a,h)anthracene	ND	0.0500									
Benzo(g,h,i)perylene	ND	0.0500									
Surr: 2-Fluorobiphenyl	0.977		1.000		97.7	22.2	146				
Surr: Terphenyl-d14 (surr)	0.984		1.000		98.4	20.2	159				

Sample ID: **LCS-42382** SampType: **LCS** Units: **mg/Kg** Prep Date: **12/19/2023** RunNo: **88499**
Client ID: **LCSS** Batch ID: **42382** Analysis Date: **12/20/2023** SeqNo: **1848189**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Naphthalene	1.82	0.0200	2.000	0	91.0	54.4	123				
2-Methylnaphthalene	1.83	0.0200	2.000	0	91.5	55.3	123				
1-Methylnaphthalene	1.85	0.0200	2.000	0	92.7	56.6	121				
Acenaphthylene	1.84	0.0200	2.000	0	91.8	57	122				
Acenaphthene	1.81	0.0200	2.000	0	90.6	50.4	123				
Fluorene	1.85	0.0200	2.000	0	92.5	51.5	127				

Fremont Analytical
An Alliance Technical Group Company

Date: *1/8/2024*

Work Order: 2312358
CLIENT: GeoEngineers
Project: LBP

QC SUMMARY REPORT

Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)

Sample ID: **LCS-42382** SampType: **LCS** Units: **mg/Kg** Prep Date: **12/19/2023** RunNo: **88499**
Client ID: **LCSS** Batch ID: **42382** Analysis Date: **12/20/2023** SeqNo: **1848189**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Phenanthrene	1.84	0.0200	2.000	0	92.1	47.4	127				
Anthracene	1.86	0.0200	2.000	0	92.8	48.5	124				
Fluoranthene	1.84	0.0200	2.000	0	91.8	46.4	132				
Pyrene	1.86	0.0400	2.000	0	93.0	45.2	134				
Benz(a)anthracene	1.84	0.0200	2.000	0	91.8	45.9	138				
Chrysene	1.91	0.0200	2.000	0	95.7	51.5	124				
Benzo(b)fluoranthene	1.87	0.0250	2.000	0	93.5	52.8	130				
Benzo(k)fluoranthene	1.85	0.0250	2.000	0	92.6	50	127				
Benzo(a)pyrene	1.88	0.0300	2.000	0	93.9	53	127				
Indeno(1,2,3-cd)pyrene	1.94	0.0400	2.000	0	97.2	55.7	129				
Dibenz(a,h)anthracene	1.89	0.0500	2.000	0	94.5	54.3	126				
Benzo(g,h,i)perylene	1.86	0.0500	2.000	0	93.2	52.7	123				
Surr: 2-Fluorobiphenyl	0.994		1.000		99.4	29.3	159				
Surr: Terphenyl-d14 (surr)	0.988		1.000		98.8	28.4	159				

Sample ID: **2312358-026AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **12/19/2023** RunNo: **88499**
Client ID: **B9-6** Batch ID: **42382** Analysis Date: **12/20/2023** SeqNo: **1848193**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Naphthalene	2.11	0.0231	2.314	0	91.1	45.1	134				
2-Methylnaphthalene	2.12	0.0231	2.314	0	91.7	45	136				
1-Methylnaphthalene	2.13	0.0231	2.314	0	92.1	46.7	133				
Acenaphthylene	2.11	0.0231	2.314	0	91.0	48.7	133				
Acenaphthene	2.12	0.0231	2.314	0	91.6	38.4	137				
Fluorene	2.16	0.0231	2.314	0	93.2	41.7	137				
Phenanthrene	2.16	0.0231	2.314	0	93.4	38.3	138				
Anthracene	2.17	0.0231	2.314	0	93.6	40.5	135				
Fluoranthene	2.18	0.0231	2.314	0	94.1	33.6	148				
Pyrene	2.19	0.0463	2.314	0	94.5	32.8	146				
Benz(a)anthracene	2.17	0.0231	2.314	0	93.9	37.8	142				
Chrysene	2.22	0.0231	2.314	0	95.9	39	136				

Date: *1/8/2024*

Work Order: 2312358
CLIENT: GeoEngineers
Project: LBP

QC SUMMARY REPORT

Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)

Sample ID: **2312358-026AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **12/19/2023** RunNo: **88499**
Client ID: **B9-6** Batch ID: **42382** Analysis Date: **12/20/2023** SeqNo: **1848193**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzo(b)fluoranthene	2.17	0.0289	2.314	0	93.6	34.3	146				
Benzo(k)fluoranthene	2.12	0.0289	2.314	0	91.7	33.7	138				
Benzo(a)pyrene	2.14	0.0347	2.314	0	92.5	41.8	137				
Indeno(1,2,3-cd)pyrene	1.92	0.0463	2.314	0	83.1	33.1	145				
Dibenz(a,h)anthracene	1.84	0.0578	2.314	0	79.4	33	142				
Benzo(g,h,i)perylene	1.75	0.0578	2.314	0	75.5	24.4	143				
Surr: 2-Fluorobiphenyl	1.15		1.157		99.5	29.3	159				
Surr: Terphenyl-d14 (surr)	1.11		1.157		96.1	28.4	159				

Sample ID: **2312358-026AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **12/19/2023** RunNo: **88499**
Client ID: **B9-6** Batch ID: **42382** Analysis Date: **12/20/2023** SeqNo: **1848194**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Naphthalene	2.22	0.0231	2.314	0	96.1	45.1	134	2.107	5.43	30	
2-Methylnaphthalene	2.23	0.0231	2.314	0	96.3	45	136	2.122	4.93	30	
1-Methylnaphthalene	2.25	0.0231	2.314	0	97.2	46.7	133	2.130	5.45	30	
Acenaphthylene	2.21	0.0231	2.314	0	95.7	48.7	133	2.106	5.05	30	
Acenaphthene	2.22	0.0231	2.314	0	95.7	38.4	137	2.119	4.46	30	
Fluorene	2.25	0.0231	2.314	0	97.3	41.7	137	2.156	4.27	30	
Phenanthrene	2.27	0.0231	2.314	0	98.1	38.3	138	2.161	4.97	30	
Anthracene	2.25	0.0231	2.314	0	97.4	40.5	135	2.165	4.03	30	
Fluoranthene	2.26	0.0231	2.314	0	97.8	33.6	148	2.177	3.85	30	
Pyrene	2.28	0.0463	2.314	0	98.6	32.8	146	2.187	4.23	30	
Benz(a)anthracene	2.26	0.0231	2.314	0	97.7	37.8	142	2.174	3.98	30	
Chrysene	2.30	0.0231	2.314	0	99.2	39	136	2.218	3.42	30	
Benzo(b)fluoranthene	2.17	0.0289	2.314	0	93.9	34.3	146	2.167	0.255	30	
Benzo(k)fluoranthene	2.25	0.0289	2.314	0	97.1	33.7	138	2.122	5.71	30	
Benzo(a)pyrene	2.22	0.0347	2.314	0	95.7	41.8	137	2.140	3.47	30	
Indeno(1,2,3-cd)pyrene	1.98	0.0463	2.314	0	85.7	33.1	145	1.923	3.02	30	
Dibenz(a,h)anthracene	1.88	0.0578	2.314	0	81.5	33	142	1.836	2.60	30	
Benzo(g,h,i)perylene	1.83	0.0578	2.314	0	79.0	24.4	143	1.747	4.58	30	

Date: *1/8/2024*

Work Order: 2312358
CLIENT: GeoEngineers
Project: LBP

QC SUMMARY REPORT

Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)

Sample ID: **2312358-026AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **12/19/2023** RunNo: **88499**
Client ID: **B9-6** Batch ID: **42382** Analysis Date: **12/20/2023** SeqNo: **1848194**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: 2-Fluorobiphenyl	1.20		1.157		103	29.3	159		0		
Surr: Terphenyl-d14 (surr)	1.15		1.157		99.7	28.4	159		0		

Work Order: 2312358
CLIENT: GeoEngineers
Project: LBP

QC SUMMARY REPORT

Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)

Sample ID: **MB-42388** SampType: **MBLK** Units: **µg/L** Prep Date: **12/19/2023** RunNo: **88537**
Client ID: **MBLKW** Batch ID: **42388** Analysis Date: **12/20/2023** SeqNo: **1848881**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Naphthalene	ND	0.0938									
2-Methylnaphthalene	ND	0.0938									
1-Methylnaphthalene	ND	0.0938									
Acenaphthene	ND	0.0938									
Acenaphthylene	ND	0.0938									
Fluorene	ND	0.0938									
Phenanthrene	ND	0.0938									
Anthracene	ND	0.0938									
Fluoranthene	ND	0.0938									
Pyrene	ND	0.188									
Benz(a)anthracene	ND	0.0938									
Chrysene	ND	0.0938									
Benzo(b)fluoranthene	ND	0.0938									
Benzo(k)fluoranthene	ND	0.0938									
Benzo(a)pyrene	ND	0.0938									
Indeno(1,2,3-cd)pyrene	ND	0.0938									
Dibenz(a,h)anthracene	ND	0.0938									
Benzo(g,h,i)perylene	ND	0.0938									
Surr: 2,4,6-Tribromophenol	3.68		4.690		78.5	31.3	143				
Surr: 2-Fluorobiphenyl	2.16		2.345		92.1	12.8	129				
Surr: Terphenyl-d14	2.37		2.345		101	12.7	150				

Sample ID: **LCS-42388** SampType: **LCS** Units: **µg/L** Prep Date: **12/19/2023** RunNo: **88537**
Client ID: **LCSW** Batch ID: **42388** Analysis Date: **12/20/2023** SeqNo: **1848882**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Naphthalene	3.48	0.0941	4.707	0	73.9	51.1	102				
2-Methylnaphthalene	3.62	0.0941	4.707	0	76.8	51	104				
1-Methylnaphthalene	3.67	0.0941	4.707	0	78.0	51	104				
Acenaphthene	3.74	0.0941	4.707	0	79.6	44.5	116				
Acenaphthylene	3.77	0.0941	4.707	0	80.1	57.3	107				

Date: *1/8/2024*

Work Order: 2312358
CLIENT: GeoEngineers
Project: LBP

QC SUMMARY REPORT

Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)

Sample ID: **LCS-42388** SampType: **LCS** Units: **µg/L** Prep Date: **12/19/2023** RunNo: **88537**
Client ID: **LCSW** Batch ID: **42388** Analysis Date: **12/20/2023** SeqNo: **1848882**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Fluorene	3.87	0.0941	4.707	0	82.2	50.9	119				
Phenanthrene	3.88	0.0941	4.707	0	82.5	49.4	121				
Anthracene	3.15	0.0941	4.707	0	67.0	46.1	113				
Fluoranthene	3.88	0.0941	4.707	0	82.5	44.4	132				
Pyrene	3.87	0.188	4.707	0	82.3	40.8	135				
Benz(a)anthracene	3.55	0.0941	4.707	0	75.4	44.6	126				
Chrysene	3.83	0.0941	4.707	0	81.4	50.7	121				
Benzo(b)fluoranthene	3.54	0.0941	4.707	0	75.1	54	115				
Benzo(k)fluoranthene	3.38	0.0941	4.707	0	71.7	48.5	112				
Benzo(a)pyrene	3.02	0.0941	4.707	0	64.2	54	105				
Indeno(1,2,3-cd)pyrene	3.16	0.0941	4.707	0	67.2	36.8	113				
Dibenz(a,h)anthracene	2.86	0.0941	4.707	0	60.7	27.1	113				
Benzo(g,h,i)perylene	2.97	0.0941	4.707	0	63.2	36.4	112				
Surr: 2,4,6-Tribromophenol	8.78		9.415		93.2	31.3	143				
Surr: 2-Fluorobiphenyl	4.78		4.707		102	29.7	124				
Surr: Terphenyl-d14	4.45		4.707		94.6	36.9	152				

Sample ID: **LCSD-42388** SampType: **LCSD** Units: **µg/L** Prep Date: **12/19/2023** RunNo: **88537**
Client ID: **LCSW02** Batch ID: **42388** Analysis Date: **12/20/2023** SeqNo: **1848883**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Naphthalene	3.82	0.0944	4.718	0	80.9	51.1	102	3.479	9.27	30	
2-Methylnaphthalene	3.95	0.0944	4.718	0	83.8	51	104	3.616	8.94	30	
1-Methylnaphthalene	4.01	0.0944	4.718	0	85.0	51	104	3.673	8.72	30	
Acenaphthene	4.07	0.0944	4.718	0	86.3	44.5	116	3.745	8.36	30	
Acenaphthylene	4.11	0.0944	4.718	0	87.1	57.3	107	3.772	8.49	30	
Fluorene	4.33	0.0944	4.718	0	91.9	50.9	119	3.870	11.3	30	
Phenanthrene	4.41	0.0944	4.718	0	93.5	49.4	121	3.882	12.8	30	
Anthracene	3.69	0.0944	4.718	0	78.3	46.1	113	3.155	15.7	30	
Fluoranthene	4.42	0.0944	4.718	0	93.6	44.4	132	3.883	12.9	30	
Pyrene	4.41	0.189	4.718	0	93.5	40.8	135	3.873	13.0	30	

Fremont Analytical
An Alliance Technical Group Company

Date: 1/8/2024

Work Order: 2312358
CLIENT: GeoEngineers
Project: LBP

QC SUMMARY REPORT

Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)

Sample ID: **LCSD-42388** SampType: **LCSD** Units: **µg/L** Prep Date: **12/19/2023** RunNo: **88537**
Client ID: **LCSW02** Batch ID: **42388** Analysis Date: **12/20/2023** SeqNo: **1848883**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benz(a)anthracene	4.07	0.0944	4.718	0	86.2	44.6	126	3.550	13.6	30	
Chrysene	4.28	0.0944	4.718	0	90.7	50.7	121	3.832	11.0	30	
Benzo(b)fluoranthene	3.84	0.0944	4.718	0	81.3	54	115	3.536	8.14	30	
Benzo(k)fluoranthene	3.61	0.0944	4.718	0	76.6	48.5	112	3.377	6.76	30	
Benzo(a)pyrene	3.32	0.0944	4.718	0	70.5	54	105	3.020	9.59	30	
Indeno(1,2,3-cd)pyrene	3.26	0.0944	4.718	0	69.0	36.8	113	3.164	2.89	30	
Dibenz(a,h)anthracene	2.93	0.0944	4.718	0	62.1	27.1	113	2.856	2.47	30	
Benzo(g,h,i)perylene	3.09	0.0944	4.718	0	65.5	36.4	112	2.975	3.79	30	
Surr: 2,4,6-Tribromophenol	8.58		9.435		90.9	31.3	143		0		
Surr: 2-Fluorobiphenyl	4.54		4.718		96.2	29.7	124		0		
Surr: Terphenyl-d14	4.28		4.718		90.8	36.9	152		0		

Sample ID: **2312375-001ADUP** SampType: **DUP** Units: **µg/L** Prep Date: **12/19/2023** RunNo: **88537**
Client ID: **BATCH** Batch ID: **42388** Analysis Date: **12/20/2023** SeqNo: **1848891**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Naphthalene	ND	0.100						0.03642	200	30	
2-Methylnaphthalene	ND	0.100						0.01254	200	30	
1-Methylnaphthalene	ND	0.100						0	0	30	
Acenaphthene	ND	0.100						0	0	30	
Acenaphthylene	ND	0.100						0	0	30	
Fluorene	ND	0.100						0.005964	200	30	
Phenanthrene	ND	0.100						0.01699	200	30	
Anthracene	0.0113	0.100						0.01206	6.79	30	J
Fluoranthene	ND	0.100						0	0	30	
Pyrene	ND	0.200						0	0	30	
Benz(a)anthracene	0.0242	0.100						0.02173	10.9	30	J
Chrysene	0.0236	0.100						0.02170	8.25	30	J
Benzo(b)fluoranthene	0.0186	0.100						0.01958	5.03	30	J
Benzo(k)fluoranthene	ND	0.100						0	0	30	
Benzo(a)pyrene	ND	0.100						0	0	30	

Fremont Analytical
An Alliance Technical Group Company

Date: 1/8/2024

Work Order: 2312358
CLIENT: GeoEngineers
Project: LBP

QC SUMMARY REPORT

Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)

Sample ID: **2312375-001ADUP**	SampType: **DUP**			Units: **µg/L**		Prep Date: **12/19/2023**			RunNo: **88537**		
Client ID: **BATCH**	Batch ID: **42388**					Analysis Date: **12/20/2023**			SeqNo: **1848891**		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Indeno(1,2,3-cd)pyrene	ND	0.100						0	0	30	
Dibenz(a,h)anthracene	ND	0.100						0	0	30	
Benzo(g,h,i)perylene	ND	0.100						0	0	30	
Surr: 2,4,6-Tribromophenol	4.70		5.000		94.0	31.3	143		0		
Surr: 2-Fluorobiphenyl	2.40		2.500		96.1	29.7	124		0		
Surr: Terphenyl-d14	2.37		2.500		95.0	36.9	152		0		

Sample ID: **2312459-001AMS**	SampType: **MS**			Units: **µg/L**		Prep Date: **12/20/2023**			RunNo: **88537**		
Client ID: **BATCH**	Batch ID: **42388**					Analysis Date: **12/21/2023**			SeqNo: **1849348**		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Naphthalene	3.75	0.0958	4.792	0	78.3	21.6	110				
2-Methylnaphthalene	3.85	0.0958	4.792	0	80.4	19.5	112				
1-Methylnaphthalene	3.88	0.0958	4.792	0	81.0	21.2	114				
Acenaphthene	4.04	0.0958	4.792	0	84.3	24.5	116				
Acenaphthylene	4.02	0.0958	4.792	0	83.9	21.6	121				
Fluorene	4.19	0.0958	4.792	0	87.5	27.7	120				
Phenanthrene	4.21	0.0958	4.792	0	87.8	28	121				
Anthracene	4.01	0.0958	4.792	0	83.7	23.4	117				
Fluoranthene	4.25	0.0958	4.792	0	88.6	36.3	123				
Pyrene	4.21	0.192	4.792	0	88.0	35.5	122				
Benz(a)anthracene	3.61	0.0958	4.792	0	75.4	16.8	129				
Chrysene	3.86	0.0958	4.792	0.04882	79.5	13.9	123				
Benzo(b)fluoranthene	2.81	0.0958	4.792	0.03906	57.9	8.45	121				
Benzo(k)fluoranthene	2.57	0.0958	4.792	0	53.6	6.1	113				
Benzo(a)pyrene	2.51	0.0958	4.792	0	52.4	5	117				
Indeno(1,2,3-cd)pyrene	1.68	0.0958	4.792	0	35.2	5	115				
Dibenz(a,h)anthracene	1.63	0.0958	4.792	0	34.0	5	113				
Benzo(g,h,i)perylene	1.55	0.0958	4.792	0	32.4	5	113				
Surr: 2,4,6-Tribromophenol	4.48		4.792		93.5	31.3	143				
Surr: 2-Fluorobiphenyl	2.18		2.396		90.8	29.7	124				

Fremont Analytical
An Alliance Technical Group Company

Date: *1/8/2024*

Work Order: 2312358
CLIENT: GeoEngineers
Project: LBP

QC SUMMARY REPORT

Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)

Sample ID: **2312459-001AMS** SampType: **MS** Units: **µg/L** Prep Date: **12/20/2023** RunNo: **88537**
Client ID: **BATCH** Batch ID: **42388** Analysis Date: **12/21/2023** SeqNo: **1849348**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Terphenyl-d14	1.39		2.396		58.1	36.9	152				

Fremont Analytical
An Alliance Technical Group Company

Sample Log-In Check List

Client Name:	GEI	Work Order Number:	2312358
Logged by:	Clare Griggs	Date Received:	12/14/2023 3:46:00 PM

Chain of Custody

1.	Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2.	How was the sample delivered?	Client		

Log In

3.	Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact)	Yes ☐	No ☐	Not Present ☑
4.	Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
5.	Were all items received at a temperature of >2°C to 6°C *	Yes ☑	No ☐	NA ☐
6.	Sample(s) in proper container(s)?	Yes ☑	No ☐	
7.	Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8.	Are samples properly preserved?	Yes ☑	No ☐	
9.	Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10.	Is there headspace in the VOA vials?	Yes ☐	No ☐	NA ☑
11.	Did all samples containers arrive in good condition(unbroken)?	Yes ☑	No ☐	
12.	Does paperwork match bottle labels?	Yes ☑	No ☐	
13.	Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
14.	Is it clear what analyses were requested?	Yes ☑	No ☐	
15.	Were all hold times (except field parameters, pH e.g.) able to be met?	Yes ☐	No ☑	

Special Handling (if applicable)

16.	Was client notified of all discrepancies with this order?	Yes ☐	No ☐	NA ☑

Person Notified: ______ Date: ______

By Whom: ______ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding: ______

Client Instructions: ______

17. Additional remarks:

Item Information

Item #	Temp ºC
Sample	5.4

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

Fremont Analytical

An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date: 12/14/23 Page: 1 of: 4

Laboratory Project No (internal): 2312358

Project Name: LBP

Project No: 0017-024-03 T200

Collected by: JAK

Location:

Report To (PM): PHIL CORDELL

Special Remarks: PM TO SELECT ANALYSES

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

Client: GEI

Address: 2101 4TH AVE STE 950

City, State, Zip: SEATTLE, WA 98121

Telephone:

Email(s): PCORDELL@GEOENGINEERS.COM

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	Lead			Comments
1	B1-1.5	12/14/23	1120	S	1																
2	B1-3.5		1125																		
3	B1-6		1130																		
4	B2-1		1055																		
5	B2-2		1100																		
6	B2-6		1110																		
7	B3-2		1015																		
8	B3-4		1020																		
9	B3-7		1025 ~~1030~~																		
10	B3-9		1030																		

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ______ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	JAMES KOLTN	12/14/23 1545	x [signature]	12/14/23	1546
x			x		

Fremont Analytical
An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date: | Page: 2 of: 4 | *Laboratory Project No (internal):* 2312358

Client: GEI
Address:
City, State, Zip: AS DAGE
Telephone:
Email(s):

Project Name:
Project No: 617-024-03 T200
Collected by:
Location: ONE
Report To (PM):

Special Remarks:

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

#	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	HOLD				Comments
1	B4-5	12/12/23	1040	S	1													X				
2	B4-10		1045																			
3	B5-1.5		1145																			
4	B5-3		1150																			
5	B5-6		1155																			
6	B6-2.5		1255																			
7	B6-6		1300																			
8	B6-8		1305																			
9	B7-1		1320																			
10	B7-3.5		1325																			

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ______ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	JAMES KOHN	12/14/23 1545	x [signature]	12/14/23	1546
x			x		

Fremont Analytical

An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date:
Page: 3 of: 4
Laboratory Project No (internal): 2312358

Project Name:
Project No: 817-024-03 T200
Collected by:
Location: ~~SAME~~

Client: GEI
Address:
City, State, Zip: AS PAGE ONE
Telephone:
Report To (PM):
Email(s):

Special Remarks:

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

#	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) | Dissolved (D)	Anions (IC)***	EDB (8011)	HOLD			Comments
1	B7-8	12/12/23	1330	S	1													X			
2	B8-3		1340																		
3	B8-6		1345																		
4	B8-10		1350																		
5	B9-4		1400																		
6	B9-6		1405																		
7	B9-7.5		1410																		
8	B10-2	12/13/23	0900																		
9	B10-6		0905																		
10	B12-1		0935																		

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ____ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	James Kohn	12/14/23 1515	x [signature]	12/14/23	1546
x			x		

www.fremontanalytical.com

Fremont Analytical
An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date:
Page: 4 of: 6
Laboratory Project No (internal): 2312358

Project Name:
Project No: 417-024-03 T200
Collected by:
Location: ONE
Report To (PM):

Special Remarks:

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

Client: GEI
Address:
City, State, Zip: AS PAGE
Telephone:
Email(s):

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	HOLD				Comments
1	B12-2	12/13/23	0940	S	1													X				
2	B12-8		0945																			
3	B13-0.5		0955																			
4	B13-1		1000																			
5	B14-1		1030																			
6	B14-3		1035																			
7	B14-6		1040																			
8	B15-1		1100																			
9	B15-5		1105																			
10	B16-3		1115																			

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ______ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	James Kohn	12/14/23 1545	x [signature]	12/14/23	1546
x			x		

www.fremontanalytical.com

COC 1.3 - 11.06.20

Fremont Analytical

An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date:
Page: 5 of: 8
Laboratory Project No (internal): 2312358

Client: GEI
Address:
City, State, Zip: AS PAGE ONE
Telephone:
Email(s):

Project Name:
Project No: 417-024-03 T200
Collected by:
Location: ONE
Report To (PM):

Special Remarks:

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	HOLD			Comments
1	B16-6	12/13/23	1120 ~~1115~~	S	1													X			
2	B16-9		1125																		
3	B17-2		1130																		
4	B17-7.5		1135																		
5	B18-2		1220																		
6	B18-8		1225																		
7	B19-1		1230																		
8	B19-3.5		1235																		
9	B19-6.5		1240																		
10	B20-1		1245																		

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ______ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	JAMES KOHN	12/14/23 1545	x [signature]	12/14/23 AM 12.14.23	1546
x			x		

Fremont Analytical
An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Client: GEI	Date:	Page: 6 of: 8	Laboratory Project No (internal): 2312358
Address:	Project Name:		Special Remarks:
City, State, Zip: AS PAGE	Project No: 817-024-03 T200		
Telephone:	Collected by:		
	Location: ONE		Disposal: Samples will be disposed in 30 days unless otherwise requested. ☐ Retain volume (specify above) ☐ Return to client
Email(s):	Report To (PM):		

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) | Dissolved (D)	Anions (IC)***	EDB (8011)	HOLD				Comments
1	B20-3	12/13/23	1250	S	1													x				
2	B20-8		1255																			
3	B21-1	12/14/23	0920																			
4	B21-3		0925																			
5	B21-8		0930																			
6	B22-1		0950																			
7	B22-3		0955																			
8	B22-6		1000																			
9	B24-2.5		1005																			
10	B24-6		1010																			

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ______ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	JAMES KOHN	12/14/23 1545	x [signature]		12/14/23 1546
Relinquished (Signature) x	Print Name	Date/Time	Received (Signature) x	Print Name	Date/Time

Chain of Custody Record & Laboratory Services Agreement

Fremont Analytical
An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Date: | Page: 7 of: 4 | Laboratory Project No (internal): 2312358

Project Name:

Special Remarks:

Client: GEI

Project No: 817-024-23 T200

Address:

Collected by:

City, State, Zip: AS PAGE

Location: ONE

Telephone:

Report To (PM):

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

Email(s):

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	HOLD	Comments
1	B24-8	12/14/23	1015	S	1													X	
2	B25-2.5		1020																
3	B25-6		1025																
4	B26-6		1030																
5	B26-8		1035																
6	B27-1.5		1150																
7	B27-3.5		1155																
8	B27-7.5		1200																
9	B28-1.5		1215																
10	B28-6		1220																

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ______ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	JAMES KOHN	12/14/23 1545	x [signature]	12/14/23	1546
Relinquished (Signature) x	Print Name	Date/Time	Received (Signature) x	Print Name	Date/Time

Fremont Analytical
An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date: Page: 8 of: 8

Laboratory Project No (internal): 2312358

Special Remarks:

Client: GEI

Address:

City, State, Zip: AS PAGE

Telephone:

Email(s):

Project Name:

Project No: 817-024-03 T200

Collected by:

Location: ONE

Report To (PM):

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	Hold				Comments
1	B28-8	12/14/23	1215	S	1													X				
2	B12-W	12/13/23	1305	W	2																	
3	B14-W		1245																			
4	B27-W	12/14/23	1400																			
5	B26-W		1215																			
6	P-5		1345																			
7																						
8																						
9																						
10																						

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ______ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	JAMES KOHN	12/14/23 1545	x [signature]	12/14/23	1546
x			x		

Fremont Analytical
An Alliance Technical Group Company
3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date: 12/14/23 Page: 1 of: 4

Laboratory Project No (internal): 2312358

Client: GEI

Address: 2101 4TH AVE STE 950

City, State, Zip: SEATTLE, WA 98121

Telephone:

Email(s): PCORDELL@GEOENGINEERS.COM

Project Name: LBP

Project No: 0617-024-03 T200

Collected by: JAK

Location:

Report To (PM): PHIL CORDELL

Special Remarks: PM TO SELECT ANALYSES

X = Off hold per PC 12/15/23 -cg

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	Hold				Comments
1	B1-1.5	12/14/23	1120	S	1					X												
2	B1-3.5		1125																			
3	B1-6		1130							X												
4	B2-1		1055																			
5	B2-2		1100							X												
6	B2-6		1110							X												
7	B3-2		1015							X		X										
8	B3-4		1020																			
9	B3-7		~~1030~~ 1025							X		X										
10	B3-9		1030																			

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL Individual: Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ______ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	JAMES KOLTON	12/14/23 1545	x [signature]	12/14/23	1546
x			x		

www.fremontanalytical.com

COC 1.3 - 11.06.20

Fremont Analytical

An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date:	Page: 2 of: 4
Laboratory Project No (internal): 2312358	Special Remarks:
Client: GEI	Project Name:
Address:	Project No: 617-024-03 T200
City, State, Zip: AS PAGE	Collected by:
Telephone:	Location: ONE
Email(s):	Report To (PM):

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	HOLD				Comments
1	B4-5	12/12/23	1040	S	1				X			X						x				
2	B4-10		1045						X			X										
3	B5-1.5		1145																			
4	B5-3		1150																			
5	B5-6		1155						X													
6	B6-2.5		1255																			
7	B6-6		1300						X			X										
8	B6-8		1305						X													
9	B7-1		1320																			
10	B7-3.5		1325																			

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ______ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	JAMES KEHN	12/14/23 1545	x [signature]	12/14/23	1546
Relinquished (Signature) x	Print Name	Date/Time	Received (Signature) x	Print Name	Date/Time

Fremont Analytical

An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date: Page: 3 of: 4

Laboratory Project No (internal): 2312358

Special Remarks:

Client: GEI

Address:

City, State, Zip: AS PAGE ONE

Telephone:

Email(s):

Project Name:

Project No: 817-024-03 T200

Collected by:

Location:

Report To (PM):

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	HOLD				Comments
1	B7-8	12/12/23	1330	S	1													x				
2	B8-3		1340																			
3	B8-6		1345																			
4	B8-10		1350																			
5	B9-4		1400																			
6	B9-6		1405							X		X										
7	B9-7.5		1410																			
8	B10-2	12/13/23	0900																			
9	B10-6		0905																			
10	B12-1		0935							X		X										

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ____ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	James Kohn	12/14/23 1515	x [signature]	12/14/23	1546
x			x		

Fremont Analytical

An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date: Page: 4 of: 6

Laboratory Project No (internal): 2312358

Project Name:

Project No: 417-024-03 T200

Collected by:

Location: ONE

Report To (PM):

Special Remarks:

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

Client: GEI

Address:

City, State, Zip: AS PAGE

Telephone:

Email(s):

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	HOLD			Comments
1	B12-2	12/13/23	0940	S	1													X			
2	B12-8		0945																		
3	B13-0.5		0955																		
4	B13-1		1000																		
5	B14-1		1030																		
6	B14-3		1035																		
7	B14-6		1040							X		X									
8	B15-1		1100																		
9	B15-5		1105																		
10	B16-3		1115																		

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ______ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	James Kohn	12/14/23 1545	x [signature]	12/14/23	1546
Relinquished (Signature) x	Print Name	Date/Time	Received (Signature) x	Print Name	Date/Time

COC 1.3 - 11.06.20

www.fremontanalytical.com

Fremont Analytical
An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date: Page: 5 of: 8

Laboratory Project No (internal): 2312358

Special Remarks:

Client: GEI

Address:

City, State, Zip: AS PAGE ONE

Telephone:

Email(s):

Project Name:

Project No: 417-024-03 T200

Collected by:

Location: ONE

Report To (PM):

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

#	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	HOLD				Comments
1	B16-6	12/13/23	1120 ~~1115~~	S	1													X				
2	B16-9		1125																			
3	B17-2		1130																			
4	B17-7.5		1135						X													
5	B18-2		1220						X													
6	B18-6		1225																			
7	B19-1		1230																			
8	B19-3.5		1235						X			X										
9	B19-6.5		1240																			
10	B20-1		1245						X													

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ____ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	JAMES KOHN	12/14/23 1545	x [signature]	[initials] 12/14/23 AM 12.14.23	1546
x			x		

COC 1.3 - 11.06.20

Fremont Analytical

An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date:	Page: 6 of: 8	Laboratory Project No (internal): 2312358	
Client: GEI	Project Name:	Special Remarks:	
Address:	Project No: 817-024-03 T200		
City, State, Zip: AS PAGE	Collected by:		
Telephone:	Location: ONE	Disposal: Samples will be disposed in 30 days unless otherwise requested. ☐ Retain volume (specify above) ☐ Return to client	
Email(s):	Report To (PM):		

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) | Dissolved (D)	Anions (IC)***	EDB (8011)	Hold				Comments
1	B20-3	12/13/23	1250	S	1													x				
2	B20-8		1255																			
3	B21-1	12/14/23	0920																			
4	B21-3		0925																			
5	B21-8		0930																			
6	B22-1		0950																			
7	B22-3		0955																			
8	B22-6		1000																			
9	B24-2.5		1005							X		X										
10	B24-6		1010							X		X										

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ______ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	JAMES KOHN	12/14/23 1545	x [signature]		12/14/23 1546
x			x		

COC 1.3 - 11.06.20

www.fremontanalytical.com

Fremont Analytical — An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date: Page: 7 of: 4

Laboratory Project No (internal): 2312358

Project Name:

Special Remarks:

Client: GEI

Project No: 817-024-23 T200

Address:

Collected by:

City, State, Zip: AS PAGE

Location: ONE

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

Telephone:

Report To (PM):

Email(s):

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	HOLD				Comments
1	B24-8	12/14/23	1015	S	1													X				
2	B25-2.5		1020																			
3	B25-6		1025																			
4	B26-6		1030																			
5	B26-8		1035																			
6	B27-1.5		1150																			
7	B27-3.5		1155																			
8	B27-7.5		1200																			
9	B28-1.5		1215																			
10	B28-6		1220																			

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ______ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	JAMES KOHN	12/14/23 1545	x [signature]	12/14/23	1546
Relinquished (Signature) x	Print Name	Date/Time	Received (Signature) x	Print Name	Date/Time

www.fremontanalytical.com

COC 1.3 - 11.06.20

Fremont Analytical

An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date: | Page: 8 of: 8 | Laboratory Project No (internal): 2312358

Project Name:

Special Remarks:

Client: GEI

Project No: 417-024-03 T200

Address:

Collected by:

City, State, Zip: AS PAGE

Location: ONE

Telephone:

Report To (PM):

Disposal: Samples will be disposed in 30 days unless otherwise requested. ☐ Retain volume (specify above) ☐ Return to client

Email(s):

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8) Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	Hold				Comments
1	B28-8	12/14/23	1215	S	1												X				
2	B12-W	12/13/23	1305	W	2					X		X					|				
3	B14-W	|	1245	|	|					X		X					|				
4	B27-W	12/14/23	1400	|	|					X		X					|				
5	B26-W	|	1215	|	|					X		X					|				
6	P-5	|	1345	|	|					X		X					|				
7																					
8																					
9																					
10																					

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time: ☐ Standard ☐ Next Day ☐ 3 Day ☐ Same Day ☐ 2 Day ______ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	JAMES KOHN	12/14/23 1545	x [signature]	12/14/23	1546
x			x		

www.fremontanalytical.com

Fremont Analytical

An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date: 12/14/23 Page: 1 of: 4

Laboratory Project No (internal): 2312358

Project Name: LBP

Project No: 0017-024-03 T200

Collected by: JAK

Location:

Report To (PM): PHIL CORDELL

Client: GEI

Address: 2101 4TH AVE STE 950

City, State, Zip: SEATTLE, WA 98121

Telephone:

Email(s): PCORDELL@GEOENGINEERS.COM

Special Remarks:
PM TO SELECT ANALYSES
X = Off hold per PC 12/15/23 -cg
X = Add Analysis per PC -mw 12/27/23

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	HOLD				Comments
1	B1-1.5	12/14/23	1120	S	1					X												
2	B1-3.5		1125																			
3	B1-6		1130							X												
4	B2-1		1055																			
5	B2-2		1100							X												
6	B2-6		1110							X												
7	B3-2		1015							X		X										
8	B3-4		1020																			
9	B3-7		1025 ~~1030~~							X		X										
10	B3-9		1030																			

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL Individual: Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ______ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	JAMES Kolton	12/14/23 1545	x [signature]	12/14/23	1546
Relinquished (Signature) x	Print Name	Date/Time	Received (Signature) x	Print Name	Date/Time

Fremont Analytical

An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date:	Page: 2 of: 4
Laboratory Project No (internal): 2312358	
Client: GEI	Project Name:
Address:	Project No: 4617-024-03 T200
City, State, Zip: AS PAGE	Collected by:
Telephone:	Location: ONE
Email(s):	Report To (PM):

Special Remarks:

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	HOLD				Comments
1	B4-5	12/12/23	1040	S	1				X	X		X						x				
2	B4-10		1045						X	X		X										
3	B5-1.5		1145																			
4	B5-3		1150																			
5	B5-6		1155						X													
6	B6-2.5		1255																			
7	B6-6		1300						X			X										
8	B6-8		1305						X													
9	B7-1		1320																			
10	B7-3.5		1325																			

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ______ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	JAMES KEHN	12/14/23 1545	x [signature]	12/14/23	1546
x			x		

Fremont Analytical

An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date: Page: 3 of: 4

Laboratory Project No (internal): 2312358

Special Remarks:

Project Name:

Client: GEI

Project No: 817-024-03 T200

Address:

Collected by:

City, State, Zip: AS PAGE ONE

Location:

Telephone:

Report To (PM):

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

Email(s):

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	HOLD			Comments
1	B7-8	12/12/23	1330	S	1													X			
2	B8-3		1340																		
3	B8-6		1345																		
4	B8-10		1350																		
5	B9-4		1400							X											
6	B9-6		1405							X		X									
7	B9-7.5		1410																		
8	B10-2	12/13/23	0900																		
9	B10-6		0905																		
10	B12-1		0935							X		X									

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ____ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	James Kahn	12/14/23 1515	x [signature]	12/14/23	1546
Relinquished (Signature) x	Print Name	Date/Time	Received (Signature) x	Print Name	Date/Time

Fremont Analytical

An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date: | Page: 4 of: 6 | *Laboratory Project No (internal):* 2312358

Project Name:

Project No: 417-024-03 T200

Collected by:

Location: ONE

Report To (PM):

Special Remarks:

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

Client: GEI

Address:

City, State, Zip: AS PAGE

Telephone:

Email(s):

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	HOLD				Comments
1	B12-2	12/13/23	0940	S	1					X								X				
2	B12-8		0945							X												
3	B13-0.5		0955																			
4	B13-1		1000																			
5	B14-1		1030																			
6	B14-3		1035							X												
7	B14-6		1040							X		X										
8	B15-1		1100																			
9	B15-5		1105																			
10	B16-3		1115																			

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ______ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	James Kohn	12/14/23 1545	x [signature]	12/14/23	1546
x			x		

Fremont Analytical
An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date: Page: 5 of: 8

Laboratory Project No (internal): 2312358

Client: GEI

Address:

City, State, Zip: AS PAGE ONE

Telephone:

Email(s):

Project Name:

Project No: 417-024-03 T200

Collected by:

Location: ONE

Report To (PM):

Special Remarks:

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	HOLD	Comments
1	B16-6	12/13/23	~~1115~~ 1120	S	1													X	
2	B16-9		1125																
3	B17-2		1130							X									
4	B17-7.5		1135						X										
5	B18-2		1220						X										
6	B18-8		1225							X									
7	B19-1		1230																
8	B19-3.5		1235						X	X		X							
9	B19-6.5		1240							X									
10	B20-1		1245						X	X									

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ______ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	JAMES KOHN	12/14/23 1545	x [signature]	12/14/23 AM 12.14.23	1546
x			x		

COC 1.3 - 11.06.20

www.fremontanalytical.com

Fremont Analytical
An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date: | Page: 6 of: 8
Laboratory Project No (internal): 2312358

Project Name:
Project No: 817-024-03 T200
Collected by:
Location: ONE
Report To (PM):

Special Remarks:

Client: GEI
Address:
City, State, Zip: AS PAGE
Telephone:
Email(s):

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	HOLD					Comments
1	B20-3	12/13/23	1250	S	1					X								*					
2	B20-8		1255																				
3	B21-1	12/14/23	0920																				
4	B21-3		0925																				
5	B21-8		0930																				
6	B22-1		0950																				
7	B22-3		0955							X													
8	B22-6		1000																				
9	B24-2.5		1005							X		X											
10	B24-6		1010							X		X											

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ______ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	JAMES KOHN	12/14/23 1545	x [signature]		12/14/23 1546
Relinquished (Signature) x	Print Name	Date/Time	Received (Signature) x	Print Name	Date/Time

Fremont Analytical

An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Client: GEI	Date:
Address:	Page: 7 of: 4
City, State, Zip: AS PAGE	Project Name:
Telephone:	Project No: 817-024-23 T200
Email(s):	Collected by:
	Location: ONE
	Report To (PM):

Laboratory Project No (internal): 2312358

Special Remarks:

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	HOLD				Comments
1	B24-8	12/14/23	1015	S	1													x				
2	B25-2.5		1020							X												
3	B25-6		1025																			
4	B26-6		1030							X												
5	B26-8		1035																			
6	B27-1.5		1150																			
7	B27-3.5		1155							X												
8	B27-7.5		1200																			
9	B28-1.5		1215							X												
10	B28-6		1220							X												

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ____ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	JAMES KOHN	12/14/23 1545	x [signature]	12/14/23 1546	
Relinquished (Signature) x	Print Name	Date/Time	Received (Signature) x	Print Name	Date/Time

Fremont Analytical

An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date: | Page: 8 of: 8 | Laboratory Project No (internal): 2312358

Project Name:

Project No: 417-024-03 T200

Collected by:

Location: ONE

Report To (PM):

Client: GEI

Address:

City, State, Zip: AS PAGE

Telephone:

Email(s):

Special Remarks:

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) | Dissolved (D)	Anions (IC)***	EDB (8011)	Hold	Comments
1	B28-8	12/14/23	1215	S	1													x	
2	B12-W	12/13/23	1305	W	2					X		X							
3	B14-W		1245							X		X							
4	B27-W	12/14/23	1400							X		X							
5	B26-W		1215							X		X							
6	P-5		1345							X		X							
7																			
8																			
9																			
10																			

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ____ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	JAMES KOHN	12/14/23 1545	x [signature]	12/14/23	1546
x			x		

APPENDIX D
Report Limitations and Guidelines for Use

APPENDIX D
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report. Please confer with GeoEngineers if you need to know more about how these "Report Limitations and Guidelines for Use" apply to your project or property.

Read These Provisions Closely

It is important to recognize that environmental engineering and geoscience practices (geotechnical engineering, geology and environmental science) are less exact than other engineering and natural science disciplines. GeoEngineers includes these explanatory "limitations" provisions in our reports to help reduce the risk of misunderstandings or unrealistic expectations that lead to disappointments, claims and disputes.

Environmental Services Are Performed for Specific Purposes, Persons and Projects

GeoEngineers has prepared this Pre-Construction Subsurface Investigation (SI) Results Summary for the City of Mercer Island Luther Burbank Park project in Mercer Island, Washington in general accordance with the scope and limitations of our fully executed proposal, dated October 6, 2023. This report has been prepared for the exclusive use of the City of Mercer Island. This report is not intended for use by others, and the information contained herein is not applicable to other properties.

GeoEngineers structures its services to meet the specific needs of its clients. For example, an Environmental Site Assessment study conducted for a property owner may not fulfill the needs of a prospective purchaser of the same property. Because each environmental study is unique, each environmental report is unique, prepared solely for the specific client and property. Use of this report is not recommended for any purpose or project other than as expressly stated in this report.

This Environmental Report is Based on a Unique Set of Project-Specific Factors

This report has been prepared for the Luther Burbank Park project in Mercer Island, Washington. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project. Unless GeoEngineers specifically indicates otherwise, it is important not to rely on this report if it was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before project changes were made.

If changes to the project or property occur after the date of this report, GeoEngineers cannot be responsible for any consequences of such changes in relation to this report unless we have been given the opportunity

[1] Developed based on material provided by GBA, GeoProfessional Business Association; www.geoprofessional.org.

to review our interpretations and recommendations in the context of such changes. Based on that review, we can provide written modifications or confirmation, as appropriate.

Reliance Conditions for Third Parties

This report was prepared for the exclusive use of the party(ies) to whom this report is addressed. No other party may rely on the product of our services unless we agree to such reliance in advance and in writing. Within the limitations of the agreed Project scope, schedule and budget, our services have been executed in accordance with our Agreement with the Client and generally accepted environmental practices in this area at the time this report was prepared.

Understand that Geotechnical Issues have not been Addressed

Unless geotechnical engineering was specifically included in our scope of service, this report does not provide any geotechnical findings, conclusions, or recommendations, including but not limited to, the suitability of subsurface materials for construction purposes.

Do Not Separate Documentation from the Report

Environmental reports often include supplemental documentation, such as maps, figures and tables. Do not separate such documentation from the report. Further, do not, and do not permit any other party to redraw or modify any of the supplemental documentation for incorporation into other professionals' instruments of service.

Environmental Regulations Change and Evolve

Some substances may be present in the vicinity of the subject property in quantities or under conditions that may have led, or may lead, to contamination of the subject property, but are not included in current local, state or federal regulatory definitions of hazardous substances or do not otherwise present current potential liability. GeoEngineers cannot be responsible if the standards for appropriate inquiry, or regulatory definitions of hazardous substances, change or if more stringent environmental standards are developed in the future.

Uncertainty May Remain Even After this Subsurface Investigation is Completed

Performance of a Site Investigation (SI) is intended to reduce uncertainty regarding the potential for contamination in connection with a property, but no SI can wholly eliminate that uncertainty. Our interpretation of subsurface conditions in this study is based on field observations and chemical analytical data from widely spaced sampling locations. It is always possible that contamination exists in areas that were not explored, sampled or analyzed.

Subsurface Conditions Can Change

This environmental report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by man-made events such as construction on or adjacent to the subject property, by new releases of hazardous substances, new information or technology that become available subsequent to the report date, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. Please contact GeoEngineers before applying this report for its intended purpose so that GeoEngineers may evaluate whether changed conditions affect the continued applicability of the report.

Soil and Groundwater End Use

The cleanup levels referenced in this report are site- and situation-specific. The cleanup levels may not be applicable for other properties or for other on-site uses of the affected soil and/or groundwater. Note that hazardous substances may be present in some of the on-site soil and/or groundwater at detectable concentrations that are less than the referenced cleanup levels. GeoEngineers should be contacted prior to the export of soil or groundwater from the subject property or reuse of the affected soil or groundwater on-site to evaluate the potential for associated environmental liabilities. GeoEngineers will not assume responsibility for potential environmental liability arising out of the transfer of soil and/or groundwater from the subject property to another location, or the reuse of such soil and/or groundwater on site in any instances that we did not recommend, know of, or control.

Most Environmental Findings are Professional Opinions

Our interpretations of subsurface conditions are based on field observations and chemical analytical data from widely spaced sampling locations at the subject property. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied its professional judgment to render an informed opinion about subsurface conditions throughout the property. Actual subsurface conditions may differ significantly from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants, and no conclusions or inferences should be drawn regarding Biological Pollutants as they may relate to this Project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria and viruses, and/or any of their byproducts.

A Client that desires these specialized services is advised to obtain them from a consultant who offers services in this specialized field.

Information Provided by Others

GeoEngineers has relied upon certain data or information provided or compiled by others in the performance of our services. Although we use sources that we reasonably believe to be trustworthy, GeoEngineers cannot warrant or guarantee the accuracy or completeness of information provided or compiled by others.

GeoEngineers

Appendix H
Luther Burbank Park Waterfront Improvements Shoreline Vegetation Plan

PUBLIC WORKS DEPARTMENT
CITY OF MERCER ISLAND, WASHINGTON
9611 S.E. 36th St. • Mercer Island, WA 98040-3732
(206) 275-7608 • FAX: (206) 275-7814
www.mercerisland.gov

Luther Burbank Park Waterfront Improvements Shoreline Vegetation Plan

1. Personnel Qualifications

a. Lizzy Stone, MS: Lizzy Stone has nearly a decade of experience working in habitat restoration and forest ecology. She earned a BS in biology from the University of New Mexico and an MS in forest ecology from the University of Washington's School of Environmental and Forest Sciences. She has worked as the Natural Resources Project Manager for the City of Mercer Island since the summer of 2021.
b. Paul West, MFR: Paul D. West has 40 years of experience in the field of landscape horticulture. He holds a BS in Natural Resources from Cornell University and a Masters of Forest Resources in Urban Horticulture from the University of Washington. He was previously the Senior Urban Forester for the City of Seattle Parks and Recreation Department. He has authored numerous natural resource and vegetation management plans for both private and public entities.

2. Site, Project Purpose, and Permit Approach

Luther Burbank Park is a 55-acre public park on the north end of Mercer Island. The address is 2040 84th Avenue SE. It slopes to Lake Washington along its eastern and northern boundaries. The site contains ¾ mile of shoreline. The City of Mercer Island Public Works Department (City) is designing the renovation of the Luther Burbank Park Waterfront, which includes renovating and replacing docks, adding new shoreline access features, and installing shoreline buffer plantings on a portion of the park known by Parcel Identification Number 0624059014. The purpose of this project is to increase capacity and accessibility for public shoreline recreation by renovating and improving the fifty-year-old facility. This goal aligns with the Washington State Shoreline Management Act.

Mercer Island City Code MICC 19.13.050(K)(4) requires a vegetation plan for the 20-foot shoreline buffer for the parcel under permit application because the sum total of all shoreline development within the past five years has or will result in an increase in hardscape coverage that is over 1000 square feet. The vegetation plan must provide native vegetation coverage over 75 percent of the 20-foot vegetation buffer. The vegetation must be a variety of groundcover, shrubs, and trees native to the Central Puget Sound lowlands. Existing mature trees and shrubs that are not comprised of noxious weeds may be included in the coverage calculation.

The code requirement appears to be intended for private residential development with shoreline lengths typically in the range of 100-200 feet. In this instance, the shoreline surveyed is approximately 2300 feet in length. This vegetation plan uses natural resource survey methodology by dividing the shoreline buffer into vegetation units that contain vegetation with a consistent composition across the unit. These units have typically evolved from an underlying soil and water characteristic (e.g. a wetland), and/or from an historical episode of development, such as agriculture. The personnel performing the survey have a combination of academic training and professional experience to visually estimate the percentage cover class of native and mature vegetation for each unit.

3. Vegetation Survey

Eighty-nine percent (41,976 square feet) of the shoreline buffer is vegetated, while 11% (5,376 square feet) is made up of a swim beach and plaza. The vegetated shoreline buffer was divided into vegetation units based on vegetation composition, management history, and landscape features. A map of the vegetation units is shown in Map 1. A summary of the vegetation survey is provided in Table 1. Expanded evaluations of each vegetation unit follow.

LUTHER BURBANK SHORELINE VEGETATION PLAN: VEGETATION UNITS

UNIT	SQ. FEET	% of 20' Buffer
1	3,859	8.1%
2	2,946	6.2%
3	23,160	48.9%
4	12,011	25.4%
Beach	1,474	
Plaza	3,902	
TOTAL	**47,352**	**88.6%**

Vegetation Area
Impervious Surface
20-ft Buffer
Luther Burbank Property Line

N

Map Date: 4/17/2024
LBImpervious2023.aprx
LutherBurbankVegetationPlan-VegUnits

Table 1: Summary of Vegetation Survey

Veg Unit	Area SF	Native Veg Class Cover Percentage	Descriptor	Management History	Proposed Management Action
1	3,859	75-100	Cottonwood forest	Not managed	Monitor
2	2,946	75-100	Off-leash Area Wetland	Enhanced in 2008 as part of the Off-leash Area project	Enhance dog exclusion along the shoreline, plant
3	23,160	75-100	North Shoreline	Constructed in 2008 as a shoreline stabilization project and maintained	Periodic noxious weed removal
4	12,011	25-50	South Shoreline	Constructed in 2023 as part of a shoreline stabilization project	Maintain new plantings

4. Vegetation Units

1. Cottonwood Forest
   Condition Description: The shoreline vegetation consists of cottonwood trees *Populus balsamifera spp. trichocarpa* with an understory of sedges. It is classified in the 75-100 percent quartile of native coverage, and the actual coverage is over 100% with multiple layers of vegetation present. Plant cover is continuous except for bare soil where social trails have formed from park users. The noxious weed Himalayan blackberry *Rubus armeniacus* is present in combination with native plants at the north end of the unit.
   Management History: This shoreline was historically part of a farm that operated from 1906 to 1965. A dock was located at the north end of this unit until the property was purchased for a county park in 1968. There is no documentation of management of this unit during the county's ownership. The City has monitored this unit for vegetation condition.
   Proposed Action: The City will continue monitoring Vegetation Unit 1 for noxious weeds and prioritize weed removal with other vegetation management in the park.

Figure 1: Representative image of Vegetation Unit 1. Note social trail through dense sedge understory.

2. Off-leash Area Wetland
   Condition Description: This shoreline vegetation unit consists of deciduous tree and tall red osier dogwood *Cornus sericea* canopy with significant areas of bare soil. It is classified in the 75-100 percent quartile of native coverage because of tree and shrub coverage, but this does not reflect an underlying management issue of bare soil. The noxious weeds Himalayan blackberry *Rubus armeniacus,* and English ivy *Hedera helix* are present in small patches.
   Management History: This shoreline was historically part of a farm that operated from 1906 to 1965. The property was purchased for a county park in 1968. There is no documentation of management of this unit during the county's ownership. The City identified this area as a wetland during the design of the Off-leash Area (OLA) redevelopment project in 2008. The City subsequently installed wetland enhancement plantings and fencing in this area as part of the OLA construction. It has monitored this unit for vegetation condition since then.
   Proposed Action: The City will enhance dog exclusion along this stretch of shoreline, plant native understory plants, maintain the buffer plantings, and continue to monitor the unit.

Figure 2: Representative image of Vegetation Unit 2. Note bare ground around mature native dogwood shrubs.

3. North Shoreline
   Condition Description: This shoreline vegetation unit consists of mature Lombardy poplar *Populus nigra 'Italica'* trees with dense native tree and tall shrub canopy. It is classified in the 75-100 percent quartile of native coverage, and the actual coverage is over 100% with multiple layers of vegetation present. The noxious weed Himalayan blackberry *Rubus armeniacus* is present but does not represent significant cover.
   Management History: This shoreline was historically part of a farm that operated from 1906 to 1965. The property was purchased for a county park in 1968. There is no documentation of management of this unit during the county's ownership. The City installed shoreline stabilization and native buffer plantings in 2008. This buffer has been maintained since, with periodic removal of invasive non-native species.
   Proposed Action: The City will continue monitoring for noxious weeds in Vegetation Unit 3 and prioritize weed removal with other vegetation management in the park.

Figure 3: Representative image of Vegetation Unit 3

4. South Shoreline
   Condition Description: This shoreline vegetation unit consists of native deciduous trees, predominantly Oregon Ash *Fraxinus latifolia* on approximately half of the unit, with dense shoreline buffer vegetation and new restoration plantings on the other half. Overall, the unit is classified in the 25-50% quartile of native coverage. The noxious weeds Himalayan blackberry *Rubus armeniacus,* English Holly *Ilex aquifolium,* and English ivy *Hedera helix* are present but do not represent significant cover. A non-native *Viburnum* species has naturalized in parts of this shoreline but does not appear to be invasive.
   Management History: This shoreline was forested during the era when it was part of a farm that operated from 1906 to 1965. The property was purchased for a county park in 1968. There is no documentation of management of this unit during the county's ownership. The City installed shoreline stabilization and native buffer plantings in 2023. An initial step in that project was noxious weed control for the year leading up to construction.
   Proposed Action: The City will maintain this buffer to ensure successful establishment of over 800 native plants installed in the fall of 2023. Maintenance will include irrigation, weeding, mulching, and deer protection. The City will install additional plants as needed to establish successful native cover throughout the buffer.

Figure 4: representative image of Vegetation Unit 4. Blue plant covers prevent deer browse on tree seedlings.

5. Analysis of Code Compliance

The vegetation cover in Vegetation Units 1, 2, and 3 is currently in compliance with MICC 19.13.050(K)(4). Each of these units has greater than 75% native and mature, non-invasive plant cover. These three vegetation units cover 29,965 square feet or 63.3 percent of the 20-foot shoreline buffer. Vegetation Unit 4 has 25-50% native and mature, non-invasive plant cover. It is 12,011 square feet or 25.4 percent of the shoreline buffer. The existing canopy that covers roughly half of the unit is compliant, with coverage close to or exceeding 100%. New plantings cover roughly half of the vegetation unit. The planned maintenance of the new plantings is expected to produce robust growth, especially in Years 2 and 3. The new plantings need only to provide something above 50% coverage to result in an average native cover of greater than 75% across the unit. In other words, an average of 75% or greater native plant cover will be achieved across the unit with only partial coverage by the new plantings. Therefore, it is realistic to expect that Unit 4 will be compliant at the end of Year 3 in 2026. Nevertheless, we expect these plantings to eventually achieve 100% native vegetation coverage, as a result of the proposed maintenance regime.

When all four vegetation units are compliant, they will provide at least 75% native or mature, non-invasive plant coverage on 88.6 percent of the shoreline buffer. This analysis is conservative in its approach. A more detailed vegetation survey would likely show that the 20-foot shoreline buffer is currently compliant. If we assume units 1, 2, and 3, along with half of unit 4 have 100% coverage, they would provide a total of 76.0% coverage across the buffer. Limitations in the study methodology do not enable us to confirm this result, however.

6. Implementation

The City of Mercer Island Public Works Natural Resources Unit (NRU) will be responsible for implementing the proposed actions in this plan. This program comprehensively manages the City's 300+ acres of public open space, including Luther Burbank Park. The NRU develops a work plan for each biennium and then implements it through a combination of contractors, volunteers, and City employees. This work is funded by the City's Capital Improvement Program.

7. Conclusion

The parcel currently has compliant coverage on 63.3% percent of the 20-foot shoreline buffer. The implementation of this vegetation plan is expected to enable this parcel to achieve full compliance with MICC 19.13.050(K)(4) by the end of 2026, or one year following the expected completion of the Luther Burbank Waterfront Improvements project. It is the goal of this vegetation plan for each vegetation unit to be compliant with greater than 75% native or mature, non-invasive plant coverage.