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ANCHOR QEA

April 13, 2023

City of Mercer Island
Community Planning and Development
9611 SE 36th Street
Mercer Island, Washington 98040

Re: Shoreline Substantial Development Permit, Shoreline Conditional Use Permit, and Shoreline Variance Request for the Luther Burbank Park Waterfront Improvements Project

To Whom It May Concern:

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. This letter has been updated in response to comments received in February 2023 from the City and the City's third-party consultant reviewer.[1]

This application is intended to provide information about the Project and to request a Shoreline Substantial Development Permit, Shoreline Conditional Use Permit, and Shoreline Variance from the City under Mercer Island City Code (MICC) Chapter 19.13 – Shoreline Master Program. The following supporting materials are provided with this letter:

- Exhibit 1. City Development Application Form
- Exhibit 2. Joint Aquatic Resources Permit Application (JARPA)
  - JARPA Form
  - Project Description (project narrative and drawings)
  - Critical Areas Study (including no net loss discussion)
  - SEPA Checklist
  - Cultural Resources Report
  - Biological Evaluation
- Exhibit 3. Shoreline Code Compliance Tables

1 Project Overview

The Project includes repairing the north dock structure, and replacing and reconfiguring the central and south dock structures, to accommodate waterfront programming and current and projected

[1] City of Mercer Island, 2023. Letter to: Paul West, City of Mercer Island. Regarding: Luther Burbank Waterfront Improvements Project (SHL22-023, SHL22-024, SHL22-025, CAO22-018, SEP22-019) Request for Information 1; 2048 84th Avenue SE, Mercer Island, Washington 98040. January 20, 2023.

watercraft uses at the park. 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 Americans with Disabilities Act (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 by the Project 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 accessible requirements. 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 plaza.

A Project Description containing a detailed narrative of each of the elements described above and project drawings are included as attachments to the JARPA (Exhibit 2).

2 Shoreline Master Program Compliance

The Project is located within the City's Shoreline Master Program (SMP) jurisdiction, within the Urban Park shoreline environment on Lake Washington. Per the SMP, the Urban Park shoreline environment consists of shoreland areas designated for public access and active and passive public recreation. The purpose of the Project is to optimize public access, recreational uses, and public safety, including reconfiguring the waterfront park to better accommodate small boats and nonmotorized watercraft and to improve 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.

The Project includes the following uses, which are allowed landward of the ordinary high water mark (OHWM) within the Urban Park shoreline environment per MICC 19.13.040 – Table A:

- Public parks and open space
- Noncommercial recreation areas
- Shoreland surface modification
- Restoration of ecological functions including shoreline habitat and natural systems enhancement

The following Project element located landward of the OHWM requires a Shoreline Conditional Use Permit (SCUP) per MICC 19.13.040 – Table A:

- New hard structural shoreline stabilization (for the terraced rock walls at the south on-grade pathway and rock revetment and sheet pile wall at the north beach expansion area)

The following Project elements are allowed waterward of the OHWM per MICC 19.13.040 – Table B:[2]

- Floating platforms
- Mooring piles
- Public access pier, dock, or boardwalk
- Restoration of ecological functions including shoreline habitat and natural systems enhancement

Although "public access piers, docks, or boardwalks" are allowed uses, the City is requesting a Shoreline Variance to provide the following design allowances for the Project. Additional details and justification are provided later in this document under the Shoreline Variance Analysis subsection:

- **Dock width requirements.** The City is requesting a variance from MICC 19.13.050(H)(4) dock width requirements to allow the central and south dock structures to exceed the 6-foot width requirement.
- **Dock grating requirements.** The City is requesting a variance from MICC 19.13.050(H)(5) dock grating requirements to allow the central wave attenuator/mooring float structure to provide less light transmittance than is allowed by the code (the code requires 40% light transmittance over 100% of the dock).
- **Fixed pier height requirements.** The City is requesting a variance from MICC 19.13.050(H)(6) fixed pier height requirements to allow the overwater access platform adjacent to the plaza to extend below the minimum height requirement of 1.5 feet above OHWM.
- **Pile spacing and pile diameter requirements.** The City is requesting a variance from MICC 19.13.050(H)(7) to allow sets of piles at corners of the dock to be less than 18 feet apart (average pile set spacing will be 18.45 feet overall) and greater than 12 inches in diameter. A variance will also be needed for the first set of piles to allow diameters greater than 10 inches. The piles are currently beyond the 18-foot minimum distance from OHWM (34 inches to 9 inches).

2.1 Shoreline Substantial Development Permit Analysis

The Project includes allowed uses within the Urban Park shoreline environment that will require a Shoreline Substantial Development Permit (SSDP) from the City. Activities to be covered under the SSDP include the following in-water and overwater activities and upland improvements (see the Project Description for details).

[2] Buoys are anticipated to be allowed as accessory to the water dependent uses described in this section.

2.1.1 In-Water and Overwater Activities

The in-water and overwater activities requiring a SSDP from the City include the following:

- North dock repairs
- Central and south docks reconfiguration (except for grating, float width, and pile distance and width elements requiring a Shoreline Variance)
- Installation of a wave attenuation float at the central dock to provide safe use and programming for the south dock and to protect shoreline ecological functions from erosion
- Waterfront gangway and overwater access platform (except for the overwater access platform height requiring a Shoreline Variance)
- Restoration of ecological functions including shoreline habitat and natural systems enhancement (installation of cobble underlayment and habitat gravel below OHWM resulting in temporary impacts)

As discussed in the Project Description, the Project will replace and reconfigure the solid decking central and south fixed dock structures. The new central dock will be installed in deeper water and will consist of a grated gangway and a concrete wave attenuator/mooring float. The new south dock will be located near shore and will include a grated gangway and floats.

Per MICC 19.13.050(H)(5), new docks are required to have a grated surface that allows for 40% light transmittance over 100% of the dock. The Project will meet this requirement for the south dock and the new overwater access platform adjacent to the waterfront plaza. To provide adequate wave attenuation and protection for users of the south dock structure and to protect shoreline ecological functions from erosion, the float material will be concrete, with light penetration options where possible. Because 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, a variance is required to cover this deviation.

Per MICC 19.13.050(G), "Breakwaters, jetties, groins, weirs, and similar structures are prohibited, except for those structures installed to protect or restore ecological functions, such as woody debris installed in streams. Breakwaters, jetties, groins, and weirs shall be designed to protect critical areas and shall provide for mitigation according to the sequence defined in WAC 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.[3]

[3] Blue Coast (Blue Coast Engineering), 2022. Memorandum to: Andy Bennett and Will Cyrier, KPFF Consulting Engineers. Regarding: Luther Burbank Marina Design: Wave and Wake Modeling. Prepared by Eduardo Sierra and Kathy Ketteridge, Blue Coast Engineering. January 9, 2022. Available as Appendix E in the Critical Areas Report (Attachment 3 to this letter).

This reduction in wave height will subsequently reduce wave energy at the nearshore and along the 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 large woody debris (LWD) and the planting of native riparian plant species (permitted under City Permit Nos. SHL20-016 and SHL SHL21-009).

Table 1 provides a summary of the proposed changes to overwater cover. Overall, the Project would slightly reduce the total amount of overwater cover and would use light-penetrating grating materials to the maximum feasible extent.

Table 1
Existing and Proposed Overwater Coverage

Description	Removed Overwater Cover (sf)	New or Relocated Overwater Cover (sf)	Net Change (sf)
Existing solid wood decking	960	--	--
Existing fixed concrete dock	3,665	--	
Existing aluminum ramp	40	--	
Proposed concrete gangway abutment	--	18	
Proposed two grated gangways	--	600	
Proposed four finger floats	--	265	
Proposed grated floats	--	615	
Proposed wave attenuator float	--	2,610	
Proposed grated overwater platform	--	552	
Total Overwater Cover Change:	**4,665**	**4,660**	**-5**

Notes:

1. Approximately 2,000 sf of new overwater cover will consist of fiberglass-reinforced plastic grating.
2. 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.

sf: square foot

The Project includes elements in nearshore areas with up to 12 feet of water depth and in offshore, or deep water, areas with approximately 40 feet of water depth (measured from OHWM or 18.67 North American Vertical Datum of 1988 [NAVD88]).[4] Lake Washington shorelines provide habitat for Chinook salmon, sockeye salmon, coho salmon, and cutthroat trout. The nearshore area (up to a water depth of 12 feet) provides habitat opportunities for migrating juvenile Chinook salmon.

[4] In on-site personal conversation with Lalena Amiotte (Department of Natural Resources).

Reducing solid overwater cover in these areas will reduce opportunities for predatory fish to congregate and improve light and dark transitions and habitat conditions for the migrating salmonids. In deeper water

where adult Chinook and juvenile sockeye salmon are found, the design has fewer impacts to habitat because overwater cover in deep water for the wave attenuator/mooring float is less likely to harbor predator species, and there would be less impact on light penetration and shadowing. The proposed design aims to minimize impacts to the nearshore area at the south dock and overwater platform with the use of grated overwater surfacing.

2.1.2 Upland Improvements

The upland improvements to be covered under an SSDP include the following:

- Boiler Building repairs
- Boiler Building restroom annex renovation
- Concession stand repairs
- Waterfront plaza renovations and access upgrades (except for the terrace rock walls at the north beach expansion area requiring a SCUP)
- Waterfront drainage LID
- Restoration of ecological functions including shoreline habitat and natural systems enhancement
- Fire Department required updates, including adding a fire water line, fire hydrants, and a fire access apparatus access road and renovating an existing gravel trail

The Boiler Building repairs, Boiler Building restroom annex renovation, and concession stand repairs all include installing improvements to the existing Boiler Building. Per MICC 19.13.050(A), Table C (A) and (B), development for structures landward of the OHWM requires a 25-foot setback and must not exceed a height of 35 feet above average building elevation. The Boiler Building is an existing nonconforming 80-foot-tall structure located partially within the 25-foot setback. The Boiler Building was constructed in 1928. The addition, which contains men's and women's toilet rooms and concessions, was constructed in 1974. The proposed repairs will not increase its nonconformity and will be completed consistent with the requirements in Table C. Exterior repairs include installing a new roof and replacing wall-mounted light fixtures. The Boiler Building restroom annex renovation proposes to construct a viewing deck on the existing restroom roof and will be constructed to an elevation of 29 feet, 10 inches compared to the existing elevation of 29 feet, 2 inches. The structure will not exceed a height of 35 feet above average building elevation. The rooftop viewing deck will be located in the existing building location approximately 35 feet from the OHWM. The concession stand repairs will occur under the rooftop viewing deck within the same footprint, located between the restrooms and Boiler Building on the ground floor.

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 propose to replace existing plaza hardscape with concrete paving and pervious paving as part of the Project's waterfront drainage LID. Two new trails, one in the north beach area and one in the south, will provide additional public access to the waterfront that is currently limited to an asphalt pathway at the north and a gravel maintenance driveway in the south. The hardscapes proposed in the design are consistent with MICC 19.13.050(A), Table C, (C) and (D), which states the maximum hardscape between 0 and 25 feet from the OHWM shall be 10% and the area between 25 and 50 feet from the OHWM shall be 30% (see Exhibit 4 to this letter).

The existing gravel north beach area above OHWM will be expanded with additional habitat-grade gravel, and native riparian plantings will be installed near the shoreline to maintain ecological functions.

2.2 Shoreline Conditional Use Permit Analysis

New hard structural shoreline stabilization activities at the north beach and near the south on-grade pathway include the installation of rock revetment and rock terraces landward of the OHWM. An up-to-6-foot-long sheet pile wall is also located at the north beach area. Per Table A in MICC 19.13.040, new hard structural shoreline stabilization measures are permitted with a SCUP within the Urban Park environment. These structures are necessary to stabilize the south on-grade trail, which is located on a steep slope, and to protect the new north beach universally accessible public access trail and the expanded and restored beach area.

MICC 19.13.050(B) allows for new structural stabilization measures to be installed that "protect projects for the restoration of ecological functions." The proposed rock revetment features will protect the proposed accessible public access trail (both south and north features) and restoration areas located landward of the beach (north feature). The rock revetment wall is located landward of the OHWM and does not encroach waterward of the OHWM. This wall functions to provide shoreline stabilization to protect the public access trail to the beach and will absorb wake energy to reduce the risk of erosion at this location.[5] Invasive species will be removed, and the upland area will be

[5] Blue Coast, 2022. Memorandum to: Andy Bennett and Will Cyrier, KPFF Consulting Engineers. Re: Luther Burbank Marina Design: Wave and Wake Modeling. Prepared by Eduardo Sierra and Kathy Ketteridge, Blue Coast Engineering. January 9, 2022. Available as Appendix E in the Critical Areas Report (Attachment 3 to this letter).

replanted with native riparian plant species. The existing beach habitat gravels and logs will be temporarily removed for construction and then replaced after the rock revetment wall is installed abutting these existing features, landward of the OHWM. This feature will protect restored ecological function in this area and will accommodate public access to the expanded beach area. The expanded beach area is designed to increase ecological function for salmonids.

The sheet pile wall is a shore stabilization feature; the sheet pile wall will be up to 6 feet long and extend 6 feet below grade to address potential scour from impacting the public access trail. The dynamic forces of wave, wake, and currents could otherwise shift the habitat gravels placed on the beach. The sheet pile wall is installed at this depth to protect against toe scour, which is calculated at approximately 2 feet, undercutting the sheet wall at the public access trail and causing wall rotation and partial or full failure.[6] This sheet pile wall will absorb wake energy to reduce the risk of erosion at this location, providing shoreline stabilization support to the landward public access trail and protection of the habitat restoration area and expanded beach.

The erosion control structures are compliant with all sections of MICC 19.13.050(B)(4). The rock terraces and rock revetment walls are located landward of the OHWM and do not encroach waterward of the OHWM. The function provided by these wall features cannot be addressed using only nonstructural methods, such as riparian vegetation, because the south on-grade trail is located on a steep slope, and walls are required to provide shoreline stabilization to protect the public access trail to the beach.

The shoreline design is also supplemented with LWD and rootwads placed landward of the OHWM to provide additional shoreline stabilization where practicable. LWD provides refuge for juvenile and adult fish, creates pools for juvenile fish, and adds hydraulic complexity and roughness along the bank. It provides food sources and habitat for aquatic insects and wildlife along shorelines and helps stabilize shorelines and reduce excessive erosion due to wave action. The beach enhancement, also installed above the OHWM, will increase beach area by 204 sf. The increased beach and nearshore area (up to a water depth of 12 feet) provides increased and improved habitat opportunities for migrating juvenile salmonids.

2.3 Shoreline Variance Analysis

Project elements requiring a Shoreline Variance include the central dock grating and width requirements; south dock width requirements; and overwater access platform height requirements.

2.3.1 Dock Width Requirements

The central dock floating structure will be 10 feet wide, and the south dock floating structure, including the reuse of an existing float, will be 8 to 10 feet wide. Per MICC 19.13.050(H)(4), public

[6] Blue Coast 2022.

docks are limited to 6 feet wide, which is more restrictive than the allowance for private dock projects to replace structures similar or less than the existing area, width, or length per MICC 19.13.050(F)(2)(ii). Additionally, from a structural and public safety standpoint, the 6-foot-wide requirement is structurally infeasible at this location to support the intended public uses. Therefore, the City is seeking a variance to the 6-foot width criteria for the south and central dock floats for the following reasons:

- A width of 10 feet is recommended for the central wave attenuator/mooring float to provide adequate attenuation for the types of waves generated by the wake surfing boats that frequently operate offshore near the park.
- A minimum of 8 feet wide is required to provide sufficient access for first responders to reach firefighting standpipes and operate firefighting equipment on the central dock. The wider dock area is also required to provide ADA-compliant access.
- The south dock floating structure will include 8-foot-wide and 10-foot-wide floats to accommodate launching a variety of small craft, including one- and two-person sailboats (typical widths of these boat types are up to 6 feet). The 10-foot-wide float is an existing float that is in good condition and will be reused for the Project. To allow someone on the dock to pass a sailboat on a hand trailer, a minimum of 2 feet of additional width is required in addition to the 6-foot typical width per sailboat, for a total minimum clearance of 8 feet. The south dock floating structure will also be used for educational purposes, and a 6-foot-wide structure will not provide sufficient stability when students are gathered on one side during educational instruction. For example, an 8-foot-wide float has 75% more stability, which should be sufficient to maintain adequate reserve freeboard under this condition. A wider south dock floating structure will also be more stable against wave energy that is not attenuated by the central wave attenuator/mooring float.

2.3.2 Dock Grating Requirements

Per MICC 19.13.050(H)(5), new docks are required to have a grated surface that allows for 40% light transmittance over 100% of the dock. The Project will meet this requirement for the south dock and overwater access platform, but the City is requesting a variance from the grating and light transmittance requirements for the central wave attenuator/mooring float. The central wave attenuator/mooring float is a solid float with significant weight used to provide safe use and programming for the south dock and to protect shoreline ecological functions from erosion. 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. Where protection is unavailable, these large waves also impact the shoreline, causing erosion. South of the project area, the City installed habitat-grade gravel and planted native plant species along the shoreline. Without protection, these areas are subject to

continued erosion from these large waves hitting the shoreline. 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.

The float material will be concrete, with light penetration options where possible. This includes larger than typical float components, including the floats and structural bracing, to provide adequate protection against anticipated wave energy. To support the larger float components and ecological restoration area, the City is requesting a waiver from this requirement. The City will work with the design engineer to evaluate the feasibility of adding grating to the structure, but prefers to use solid decking as currently proposed. The bulk of the structure is located as far offshore as practical (the closest point is approximately 115 feet from the OHWM) and in deeper water (approximately 40 feet) to reduce the effect of shading on the lake bottom.

2.3.3 Fixed Pier Height Requirements

The City is seeking a variance from the fixed pier height requirements for a minimum distance between 1.5 feet above OHWM and the bottom beam of any fixed docks per MICC 19.13.050(H)(6). This variance request is to support installation of the grated overwater access platform adjacent to the waterfront plaza. The proposed platform is intended to bring the public closer to the water's edge than is currently possible in the plaza area, providing the opportunity for people to touch the lake surface during the summer high water season. People with mobility limitations have trouble accessing the shoreline on an uneven, unstable beach surface. The proposed structure provides a stable platform to allow greater access.

To provide this experience, the platform structure will need to be at or below the surface of the water at higher lake levels. The platform is designed with a grated surface meeting or exceeding light transmittance requirements to minimize shading of the water below. The platform is also located over a degraded nearshore habitat. Based on these considerations, it is anticipated that installation of the platform at this location would result in negligible impacts to the nearshore habitat functions and values, as confirmed at a site visit with the City and Washington Department of Fish and Wildlife (WDFW).

1.3.4 Pile Spacing and Pile Diameter Requirements

The City is seeking a variance from pile spacing and pile diameter requirements for a minimum distance of 18 feet between piles and a maximum diameter of 12 inches per MICC 19.13.050(H)(7). In general, piles are spaced at 18 feet or more (average spacing is approximately 18.45 feet). However, closer spacing of the piles is required to support areas of the dock structure where it turns at an angle. Providing 18-foot spacing of the piles in these areas would leave the corners of the dock structure unsupported and pose an overwater safety issue if structural loads were exceeded, resulting in potential collapse. Leaving the corners of the dock structure unsupported is also inconsistent with design standards. This requirement presents an undue hardship due to the unique

design of the dock to be replaced and the need to reconstruct the dock in a similar manner to support public programs at the park.

A variance from MICC 19.13.050(H)(7) is also being requested to allow the dock structure to be supported by 18-inch-diameter steel piles, which exceed the maximum diameter requirement of 12 inches. Geotechnical conditions were evaluated at the site, and an 18-inch-diameter steel pile type is required to provide adequate support to the dock structure. See Appendix D in the Critical Areas Report (Attachment 3 to this letter).

3 SCUP and Shoreline Variance Compliance

The City of Mercer Island SMP does not have specific variance or SCUP criteria. However, per MICC 19.13.020(C)(2), whenever an applicant seeks a variance, the applicant shall provide the City with a plan that demonstrates the project will not create a net loss in ecological function to the shorelands. The Critical Areas Report for the Project, included with this letter, provides a demonstration of no net loss of ecological function to the shoreline environment from the Project.

The Washington State Department of Ecology promulgates the Shoreline Management Act at a state level and reviews SCUPs and Shoreline Variances once approved by the local jurisdiction. To support City and Ecology review, the tables in Exhibit 3 describe the Project's consistency with Shoreline Variance criteria in the Washington Administrative Code (WAC) 173-27-170 and SCUP criteria per WAC 173-27-160.

4 Conclusion

Overall, it is anticipated that the Project will result in no net loss of shoreline ecological function as demonstrated in the Critical Areas Report provided with this application. The Project's upland improvements at the shoreline and plaza are consistent with existing shoreline uses per Table A in MICC 19.13.040. The Project includes LID measures to improve stormwater management.

New hard structural shoreline stabilization is compliant with SCUP criteria as described in Exhibit 3. Placing habitat-grade gravel and installing riparian plantings at the shoreline as part of the beach expansion will restore the shoreline and provide ecological functions as permitted under MICC 19.13.040.

The Project will adequately offset temporary construction impacts and avoid or minimize long-term impacts consistent with MICC 19.13.020(C) and critical areas mitigation sequencing requirements per MICC 19.07.100. The Project minimizes impacts to the nearshore environment through the use of grated surfacing to the maximum extent feasible. Although the Project proposes solid surface decking for the wave attenuator/mooring float in the deeper water, impacts to salmonids are diminished for deeper water cover as the habitat is less suitable for predators and light and dark shadows are diminished in deeper water.

Through implementation of avoidance and minimization measures, it is expected that the Project will comply with MICC 19.13.040 for allowed activities, including public parks and open space, and restoration of ecological functions including shoreline habitat and natural systems enhancement. Therefore, we believe that the Project as proposed meets the intent of the SMP and complies with Shoreline Variance and SCUP criteria per WAC 173-27-160 and WAC 173-27-170.

Thank you in advance for your attention to this project. Please feel free to contact me by phone at (206) 903-3374, or email at jjensen@anchorqea.com, with any questions.

Sincerely,

Josh Jensen
Senior Managing Environmental Planner
Anchor QEA, LLC

cc: Paul West, City of Mercer Island

Attachments

- Exhibit 1. City Development Application Form
- Exhibit 2. Joint Aquatic Resources Permit Application (JARPA)
- Exhibit 3. Analysis of Compliance with Shoreline Conditional Use and Variance Requirements
- Exhibit 4. Analysis of Luther Burbank Impervious Surface (City of Mercer Island, Information and Geotechnical Services)

Exhibit 1 Previously provided

City Development Application Form

Exhibit 2 Previously provided

Joint Aquatic Resources Permit Application (JARPA)

Exhibit 3
Analysis of Compliance with Shoreline Conditional Use and Variance Requirements

Consistency with WAC 173-27-160, Review Criteria for Conditional Use Permits

Code Reference	Development Standard Compliance
(1) Uses which are classified or set forth in the applicable master program as conditional uses may be authorized provided that the applicant demonstrates all of the following:	The City is applying for a SCUP as required for new hard structural shoreline stabilization in shoreline environments landward of the OHWM, per Table A in MICC 19.13.040. The new hard structural shoreline stabilization landward of the OHWM will consist of the rock revetment and sheet pile wall at the north beach expansion area and rock terraces along the south on-grade trail.
(a) That the proposed use is consistent with the policies of RCW 90.58.020 and the master program;	The Project complies with the City's shoreline policies as demonstrated throughout this application. The proposed use of the Project will be consistent with RCW 90.58.020 by preserving the natural character of the shoreline. The new rock revetment, sheet pile wall, and rock terraces landward of the OHWM will also protect the shoreline restoration areas and primary public access structure to the expanded north beach area.
(b) That the proposed use will not interfere with the normal public use of public shorelines;	The new rock revetment, sheet pile wall, and rock terraces landward of the OHWM will not interfere with the normal public use of the shoreline and are designed to protect public access features that are intended to increase public access to the waterfront.
(c) That the proposed use of the site and design of the project is compatible with other authorized uses within the area and with uses planned for the area under the comprehensive plan and shoreline master program;	The Project will improve existing waterfront recreational opportunities and access. It complies with the authorized use of the Urban Park environment per MICC 19.13.040 for public parks and open space. The proposed rock revetment and rock terraces landward of the OHWM will support the north beach access and new on-grade pathway.
(d) That the proposed use will cause no significant adverse effects to the shoreline environment in which it is to be located; and	The new rock revetment, sheet pile wall, and rock terraces will not cause significant adverse effects to the shoreline. This work will be landward of the OHWM and will have required measures in place to prevent water quality impacts. The Project Description included with the JARPA (Exhibit 2) includes a list of best management practices (BMPs) to be implemented during construction to avoid or minimize potential impacts on the shoreline environment. The Biological Evaluation and Critical Areas Report describe conservation measures proposed to avoid or minimize potential impacts on federally listed species and critical habitat. With these measures in place, no net loss of ecological functions will occur as described in the Critical Areas Report.

Code Reference	Development Standard Compliance
(e) That the public interest suffers no substantial detrimental effect.	The Project will enhance public access to the existing waterfront plaza and shoreline and will enhance the user experience. Proposed activities will protect public access features and are integrated into the public access design. These features will not cause substantial detrimental effects to the public.
(2) In the granting of all conditional use permits, consideration shall be given to the cumulative impact of additional requests for like actions in the area. For example, if conditional use permits were granted for other developments in the area where similar circumstances exist, the total of the conditional uses shall also remain consistent with the policies of RCW 90.58.020 and shall not produce substantial adverse effects to the shoreline environment.	The City is not aware of other conditional use permits that have been issued in the area for similar circumstances.
(3) Other uses which are not classified or set forth in the applicable master program may be authorized as conditional uses provided the applicant can demonstrate consistency with the requirements of this section and the requirements for conditional uses contained in the master program.	Not applicable. All uses are classified within the City's SMP and consistent with permitted uses per MICC 19.13.040. Proposed elements for which the City is seeking a variance are analyzed in the table for WAC 173-27-170 in this attachment.
(4) Uses which are specifically prohibited by the master program may not be authorized pursuant to either subsection (1) or (2) of this section.	Not applicable. All uses are classified within the City's SMP and consistent with permitted uses per MICC 19.13.040. Proposed elements for which the City is seeking a variance are analyzed in the table for WAC 173-27-170 in this attachment.

Consistency with WAC 173-27-170, Review Criteria for Variance Permits

Code Reference	Development Standard Compliance
1) Variance permits should be granted in circumstances where denial of the permit would result in a thwarting of the policy enumerated in RCW 90.58.020. In all instances the applicant must demonstrate that extraordinary circumstances shall be shown and the public interest shall suffer no substantial detrimental effect.	The City is seeking a variance from the following criteria in the SMP per MICC 19.13.050(H) for public access docks or boardwalks. A variance for **dimensional standards for dock width** is being requested to allow the public dock to be replaced in an updated orientation, with floats that are wide enough to bring the docks up to current standards and provide sufficient protection for safe use. This includes expanding dock width beyond the MICC 19.13.050(H)(4) 6-foot width requirements for public moorage facilities. The City is specifically requesting a variance from the dimensional standards to allow the proposed central dock to be up to 10 feet wide in order to provide adequate wave attenuation for safe operation of the inner float as well as sufficient width for access by first responders. The City is also requesting to allow the proposed southern dock float structures to be 8 and 10 feet wide to allow for safe launching of watercraft; better accommodate groups of students that will be using the float; and provide for a more stable structure that will be safer for continued public use. The City is also seeking a variance from the **light transmittance conditions** of MICC 19.13.050(H)(5) requiring public access docks to be grated with materials that allow a minimum of 40% light transmittance over 100% of the surface area. Light transmittance would be inhibited by structural components required to allow the wave attenuator/mooring float to provide critical safety functions for public use of the dock and protect shoreline ecological functions. The City is also seeking a variance from the **fixed pier height conditions** of MICC 19.13.050(H)(6) requiring a minimum 1.5-foot distance between the water surface and bottom structural beam. This variance would allow the overwater access platform located adjacent to the waterfront plaza to extend from the plaza edge into the water. The platform is another major public access component of the Project. The City is also seeking a variance from **pile spacing and pile diameter requirements** per MICC 19.13.050(H)(7). The average pile spacing is approximately 18.45 feet.

Code Reference	Development Standard Compliance
	However, a variance will allow closer spacing of the piles at areas where the dock structure turns at an angle in order to be consistent with structural design standards and provide safe access in an overwater environment. A variance is also being requested to allow the dock structure to be supported by 18-inch-diameter steel piles to provide adequate support to the dock structure based on geotechnical conditions. The dock structure and platform are located within a shoreline environment that was previously used as a steam plant and is heavily modified from natural conditions, including shoreline fill and overwater development and structures. Consistent with RCW 90.58.020, the Project is compliant with statewide standards for shoreline protection. The City is committed to incorporating environmental enhancements and avoidance and minimization measures into the Project to demonstrate no net loss of ecological functions. Measures include reducing net overwater coverage, installing functional grating to the extent practicable, and shoreline landscaping and riparian plantings. Additionally, BMPs will be implemented during construction to reduce potential impacts to the shoreline environment. Overall, the Project will improve public access and safety at the dock and plaza area and enhance the user experience. The Project is consistent with the approved master plan for Luther Burbank Park and is supported by the City's Parks, Recreation and Open Space Plan adopted in 2022.[7] The Project is not anticipated to result in any detriment to the public interest.
2) Variance permits for development and/or uses that will be located landward of the ordinary high water mark (OHWM), as defined in RCW 90.58.030 (2)(c), and/or landward of any wetland as defined in RCW 90.58.030 (2)(h), may be authorized provided the applicant can demonstrate all of the following: 1. That the strict application of the bulk, dimensional or performance standards set forth in the applicable master program precludes, or significantly interferes with, reasonable use of the property; 2. That the hardship described in (a) of this subsection is specifically related to the property, and is the result of unique conditions such as irregular lot shape, size, or natural features and the application of the master	Not applicable. Variance permits are not being requested for upland development or uses. For compliance with WAC 173-27-170(3), in-water activities must demonstrate compliance with WAC 173-27-170(2)(b-f). These activities are consistent with these standards described as follows: b) The hardship on the applicant for meeting the standards of this SMP is specifically related to the property and unique conditions. For the dock structure variance requests, wider decking, a solid wave attenuation float, and wider piles are proposed to protect the structure and its users against higher wave action. The 18-inch-diameter piles are also

[7] City of Mercer Island, 2022. *City of Mercer Island Parks, Recreation & Open Space Plan*. March 2022.

Code Reference	Development Standard Compliance
program, and not, for example, from deed restrictions or the applicant's own actions; 3. That the design of the project is compatible with other authorized uses within the area and with uses planned for the area under the comprehensive plan and shoreline master program and will not cause adverse impacts to the shoreline environment; 4. That the variance will not constitute a grant of special privilege not enjoyed by the other properties in the area; 5. That the variance requested is the minimum necessary to afford relief; and 6. That the public interest will suffer no substantial detrimental effect.	proposed to accommodate the dock structure in response to evaluated geological conditions. The variance from fixed pier height conditions is proposed for the overwater access platform that extends from the upland plaza to provide access to the water. A variance is being requested due to the unique interface between built and natural environments in this area that currently prohibits public access to the water. c) The project includes replacing an existing dock and providing waterfront improvements that are compatible with existing authorized uses and programs at the park. This is consistent with the comprehensive plan and SMP and will result in no net loss in ecological function at the site. d) The existing dock structure to be replaced is designed specifically to accommodate park programming, which is unique to the area. The variance is being requested to support a public dock and programming in a unique waterfront environment and is not expected to constitute a grant of special privilege not enjoyed by the other properties in the area. e) The requested variance is the minimum necessary to afford relief. f) The variance is being requested to support a public dock and programming in a unique waterfront environment, and it is expected that the public will benefit from the proposed waterfront improvements.
3) Variance permits for development and/or uses that will be located waterward of the ordinary high water mark (OHWM), as defined in RCW 90.58.030 (2)(c), or within any wetland as defined in RCW 90.58.030 (2)(h), may be authorized provided the applicant can demonstrate all of the following: (a) That the strict application of the bulk, dimensional or performance standards set forth in the applicable master program precludes all reasonable use of the property; (b) That the proposal is consistent with the criteria established under subsection (2)(b) through (f) of this section; and (c) That the public rights of navigation and use of the shorelines will not be adversely affected.	A variance for dimensional and performance standards for development located waterward of the OHWM is being requested for several Project elements, as described earlier in response to WAC 173-27-170(1) and (2). The strict application of the bulk dimensional standards set forth in the City's SMP interferes with the reasonable use of the property by requiring dock dimensions, grating requirements, and structural height requirements that limit the City's ability to replace the existing structure in a manner that accommodates the unique waterfront environment and adequately protects the safety of public users while improving access to the shoreline. For example, standard SMP conditions limit a wave attenuation float to 6 feet wide, which would significantly reduce its intended functions, including limiting the width available for small sailboat trailers to be able to access the float; increasing the potential for tipping users off of the float during high wake or wave

Code Reference	Development Standard Compliance
	events; and providing insufficient wave attenuation for adequate protection of the small finger floats intended to provide public access to stand-up paddle boards, kayaks, and small sailboats. A variance for dimensional and performance standards is being requested to allow the City to waive grating requirements for the wave attenuation/mooring float below the 40% functional grating requirement over 100% of the surface area for public moorage facilities per MICC 19.13.050(H)(5). To support a safe float design, the 40% grating requirement is structurally infeasible due to the need to install larger than typical float components, including the floats and structural bracing, to provide adequate protection against anticipated wave energy. A variance for dimensional standards is being requested to allow the City to install an overwater access platform that extends waterward from the plaza area to increase public access opportunities. This would require a variance from the requirement to provide a minimum 1.5-foot clearance between the water surface and bottom of structural bracing per MICC 19.13.050(H)(6). The strict application of the dimensional standards interferes with the City's ability to provide reasonable and safe public use of the property. The hardship described in this section is specifically related to the property and unique conditions, including increased use of wake surfing boats in Lake Washington that present dangerous conditions that could impact public dock users if not addressed in the design of the Project. Furthermore, the existing location of the waterfront plaza, which is elevated due to underlying fill used to construct the steam building and appurtenances, does not provide direct public access to the water and is currently fenced off to the public. The proposed platform would provide public access directly to the water but is currently limited by strict application of the shoreline code. The proposed dock repairs to improve public access and use of the shoreline are included in the 2006 Luther Burbank Park Master Plan, which is cited in the most recent Comprehensive Plan. The Luther Burbank Park Master Plan was used to guide the design process, which provides a vision of a waterfront activity center that is centered around small boats. The dock structure and platform are located within a shoreline environment that was previously used as a steam plant

Code Reference	Development Standard Compliance
	and is heavily modified from natural conditions, including shoreline fill and overwater development and structures. Consistent with RCW 90.58.020, the Project is compliant with statewide standards for shoreline protection. The City is committed to incorporating environmental enhancements and avoidance and minimization measures into the Project to demonstrate no net loss of ecological functions. Measures include reducing net overwater coverage, installing functional grating to the extent practicable, and shoreline landscaping and riparian plantings. Additionally, BMPs will be implemented during construction to reduce potential impacts and result in no net loss of shoreline ecological functions, as described in the Critical Areas Report and Biological Evaluation included with the JARPA (Exhibit 2). The variance is being requested by the City to provide safe access and operation to users who frequent the Luther Burbank Park dock. The variance is for a public facility and is not being requested to grant special privilege that could not be enjoyed by other properties in the area, and it would allow the minimum necessary to afford relief. Overall, the Project will improve public access and safety at the Luther Burbank Park dock and waterfront plaza. The Project is supported by the City and park users and is not anticipated to result in any detriment to public interest.
4) In the granting of all variance permits, consideration shall be given to the cumulative impact of additional requests for like actions in the area. For example if variances were granted to other developments and/or uses in the area where similar circumstances exist the total of the variances shall also remain consistent with the policies of RCW 90.58.020 and shall not cause substantial adverse effects to the shoreline environment.	The City is not aware of other variances that have been issued in the area for similar circumstances.
5) Variances from the use regulations of the master program are prohibited.	Not applicable. A variance from the use regulations of the SMP is not being requested for the Project.

Consistency with MICC 19.13.050(A) Table C – Requirements for Development Located Landward from the OHWM

Code Reference	Development Standard Compliance
Setbacks for All Structures (Including Fences over 48 Inches High) and Parking A. 25 feet from the OHWM and all required setbacks of the development code, except 1) light rail transit facilities; and 2) shore access structures less than 30 inches above the existing or finished grade, whichever is lower. If a wetland is adjacent to the shoreline, measure the shoreline setback from the wetland's boundary	The Project complies with this development standard. The Boiler Building is an existing nonconforming 80-foot-tall structure located partially within the 25-foot setback. The proposed repairs will not increase its nonconformity and will be completed consistent with the requirements in Table C. Exterior repairs include installing a new roof and replacing wall-mounted light fixtures. The Boiler Building restroom annex renovation proposes to construct a viewing deck on the existing restroom roof and will be constructed to an elevation of 29 feet and 10 inches compared to the existing elevation of 29 feet and 2 inches. The structure will not exceed a height of 35 feet above average building elevation. The rooftop viewing deck will be located in the existing building location approximately 35 feet from the OHWM. The concession stand repairs will occur under the rooftop viewing deck within the same footprint, located between the restrooms and Boiler Building on the ground floor. No new structures will be installed within 25 feet from the OHWM. The overwater access platform is a new structure that will be installed less than 30 inches above the existing grade.
Height Limits for All Structures B. Shall be the same as height limits specified in the development code but shall not exceed a height of 35 feet above average building elevation, except light rail transit facilities	The Project complies with this development standard. No new or replacement structures will exceed 35 feet above average building elevation.
Maximum Hardscape and Lot Coverage C. 10%: between 0 and 25 feet from the OHWM D. 30%: between 25 and 50 feet from the OHWM	The Project complies with these development standards. A total area of 7,083 sf or 0.71% of impervious surface is proposed between 0 and 25 feet from the OHWM. Per the development standards, no greater than 10% new hardscape coverage will be installed between 0 and 25 feet from the OHWM. A total of 6,255 sf or 0.63% of impervious surface is proposed between 25 and 50 feet from the OHWM. Per the development standards, no greater than 30% new hardscape coverage will be installed between 25 and 50 feet from the OHWM.
Minimum Land Area Requirements E. All semiprivate commercial and noncommercial recreational tracts and areas shall have a minimum land area of 200 sf per family, but not less than 600 sf, exclusive of driveways or parking areas. Screening of the boundaries with abutting properties will be required.	Not applicable.

Code Reference	Development Standard Compliance
Height Limits for Light Rail Transit Facilities within the Existing I-90 Corridor: The trackway and overhead wires, support poles, and similar features necessary to operate light rail transit facilities may be erected upon and exceed the height of the existing I-90 bridges.	Not applicable.

Consistency with MICC 19.13.050(D) Table D – Requirements for Moorage Facilities and Development Located Waterward from the OHWM

Code Reference	Development Standard Compliance
Setbacks for Docks, Covered Moorages, and Floating Platforms A. 10 feet from the lateral line (except where moorage facility is built pursuant to the agreement between the owners of adjoining lots on the shoreline as shown in Figure B below). B. Where a property shares a common boundary with the urban park environment, the setback shall be 50 feet from the lateral line or 50% of the water frontage of the property, whichever is less.	The Project complies with this development standard. The replacement dock structure is not located near a common line or property boundary.
Setbacks for Boat Ramps and Other Facilities for Launching Boats by Auto or Hand, Including Parking and Maneuvering Space C. 25 feet from any adjacent private property line.	Not applicable.
Length or Maximum Distance Waterward from the OHWM for Docks, Covered Moorage, Boatlifts, and Floating Platforms D. Maximum 100 feet, but in cases where water depth is less than 11.85 feet below OHWM, length may extend up to 150 feet or to the point where water depth is 11.85 feet at the OHWM, whichever is less.	Not applicable. There is no dock length or area limit for public access docks per MICC 19.13.050(H)(3).
Width of Docks within 30 Feet Waterward from the OHWM E. Maximum 4 feet. Width may increase to 5 feet if one of the following is met: 1) Water depth is 4.85 feet or more, as measured from the OHWM; or 2) A moorage facility is required to comply with ADA requirements; or 3) A resident of the property has a documented permanent state disability as defined in WAC 308-96B-010(5); or 4) The proposed project includes mitigation option A, B, or C listed in Table E; and for replacement actions, there is either a net reduction in overwater coverage within 30 feet waterward from the OHWM, or a site-specific report is prepared by a qualified professional demonstrating no net loss of ecological function of the shorelands. Moorage facility width shall not include pilings, boat ramps, and boatlifts.	Not applicable. Public access docks may have a width of up to 6 feet subject to U.S. Army Corps of Engineers and/or WDFW approval per MICC 19.13.050(H)(4). The central dock floating structure will be 10 feet wide, and the south dock floating structure, including the reuse of an existing float, will be 8 to 10 feet wide. An exemption from this standard is being requested, as described in the above table describing compliance with WAC 173-27-170.

Code Reference	Development Standard Compliance
Width of Moorage Facilities More Than 30 Feet Waterward from the OHWM E. Maximum 6 feet wide. Moorage facility width shall not include pilings, boat ramps and boatlifts.	The central dock floating structure will be 10 feet wide, and the south dock floating structure, including the reuse of an existing float, will be 8 to 10 feet wide. An exemption from this standard is being requested, as described in the above table describing compliance with WAC 173-27-170.
Height Limits for Walls, Handrails, and Storage Containers Located on Piers F. 3.5 feet above the surface of a dock or pier; 4 feet for ramps and gangways designed to span the area 0 feet to 30 feet from the OHWM.	Not applicable.
Height Limits for Mooring Piles, Diving Boards, and Diving Platforms G. 10 feet above the elevation of the OHWM.	Not applicable.
Height Limits for Light Rail Transit Facilities Within the Existing I-90 Corridor: The trackway and overhead wires, support poles, and similar features necessary to operate light rail transit facilities may be erected upon and exceed the height of the existing I-90 bridges.	Not applicable.
Minimum Water Frontage for Docks H. Single-family lots: 40 feet. I. Shared – Two adjoining lots on the shoreline: 40 feet combined. J. Semiprivate recreational tracts: 2 families: 40 feet. 3–5 families: 40 feet plus 10 feet for each family more than 2. 6–10 families: 70 feet plus 5 feet for each family more than 5. 11–100 families: 95 feet plus 2 feet for each family more than 10. 101+ families: 275 feet plus 1 foot for each family more than 100.	Not applicable.
Covered Moorage Permitted on single-family residential lots subject to the following: a) Maximum height above the OHWM: 16 feet; 16 to 21 feet subject to criteria of Subsection (E)(1) of this section. b) Location/area requirements: See Figure A for single-family lots and Figure B for shared moorage. c) Building area: 600 sf; however, a covered moorage may be built larger than 600 sf within the triangle subject to a shoreline conditional use permit. d) Covered moorage shall have open sides.	Not applicable.

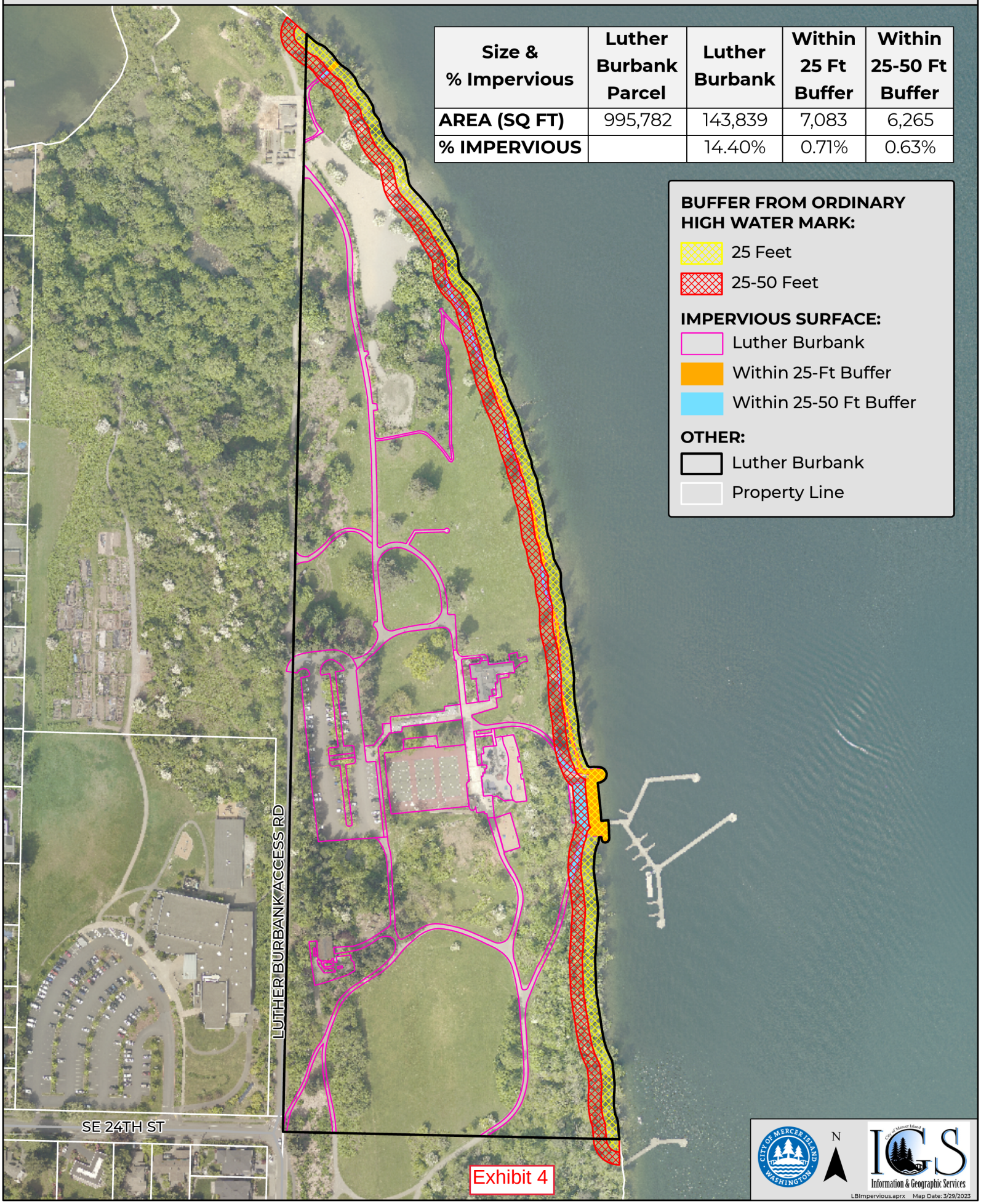
Code Reference	Development Standard Compliance
e) Prohibited in semiprivate recreational tracts and noncommercial recreational areas. f) Translucent coverings are required.	

Consistency with MICC 19.13.050(H) for Public Access Piers, Docks, and Boardwalks

Code Reference	Development Standard Compliance
Public access piers, docks, or boardwalk. New public access piers, docks, or boardwalks on public lands shall comply with the following: 1. Public access piers, docks, or boardwalks shall be designed and constructed using WDFW-approved methods and materials;	The Project complies with this development standard. A site visit was conducted with WDFW in November 2021 to describe the project design and construction methods. The proposed dock structure will be designed and constructed using WDFW-approved methods and materials.
2. With the exception of the requirements for moorage facilities related to width and length, public access piers, docks, or boardwalks shall comply with design standards required for moorage facilities listed in Table D, Requirements for Moorage Facilities and Development Located Waterward from the OHWM;	Compliance with this standard is described in the above table describing compliance with MICC 19.13.050(D) – Table D.
3. There is no dock length or area limit for public access piers, docks, or boardwalks; however, public access piers, docks, and boardwalks shall not interfere with navigation and shall be the minimum size necessary to meet the needs of the proposed water-dependent use;	The Project complies with this development standard. The Project includes replacing an existing public dock and will not interfere with navigation. The proposed dock structure is the minimum size necessary to meet the needs of programming at the site.
4. Public access piers, docks, or boardwalks may have a width of up to six feet subject to U.S. Army Corps of Engineers and/or WDFW approval;	The central dock floating structure will be 10 feet wide, and the south dock floating structure, including the reuse of an existing float, will be 8 to 10 feet wide. A variance from this standard is being requested, as described in the above table describing compliance with WAC 173-27-170.
5. Public access piers, docks, or boardwalks must be fully grated with materials that allow a minimum of 40% light transmittance;	The Project will comply with this development standard to the extent practicable. The central wave attenuator/mooring float will be a solid float with significant weight used to provide safe use and programming for the south dock and protect shoreline ecological functions from erosion. A variance from this standard is being requested, as described in the above table describing compliance with WAC 173-27-170.
6. Minimum of 1.5 feet above ordinary high water to bottom of pier stringer, except the floating section of a dock attached to a pier;	The proposed overwater access platform will need to be installed at or below the surface of the water at higher lake levels to provide public access to the water. A variance from this standard is being requested, as described in the above table describing compliance with WAC 173-27-170.
7. The first in-water (nearest the OHWM) set of pilings shall be steel, 10 inches in diameter or less, and at least 18 feet from the OHWM. Piling sets beyond the first shall also be spaced at least 18 feet apart and shall not be greater than 12 inches in diameter. Piles shall not be	The proposed dock structure includes sets of piles at corners of the dock that will be less than 18 feet apart, although the average pile set spacing will be 18.45 feet overall. Piles supporting the dock will also be greater than 12 inches in diameter. A variance from this

Code Reference	Development Standard Compliance
treated with pentachlorophenol, creosote, CCA or comparably toxic compounds. If ammoniacal copper zinc arsenate (ACZA) pilings are proposed, the applicant shall meet all of the best management practices, including a post-treatment procedure, as outlined in the amended Best Management Practices of the Western Wood Preservers. All piling sizes are in nominal diameter;	standard is being requested, as described in the above table describing compliance with WAC 173-27-170.
8. Any paint, stain, or preservative applied to components of the overwater structure must be leach resistant, completely dried or cured prior to installation. Materials shall not be treated with pentachlorophenol, creosote, CCA or comparably toxic compounds;	The Project complies with this development standard. Environmentally benign and approved materials will be installed as part of the Project.
9. Disturbance of bank vegetation shall be limited to the minimum amount necessary to accomplish the project. Disturbed bank vegetation shall be replaced with native, locally adapted herbaceous and/or woody vegetation;	The Project complies with this development standard. Disturbance of the bank will occur to expand the beach area to the north. Disturbed bank vegetation will be replaced with native, locally adapted herbaceous or woody vegetation.
10. Construction of public access piers, docks, or boardwalks shall abide by the work windows for listed species established by the U.S. Army Corps of Engineers and WDFW; and	The Project complies with this development standard. Construction will occur within the designated in-water work window or approved extension.
11. A no net loss plan shall be prepared pursuant to MICC 19.13.020 demonstrating that the proposed project will not create a net loss in ecological function of the shorelands.	The Project complies with this development standard. A no net loss plan is included in the Project Critical Areas Study (provided under separate cover).

LUTHER BURBANK IMPERVIOUS SURFACE



Size & % Impervious	Luther Burbank Parcel	Luther Burbank	Within 25 Ft Buffer	Within 25-50 Ft Buffer
AREA (SQ FT)	995,782	143,839	7,083	6,265
% IMPERVIOUS		14.40%	0.71%	0.63%

BUFFER FROM ORDINARY HIGH WATER MARK:
- 25 Feet
- 25-50 Feet

IMPERVIOUS SURFACE:
- Luther Burbank
- Within 25-Ft Buffer
- Within 25-50 Ft Buffer

OTHER:
- Luther Burbank
- Property Line

N

Information & Geographic Services

LBImpervious.aprx Map Date: 3/29/2023

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.

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

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 ($\%\boldsymbol{k_{tM}}$)	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.

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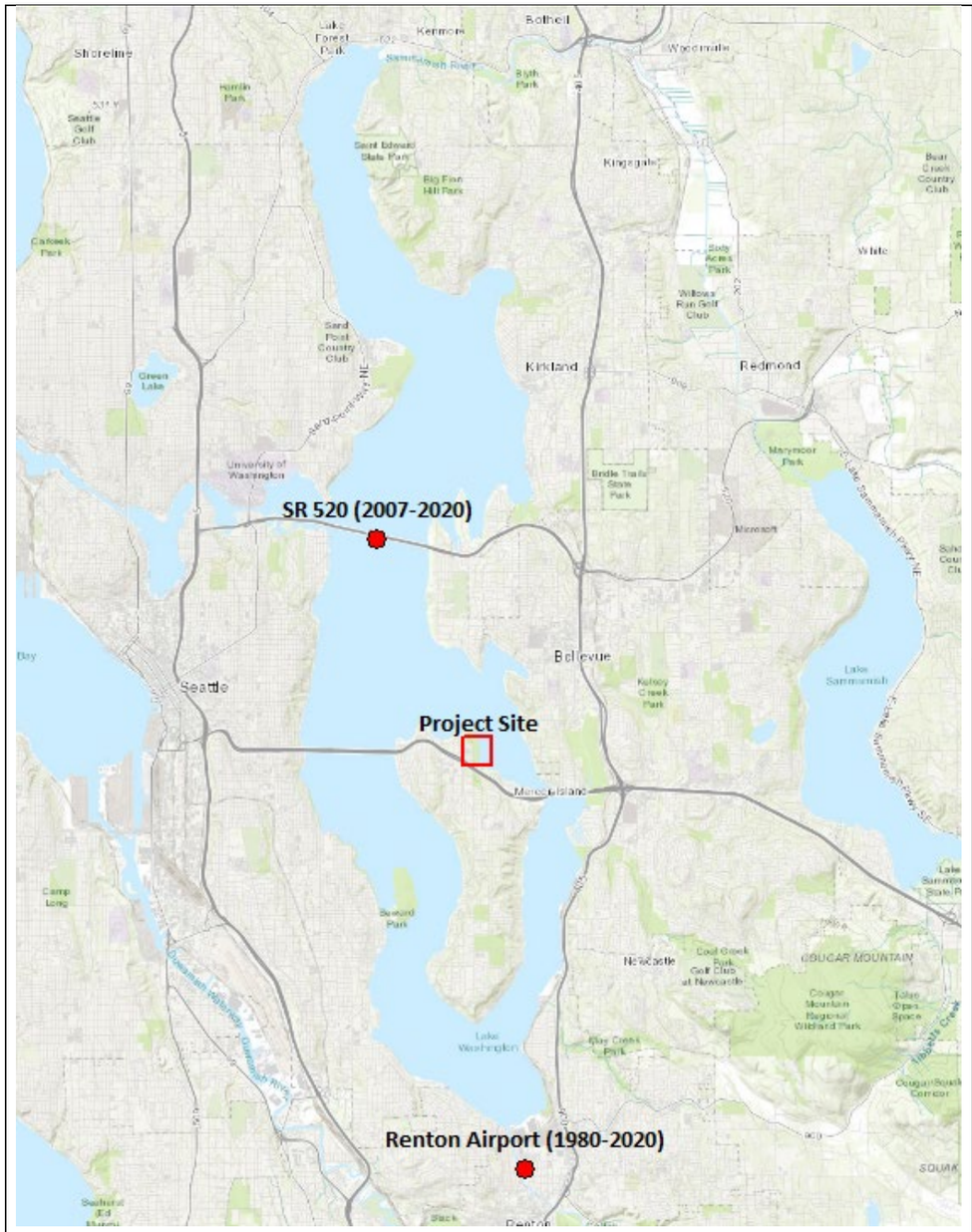
NOAA bathymetry (2005) Combined bathymetry and topography of the Puget Lowlands, Washington State (tile: g1225480 and g1225475). Data originator; David Finlayson, School of Oceanography, University of Washington [accessed September 2, 2020 at http://www.ocean.washington.edu/data/pugetsound/]

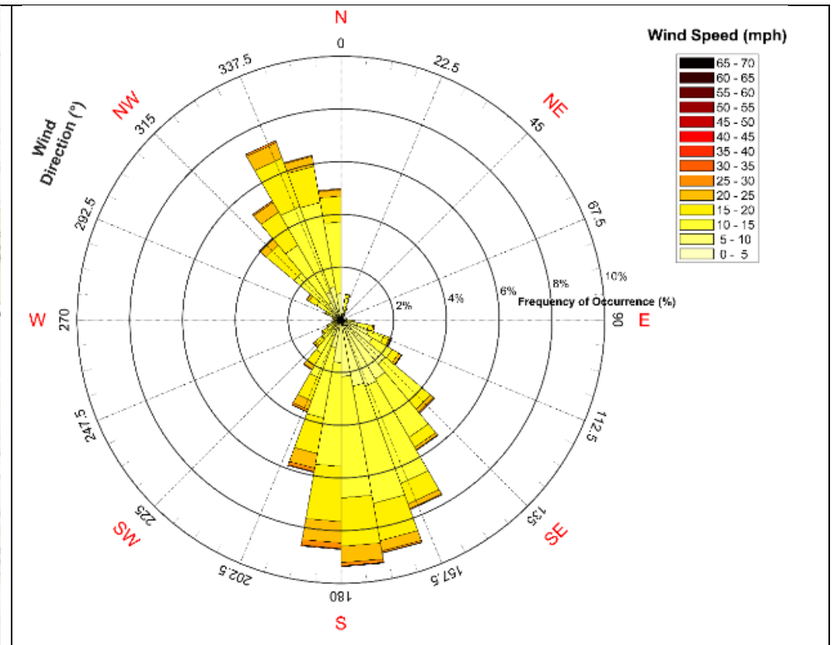
Ruol, Piero & Martinelli, Luca & Pezzutto, Paolo. (2013). Formula to Predict Transmission for -Type Floating Breakwaters. Journal of waterway, port, coastal, and ocean engineering. 139. 1-8. 10.1061/(ASCE)ww.1943-5460.0000153.

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

New figures attached, refer to previously provided figures and revised plan set





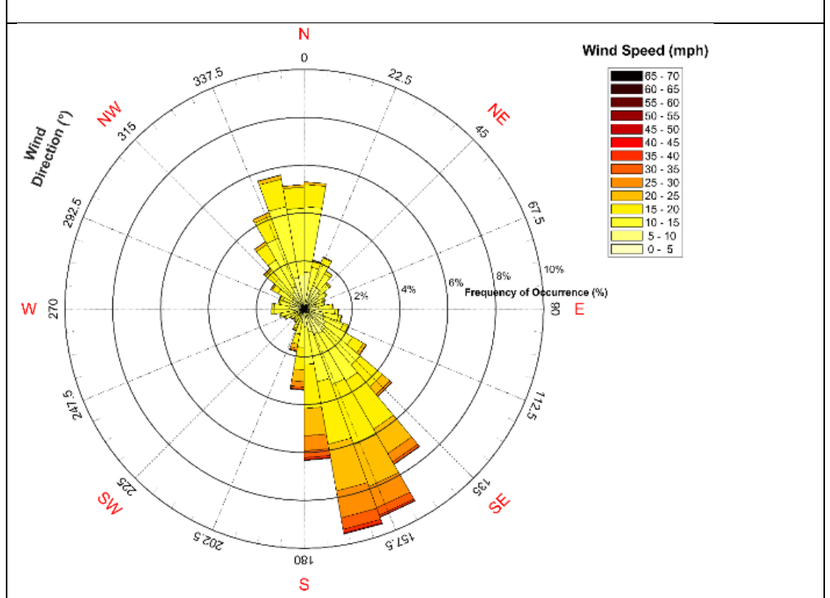


Figure 1. Left: Location of Project Site and Wind Stations used in the Evaluation. Upper Right: Wind Rose for 520 Bridge Station (2007-2020) and Bottom Right: Wind Rose for Renton Municipal Airport (1980-2020)

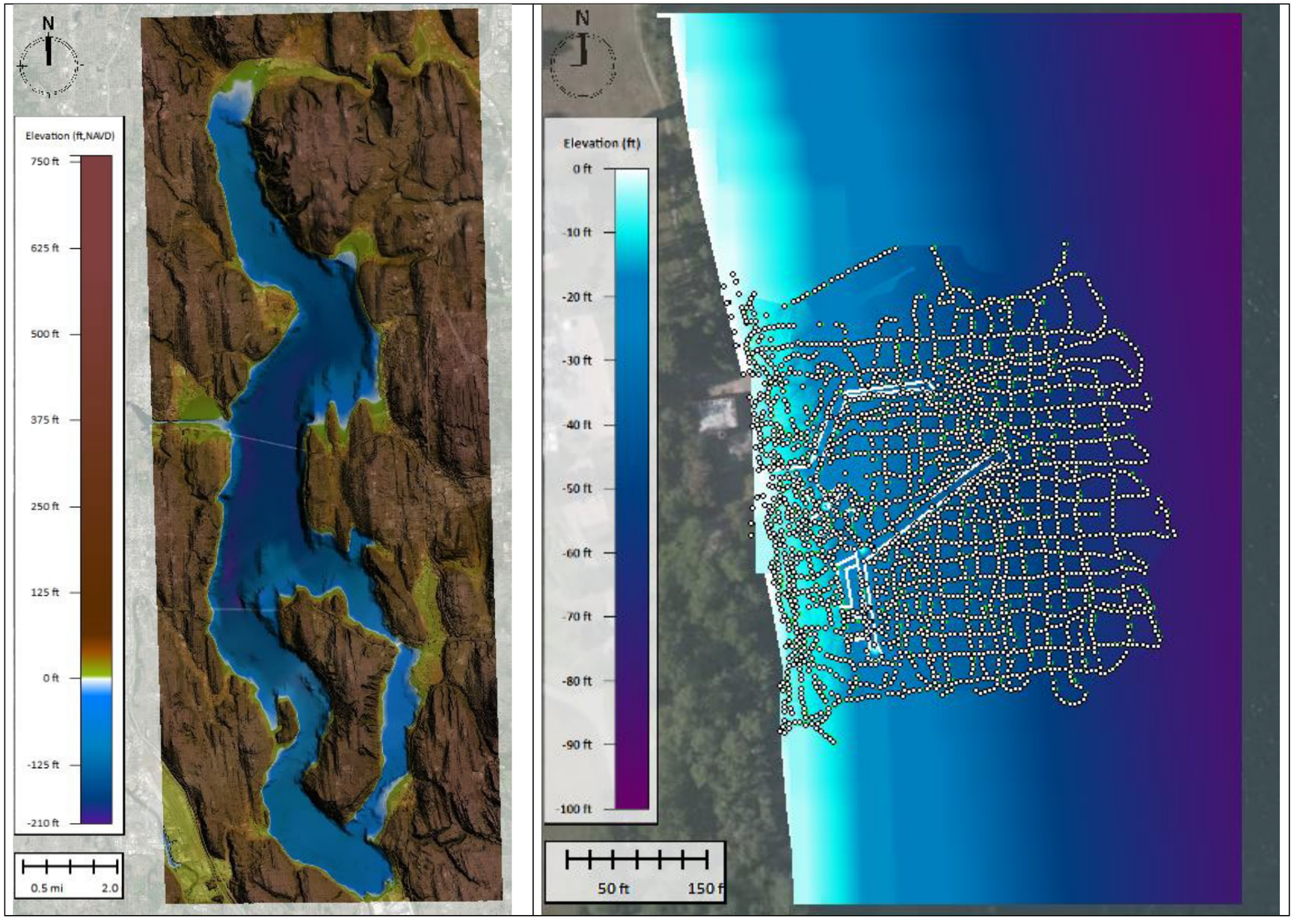
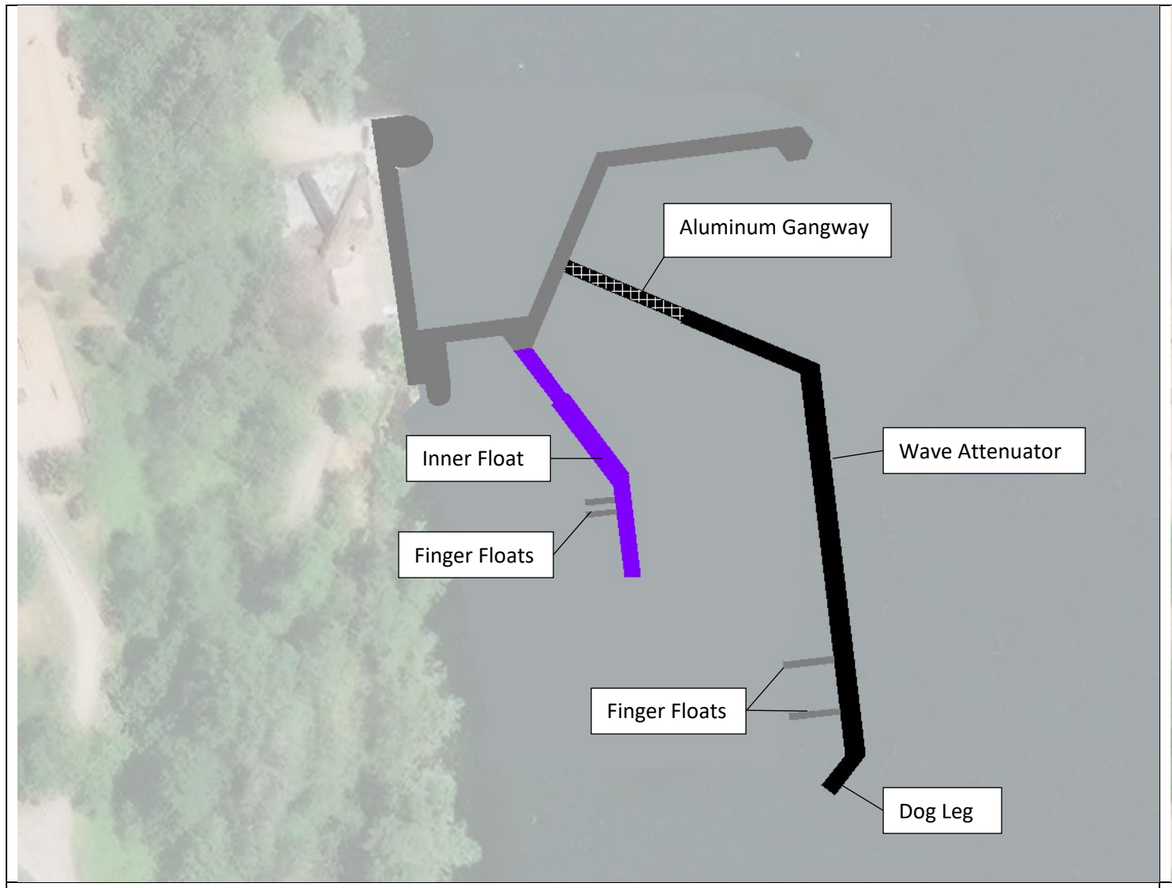
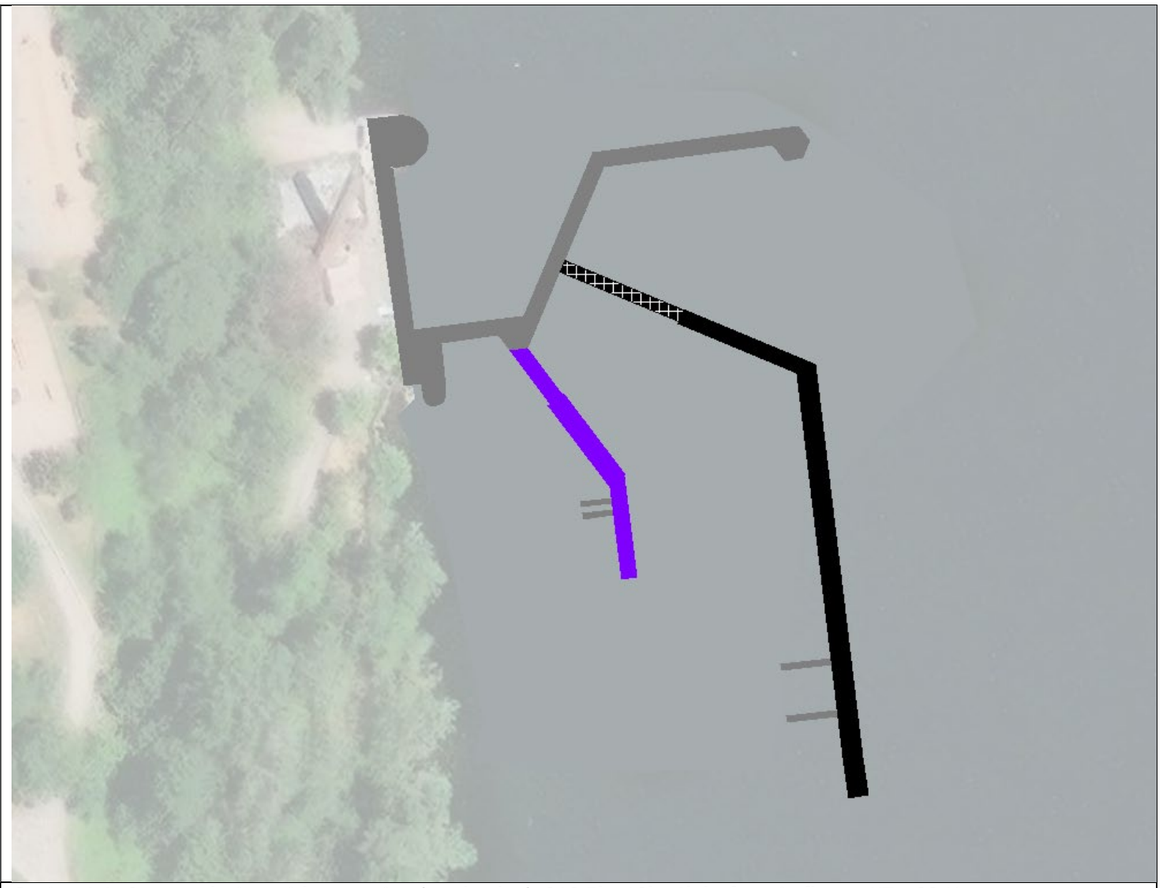


Figure 2. Left: Combined Bathymetry and Topography cropped to Lake Washington and NOAA NOS hydrographic data H11810 (2008) and H11376 (2005). Right: Bathymetric Survey (white dots) merged with NOAA NOS hydrographic data H11376 (2005) at the project site.

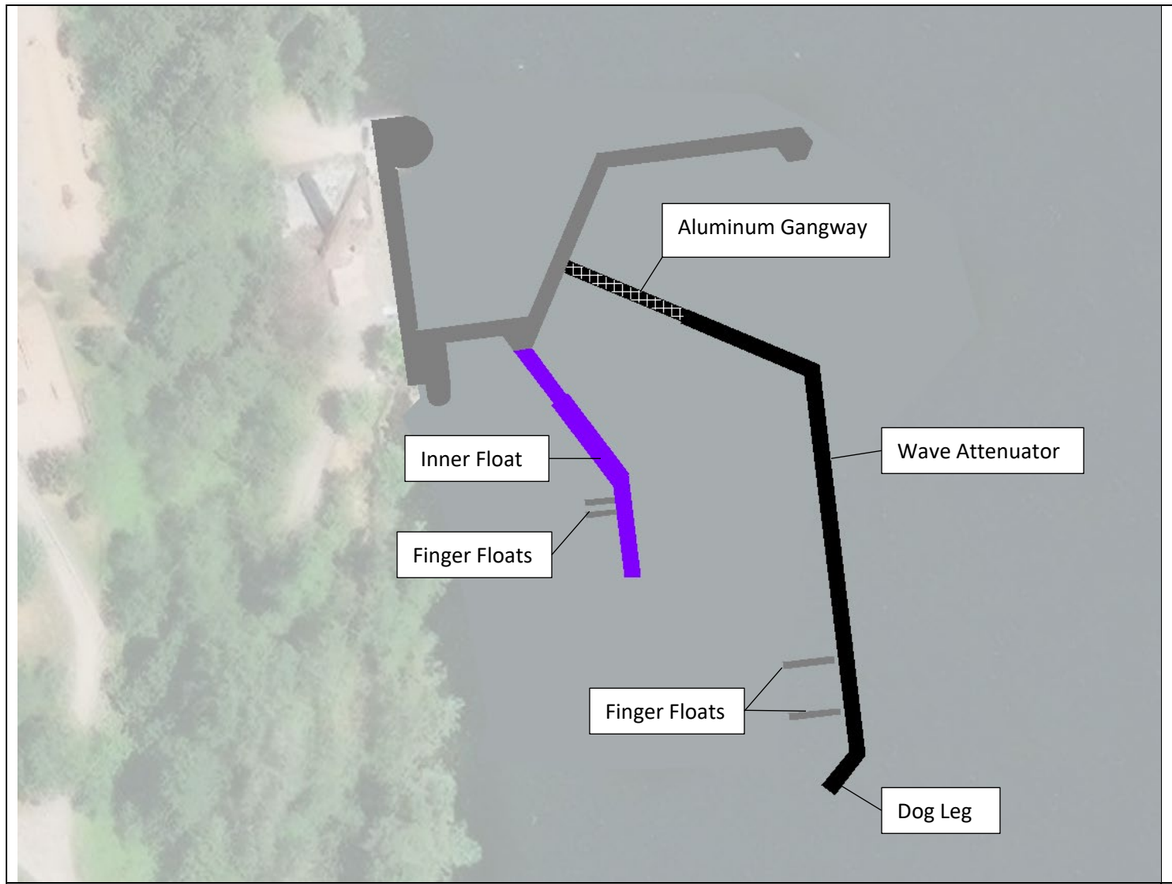


Option 1: Current design: 193' x 10' x 4' draft main float – KT = 23 %

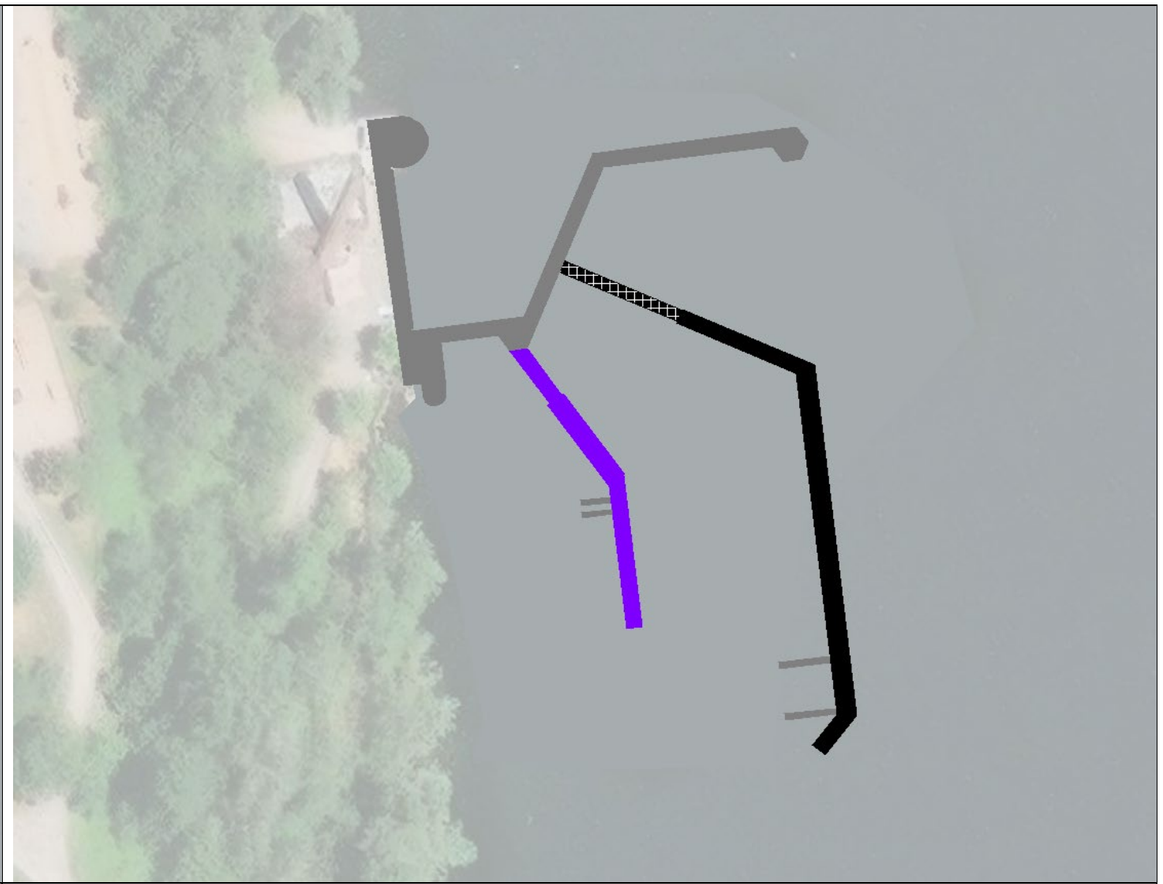


Option 1.1: Current design with extension (no dog leg): 210.5' x 10' x 4' draft main float – KT = 23 %

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

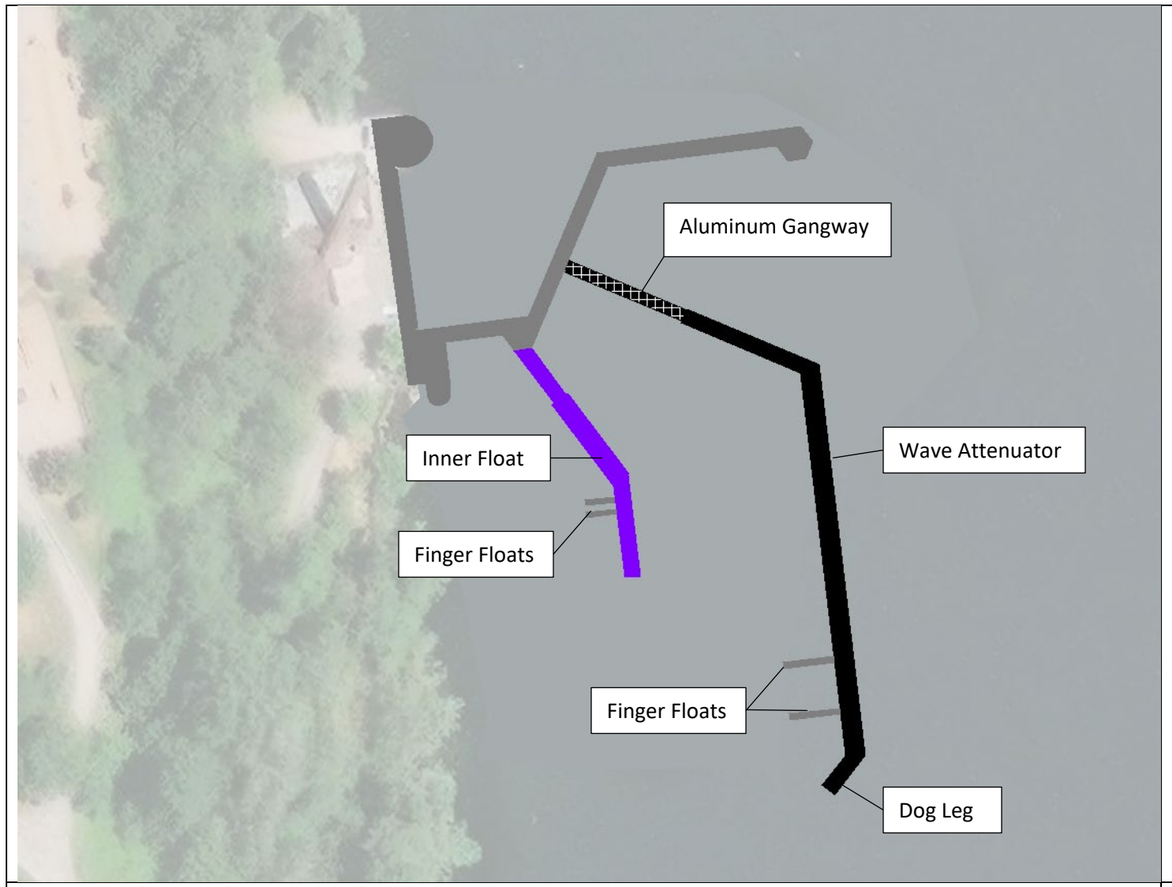


Option 2: Narrower: 193' x 8' x 4' draft main float – KT = 28 %

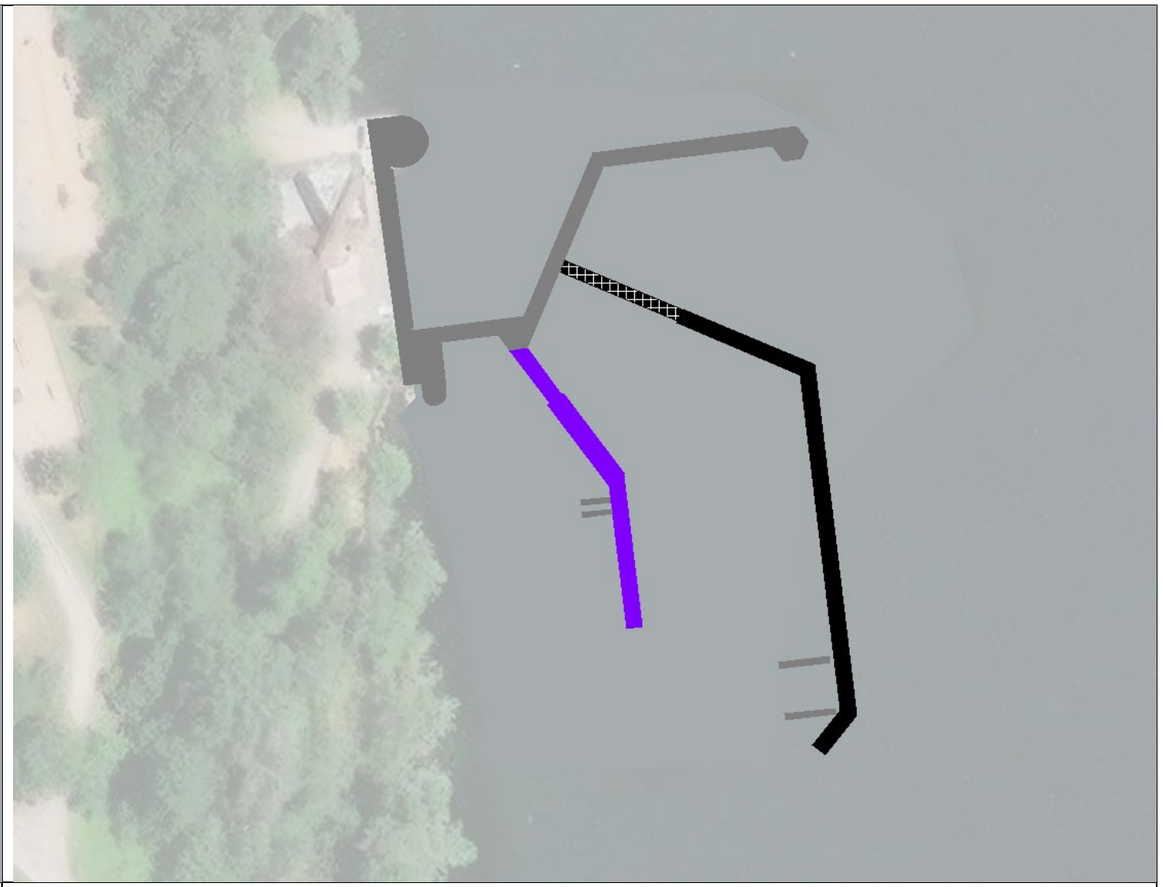


Option 3: Shorter: 173' x 10' x 4' draft main float (inner float +25') – KT = 23 %

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.

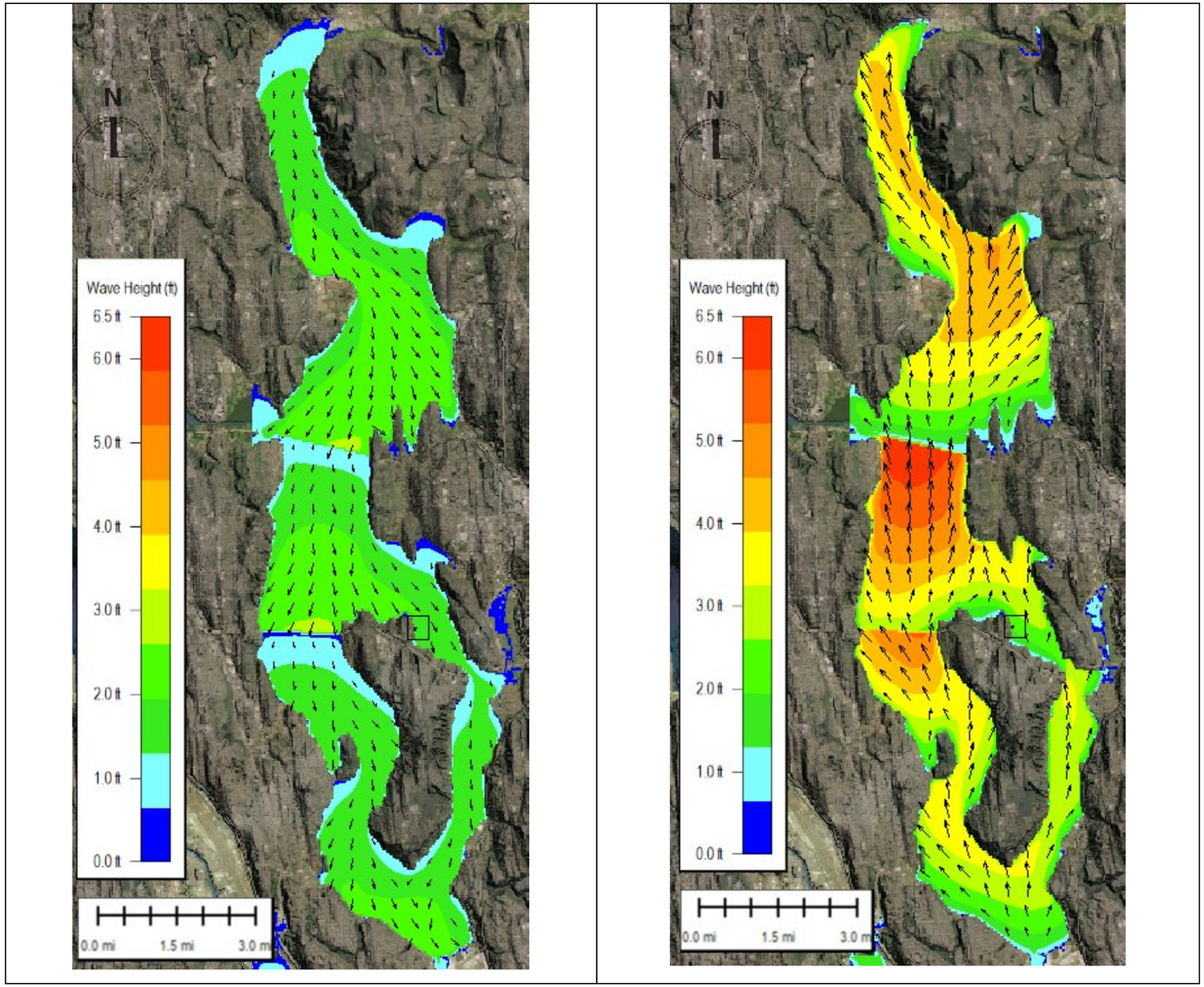
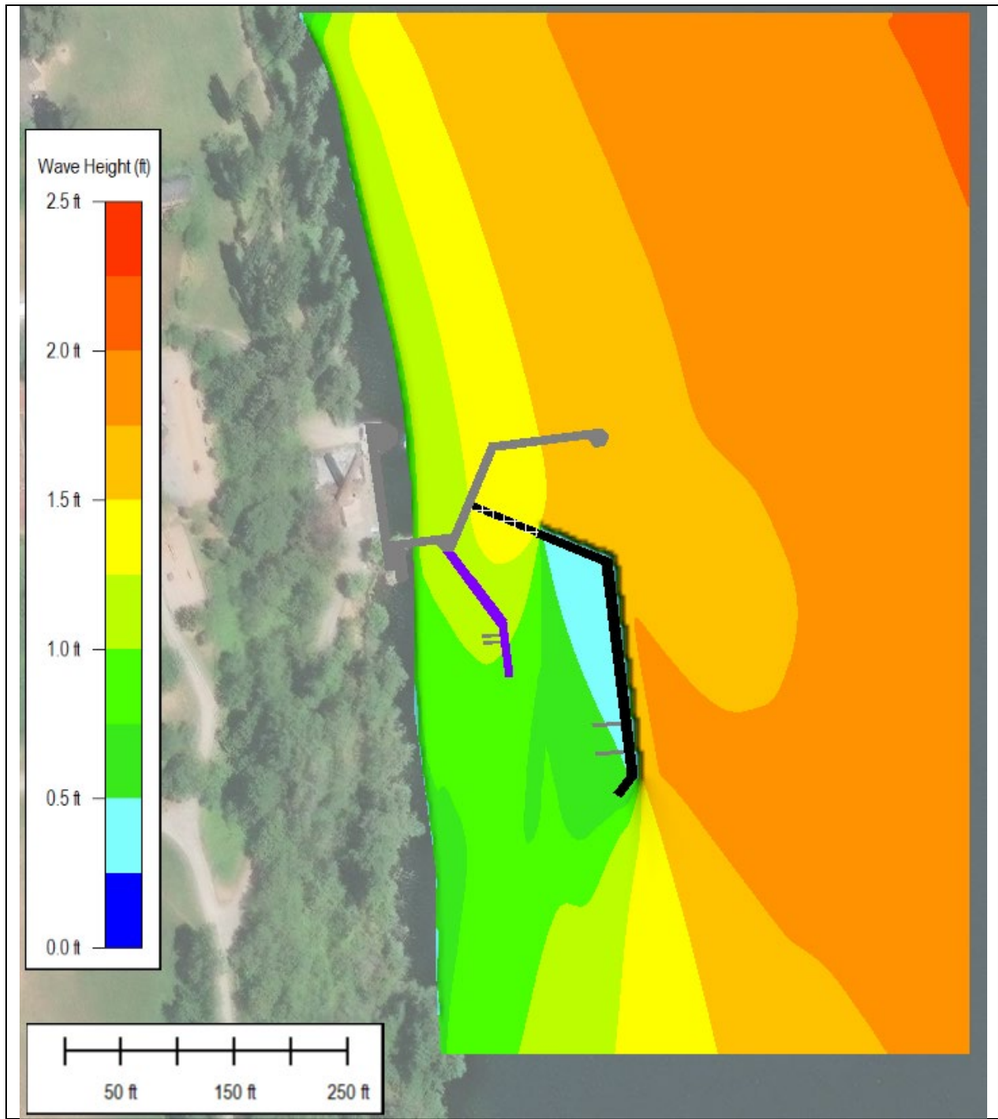
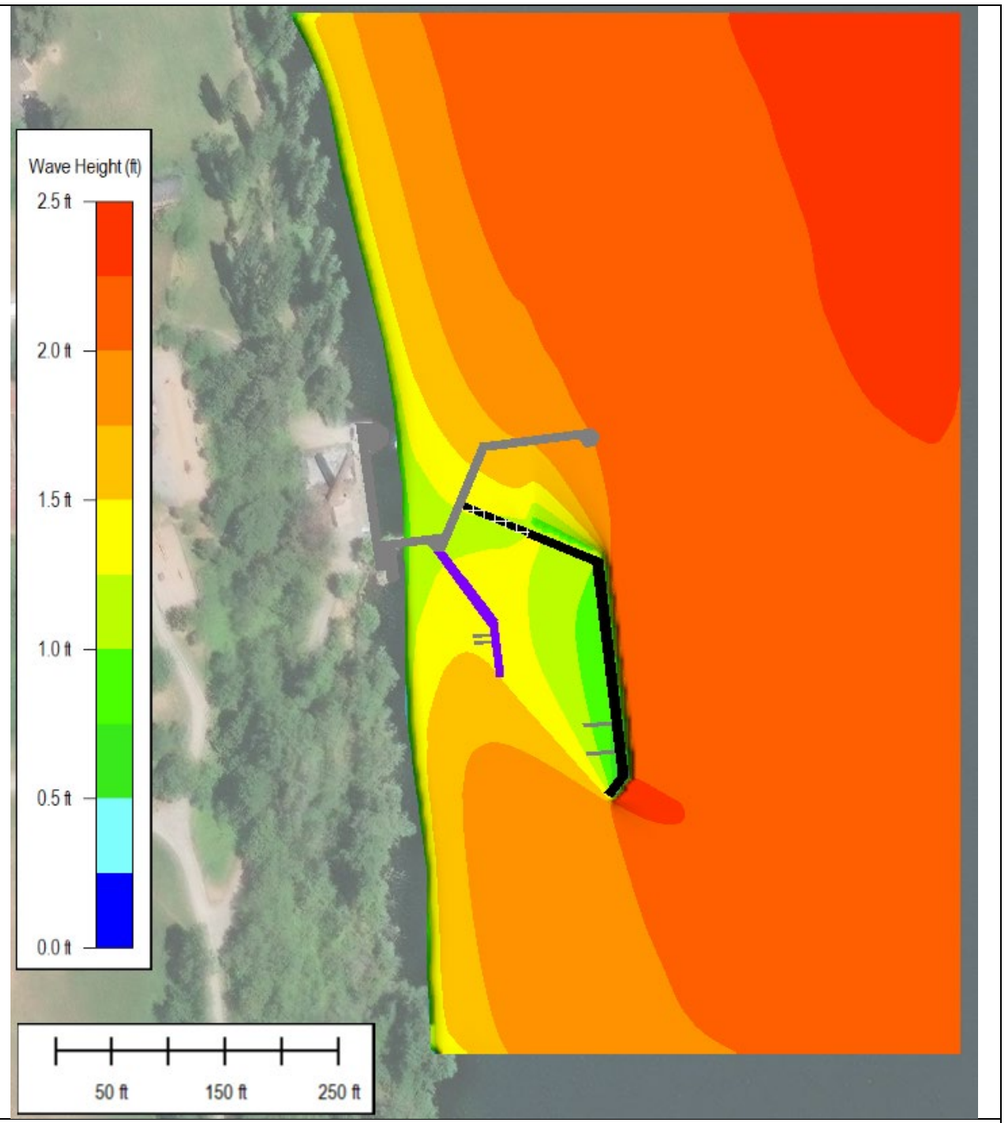


Figure 6. Simulated results for Lake Washington Northerly 100-yr return period wind (left) and 100-yr return period southerly wind (right).

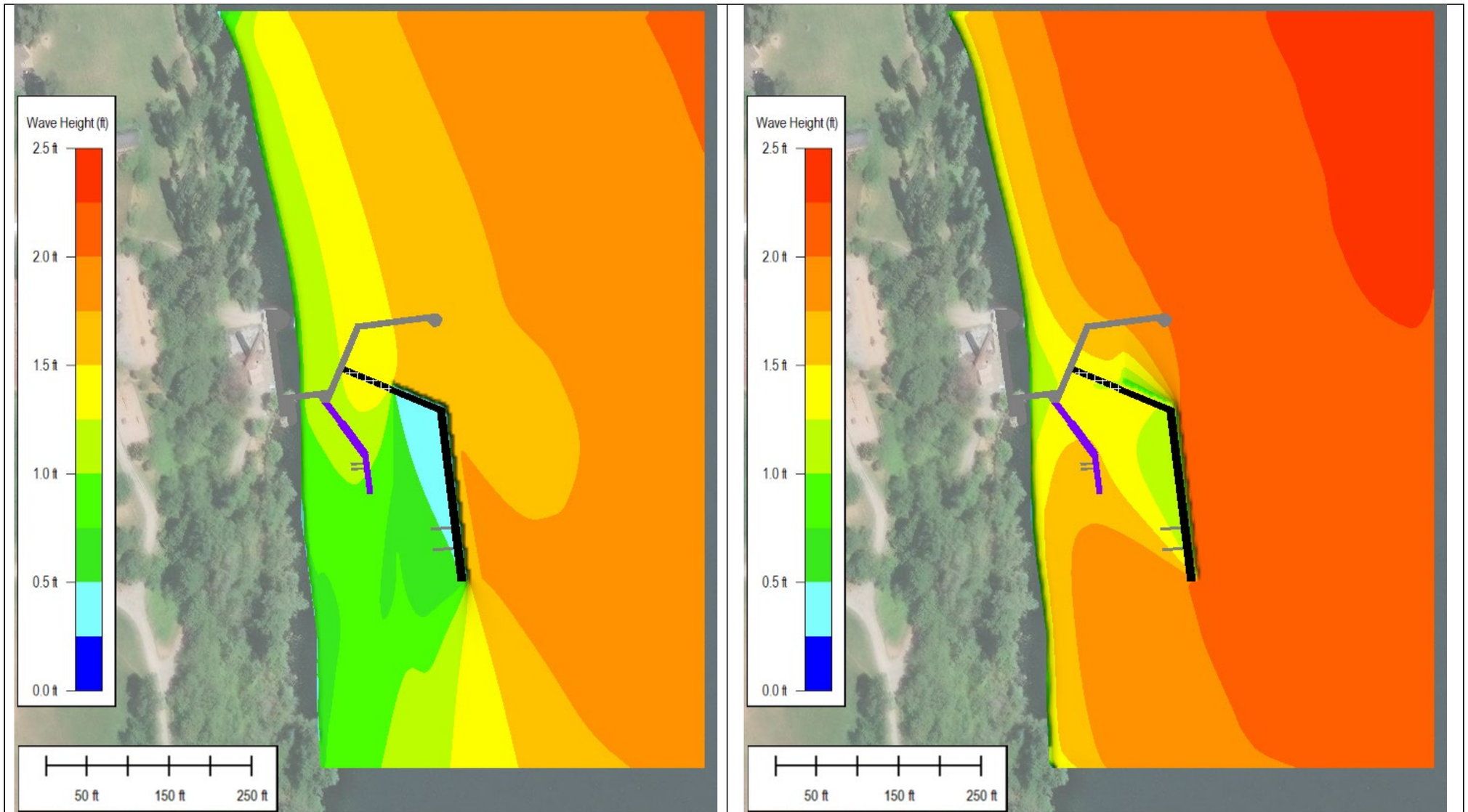


Northerly Wind-Waves



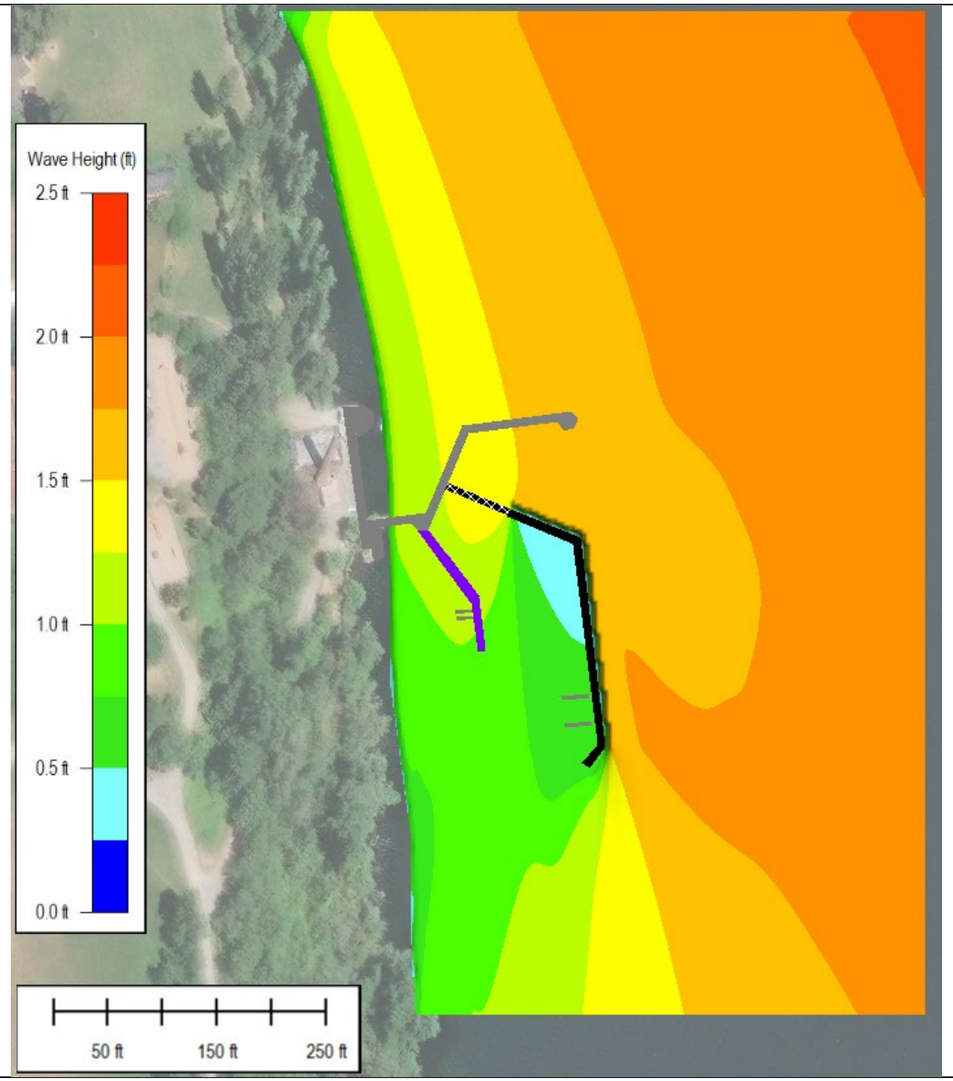
Southerly Wind-Waves

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 %

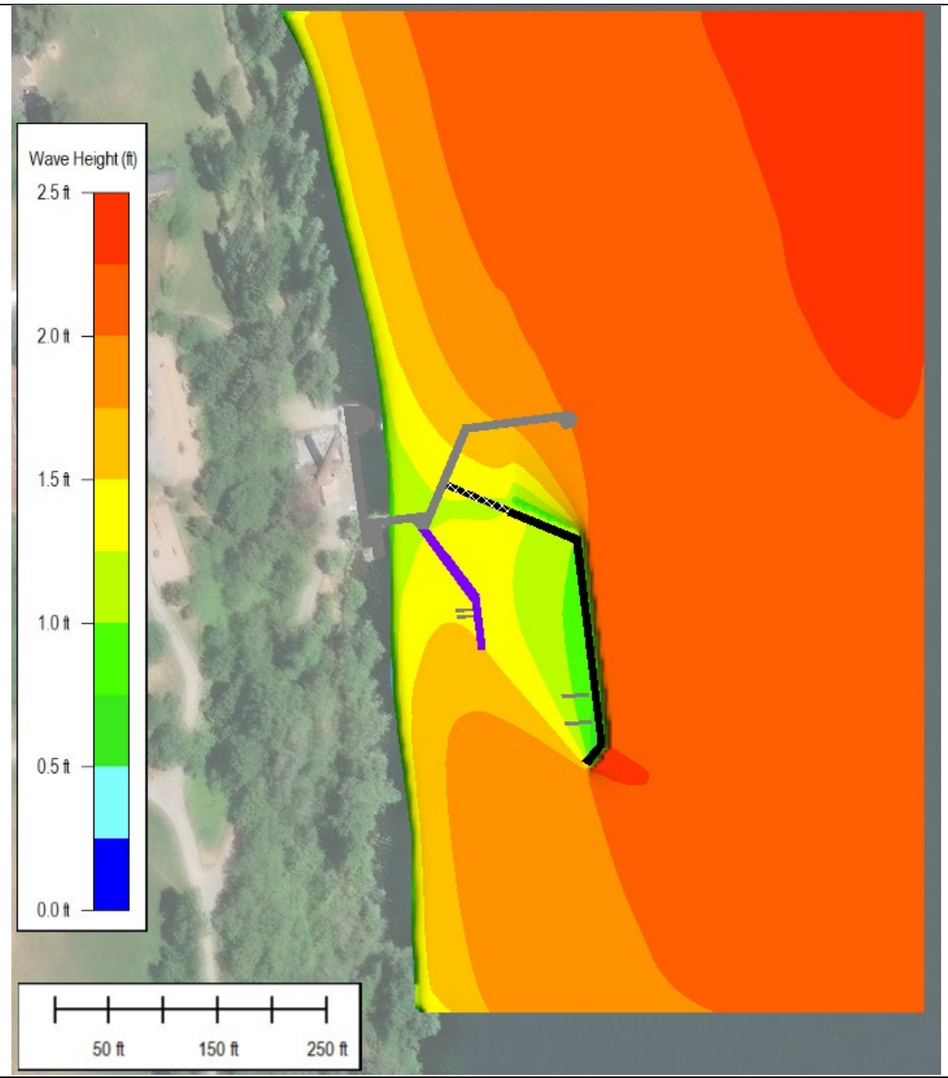


Northerly Wind-Waves | **Southerly Wind-Waves**

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 %

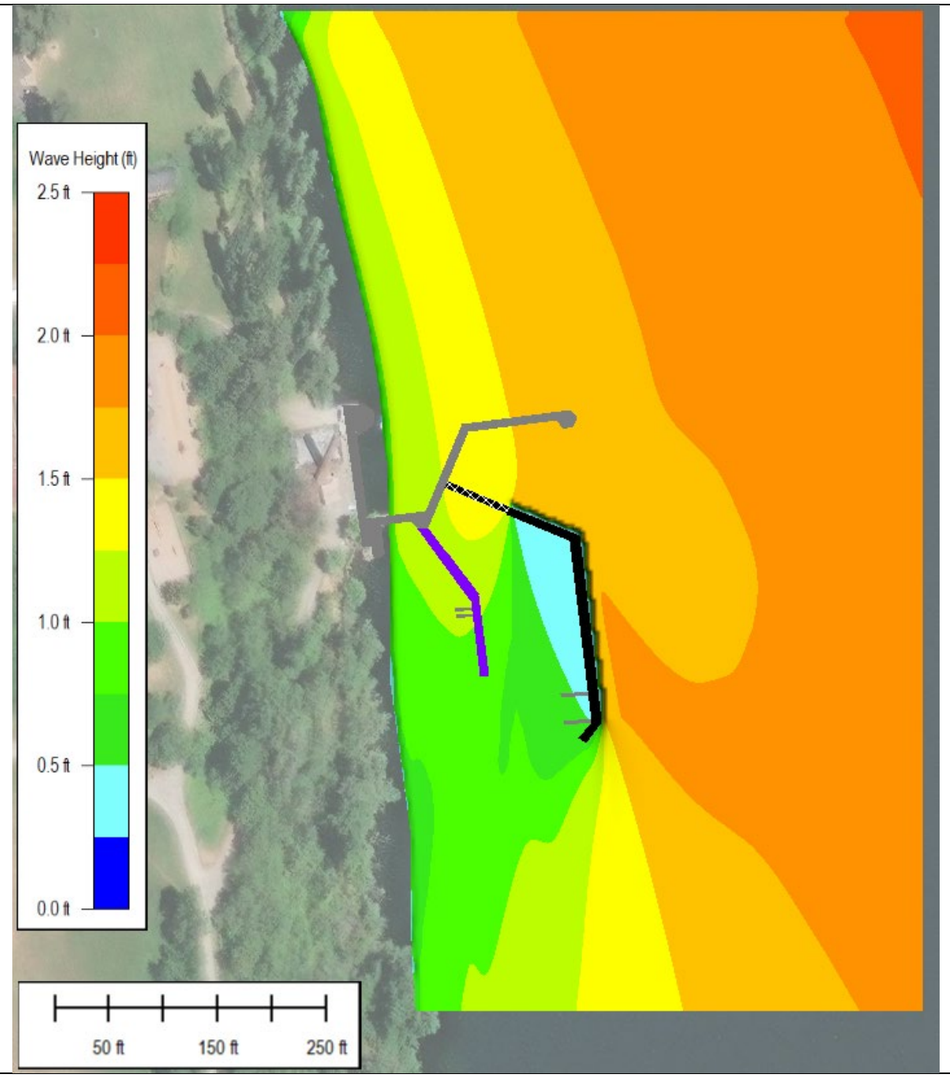


Northerly Wind-Waves

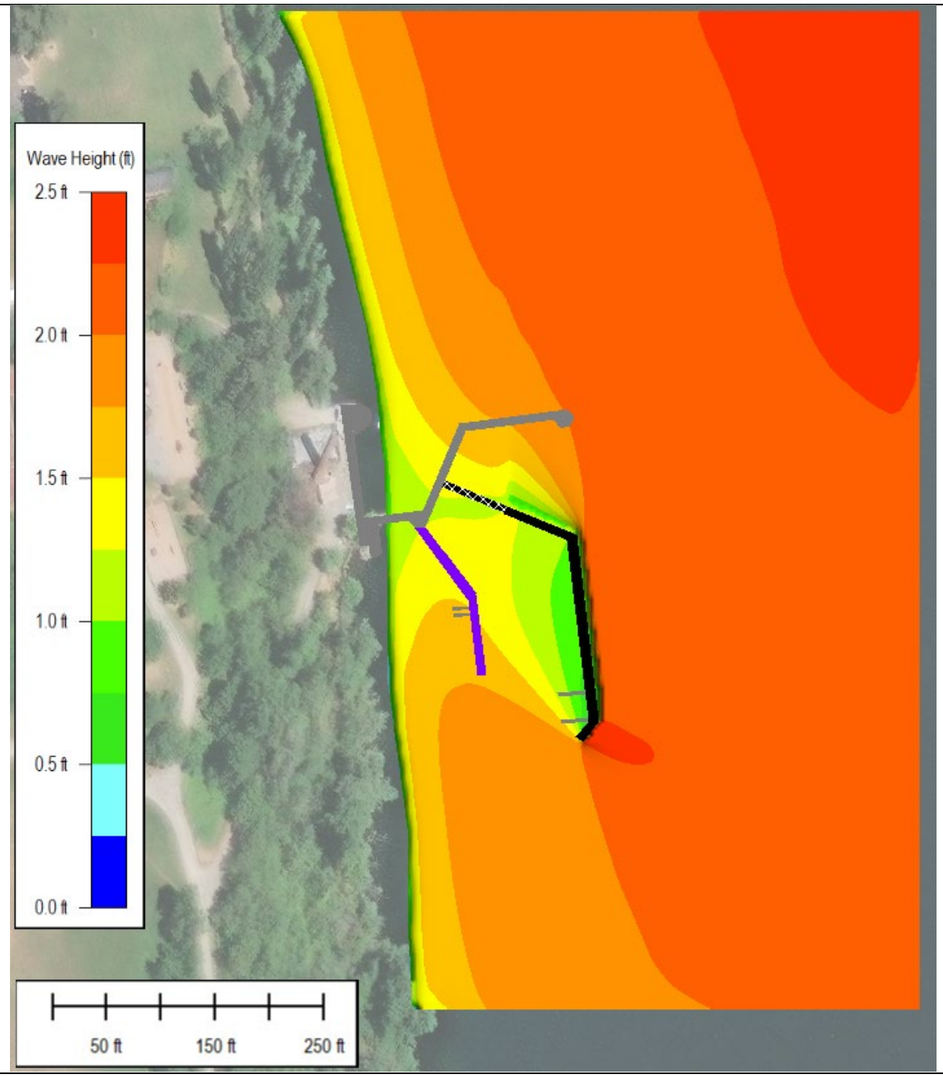


Southerly Wind-Waves

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 %

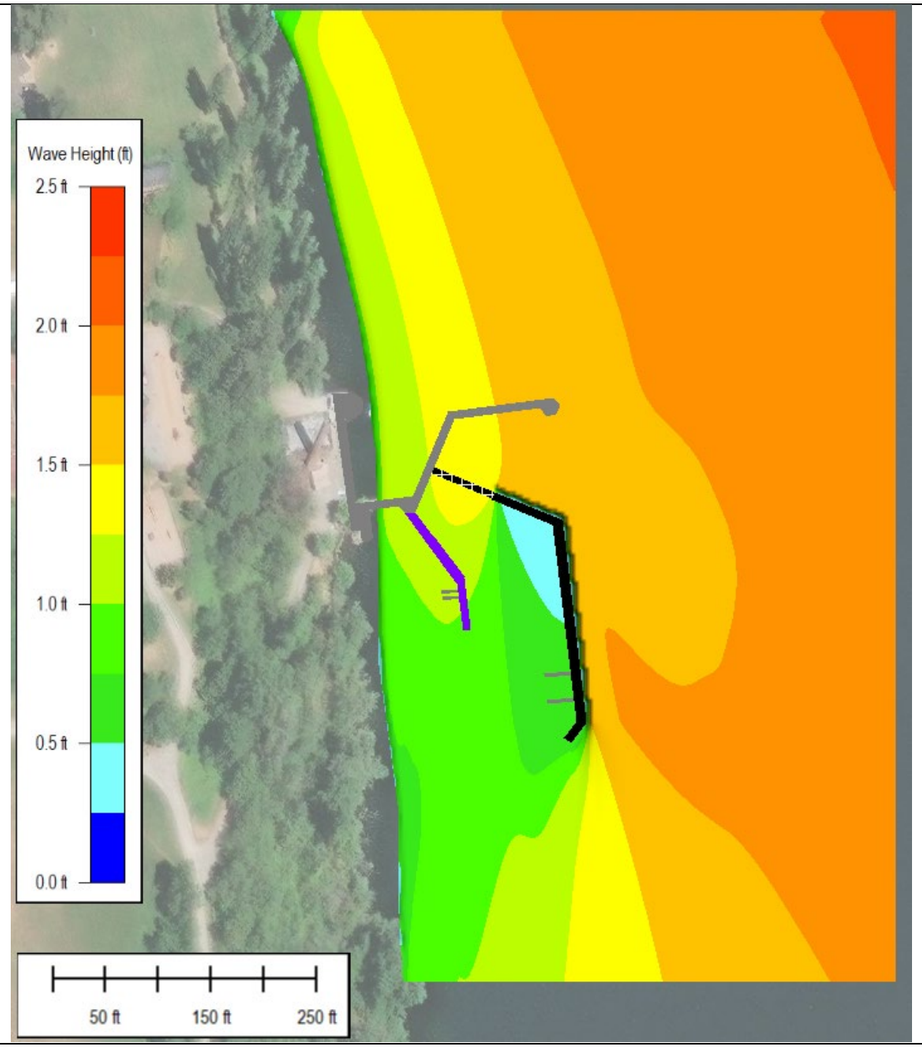


Northerly Wind-Waves

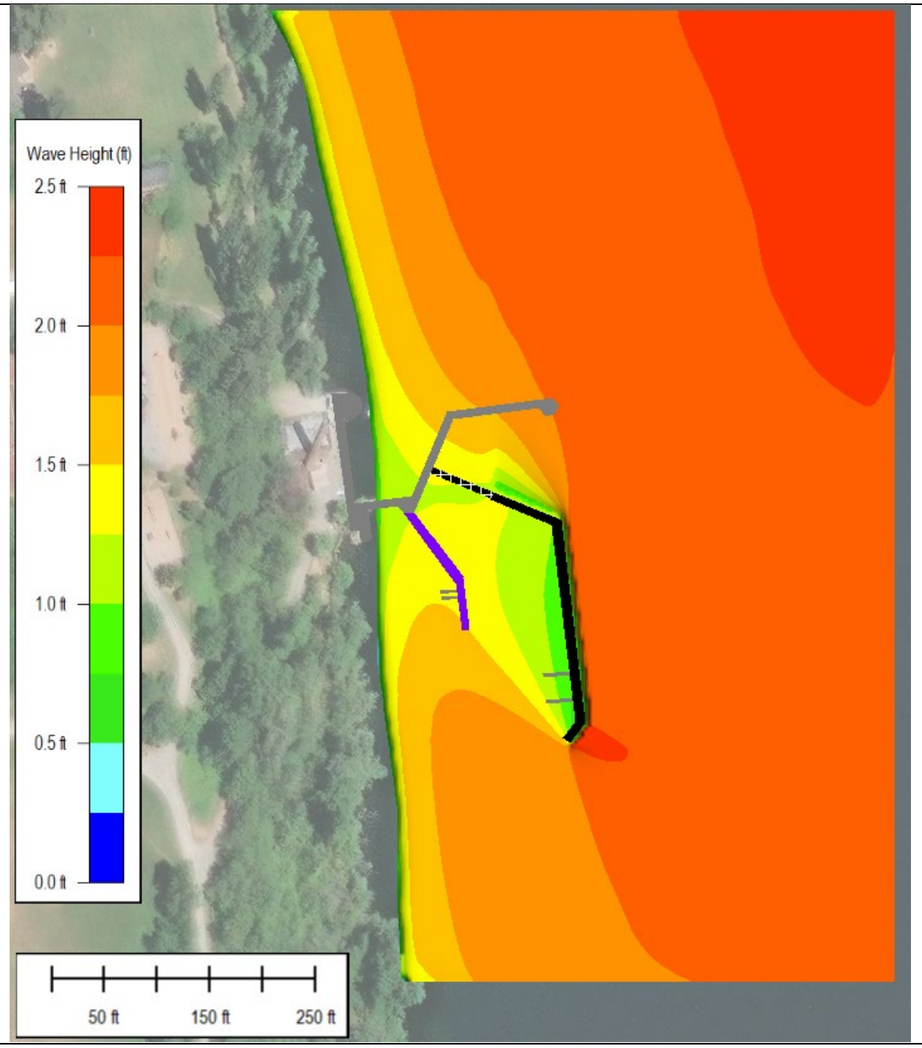


Southerly Wind-Waves

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 %

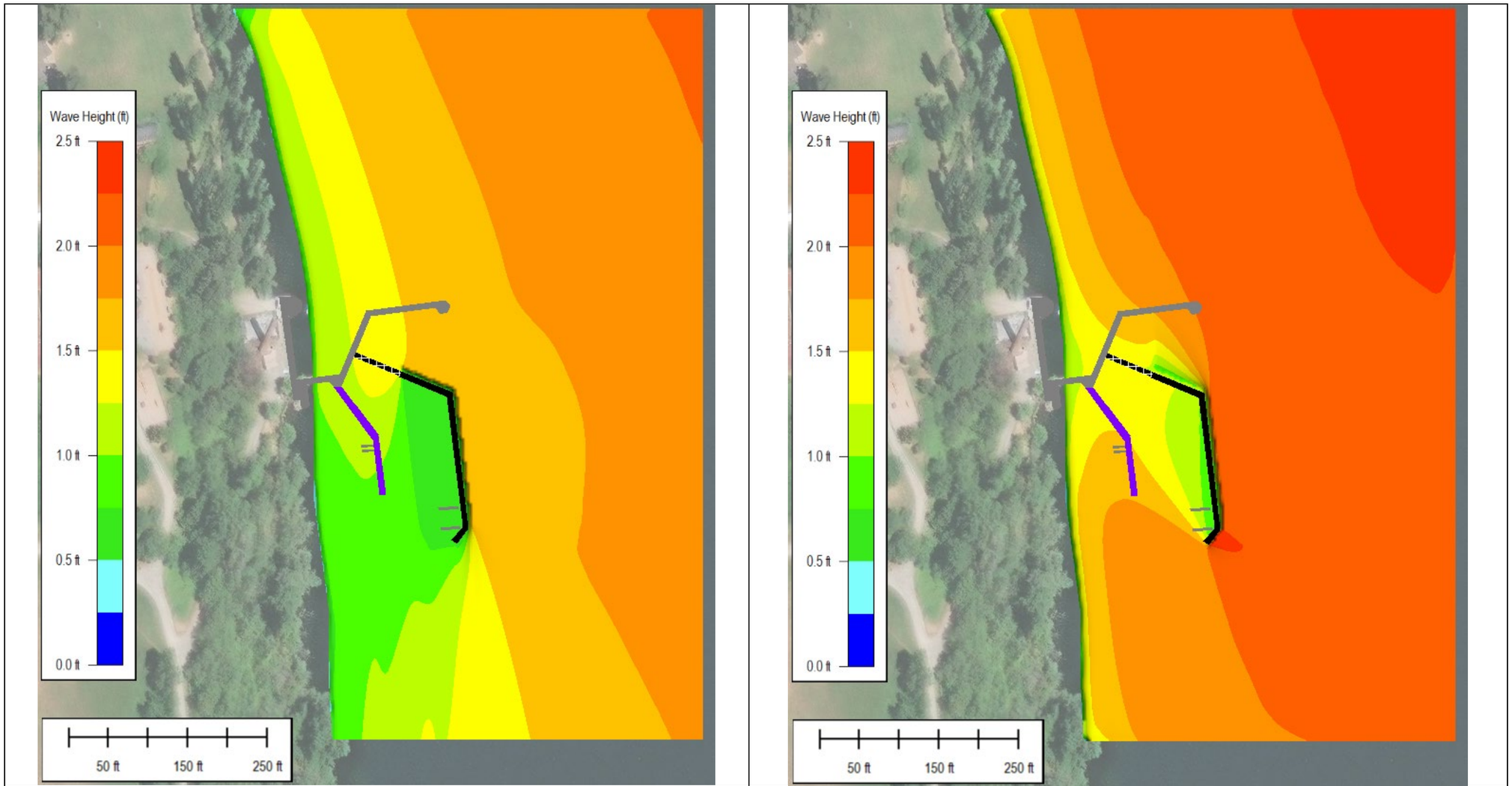


Northerly Wind-Waves



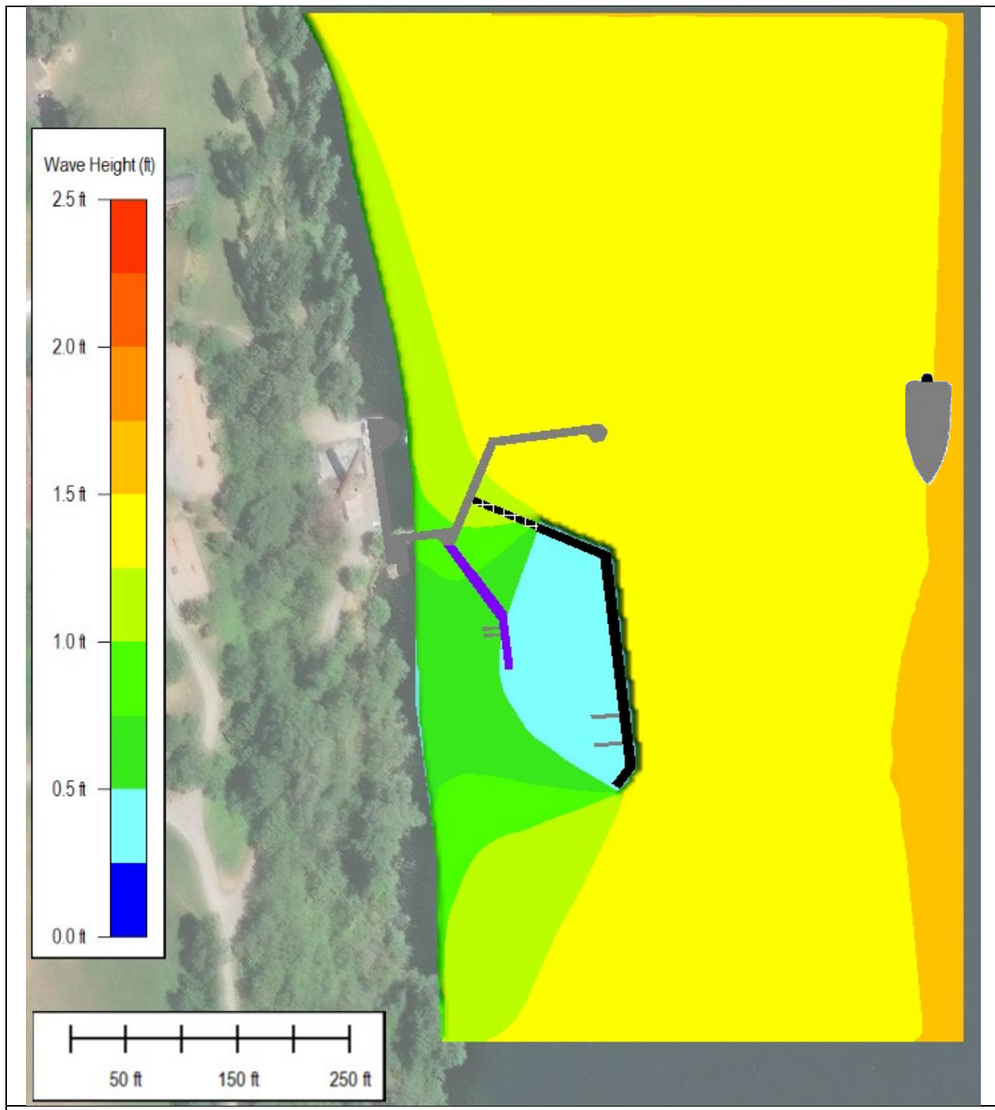
Southerly Wind-Waves

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 %

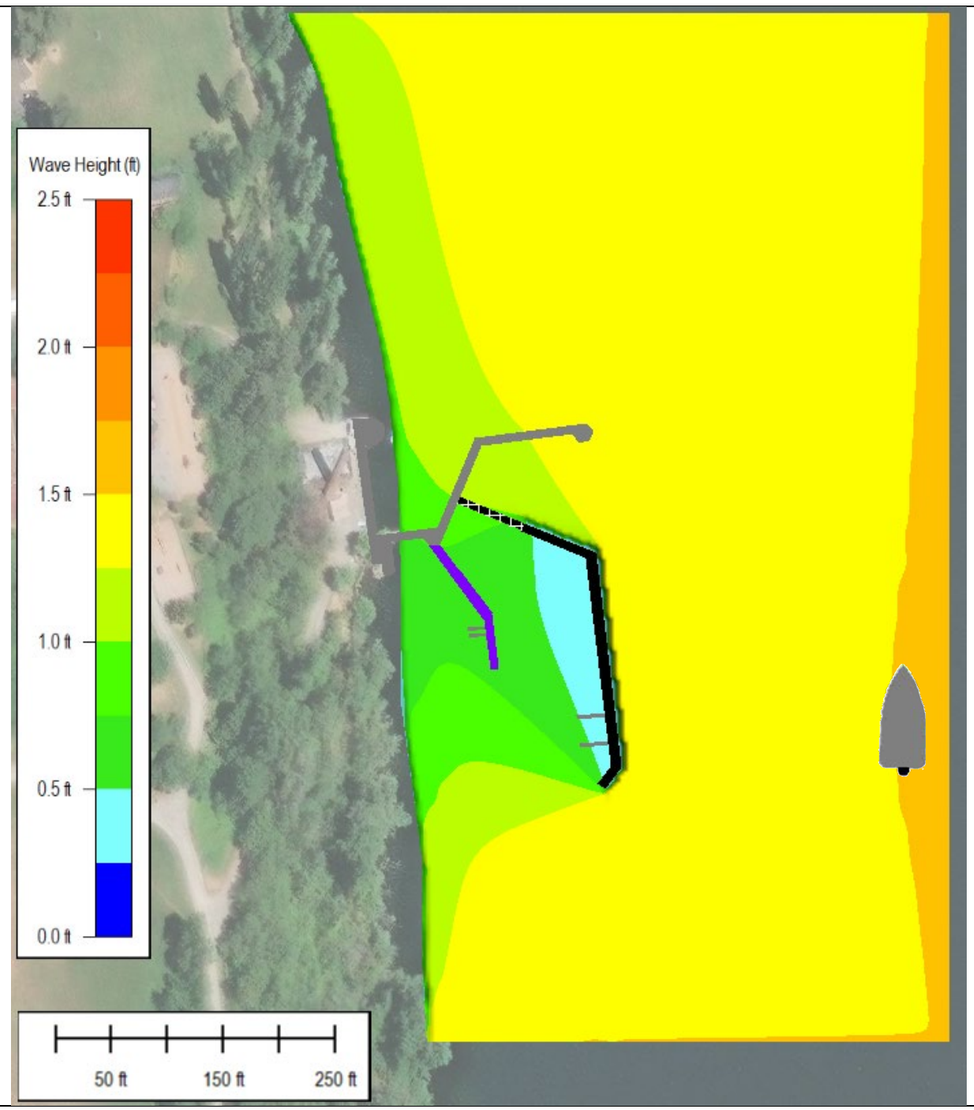


Northerly Wind-Waves	Southerly Wind-Waves

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 %

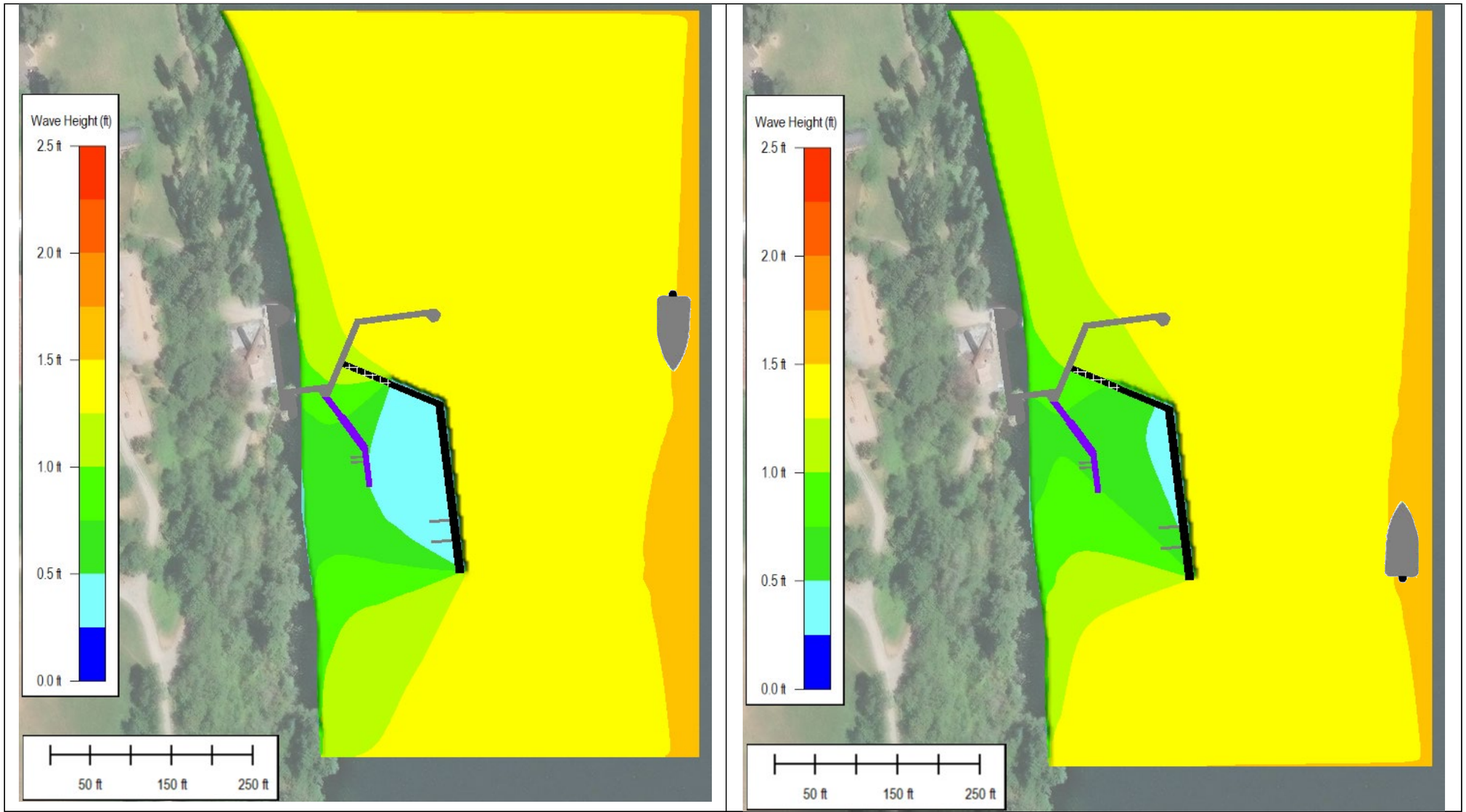


Northerly Wind-Waves



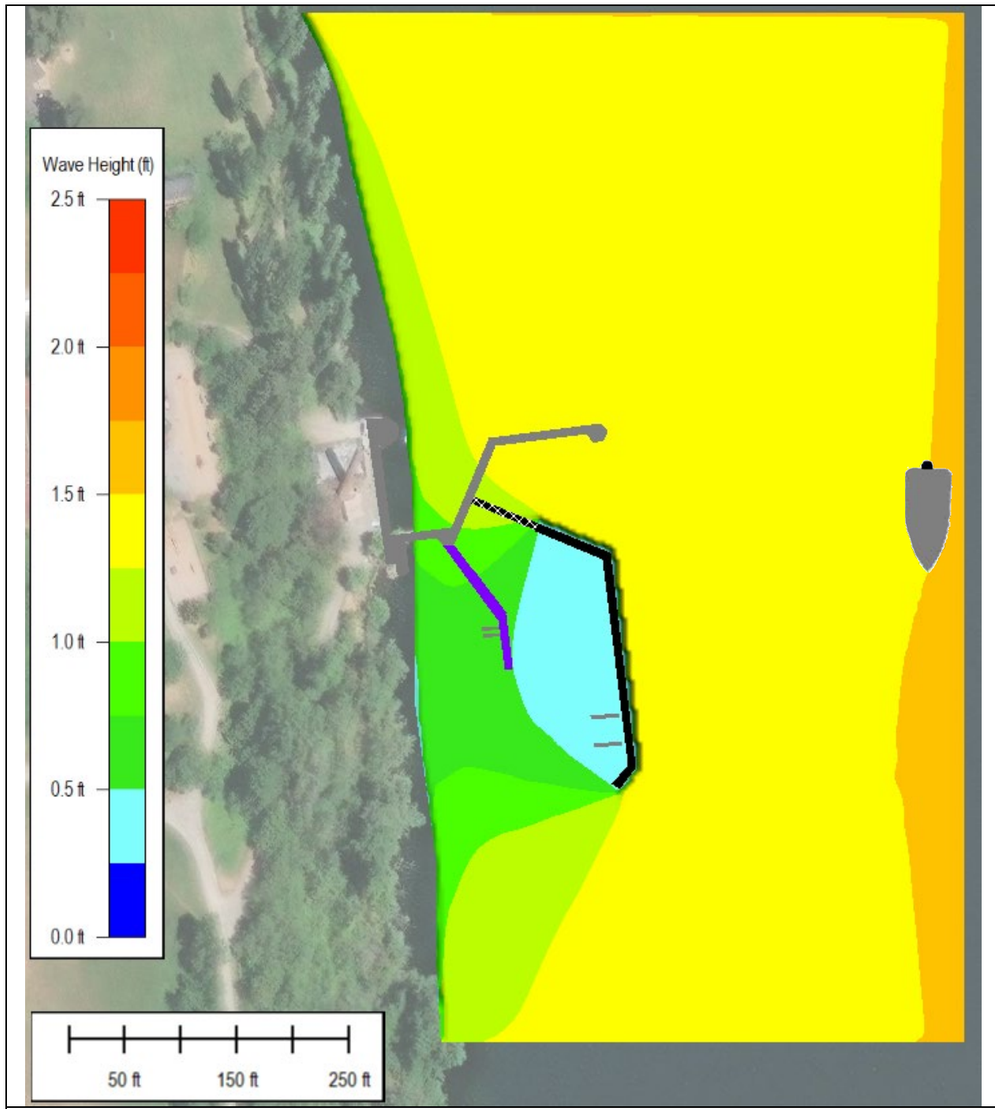
Southerly Wind-Waves

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

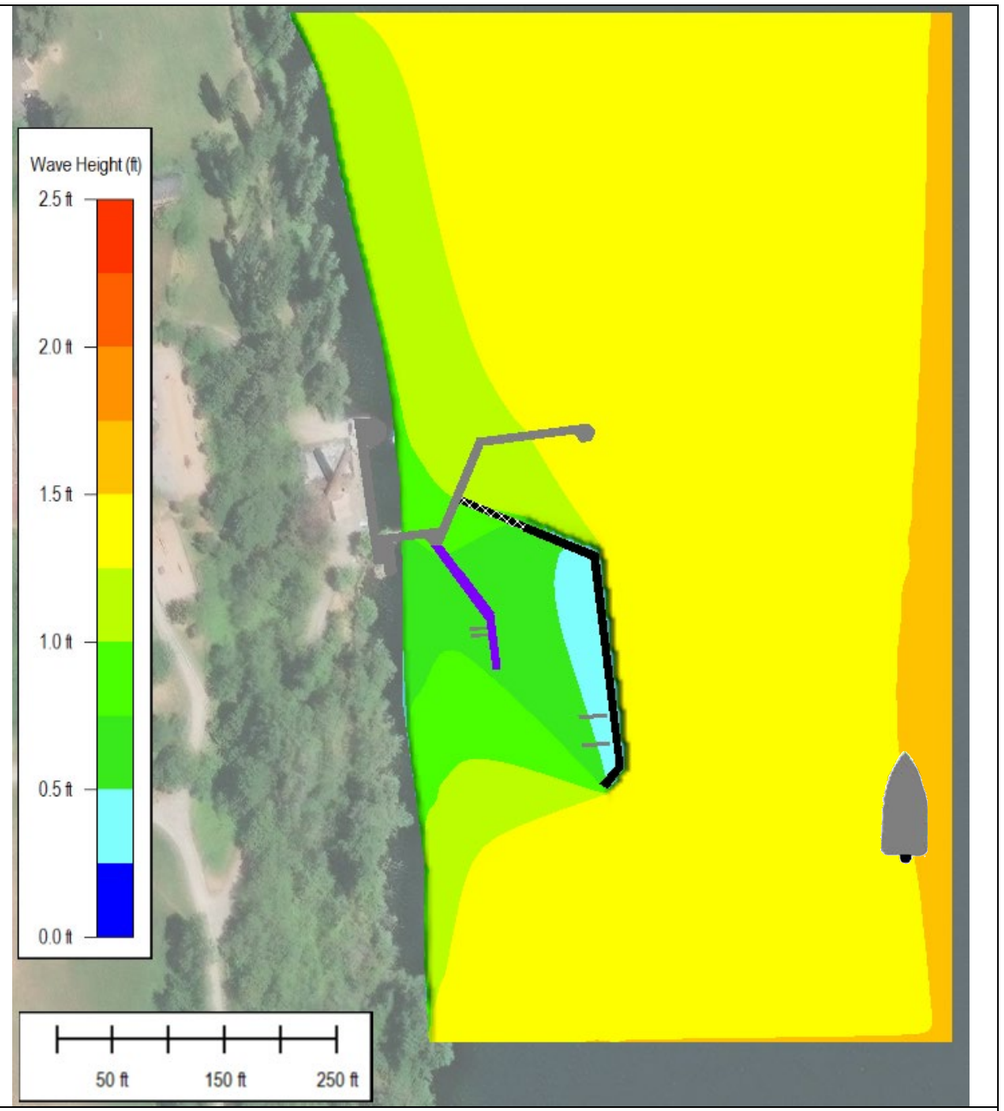


Northerly Wind-Waves	Southerly Wind-Waves

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 %

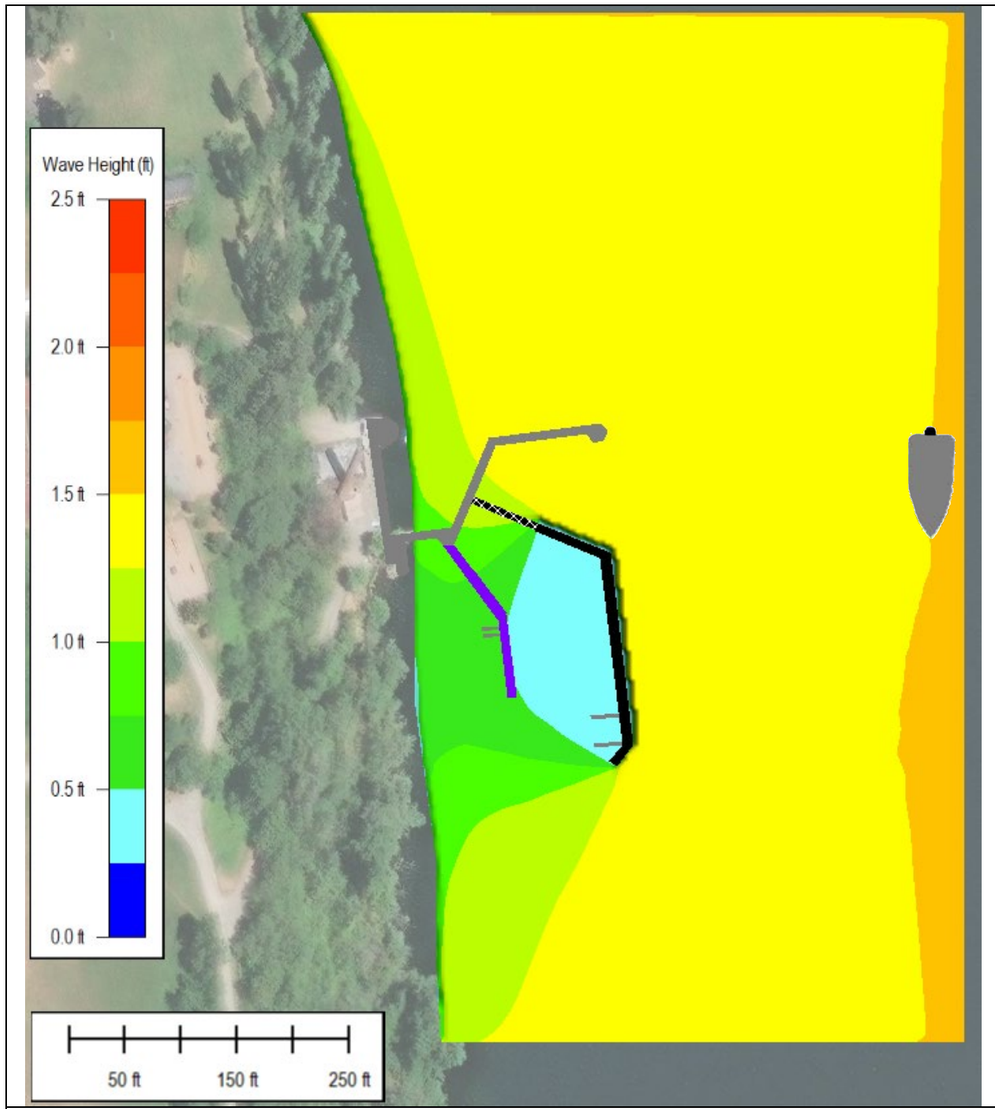


Northerly Wind-Waves

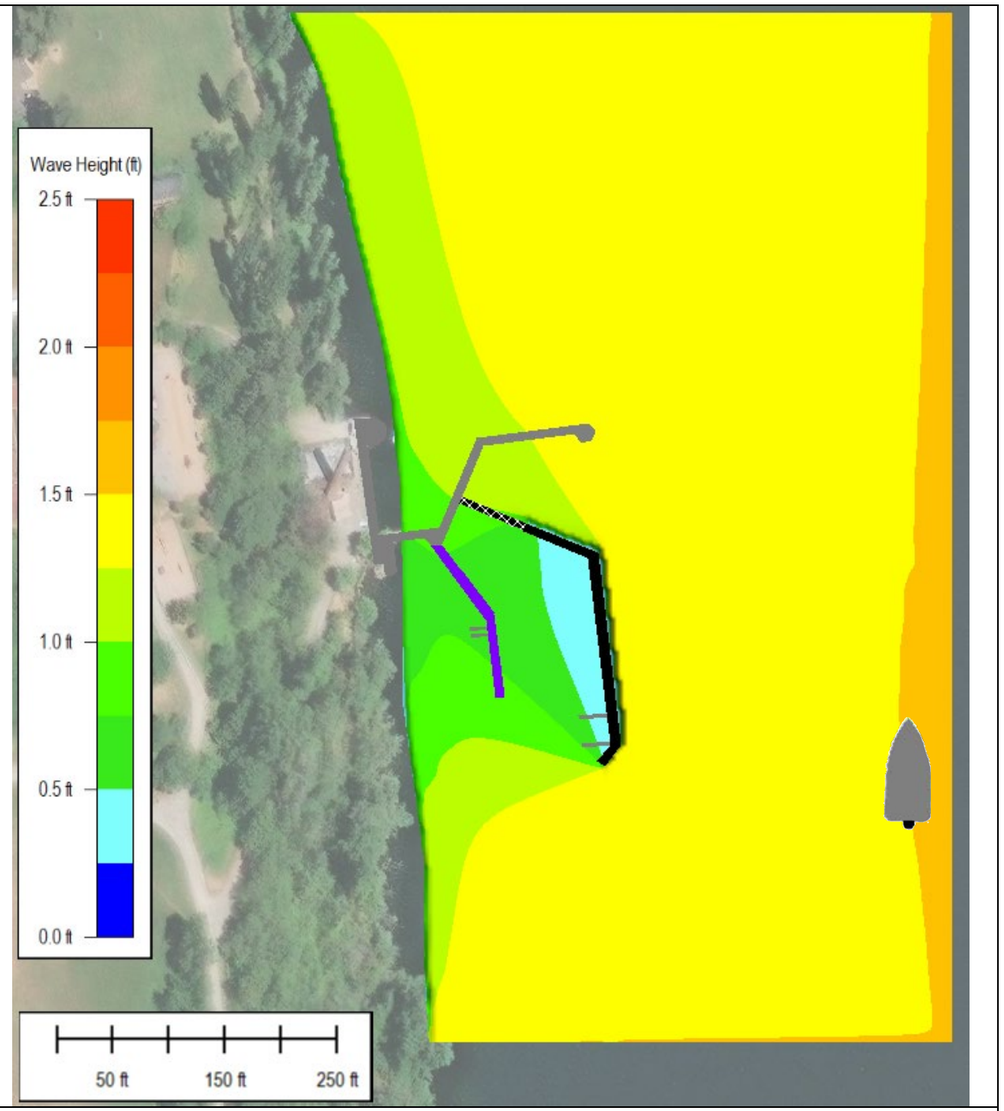


Southerly Wind-Waves

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

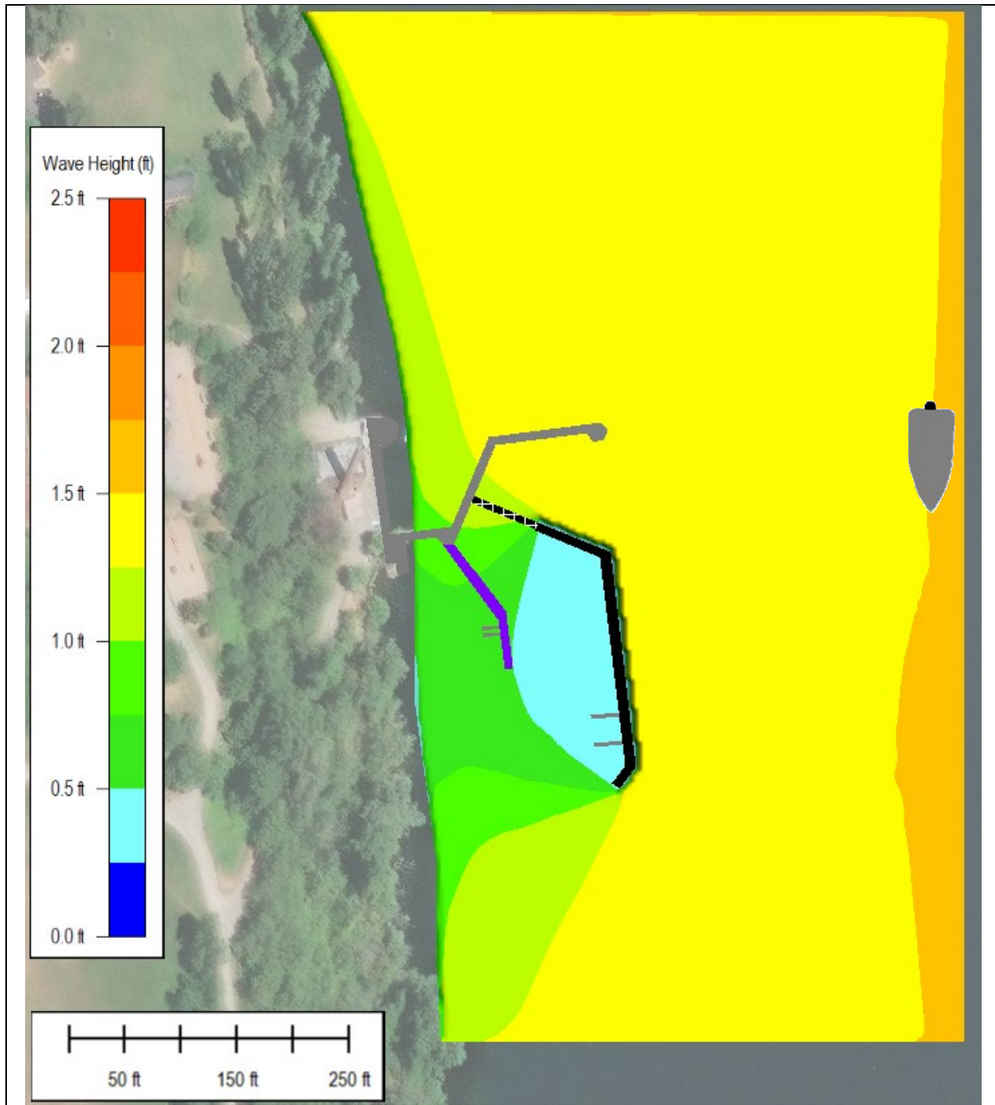


Northerly Wind-Waves

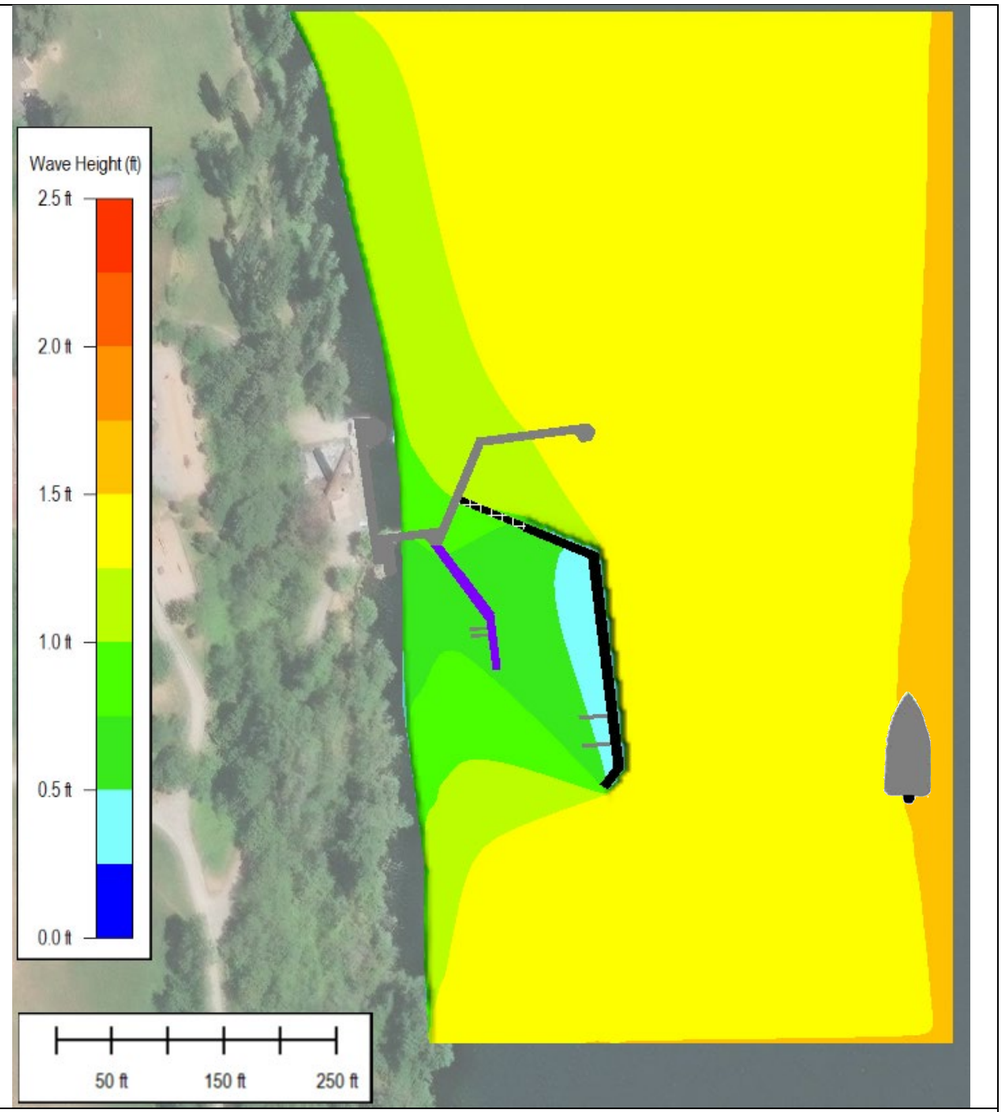


Southerly Wind-Waves

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 %

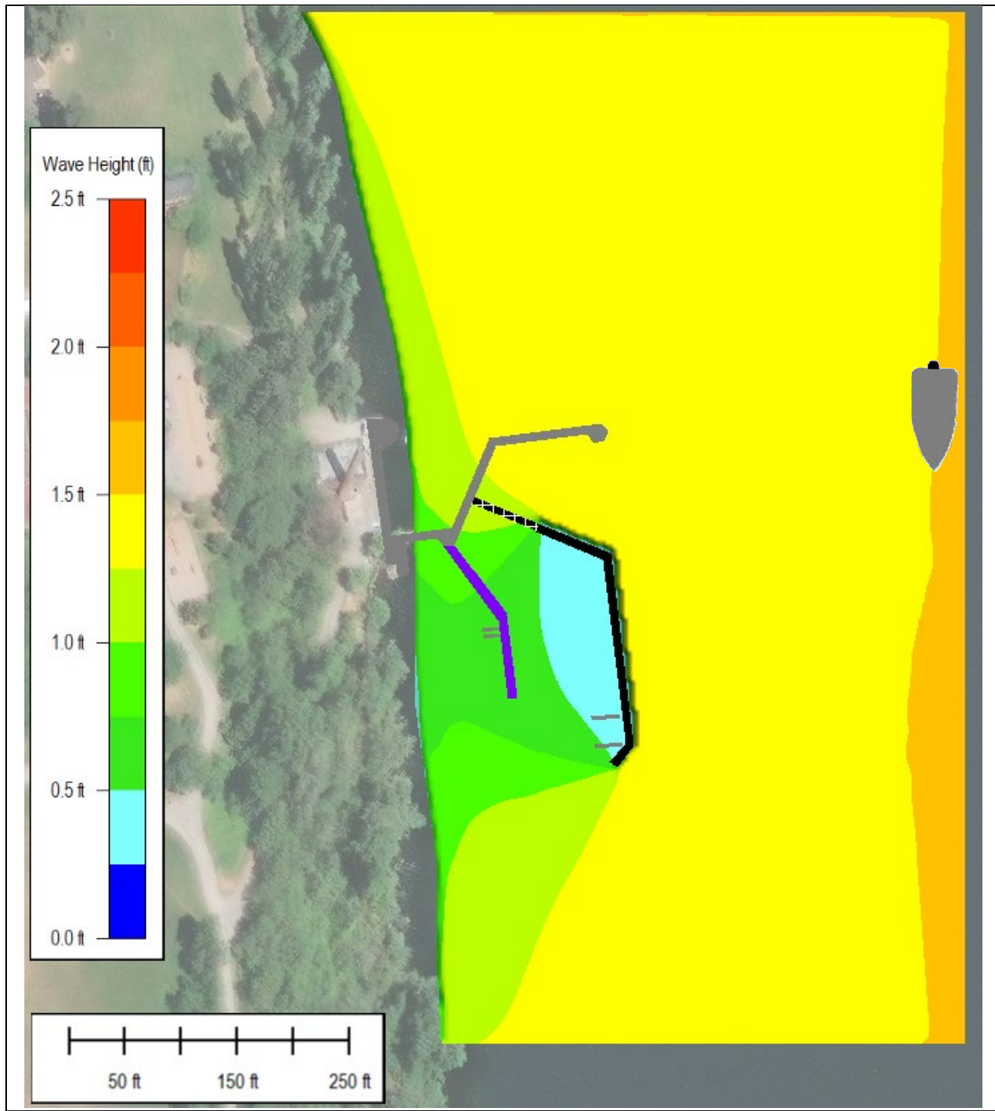


Northerly Wind-Waves

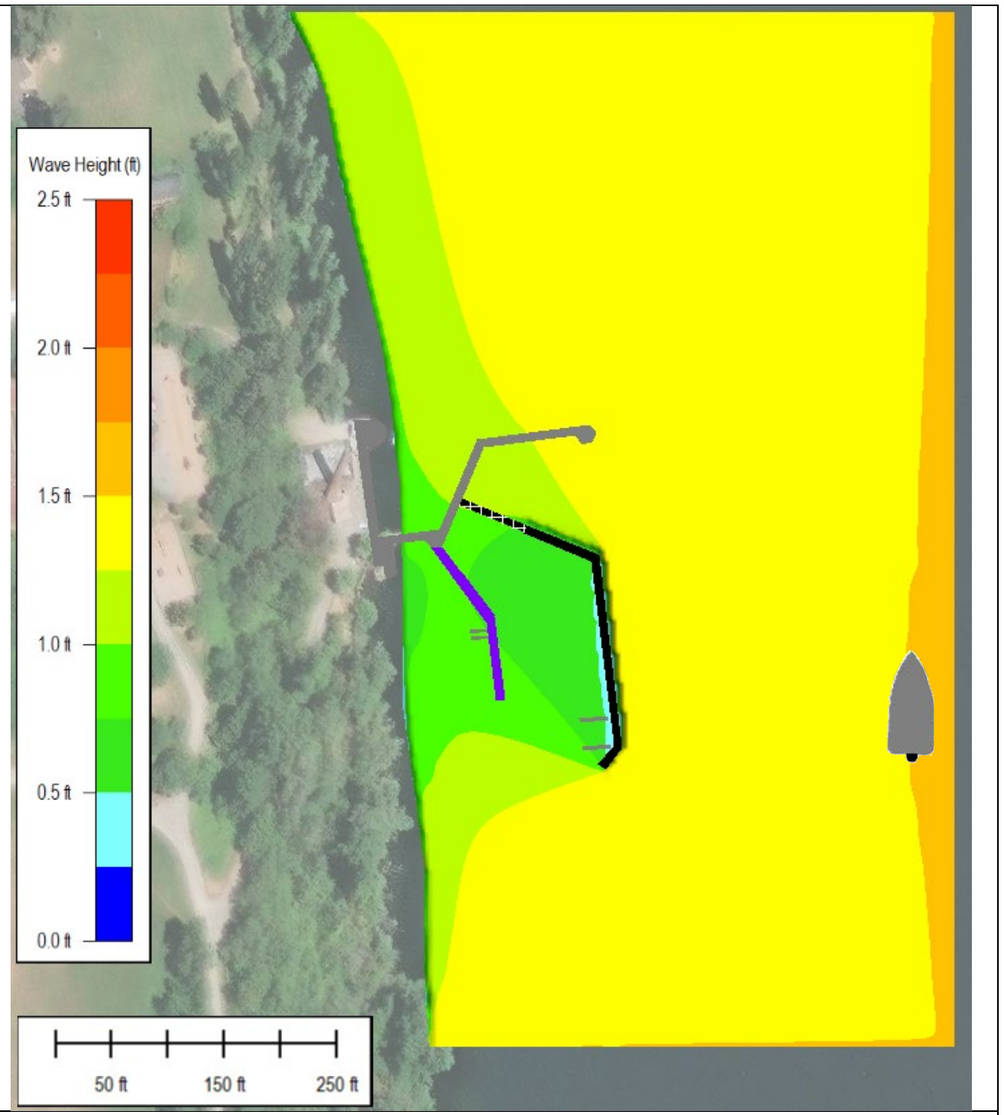


Southerly Wind-Waves

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 %

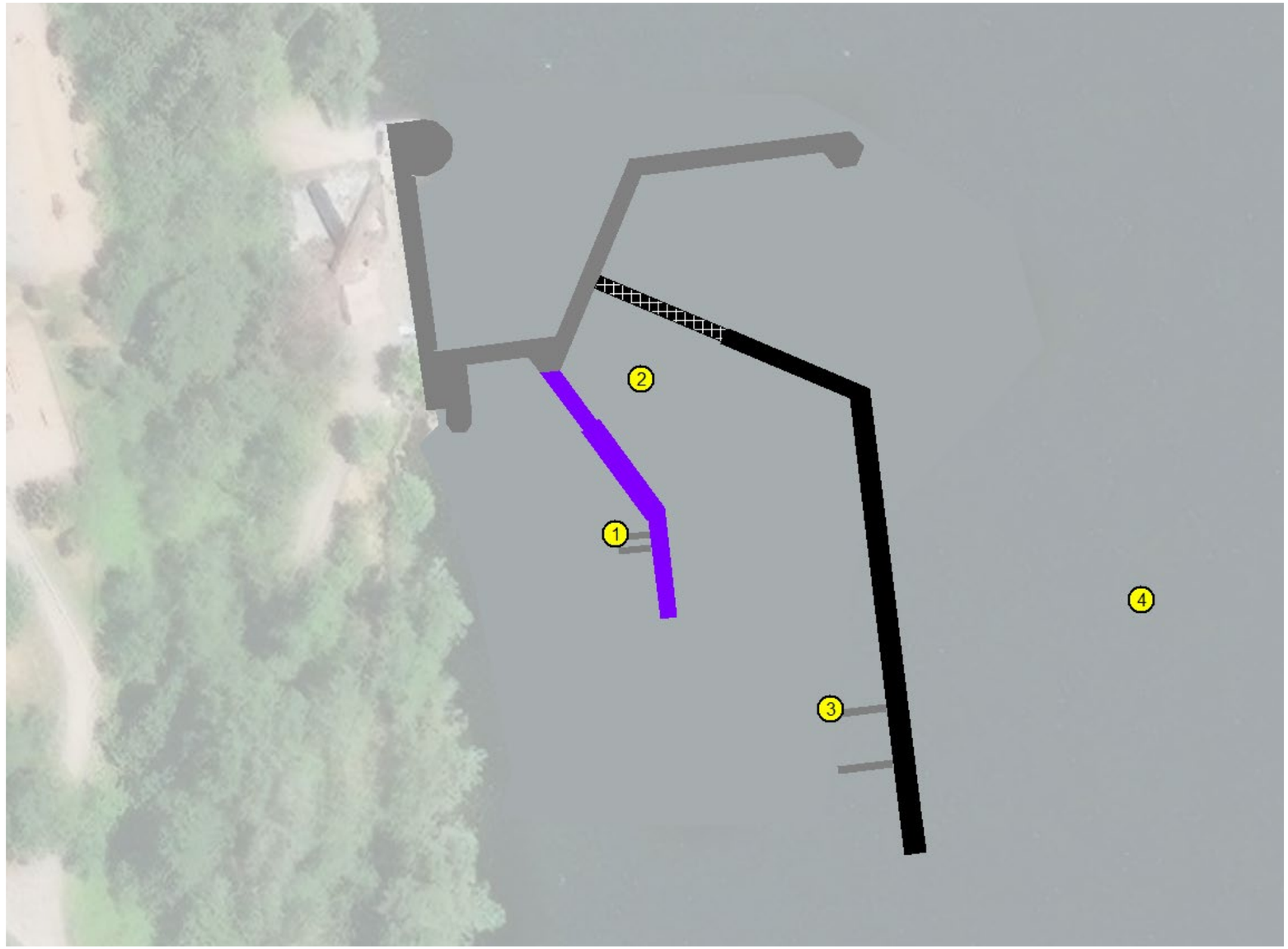


Figure 19: Location of Wave Height Extraction Points Inside the Marina