1201 3rd Avenue, Suite 2600
Seattle, Washington 98101
206.287.9130

ANCHOR QEA

Memorandum

April 3, 2023

To: Benjamin Laws, National Oceanic and Atmospheric Administration

From: Merri Martz, Hannah Fotherby, Michelle Havey, and Josh Jensen, Anchor QEA, LLC

cc: Katherine Chesick, Jill Macik, and Ticson Mach, City of Seattle Department of Transportation

Re: Incidental Harassment Authorization Renewal Request, Waterfront Park (Pier 58), City of Seattle

Introduction

This memorandum has been prepared to request a renewal of the Incidental Harassment Authorization (IHA) approved by the National Oceanic and Atmospheric Administration (NOAA) for Waterfront Park (Pier 58) within the City of Seattle, Washington, on May 20, 2022, that is valid from August 1, 2022, through July 31, 2023 (Season 1; NOAA 2022). This request for renewal is for a second season (Season 2) to complete the original work authorized plus a minor addition of limited pile removal and installation at Don Armeni Boat Ramp within Elliott Bay.

The City of Seattle has partially completed the reconstruction of Pier 58 along the Elliott Bay shoreline in Seattle, Washington (Figure 1). The purpose of the project is to rebuild the pier to address structural and safety deficiencies, optimize public access and recreational uses of the pier, and install habitat enhancement measures within the nearshore marine environment. The project is located in downtown Seattle, King County, Washington.

Description of Specified Activity Under Renewal

The approved IHA allowed for the following pile-related activities during Season 1:

- Removal of 31 steel H-piles and timber piles via vibratory hammer
- Installation of one hundred and twenty 30-inch steel piles and two hundred 24-inch steel template piles via vibratory hammer and impact proofing of the one hundred and twenty 30-inch steel piles

The proposed work for this Season 2 IHA renewal is both a subset of the work that was previously authorized (because not all the authorized work was completed during the originally authorized year) and a smaller, nearly identical activity.

The subset of the work will be the remaining installation of forty-four 30-inch steel piles via vibratory hammer and impact proofing. All of the pile removal and the installation of seventy-six of the

proposed total of one hundred and twenty 30-inch steel pilings were completed during the Season 1 in-water work window for the approved IHA between September 1, 2022, and February 15, 2023.

The nearly identical activity will be the removal of eight 12-inch creosote timber pilings and the vibratory installation of eight 16-inch steel pilings at Don Armeni Boat Ramp as shown in Figure 1. This work is also proposed during the in-water work window described in the following section.

Dates, Duration, and Specified Geographic Area

All in-water work with the potential to affect marine mammals will occur during the in-water work window allowed by NOAA, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, and Washington State Department of Fish and Wildlife. For this renewal request, this window is anticipated to be September 1, 2023, through February 15, 2024. Pile removal and installation will occur during daylight hours, typically during a work shift of 8 hours or fewer. The work will include periods of vibratory removal of timber piles, vibratory installation of steel piles, and impact installation of steel piles.

Preliminary Monitoring Results for Originally Authorized Work

As part of the originally authorized IHA, Season 1 in-water pile activity occurred at Pier 58 across 45 workdays between October 3, 2022, and February 15, 2023. Vibratory removal of timber piles and steel H-piles occurred October 3 through 5, 2022. No 24-inch steel template piles were driven in the 45 workdays. Most workdays consisted of both vibratory and impact hammer installation of 30-inch steel piles; vibratory pile activity occurred on 36 workdays, and impact pile activity occurred on 36 workdays. Of the total 81 piles installed, 5 test piles and 76 production piles were installed via vibratory and impact hammer. The Waterfront Park Reconstruction Project (NWS-2019-703-WRD) Marine Mammal Monitoring Season 1 Report is attached to this renewal request (Attachment 1) and further describes the results of the monitoring effort.

It is anticipated that approximately an additional 8 days will be required for installation of the remaining forty-four 30-inch steel piles at Pier 58, and approximately 10 days will be required for impact proofing of the 30-inch steel piles. It is anticipated that only 1 day will be required to remove the eight timber piles at Don Armeni Boat Ramp, and 2 days will be required for the installation of eight 16-inch steel piles.

Source sound levels for the vibratory and impact installation of 30-inch steel piles are updated herein according to data from Season 1 provided in Attachment 2, Waterfront Park Reconstruction Project Acoustic Monitoring Report. The source level used herein for the vibratory installation of steel 30-inch piles is 170.05 decibels (dB) root mean square (RMS), and for the impact installation of 30-inch steel piles, 186.84 dB RMS with a peak of 201.5 dB is used. The source level used for the vibratory installation of 16-inch steel piles (158 dB RMS) at Don Armeni Boat Ramp is provided by a previous acoustic study

(Caltrans 2020). The source level used for the vibratory removal of 12-inch timber piles (144.8471 dB RMS) at the Don Armeni Boat Ramp is provided by the Pier 63 Removal Project (Greenbusch 2023). The updated Level A Exclusion Zones and Level B Harassment Zones are shown in Figures 2 through 4 for each species hearing group and pile activity.

No species were observed in the Level A Exclusion Zones during Season 1 pile driving. Individuals observed in the Level B Harassment Zones during pile activity include 130 harbor seals (*Phoca vitulina*), 92 California sea lions (*Zalophus californianus*), and 1 Steller sea lion (*Eumetopias jubatus*). No other species or individuals were observed in the Level B Harassment Zones during pile activity. The total number of Level B takes for Season 1 were only a fraction of what were authorized in the IHA: harbor seal takes were only 20% of the authorized takes, California sea lion takes were only 13% of the authorized takes, and Steller sea lion takes were only 0.7% of the authorized takes.

Take Estimates

The authorized takes in the approved IHA and the actual takes are shown in Table 1, and the authorized Level A and Level B zones are shown in Table 2.

Table 1
Authorized Incidental Take and Actual Take, Season 1

Species	Stock	Authorized Take by Level B Harassment	Actual Level B Take, Season 1	Authorized Take by Level A Harassment	Actual Level A Take, Season 1
Gray whale (*Eschrichtius robustus*)	Eastern North Pacific	4	0	0	0
Minke whale (*Balaenoptera acutorostrata*)	California/Oregon/ Washington	6	0	0	0
Killer whale (*Orcinus orca*)	West Coast Transient	36	0	0	0
Bottlenose dolphin (*Tursiops truncatus*)	California Coastal	42	0	0	0
Long-beaked common dolphin (*Delphinus capensis*)	California	42	0	0	0
Harbor porpoise (*Phocoena phocoena*)	Washington Inland Waters	408	0	12	0
Dall's porpoise (*Phocoenoides dalli*)	California/Oregon/ Washington	60	0	12	0
California sea lion (*Zalophus californianus*)	United States	700	92	0	0
Steller sea lion (*Eumetopias jubatus*)	Eastern	140	1	0	0
Northern elephant seal (*Mirounga angustirostris*)	California Breeding	6	0	0	0
Harbor seal (*Phoca vitulina*)	Washington Northern Inland Waters	660	130	40	0

Table 2
Authorized Shutdown and Harassment Zones

Pile Size, Type, and Method	Minimum Shutdown Zone (m)					Level B Harassment Zone/Unauthorized Species Shutdown Zone (m)
	Low-Frequency Cetacean	Mid-Frequency Cetacean	High-Frequency Cetacean	Phocid	Otariid	
Timber and steel H-pile vibratory removal	10	10	10	10	10	1,359
24-inch steel vibratory installation and removal; 30-inch steel vibratory installation	20	10	30	15	10	7,357
30-inch steel impact installation	155	10	185	85	10	215

Note:
m: meter

This renewal does not request a change in the number of Level A or Level B takes authorized in the approved IHA for this project. This renewal requests a change in the Level A Exclusion Zones and Level B Harassment Zones for the impact installation of 30-inch steel piles to increase the total impact strikes per day from the approved 1,200 strikes to 4,500 strikes per day and use updated actual monitored sound levels. Table 3 describes the proposed zones. Attachment 3 of this report provides the calculations for the proposed shutdown and harassment zones.

Table 3
Proposed Season 2 Shutdown and Harassment Zones

Pile Size, Type, and Method	Minimum Shutdown Zone (m)					Level B Harassment Zone/Unauthorized Species Shutdown Zone (m)
	Low-Frequency Cetacean	Mid-Frequency Cetacean	High-Frequency Cetacean	Phocid	Otariid	
Timber vibratory removal	1	1	2	1	1	453
30-inch steel vibratory installation	57	5	84	35	2	21,710
30-inch steel impact installation	551	20	656	295	21	616
16-inch steel vibratory installation	9	1	13	5	1	3,415

Note:
Refer to Attachment 3 for proposed shutdown and harassment zone calculations; zones are shown in Figures 2 through 4.

Monitoring and Reporting

Marine mammal monitoring and reporting will be completed and submitted for Season 2 in the same manner as outlined in the approved IHA for Season 1 and the approved marine mammal monitoring plan (NOAA 2022; Anchor QEA 2022), with the exception that because the Level A Exclusion Zone for high-frequency cetaceans now extends slightly beyond the Level B Harassment Zone for impact installation of 30-inch steel piles, two protected species observers will be present during all impact pile driving of 30-inch steel piles. Marine mammal monitoring will be conducted during in-water pile driving and removal and will occur in strategic locations around the area of potential effects. The work at Don Armeni Boat Ramp may occur on days when there is no pile-related work happening at Pier 58; thus, there will be up to three Protected Species Observers positioned during the Don Armeni Boat Ramp work, including the construction site monitoring location. The Waterfront Park Reconstruction Project (NWS-2019-703-WRD) Marine Mammal Monitoring Season 2 Report (Attachment 1) will include a description of the pile driving and removal activities, the monitoring effort, total takes, takes by day, stop-work orders for each species, and information on observed behavior. This report will be submitted to the NOAA Office of Protected Resources at the end of the construction.

References

Anchor QEA, 2022. *Marine Mammal Monitoring Plan: Waterfront Park Reconstruction Project*. September 2022.

Caltrans (California Department of Transportation), 2020. *Technical Guidance for the Assessment of Hydroacoustic Effects of Pile Driving on Fish (2020 Update)*. California Department of Transportation, Division of Environmental Analysis. October 2020.

Greenbusch (Greenbusch Group, Inc), 2023. *Pier 63 Removal Project Acoustic Monitoring Report*. Prepared for City of Seattle Department of Transportation. February 2023.

NOAA (National Oceanic and Atmospheric Administration, National Marine Fisheries Service), 2022. *Marine Mammal Protection Act Incidental Harassment Authorization for the Pier 58 Reconstruction Project*. May 20, 2022.

Figures

Attachments

Attachment 1	Waterfront Park Reconstruction Project (NWS-2019-703-WRD) Marine Mammal Monitoring Season 1 Report
Attachment 2	Waterfront Park Reconstruction Project Acoustic Monitoring Report (Season 1)
Attachment 3	NMFS User Spreadsheet for Project Activities

Figures

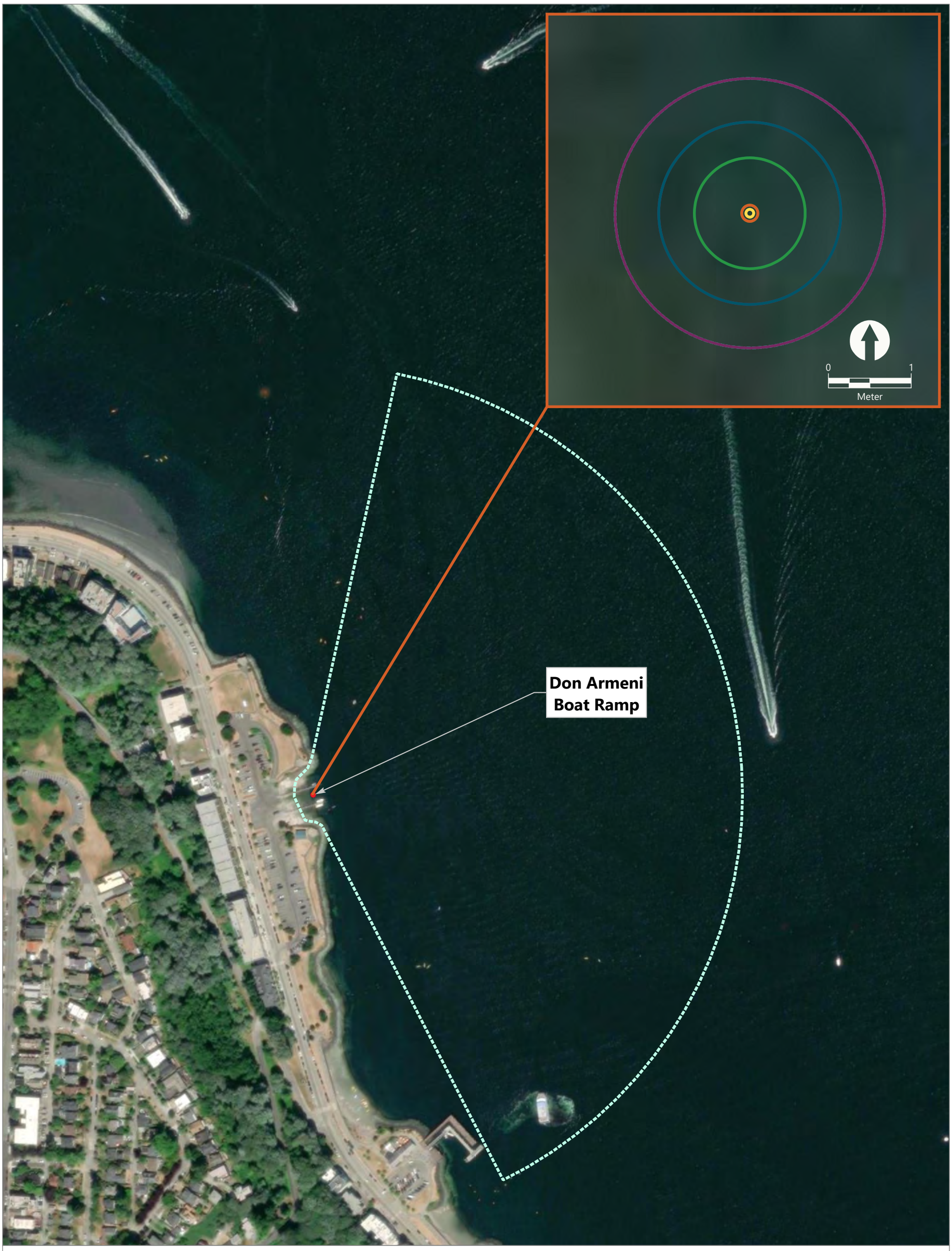
LEGEND:

Waterfront Park

Publish Date: 2023/03/27, 1:56 PM | User: dlockwood
Filepath: \\orcas\gis\Jobs\City_of_Seattle_0795\Maps\MarineMammalMonitoringPlan\Pier_58\AQ_WFP_Renewal\AQ_WFP_Renewal.aprx

ANCHOR QEA

Figure 1
Waterfront Park and Don Armeni Boat Ramp Vicinity Map
Incidental Harassment Authorization Renewal Request
Waterfront Park Reconstruction Project



LEGEND:

- Hammer Location

Level B Harassment Zone - All Hearing Groups

- Vibratory Removal (Timber Piles): 453 meters

Exclusion Zones

- Otariid Pinnipeds (0 meters)
- Mid-Frequency Cetaceans (0 meters)
- Phocid Pinnipeds (1 meter)
- Low-Frequency Cetaceans (1 meter)
- High-Frequency Cetaceans (2 meters)

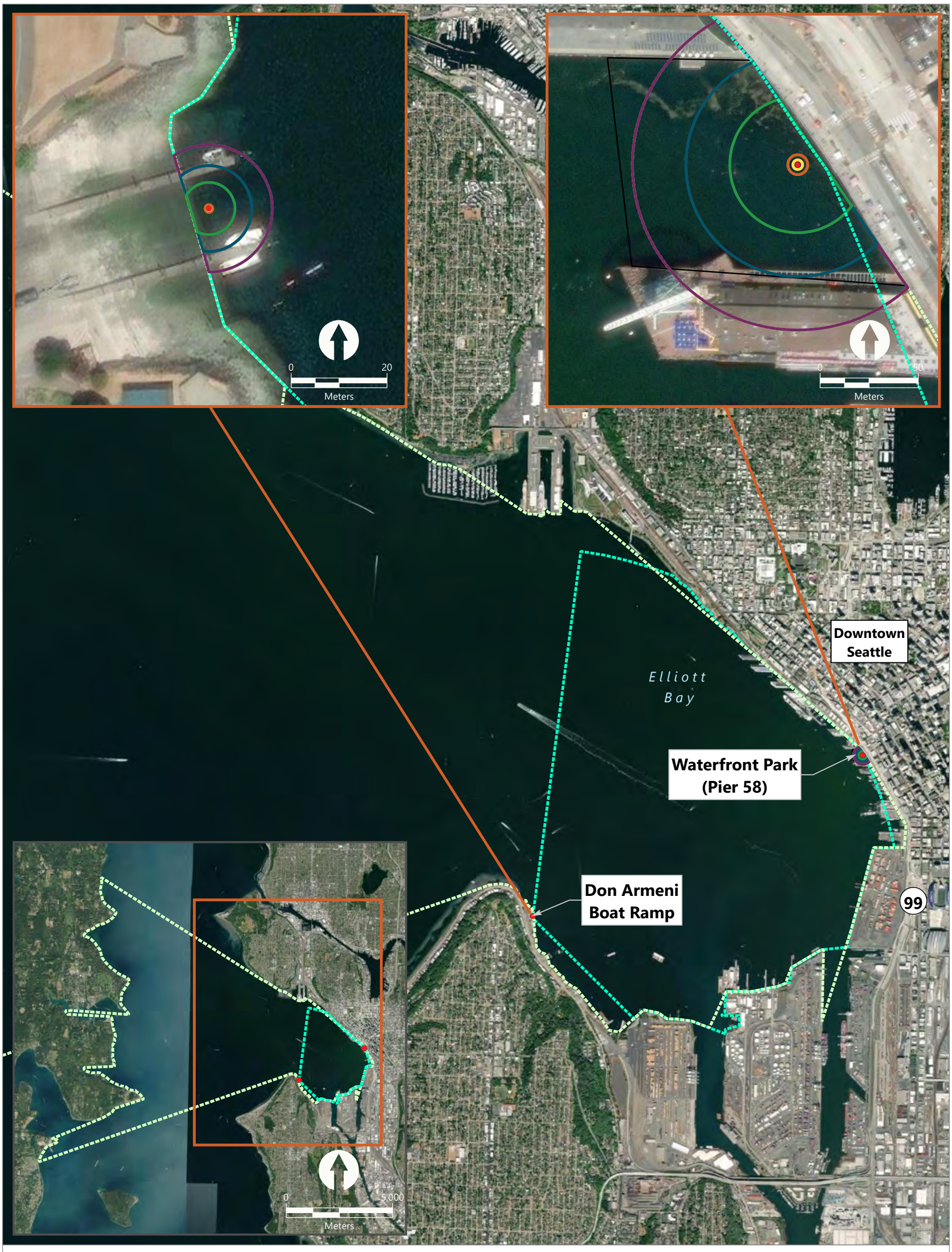
NOTES:
1. Exclusion zones will be adjusted as needed, based on location of hammer operations.

0 150
Meters

Publish Date: 2023/03/27, 1:41 PM | User: dlockwood
Filepath: \\orcas\gis\Jobs\City_of_Seattle_0795\Maps\MarineMammalMonitoringPlan\Pier_58\AQ_WFP_Renewal\AQ_WFP_Renewal.aprx

ANCHOR QEA

Figure 2
Exclusion and Level B Harassment Zones for Vibratory Removal of Timber Piles
Incidental Harassment Authorization Renewal Request
Waterfront Park Reconstruction Project



LEGEND:

- Hammer Location
- Waterfront Park

Waterfront Park (Pier 58)

Level B Harassment Zone - All Hearing Groups

- Vibratory Installation (30-inch Steel Pile): 21,710 meters

Exclusion Zones

- Otariid Pinnipeds (0 meters)
- Mid-Frequency Cetaceans (1 meter)
- Phocid Pinnipeds (5 meters)
- Low-Frequency Cetaceans (9 meters)
- High-Frequency Cetaceans (13 meters)

Don Armeni Boat Ramp

Level B Harassment Zone - All Hearing Groups

- Vibratory Installation (16-inch Steel Pile): 3,415 meters

Exclusion Zones

- Otariid Pinnipeds (2 meters)
- Mid-Frequency Cetaceans (5 meters)
- Phocid Pinnipeds (35 meters)
- Low-Frequency Cetaceans (57 meters)
- High-Frequency Cetaceans (84 meters)

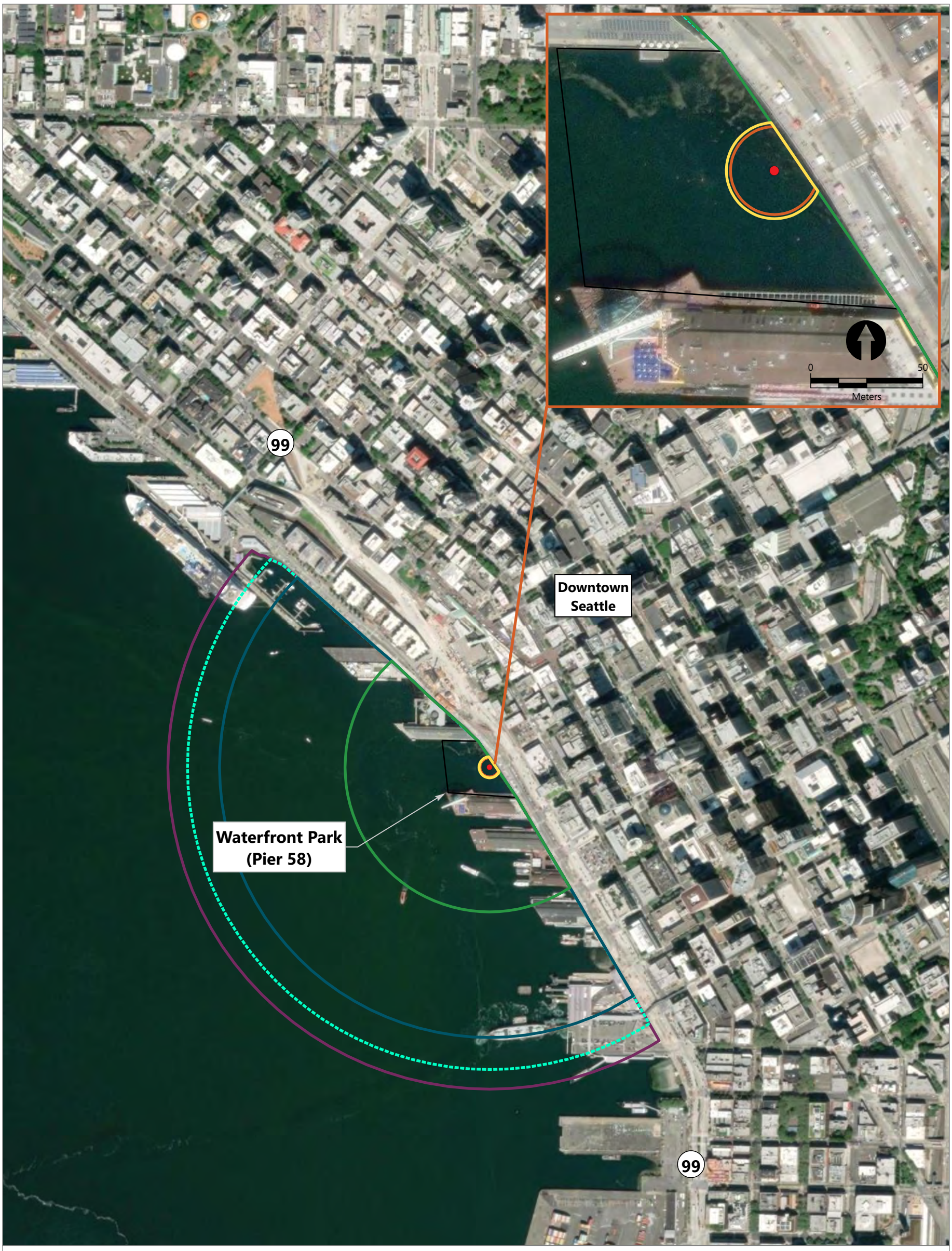
NOTES:
1. Exclusion zones will be adjusted as needed, based on location of hammer operations.

0 1,000
Meters

Publish Date: 2023/03/27, 1:25 PM | User: dlockwood
Filepath: \\orcas\gis\Jobs\City_of_Seattle_0795\Maps\MarineMammalMonitoringPlan\Pier_58\AQ_WFP_Renewal\AQ_WFP_Renewal.aprx

ANCHOR QEA

Figure 3
Exclusion and Level B Harassment Zones for Vibratory Installation of Steel Piles
Incidental Harassment Authorization Renewal Request
Waterfront Park Reconstruction Project



LEGEND:

- Hammer Location
- Waterfront Park

Level B Harassment Zone - All Hearing Groups

- Impact Installation (Steel Pile): 616 meters

Exclusion Zones

- Mid-Frequency Cetaceans (20 meters)
- Otariid Pinnipeds (21 meters)
- Phocid Pinnipeds (295 meters)
- Low-Frequency Cetaceans (551 meters)
- High-Frequency Cetaceans (656 meters)

NOTES:
1. Exclusion zones will be adjusted as needed, based on location of hammer operations.

Publish Date: 2023/03/27, 1:26 PM | User: dlockwood
Filepath: \\orcas\gis\Jobs\City_of_Seattle_0795\Maps\MarineMammalMonitoringPlan\Pier_58\AQ_WFP_Renewal\AQ_WFP_Renewal.aprx

ANCHOR QEA

Figure 4
Exclusion and Level B Harassment Zones for Impact Installation of Steel Piles
Incidental Harassment Authorization Renewal Request
Waterfront Park Reconstruction Project

Attachment 1
Pier 58 Season 1 Marine Mammal Monitoring Report

1201 3rd Avenue, Suite 2600
Seattle, Washington 98101
206.287.9130

Memorandum

April 3, 2023

To: Katherine Chesick and Jill Macik, Seattle Department of Transportation

From: Michelle Havey and Reed Peloquin, Anchor QEA, LLC

cc: Jeff Bertram, Seattle Department of Transportation
Jody Robinson and Dean Beauchamp, Jacobs
Heather Page and Adam Carlson, Anchor QEA, LLC

Re: Waterfront Park Reconstruction Project (NWS-2019-703-WRD) Marine Mammal Monitoring Season 1 Report

This report provides the marine mammal monitoring results for Season 1 (Fall 2022 and Winter 2023) for the Waterfront Park Reconstruction Project (Project) located at Pier 58. Pier 58 is located on the downtown Seattle waterfront in Elliott Bay, Washington (Figure 1). In compliance with the Endangered Species Act and the Marine Mammal Protection Act, marine mammal monitoring was conducted during all in-water pile driving and removal activities for the Project. As part of the Marine Mammal Protection Act compliance, the National Marine Fisheries Service issued an Incidental Harassment Authorization (IHA) for in-water pile driving and removal, which allows take of marine mammals by harassment incidental to pile driving and removal activities in Elliott Bay.

Marine Mammal Monitoring Methods

Season 1 marine mammal monitoring methods and protocols were established per agency guidelines and permits, based on information in the following Project monitoring plan and permit documents:

- *Marine Mammal Monitoring Plan for the Waterfront Park Reconstruction Project* (Anchor QEA 2022)
- *Request for Incidental Harassment Authorization: Waterfront Park Reconstruction Project 2022–2023* (Anchor QEA 2021)
- *Marine Mammal Protection Act Incidental Harassment Authorization for the Pier 58 Reconstruction Project* (NOAA 2022)
- *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts* (NMFS 2018)

Under the 2022 IHA, the Project is required to monitor for 12 species (NOAA 2022). The 12 species are organized into the following five functional hearing groups:

- High-Frequency Cetaceans (Porpoises)
  - Dall's porpoise (*Phocoena dalli*)

  - Harbor porpoise (*Phocoena phocoena*)
- Mid-Frequency Cetaceans (Dolphins and Whales)
  - Southern Resident distinct population segment (DPS; *Orcinus orca*) and transient killer whales
  - Common bottlenose dolphin
  - Long-beaked common dolphin (*Delphinus capensis*)
- Low-Frequency Cetaceans (Whales)
  - Gray whale (*Eschrichtius robustus*)
  - Humpback whale (*Megaptera novaeangliae*)
  - Minke whale (*Balaenoptera acutorostrata*)
- Otariid Pinnipeds (Sea Lions/Eared)
  - California sea lion (*Zalophus californianus*)
  - Steller sea lion (*Eumetopias jubatus*)
- Phocid Pinnipeds (Seals/Earless)
  - Elephant seal (*Mirounga angustirostris*)
  - Harbor seal (*Phoca vitulina*)

The monitoring area included an Exclusion Zone (Level A Take) and a Level B Harassment Zone (Level B Take) for each group. The two zones varied by the type of pile work and marine mammal functional hearing group. The Exclusion Zone was composed of areas where a Stop Work Order was to be issued if species were present; for killer whales and humpback whales, the Exclusion Zones were equal to the size of the Level B Harassment Zones for other marine mammal species (see Table 1). Within the Level B Harassment Zones, marine mammals were closely monitored, and take was documented and work allowed to continue; if the mammals were killer whales or humpback whales, a Stop/Change/Delay Work would be initiated. Exclusion Zones and Level B Harassment Zones were established for each hearing group based on the type of in-water pile driving and removal construction activities, including the following:

- Pile removal of steel H-piles and 14-inch timber piles via vibratory hammer
- Pile installation of 30-inch steel piles via vibratory hammer
- Pile installation of 30-inch steel piles via impact hammer

During Season 1, a vibratory hammer and an impact hammer were used for steel pile installation. Steel pile and timber pile removal via a vibratory hammer was also performed during Season 1 to complete the demolition of Pier 58. The Exclusion Zones and Level B Harassment Zones implemented during Season 1 are presented on Table 1 and shown in Figure 2 for vibratory removal of timber piles and steel-H piles, in Figure 3 for vibratory pile installation of 30-inch steel piles, and in Figure 4 for impact installation of 30-inch steel piles.

Strike counts from steel pile impact installation were initially limited to 1,200 strikes per day but were increased to 2,400 per day on November 7 for the remainder of Season 1. The acoustic monitoring of impact pile driving showed a much shorter strike duration than had been originally used, and a recalculation of the exclusion zones indicated little to no increase in zones using the measured strike duration and an increase in number of strikes. This had no effect on take and facilitated completion of the planned pile installation. The official count was kept by the lead monitor at the Project construction site; this daily count is available in Attachment A-1. On December 8, this limit was exceeded by 106 strikes. In response, the Exclusion Zone was extended to 10 meters for California sea lions and 100 meters for harbor seals. This increase did not result in any takes.

Table 1
Season 1 Exclusion Zone and Level B Harassment Zone Monitoring Thresholds, by Species Group and Pile Activity

Zone Threshold	Location to Monitor[1]	Species Group
Impact Installation (30-inch Steel Pile)		
Exclusion Zone (Stop Work Order)	33 feet (10 m) to Source	Otariids
	33 feet (10 m) to Source	Mid-frequency cetaceans
	279 feet (85 m) to Source	Phocids
	508 feet (155 m) to Source	Low-frequency cetaceans
	606 feet (185 m) to Source	High-frequency cetaceans
	705 feet (215 m) to Source	Killer whales, humpback whales[2]
Level B Harassment Threshold (Take)	From 705 feet (215 m) to Exclusion Zone for each hearing group	All hearing groups
Vibratory Removal (Timber Pile and Steel-H Pile)		
Exclusion Zone (Stop Work Order)	33 feet (10 m) to Source	All hearing groups
	4,458 feet/0.8 mile (1,359 m) to Source	Killer whales, humpback whales[2]
Level B Harassment Threshold (Take)	From 4,459 feet (1,359 m) to Exclusion Zone for each hearing group	All hearing groups
Vibratory Installation (30-inch Steel Pile)		
Exclusion Zone (Stop Work Order)	33 feet (10 m) to Source	Otariids
	33 feet (10 m) to Source	Mid-frequency cetaceans
	49 feet (15 m) to Source	Phocids
	66 feet (20 m) to Source	Low-frequency cetaceans
	98 feet (30 m) to Source	High-frequency cetaceans
	24,137 feet/4.6 miles (7,357 m) to Source	Killer whales, humpback whales[2]
Level B Harassment Threshold (Take)	From 24,137 feet/4.6 miles (7,357 m) to Exclusion Zone for each hearing group	All hearing groups

Notes:

1. Rounded up to nearest whole number

2. If killer whales (Southern Resident and transient) or humpback whales entered the Level A Zone (215 m for impact steel installation, 1,359 m for vibratory timber and steel-H pile removal, and 7,357 m for vibratory steel installation), a Stop/Change/Delay Work was initiated to prevent a take of these species.

m: meter
Sources: NMFS 2018; NOAA 2022

Monitoring was performed by up to four monitors depending on the activity as follows: three land-based observers and one ferry boat-based observer for steel pile vibratory installation and two land-based observers for timber and steel-H pile removal and steel pile impact installation.[1]

One observer was located at the Project construction site during all vibratory and impact pile installation and vibratory pile removal. Two additional land-based observers conducted monitoring at designated viewpoints on the north and south entrances to Elliott Bay, with unobstructed views of the bay. The south monitoring point was located at the Alki Beach Pier, identified as the Alki Monitoring Site. The north monitoring point is located at the West 32nd Avenue City pump station, identified as the Magnolia Monitoring Site. The ferry boat-based observer was based on the Seattle to Bainbridge Island ferry route, identified as the Ferry Monitoring Site. The monitoring sites are shown in Figure 3.

Trained marine mammal monitors from Anchor QEA, LLC, and The Greenbusch Group, Inc, used binoculars to search the monitoring zones for the presence of marine mammals during pile driving and removal activities. Observations and positions of marine mammals were recorded on an electronic daily monitoring form within the Esri Survey123 application on each observer's phone, which was developed prior to program implementation for efficient and consistent data collection. The following data were collected:

- Date
- Time monitoring activity begins and ends
- Site
- Construction activity during monitoring period
- Weather conditions and environmental conditions that could deter or prevent marine mammal detections
- Marine mammal species observed and number of species and sex and age class, if possible
- Time, duration, and location of marine mammals observed
- Observable species behavior during pile driving and removal activities
- Pile-related activities taking place during monitoring
- Distances from pile activities to marine mammals
- Communication between the observers and the contractor or Seattle Department of Transportation

[1] From October 12 to November 30, there was a fifth observer at Pier 63 monitoring for a concurrent project.

- Notable human activity in the area
- Reason a Stop Work Order was or was not initiated, if applicable

The locations of marine mammal sightings were also noted on grid maps. Take numbers were tallied each day to ensure the Project did not exceed the authorized number of incidental take for each species.

Waterfront Park Reconstruction Project Season 1 Marine Mammal Monitoring Results

Marine mammal monitoring during vibratory removal of timber and steel piles, vibratory installation of steel piles, and impact steel pile installation activities was performed by trained marine mammal monitors from Anchor QEA and The Greenbusch Group for 47 days between October 3, 2022, and February 15, 2023. Vibratory and impact installations were the primary activities performed during Season 1, with vibratory removal only being performed for the first 3 days of the season. On 3 monitoring days, October 27, December 2, and January 3, hammer activity was scheduled but did not occur due to changes in the work plan. Overall, vibratory pile installation and removal of steel piles occurred on 36 monitoring days. On 2 monitoring days, the vibratory hammer was used to remove timber piles. On 28 monitoring days, both vibratory and impact installations were conducted, with 9 days of only impact hammer activity. On most days, pile activity occurred off and on throughout the monitoring period, with breaks in hammer activity ranging from fewer than 30 minutes to several hours. A total of 2 timber and 12 steel H-piles were removed from Pier 58 using a vibratory hammer; removal occurred over 3 days from October 3 to October 5, 2022. A total of seventy-seven 30-inch steel piles were installed using a vibratory and impact hammer.[2]

Throughout Season 1, 4 of the 12 potential marine mammal species were observed during the monitoring period: California sea lion, Steller sea lion, harbor seal, and killer whale (Southern Resident DPS and transient). Three species were observed in the Level B Harassment Zone during pile driving and removal activities. Total Level B takes documented during monitoring included 92 California sea lions, 130 harbor seals, and 1 Steller sea lion. Overall, no observable changes in behavior in the marine mammal species were noted during vibratory install or removal. Monitors did observe two instances of California sea lions located approximately 3,600 meters away from the Project site changing their swimming direction in response to the vibratory hammer being engaged. Three California sea lions and one harbor seal that entered their respective Level B Harassment Zones during impact pile driving were observed quickly changing directions to exit the Level B Harassment Zone. The general locations where marine mammals were observed during this monitoring season are presented in Figures 5 and 6.

[2] An impact hammer was used to complete installation for most, but not all, of the installed piles.

During Season 1 monitoring, the number of takes documented for California sea lions, harbor seals, and Steller sea lions were considerably below the maximum number of Level B takes authorized for these species in the Project IHA for Season 1 (NOAA 2022). There were no Level A takes for any observed species in Season 1. Table 2 compares documented take per species to the amount of authorized Level A and Level B takes.

Table 2
Season 1 Take Per Species

Species	Documented Level A Take	IHA-Authorized Level A Take	Documented Level B Take	IHA-Authorized Level B Take
California Sea Lion	0	0	92	700
Harbor Seal	0	40	130	660
Steller Sea Lion	0	0	1	140

Stop Work Initiation

In Season 1, work was only delayed on November 10, 2022, for 15 minutes due to killer whales entering the Exclusion Zone; work did not resume until all monitors confirmed the killer whales were observed outside of the Exclusion Zone. Killer whales were also observed approaching and within Elliott Bay on November 7, November 9, December 5, and December 9; however, no pile activity was occurring during those times so a Stop/Change/Delay Work was not warranted.

California Sea Lions

The number of California sea lion takes from all four monitoring sites combined ranged from 0 to 7 per day, with a per-day average of 2.[3] Excluding the monitoring days with no pile driving due to mechanical issues, there were 9 monitoring days when no sea lion takes were documented. More than half (49 of 92) of California sea lion takes were observed from the Alki Monitoring Site, where they were frequently observed foraging and resting in the nearshore environment.

On three occasions, California sea lions entering the Level B Harassment Zone during impact pile driving were observed quickly changing directions to leave the area. Additionally, monitors observed two instances of California sea lions located approximately 3,600 meters away from the Project site changing their swimming direction in response to the vibratory hammer being engaged.

In addition to the 92 California sea lion takes documented during the monitoring, 169 California sea lions were observed during the monitoring period that were not documented takes because they

[3] The per-day average is rounded to nearest whole number.

were observed more than 30 minutes outside of pile driving and removal activities, outside the Level B Harassment Zone, or were already documented as takes for the day.

California sea lion information from the daily monitoring forms is presented in the tables in Attachment A. Table 3 summarizes California sea lion takes per monitoring site during Season 1 monitoring.

Table 3
Summary of Season 1 California Sea Lion Takes, Per Monitoring Site

Monitoring Site	Total Level B Takes	Minimum and Maximum Number of Level B Takes Per Day During Monitoring Days
Construction	29	0 to 7
Alki	48	0 to 5
Magnolia	8	0 to 2
Ferry	7	0 to 1
Total	**92**	

Harbor Seals

Harbor seal takes from all four monitoring sites combined ranged from 0 to 15 per day, with a per-day average of 3.[4] Excluding the monitoring days with no pile driving due to mechanical issues, there were 14 monitoring days when no harbor seal takes were documented. For a single monitoring site, the highest number of total harbor seal observations (124) and takes (65) and the highest number of takes in a single day (9) were observed from the Magnolia Monitoring Site.

There were no observable changes in harbor seal behavior during vibratory removal or installation and only one instance of a harbor seal reacting to the impact hammer by changing swimming direction.

In addition to the 130 harbor seal Level B takes documented during the monitoring, 218 harbor seals were observed during the monitoring period that were not documented takes because they were observed more than 30 minutes outside of pile driving and removal activities, outside the Level B Harassment Zone, or were already documented as takes for the day.

Harbor seal information from the daily monitoring forms is presented in the tables in Attachment A. Table 4 summarizes harbor seal takes per monitoring site during Season 1 monitoring.

[4] The per-day average is rounded to nearest whole number.

Table 4
Summary of Season 1 Harbor Seal Takes, Per Monitoring Site

Monitoring Site	Total Level B Takes	Minimum and Maximum Number of Level B Takes Per Day During Monitoring Days
Construction	13	0 to 2
Alki	32	0 to 5
Magnolia	65	0 to 9
Ferry	20	0 to 3
Total	**130**	

Steller Sea Lion

Steller sea lions were observed on 4 monitoring days during Season 1 monitoring; one of these observations on December 8 from the Alki Monitoring Site resulted in a Level B take. Steller sea lions were also observed at the Alki Monitoring Site on November 2 and December 7, and from the Ferry Monitoring Site on December 5. However, none of these observations resulted in takes due to the work type being conducted on those days. Steller sea lion information from the daily monitoring forms is presented in the tables in Attachment A.

Killer Whales

Killer whales (Southern Resident or transient) were observed on 6 monitoring days, from November 7, 2022, to November 10, 2022. Because no takes were authorized for Southern Resident killer whales, and marine mammal monitors could not confirm observations of transient versus Southern Resident DPS, all killer whale observations were treated as Southern Resident DPS. Killer whales entered the Exclusion Zone on November 7, November 9, December 5, and December 9; however, none of these incursions resulted in a work delay or stop work because there was no pile activity at that time. One incursion on November 10 led to a 15-minute delay in work. As a result of this action, no killer whale observations were documented as takes. Typically, killer whales were observed in the mid-channel, but sometimes they would favor the Elliot Bay side of the channel as they moved through the area. All observations were recorded either outside of the Exclusion Zone or during no pile activity.

Killer whale information from the daily monitoring forms is presented in the tables in Attachment A.

Waterfront Park Reconstruction Project Season 1 Supporting Details

Detailed data collected during Season 1 monitoring are presented in Attachment A, as follows:

- Table A-1 provides a summary of the daily log kept by the lead Protected Species Observer located at the Project site.

- Table A-2 provides a daily summary of pile driving and removal activity, weather conditions during the monitoring period, marine mammal species observed, time and duration of observations, distance from pile driving and removal activities, and species behavior.
- Table A-3 provides a daily summary of California sea lion Level B takes, observations that did not include takes, and the totals.
- Table A-4 provides a daily summary of harbor seal Level B takes, observations that did not include takes, and the totals.
- Table A-5 provides a daily summary of Steller sea lion Level B takes, observations that did not include takes, and the totals.
- Table A-6 provides a daily summary of killer whale (Southern Resident and transient) Level B takes, observations that did not include takes, and the totals.

As noted in Table A-2, some monitoring days included fog, rain, or wind conditions that made monitoring more challenging than during clear weather periods. The only instance of weather conditions leading to a stop work was on December 20 for 1.5 hours; on this day, snow fall was heavy enough to critically limit visibility. In addition, monitoring was conducted during a range of tidal cycles; however, no changes in marine mammal behavior were identified based on tidal fluctuations.

References

Anchor QEA, LLC, 2021. *Request for Incidental Harassment Authorization: Waterfront Park Reconstruction Project 2022–2023*. Waterfront Park Reconstruction Project. 2021.

Anchor QEA, 2022. *Marine Mammal Monitoring Plan*. Waterfront Park Reconstruction Project. November 2022.

NMFS (National Marine Fisheries Service), 2018. *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts*. U.S. Dept. of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-59, 178 p.

NOAA (National Oceanic and Atmospheric Administration), 2022. *Marine Mammal Protection Act Incidental Harassment Authorization for the Pier 58 Reconstruction Project*. May 2022.

Figures

LEGEND:

Waterfront Park (Pier 58)

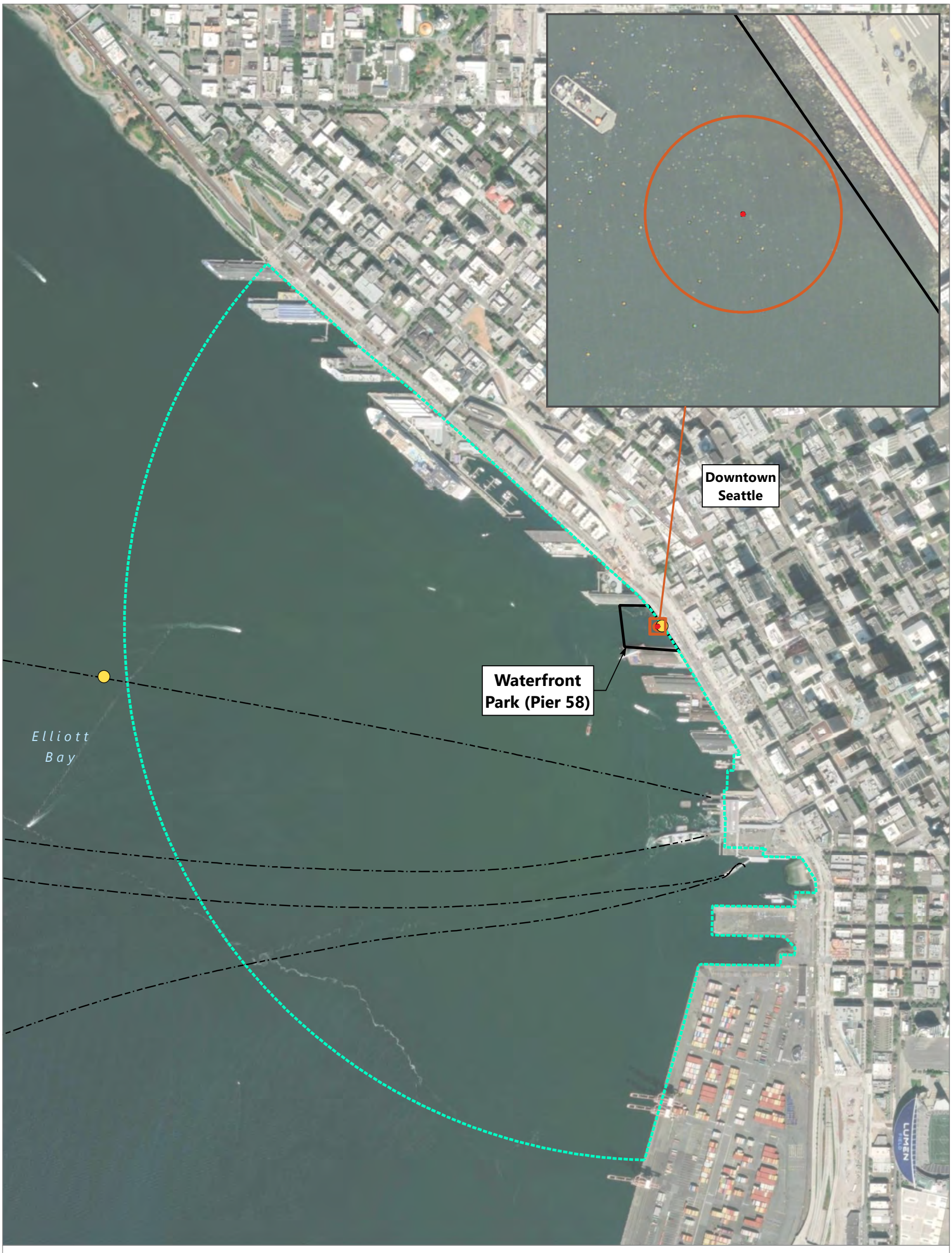
0 400

Meters

Publish Date: 2023/03/30, 2:42 PM | User: tweldy
Filepath: \\orcas\GIS\Jobs\City_of_Seattle_0795\Maps\MarineMammalMonitoringPlan\Pier_58\AQ_WFP_fig01_Vicinity_Map.mxd

ANCHOR QEA

Figure 1
Waterfront Park (Pier 58) Vicinity Map
Season 1 Marine Mammal Report
Waterfront Park Reconstruction Project



LEGEND:

- Hammer Location
- Marine Mammal Monitor Site
- Ferry Route
- Waterfront Park (Pier 58)

Level B Harassment Zone – All Hearing Groups

- Vibratory Removal (Timber Piles and Steel H-Piles): 1,359 meters

Exclusion Zones

- All Hearing Groups: 10 meters
- Killer Whales and Humpback Whales: 1,359 meters

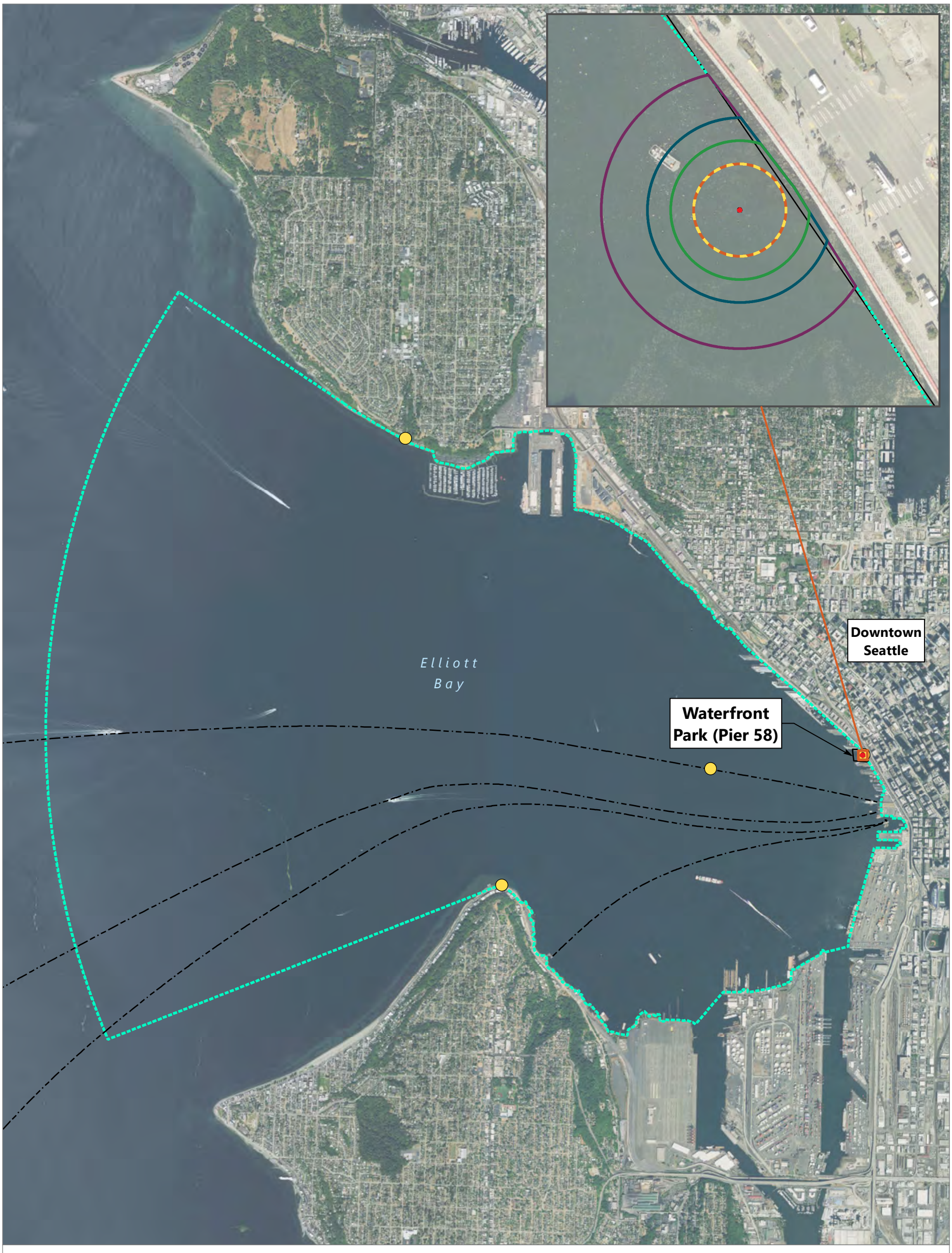
NOTES:
1. Exclusion Zones were adjusted as needed, based on location of hammer operations.

0 400
Meters

Publish Date: 2023/03/30, 2:45 PM | User: tweldy
Filepath: \\orcas\GIS\Jobs\City_of_Seattle_0795\Maps\MarineMammalMonitoringPlan\Pier_58\AQ_WFP_fig02_VibratoryRemoval_Timber_SteelH.mxd

ANCHOR QEA

Figure 2
Exclusion and Level B Harassment Zones for Vibratory Removal of Timber Piles and Steel H-Piles
Season 1 Marine Mammal Report
Waterfront Park Reconstruction Project



LEGEND:

- Hammer Location
- Marine Mammal Monitor Site
- Ferry Route
- Waterfront Park (Pier 58)

Level B Harassment Zone – All Hearing Groups

- Vibratory Installation (Steel Piles): 7,357 meters

Exclusion Zones

- Otariid Pinnipeds: 10 meters
- Mid-Frequency Cetaceans: 10 meters
- Phocid Pinnipeds: 15 meters
- Low-Frequency Cetaceans: 20 meters
- High-Frequency Cetaceans: 30 meters
- Killer Whales and Humpback Whales: 7,357 meters

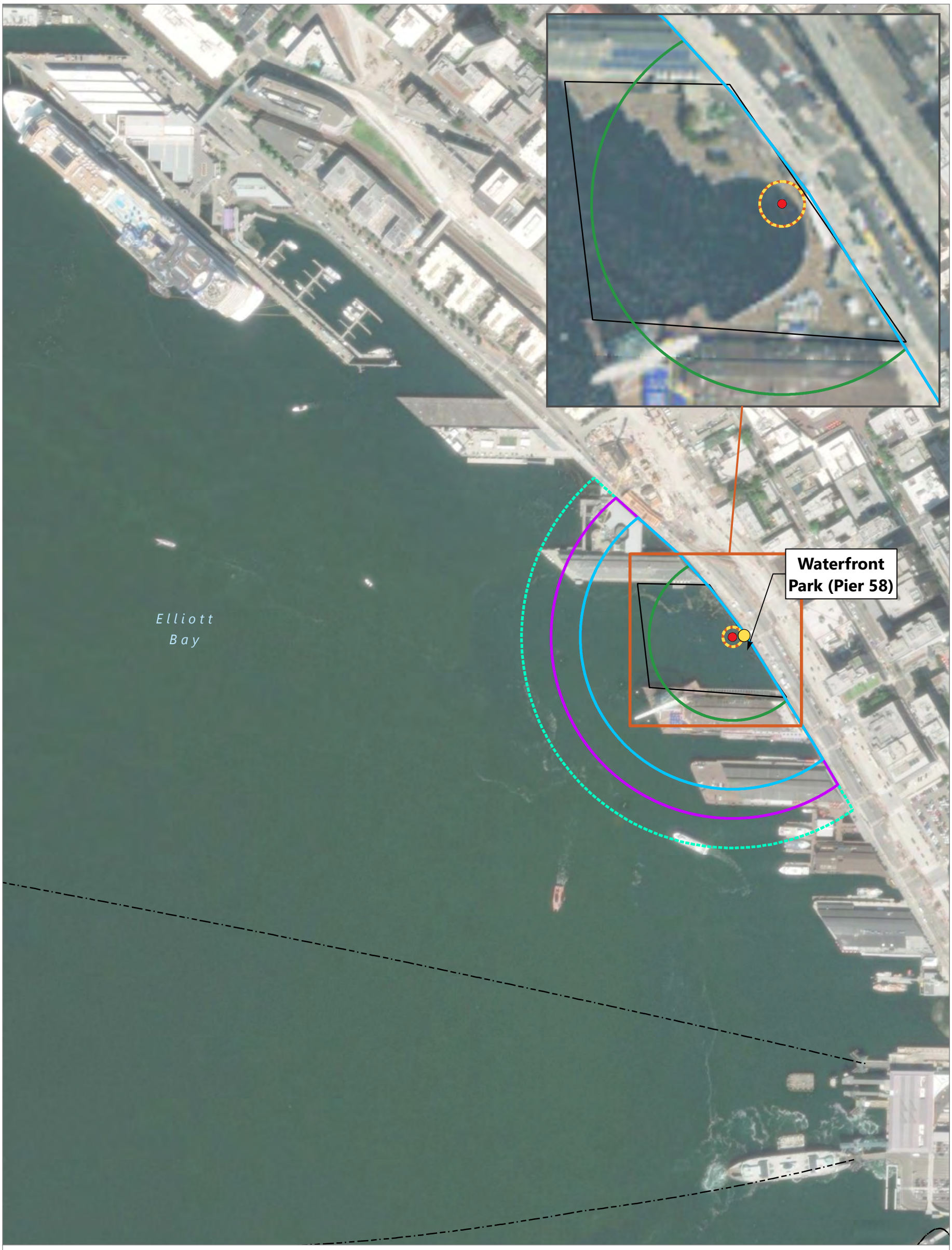
NOTES:
1. Exclusion Zones were adjusted as needed, based on location of hammer operations.

0 1,000
Meters

Publish Date: 2023/03/30, 2:46 PM | User: tweldy
Filepath: \\orcas\GIS\Jobs\City_of_Seattle_0795\Maps\MarineMammalMonitoringPlan\Pier_58\AQ_WFP_fig03_VibratoryInstallation_Steel_Piles.mxd

ANCHOR QEA

Figure 3
Exclusion and Level B Harassment Zones for Vibratory Installation of Steel Piles
Season 1 Marine Mammal Report
Waterfront Park Reconstruction Project



LEGEND:

- Hammer Location
- Marine Mammal Monitor Site
- Ferry Route
- Waterfront Park (Pier 58)

Level B Harassment Zone – All Hearing Groups

- Impact Installation (Steel Pile): 215 meters

Exclusion Zones

- Otariid Pinnipeds: 10 meters
- Mid-Frequency Cetaceans: 10 meters
- Phocid Pinnipeds: 85 meters
- Low-Frequency Cetaceans: 155 meters
- High-Frequency Cetaceans: 185 meters
- Killer Whales and Humpback Whales: 215 meters

NOTES:
1. Exclusion Zones were adjusted as needed, based on location of hammer operations.

0 200
Meters

Publish Date: 2023/03/30, 2:47 PM | User: tweldy
Filepath: \\orcas\GIS\Jobs\City_of_Seattle_0795\Maps\MarineMammalMonitoringPlan\Pier_58\AQ_WFP_fig04_ImpactInstallation_Steel_Piles.mxd

ANCHOR QEA

Figure 4
Exclusion and Level B Harassment Zones for Impact Installation of Steel Piles
Season 1 Marine Mammal Report
Waterfront Park Reconstruction Project

LEGEND:

- Mooring Buoy
- Marine Mammal Monitor Site
- Seattle-Bainbridge Island Ferry Route

Marine Mammal Sightings

- California Sea Lion (Otariid/Eared)
- Harbor Porpoise (High-Frequency Cetacean)
- Harbor Seal (Phocid/Earless)
- Killer Whale (Mid-Frequency Cetacean)
- Stellar Sea Lion (Otariid/Eared)

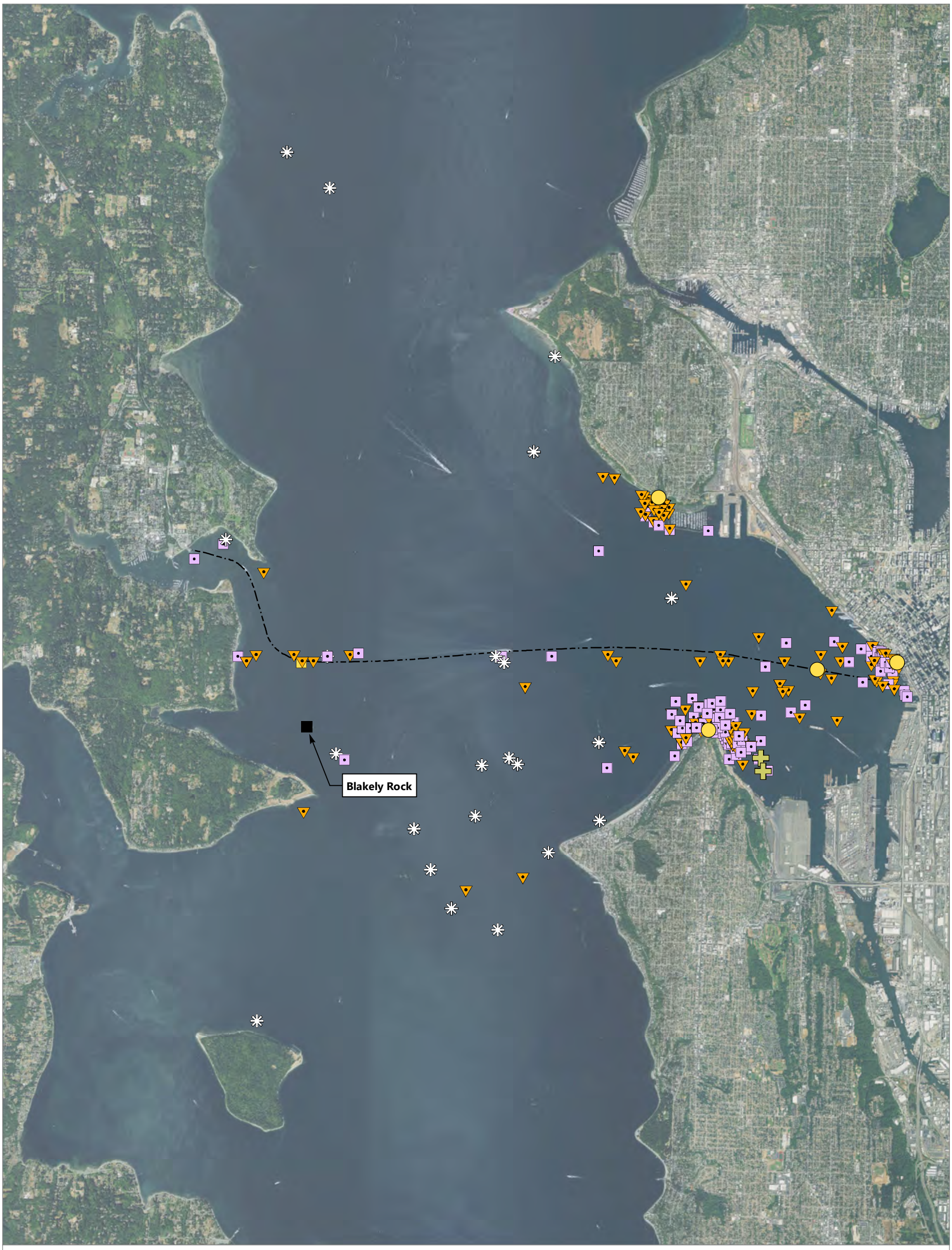
NOTE:
1. Approximate locations are where marine mammals were observed; many of the symbols represent multiple sightings over the monitoring period.

0 1,000
Meters

Publish Date: 2023/03/30, 2:47 PM | User: tweldy
Filepath: \\orcas\GIS\Jobs\City_of_Seattle_0795\Maps\MarineMammalMonitoringPlan\Pier_58\AQ_WFP_fig5_MMMsightingsElliottBay.mxd

ANCHOR QEA

Figure 5
Monitoring Locations and Marine Mammal Sightings Elliott Bay
Season 1 Marine Mammal Report
Waterfront Park Reconstruction Project



LEGEND:

- Mooring Buoy
- Marine Mammal Monitor Site
- Seattle-Bainbridge Island Ferry Route

Marine Mammal Sightings

- California Sea Lion (Otariid/Eared)
- Harbor Porpoise (High-Frequency Cetacean)
- Harbor Seal (Phocid/Earless)
- Killer Whale (Mid-Frequency Cetacean)
- Stellar Sea Lion (Otariid/Eared)

NOTE:
1. Approximate locations are where marine mammals were observed; many of the symbols represent multiple sightings over the monitoring period.

0 2,000
Meters

Publish Date: 2023/03/30, 2:48 PM | User: tweldy
Filepath: \\orcas\GIS\Jobs\City_of_Seattle_0795\Maps\MarineMammalMonitoringPlan\Pier_58\AQ_WFP_fig6_MMMsightingsMainChannel.mxd

ANCHOR QEA

Figure 6
Monitoring Locations and Marine Mammal Sightings Puget Sound Main Channel
Season 1 Marine Mammal Report
Waterfront Park Reconstruction Project

Attachment A
Monitoring Data

Table A-1
Waterfront Park Pile Removal and Pile Driving Activity

Date	Daily Monitoring Start Time	Daily Monitoring Stop Time	Daily Notes	Pile Activity	Pile Type	Activitiy Start Time	Activitiy Stop Time	Time Period Notes (shutdowns/delays/WQ issues/pile names)	Strike Count During Time Period
Monday, October 3, 2022	12:15	14:35	7 piles partially removed using vibratory hammer. 1 pile completely pulled out of the water.	Vibratory Removal	Steel H-Pile	13:01	14:04	H-Piles: 1-8.	-
Tuesday, October 4, 2022	7:13	14:43	Finished removing H piles from previous day along with 3 more piles removed.	Vibratory Removal	Steel H-Pile	8:16	9:07	H-Piles: 1,2,3,4,5	-
				Vibratory Removal	Steel H-Pile	11:50	12:24	H-Piles: 6,7	-
				Vibratory Removal	Timber	13:38	13:40	Pile: 8	-
				Vibratory Removal	Steel H-Pile	13:45	14:13	H-Piles: 9, 10, 11	-
Wednesday, October 5, 2022	7:38	8:44	Finished removing 1 H pile from previous day along with 1 more timber pile.	Vibratory Removal	Steel H-Pile	8:08	8:12	H-Pile: 1	-
				Vibratory Removal	Timber	8:14	8:14	Pile: 2	-
Wednesday, November 2, 2022	7:55	15:19	Vibratory installation of 2 piles. Impact installation of 1 pile.	Vibratory Installation	Steel 30-inch	10:36	11:10	Pile: Y13B	-
				Impact Installation	Steel 30-inch	12:12	13:25	Pile: Y13B	1228
				Vibratory Installation	Steel 30-inch	14:30	14:49	Pile: D11	-
Thursday, November 3, 2022	7:57	16:00	Attempted vibratory installation of 1 pile. Impact installation of 1 pile.	Impact Installation	Steel 30-inch	9:04	10:07	Pile: D11	887
				Vibratory Installation	Steel 30-inch	13:09	15:30	Pile: X3, several attempts were made to installation this pile due to refusal.	-
Friday, November 4, 2022	7:58	14:56	Impacts to complete the preliminary installation on pile X3. Vibratory installation and impact installation of 2 more piles.	Impact Installation	Steel 30-inch	9:03	9:55	Pile: X3, impact hammer used to complete preliminary installation.	759
				Vibratory Installation	Steel 30-inch	11:52	12:39	Pile: X5	-
				Impact Installation	Steel 30-inch	14:10	14:26	Pile: X5	537
Monday, November 7, 2022	7:03	15:55	Vibratory installation of 4 piles. Killer whales moved into stop work zone; resulted in a short pause but did not stop work in progress.	Vibratory Installation	Steel 30-inch	8:49	9:09	Pile: 1. Killer whales in stop work zone 10:03–10:25	-
				Vibratory Installation	Steel 30-inch	10:47	12:08	Piles: 2, 3	-
				Vibratory Installation	Steel 30-inch	14:50	15:25	Pile: 4	-
Tuesday, November 8, 2022	12:15	15:17	Barge moved from Pier 63 to continue work at Pier 58; vibratory installation of 1 pile.	Vibratory Installation	Steel 30-inch	14:01	14:20	Pile: 1	-
Wednesday, November 9, 2022	7:16	15:45	Vibratory installation of 3 piles.	Vibratory Installation	Steel 30-inch	8:54	9:40	Pile: 1, killer whales spotted approaching exclusion zone as work ended.	-
				Vibratory Installation	Steel 30-inch	12:57	13:39	Pile: X4, hit refusal	-
				Vibratory Installation	Steel 30-inch	14:48	15:15	Pile: 3	-
Thursday, November 10, 2022	7:07	15:26	Installation of 5 piles; killer whales spotted outside the Exclusion Zone during the 30-minute pre-monitoring period.	Impact Installation	Steel 30-inch	8:12	819	Pile: X4: PPM approved to finish initial installation with impact hammer due to refusal.	167
				Vibratory Installation	Steel 30-inch	10:16	10:31	Pile: 2	-
				Vibratory Installation	Steel 30-inch	11:34	11:54	Pile: 3, Orca spotted in work zone at 11:10. Work delayed for approximately 10 minutes. All clear given at 11:34.	-
				Vibratory Installation	Steel 30-inch	13:22	13:33	Pile: 4	-
				Vibratory Installation	Steel 30-inch	14:34	14:56	Pile: 5	-
Friday, November 11, 2022	7:08	11:44	Restrikes on 4 test piles.	Impact Installation	Steel 30-inch	8:35	9:10	Piles: X3, X5	1296
				Impact Installation	Steel 30-inch	10:30	11:44	Piles: Y13B, D11	154
Monday, November 14, 2022	7:13	15:36	Vibratory installation of 5 piles.	Vibratory Installation	Steel 30-inch	9:12	10:29	Piles: F8, X12	-
				Vibratory Installation	Steel 30-inch	12:09	15:06	Piles: X13, Y13A, E12	-

Table A-1
Waterfront Park Pile Removal and Pile Driving Activity

Date	Daily Monitoring Start Time	Daily Monitoring Stop Time	Daily Notes	Pile Activity	Pile Type	Activitiy Start Time	Activitiy Stop Time	Time Period Notes (shutdowns/delays/WQ issues/pile names)	Strike Count During Time Period
Tuesday, November 15, 2022	7:15	15:54	Vibratory installation of 5 piles; impact installation of 3 piles.	Vibratory Installation	Steel 30-inch	8:18	9:13	Piles: E11, E10	-
				Vibratory Installation	Steel 30-inch	10:31	12:05	Piles: D12, D10, D13	-
				Impact Installation	Steel 30-inch	13:45	15:24	Piles: D13, D12, D10, E11	2400
Wednesday, November 16, 2022	7:16	13:59	Vibratory installation of 2 piles; impact installation of 5 piles.	Vibratory Installation	Steel 30-inch	8:22	10:12	Piles: Z14, Z15	-
				Impact Installation	Steel 30-inch	11:07	13:29	Piles: Z14, Z15, E12, E11. E10	2400
Thursday, November 17, 2022	7:18	10:59	Impact installation of 5 piles.	Impact Installation	Steel 30-inch	8:28	10:29	Piles: E10, E11, X13, Y13A, X12	2400
Tuesday, November 22, 2022	7:25	13:54	Vibratory installation of 1 pile; impact installation of 4 piles.	Vibratory Installation	Steel 30-inch	9:01	9:21	Pile: F6	-
				Impact Installation	Steel 30-inch	10:10	11:17	Pile: F6	1166
				Impact Installation	Steel 30-inch	12:23	13:24	Piles: F9, X9, X8	1224
Wednesday, November 23, 2022	7:26	10:44	Impact installation of 4 piles.	Impact Installation	Steel 30-inch	8:00	10:10	Piles: X12, X11, X10, X9	2400
Monday, November 28, 2022	7:33	12:21	Impact installation of 4 piles.	Impact Installation	Steel 30-inch	8:56	11:51	Piles: Y13A, X8, X7, X6	2400
Tuesday, November 29, 2022	7:34	13:21	Impact installation of 4 piles.	Impact Installation	Steel 30-inch	8:27	9:41	Piles: F6, X6. Lead PSO observed the work barge discharging rust-colored ballast water, which resulted in mild turbidity around the front of the barge from 0835–0845 during the F6 impact. Impacting event on X6 ended early due to a damaged a fuel line that resulted in fuel spilling into the water. The contractor crew was quick to respond to the spilled fuel; there was no noticeable sheen after their response. Barge discharged ballast water again from 0945-0955.	323
				Impact Installation	Steel 30-inch	11:07	13:21	Piles: X6, X4, H3	2,077
Wednesday, November 30, 2022	7:36	11:42	Impact installation of 4 piles.	Impact Installation	Steel 30-inch	8:30	11:12	Piles: H2, H1, X2, X1. Work paused for 2 minutes during H2 impact due to excess vibrations on pier 57.	2400
Thursday, December 1, 2022	7:37	11:17	Impact installation of 2 piles. 1 pile partially removed and reinstalled to correct the alignment. The vibratory hammer created excess vibrations on Pier 57 that resulted in several pauses in work.	Impact Installation	Steel 30-inch	8:21	8:44	Pile: X1	144
				Vibratory Installation	Steel 30-inch	9:11	9:49	Pile: H1. Resetting out of alignment Pile: that was already installed	-
				Impact Installation	Steel 30-inch	10:29	10:47	Pile: H1. Reinstallation of pile	751
Monday, December 5, 2022	7:41	15:09	Vibratory installation of 5 piles; impact installation of 3 piles. Killer whales spotted around stop work zone during vibratory installation; the killer whales moved into the Exclusion Zone while the crew was on lunch break and left before the crew returned.	Vibratory Installation	Steel 30-inch	9:08	11:17	Piles: G1, G2, G3. Killer whales spotted outside stop work zone during the installation of these piles. Moved into stop work zone after the completion of vibratory installs.	-
				Impact Installation	Steel 30-inch	12:20	13:30	Piles: G1, G2, G3.	1730
				Vibratory Installation	Steel 30-inch	14:18	14:39	Pile: G4	-
Tuesday, December 6, 2022	7:42	14:41	Vibratory installation of 3 piles. Impact installation of 3 piles.	Vibratory Installation	Steel 30-inch	9:02	10:33	Piles: G5, G6	-
				Impact Installation	Steel 30-inch	11:59	13:17	Piles: G6, G5, G4	2259
				Vibratory Installation	Steel 30-inch	13:56	14:11	Pile: F1	-

Table A-1
Waterfront Park Pile Removal and Pile Driving Activity

Date	Daily Monitoring Start Time	Daily Monitoring Stop Time	Daily Notes	Pile Activity	Pile Type	Activitiy Start Time	Activitiy Stop Time	Time Period Notes (shutdowns/delays/WQ issues/pile names)	Strike Count During Time Period
Wednesday, December 7, 2022	7:44	15:41	Vibratory installation of 4 piles. Impact installation of 4 piles.	Impact Installation	Steel 30-inch	8:15	9:08	Piles: G4, F1	1201
				Vibratory Installation	Steel 30-inch	10:33	12:27	Piles: F2, F3, F4	-
				Impact Installation	Steel 30-inch	13:21	14:03	Piles: F4, F3	1192
				Vibratory Installation	Steel 30-inch	14:52	15:11	Pile: F5. Pile F5 is misaligned, will be re-aligned on next workday.	-
Thursday, December 8, 2022	7:45	15:11	Vibratory installation of 3 piles. Impact installation of 3 piles. Impact count limit exceeded today.	Vibratory Installation	Steel 30-inch	8:17	8:45	Pile: F5, re-alignment.	-
				Impact Installation	Steel 30-inch	9:23	11:42	Piles: F5, F3, F2	2400
				Impact Installation	Steel 30-inch	12:50	12:56	Pile: F2. City allowed the driving crew to exceed the 2400 daily strike limit. Takes zones adjusted. No takes from this impact event.	106
				Vibratory Installation	Steel 30-inch	13:42	14:41	Piles: F7, F8	-
Friday, December 9, 2022	7:46	14:58	Vibratory installation of 3 piles. Impact installation of 3 piles. Coast Guard on site in the morning to investigate reports of project related sheen (non-found). Killer whales spotted just outside of the Exclusion Zone but never spotted entering the zone.	Vibratory Installation	Steel 30-inch	8:52	9:01	Pile: D6. Coast Guard on site during the installation of this pile.	-
				Impact Installation	Steel 30-inch	9:29	10:42	Pile: D6. Long break halfway through the installation of this pile due to a ribbon-cutting ceremony at an adjacent project.	920
				Vibratory Installation	Steel 30-inch	11:52	13:07	Piles: E9, E7. Killer whales spotted around the border of the Exclusion Zone before vibratory installation, all clear given before starting work.	-
				Impact Installation	Steel 30-inch	13:36	14:29	Piles: E9, E7	1480
Monday, December 12, 2022	7:49	12:33	Vibratory installation of 1 pile. Impact installation of 2 piles.	Impact Installation	Steel 30-inch	8:33	9:06	Pile: E9	1117
				Vibratory Installation	Steel 30-inch	10:20	10:35	Pile: D9	-
				Impact Installation	Steel 30-inch	11:25	12:03	Pile: F7	1283
Tuesday, December 13, 2022	7:49	9:18	Impact installation of 1 pile.	Impact Installation	Steel 30-inch	8:20	8:48	Pile: F8	987
Wednesday, December 14, 2022	7:50	14:06	Vibratory installation of 2 piles. Impact installation of 2 piles.	Vibratory Installation	Steel 30-inch	9:50	11:25	Piles: E1, E2	-
				Impact Installation	Steel 30-inch	12:43	13:36	Piles: E1, E2	1637
Thursday, December 15, 2022	7:51	12:06	Vibratory installation of 2 piles. Impact installation of 2 piles.	Vibratory Installation	Steel 30-inch	8:25	10:00	Piles: E3, E4	-
				Impact Installation	Steel 30-inch	10:43	11:36	Piles: E3, E4	1669
Friday, December 16, 2022	7:52	10:56	Impact installation of 2 piles.	Impact Installation	Steel 30-inch	9:32	10:26	Piles: D6, D8. Barge discharging turbid. The construction manager with Seattle Waterfront informed them to cease that activity.	1127
Monday, December 19, 2022	7:54	15:00	Vibratory installation of 3 piles. Impact installation of 3 piles. Low ambient temperatures resulted in mechanical issues with the vibratory hammer in the morning. Pile cut offs began today.	Vibratory Installation	Steel 30-inch	9:20	11:05	Piles: E6, E5	-
				Impact Installation	Steel 30-inch	11:21	12:18	Piles: E6, E5	2157
				Vibratory Installation	Steel 30-inch	13:38	13:52	Pile: D1	-
				Impact Installation	Steel 30-inch	14:15	14:30	Pile: D1	466
Tuesday, December 20, 2022	7:54	14:46	Vibratory installation of 3 piles. Impact installation of 3 piles. Work stopped for 1.5 hours during vibratory installs due to poor visibility (snow).	Vibratory Installation	Steel 30-inch	8:31	8:53	Pile: D2. Stop work called after this pile at 09:22. Poor visibility from snow	-
				Vibratory Installation	Steel 30-inch	11:15	12:41	Piles: D3. D4. All clear given at 11:00.	-
				Impact Installation	Steel 30-inch	13:03	14:16	Piles: D4, D3, D2	1912

Table A-1
Waterfront Park Pile Removal and Pile Driving Activity

Date	Daily Monitoring Start Time	Daily Monitoring Stop Time	Daily Notes	Pile Activity	Pile Type	Activitiy Start Time	Activitiy Stop Time	Time Period Notes (shutdowns/delays/WQ issues/pile names)	Strike Count During Time Period
Wednesday, December 21, 2022	7:55	11:54	Vibratory installation of 2 piles. Impact installation of 2 piles.	Vibratory Installation	Steel 30-inch	8:40	9:41	Piles: D5, D7	-
				Impact Installation	Steel 30-inch	10:34	11:24	Piles: D7, D5	1401
Thursday, December 22, 2022	7:55	14:47	Vibratory installation of 2 piles. Impact installation of 3 piles. Hydraulic fluid leak occurred during vibratory installation. Anchor QEA water quality on site during clean up.	Vibratory Installation	Steel 30-inch	8:55	9:07	Pile: E8. Hammer began leaking hydraulic fluid at 09:07. PPM deployed a curtain around the spill and worked on cleaning the spill up for next hour.	-
				Impact Installation	Steel 30-inch	10:14	10:40	Pile: E8	856
				Vibratory Installation	Steel 30-inch	13:03	13:14	Pile: D9	-
				Impact Installation	Steel 30-inch	13:33	13:51	Piles D4 and D9. Restrikes on D4 to achieve target depth.	771
Monday, January 30, 2023	7:38	10:36	1 pile partially removed and reinstalled to correct the alignment.	Vibratory Removal	Steel 30-inch	8:26	8:45	Pile: E1	-
				Impact Installation	Steel 30-inch	9:59	10:06	Pile: E1	149
Wednesday, February 1, 2023	7:36	15:12	Vibratory installation of 3 piles. Impact installation of 2 piles.	Vibratory Installation	Steel 30-inch	9:29	12:25	Piles: C3, C2, A2. Pile: C3 moved to C2 location due to refusal at original location.	-
				Impact Installation	Steel 30-inch	13:16	14:42	Piles C2 and A2	1016
Monday, February 6, 2023	7:29	13:57	Vibratory installation and impact installation of 3 piles.	Vibratory Installation	Steel 30-inch	8:50	11:09	Piles: B1, B2, C1	-
				Impact Installation	Steel 30-inch	11:26	13:27	Piles: B1, B2, C1	1384
Tuesday, February 7, 2023	7:28	15:52	Vibratory installation of 3 piles. Impact installation of 2 piles.	Vibratory Installation	Steel 30-inch	8:02	8:19	Pile: A1	-
				Impact Installation	Steel 30-inch	8:41	9:58	Pile: A1	444
				Vibratory Installation	Steel 30-inch	11:22	11:43	Pile: B3	-
				Impact Installation	Steel 30-inch	12:28	12:50	Pile: B3	662
				Vibratory Installation	Steel 30-inch	15:03	15:22	Pile: C8	-
Wednesday, February 8, 2023	7:26	14:50	Restrikes on 2 test piles. Vibratory installation and impact installation of 3 piles.	Impact Installation	Steel 30-inch	8:19	9:36	Piles: A2, C2, C8	988
				Vibratory Installation	Steel 30-inch	10:27	11:51	Piles C9 and C10	-
				Vibratory Installation	Steel 30-inch	13:02	13:12	Pile: C11	-
				Impact Installation	Steel 30-inch	13:30	14:20	Piles C11 and C10	1412
Thursday, February 9, 2023	7:24	15:10	Vibratory installation of 4 piles, Impact installation of 3 piles.	Impact Installation	Steel 30-inch	8:07	9:12	Piles C10 and C9	1841
				Vibratory Installation	Steel 30-inch	9:59	12:09	Piles C12, C13, C15	-
				Vibratory Installation	Steel 30-inch	13:48	14:03	Pile: C14	-
				Impact Installation	Steel 30-inch	14:22	14:40	Pile: C12	559
Friday, February 10, 2023	7:23	15:55	Impact installation of 4 piles. Vibratory installation of 1 pile after clearing obstruction.	Impact Installation	Steel 30-inch	8:00	9:31	Piles: C12, C13, C14, C15	2400
				Vibratory Installation	Steel 30-inch	13:43	15:35	Pile: C2. Used a jackhammer-like pile to clear a subsurface obstruction	-
Monday, February 13, 2023	7:18	12:06	Impact installation of 3 piles. 1 pile partially removed and reinstalled to correct the alignment.	Impact Installation	Steel 30-inch	8:00	8:24	Pile: C3	810
				Vibratory Installation	Steel 30-inch	8:41	9:04	Pile: B3	-
				Impact Installation	Steel 30-inch	9:22	9:42	Pile: B3	662
				Impact Installation	Steel 30-inch	11:13	11:26	Pile: C12	332
Tuesday, February 14, 2023	7:17	14:20	Vibratory installation of 2 mooring piles.	Vibratory Installation	Steel 30-inch	9:48	10:04	Mooring Pile: 1	-
				Vibratory Installation	Steel 30-inch	13:00	13:50	Mooring Pile: 2	-
Wednesday, February 15, 2023	7:15	11:03	Vibratory installation of 1 mooring pile.	Vibratory Installation	Steel 30-inch	10:22	10:33	Mooring Pile: 3	-

Notes:
PPM: Pacific Pile and Marine
PSO: Protected Species Observer

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Monday, October 3, 2022	Alki	Sunny	CSL	2	12:15	12:18	No	3450	240	Swimming	No Pile Activity	No Take		
Monday, October 3, 2022	Alki	Sunny	CSL	1	12:57	12:58	No	3300	240	Swimming	No Pile Activity	No Take		
Monday, October 3, 2022	Alki	Sunny	CSL	1	13:16	13:17	No	3500	253	Swimming	No Reaction Observed	No Take	Vibratory Removal Steel H-piles	Previously observed recorded as a take of the day.
Monday, October 3, 2022	Alki	Sunny	CSL	1	13:30	13:31	No	3500	253	Swimming	No Reaction Observed	No Take	Vibratory Removal Steel H-piles	Previously observed recorded as a take of the day.
Monday, October 3, 2022	Pier 58	Sunny	CSL	1	13:04	13:04	No	200	280	Swimming	No Reaction Observed	Level B	Vibratory Removal Steel H-piles	
Monday, October 3, 2022	Pier 58	Sunny	CSL	1	13:19	13:19	No	200	260	Swimming	No Reaction Observed	Level B	Vibratory Removal Steel H-piles	
Monday, October 3, 2022	Pier 58	Sunny	CSL	1	13:58	13:59	No	250	280	Swimming	No Reaction Observed	Level B	Vibratory Removal Steel H-piles	
Tuesday, October 4, 2022	Alki	Fog, Overcast, Light Wind	HS	1	8:09	13:30	No	5000	250	Swimming	No Pile Activity	No Take		Observed swimming and foraging in the area throughout the day.
Tuesday, October 4, 2022	Alki	Fog, Overcast, Light Wind	CSL	1	9:49	10:20	No	3700	260	Swimming	No Pile Activity	No Take		Observed moving North.
Tuesday, October 4, 2022	Alki	Fog, Overcast, Light Wind	CSL	4	11:05	13:15	No	5500	250	Intermittent	No Pile Activity	No Take		Observed swimming and foraging in the area before moving south.
Tuesday, October 4, 2022	Pier 58	Fog	CSL	1	7:20	7:20	No	150	250	Swimming	No Pile Activity	No Take		
Tuesday, October 4, 2022	Pier 58	Fog	CSL	1	8:20	8:20	No	160	265	Swimming	No Reaction Observed	Level B	Vibratory Removal Steel H-piles	
Tuesday, October 4, 2022	Pier 58	Fog	CSL	1	8:24	8:24	No	160	270	Swimming	No Reaction Observed	Level B	Vibratory Removal Steel H-piles	
Tuesday, October 4, 2022	Pier 58	Fog	CSL	2	8:29	8:29	No	170	250	Swimming	No Reaction Observed	Level B	Vibratory Removal Steel H-piles	
Tuesday, October 4, 2022	Pier 58	Fog	CSL	3	8:38	8:38	No	180	240	Swimming	No Reaction Observed	No Take	Vibratory Removal Steel H-piles	Previously observed recorded as a take of the day.
Tuesday, October 4, 2022	Pier 58	Fog	CSL	1	9:17	9:17	No	150	265	Swimming	No Pile Activity	Level B		
Tuesday, October 4, 2022	Pier 58	Fog	CSL	3	9:43	9:47	No	180	260	Foraging	No Pile Activity	No Take		
Tuesday, October 4, 2022	Pier 58	Fog	CSL	1	12:38	12:38	No	150	280	Foraging	No Pile Activity	Level B		
Tuesday, October 4, 2022	Pier 58	Fog	CSL	1	13:20	13:20	No	105	300	Foraging	No Pile Activity	Level B		
Tuesday, October 4, 2022	Pier 58	Fog	CSL	1	13:27	13:27	No	200	280	Swimming	No Pile Activity	No Take		Previously observed recorded as a take of the day.
Wednesday, October 5, 2022	Alki	Fog, Overcast	HS	1	7:38	8:11	No	4000	255	Foraging	No Reaction Observed	No Take	Vibratory Removal Steel H-piles	
Wednesday, October 5, 2022	Alki	Fog, Overcast	HS	1	8:04	8:21	No	3500	250	Swimming	No Pile Activity	No Take		
Wednesday, October 12, 2022	Alki	Sunny, Light Wind	HS	1	10:38	10:39	No	7355	245	Swimming	No Pile Activity	No Take		
Wednesday, October 12, 2022	Pier 63	Sunny	CSL	1	8:32	8:35	No	400	180	Swimming	No Pile Activity	No Take		
Wednesday, October 12, 2022	Pier 63	Sunny	CSL	1	8:56	8:58	No	100	300	Swimming	No Pile Activity	No Take		
Wednesday, October 12, 2022	Pier 63	Sunny	HS	1	9:45	9:57	No	100	300	Intermittent	No Pile Activity	No Take		
Wednesday, October 12, 2022	Pier 63	Sunny	CSL	1	10:22	10:23	No	100	300	Swimming	No Pile Activity	No Take		

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Wednesday, October 12, 2022	Ferry	Sunny, Light Wind	CSL	1	10:20	10:40	No	200	195	Swimming	No Pile Activity	No Take		Previously observed recorded as a take of the day.
Wednesday, October 12, 2022	Magnolia	Sunny, Light Wind	HS	2	7:35	8:42	No	4500	304	Swimming	No Pile Activity	No Take		
Wednesday, October 12, 2022	Magnolia	Sunny, Light Wind	HS	1	7:38	14:05	No	5000	303	Intermittent	No Pile Activity	No Take		Intermittently observed for much of the monitoring day.
Wednesday, October 12, 2022	Magnolia	Sunny, Light Wind	HS	1	11:34	12:15	No	4500	303	Swimming	No Pile Activity	No Take		Previously observed recorded as a take of the day.
Monday, October 31, 2022	Alki	Light Wind, Whitecaps, Other	HS	4	7:52	9:37	No	5000	240	Intermittent	No Pile Activity	No Take		Group observed before the official start of the monitoring period. The group dispersed before swimming away during the monitoring period.
Monday, October 31, 2022	Alki	Light Wind, Whitecaps, Other	CSL	1	8:46	9:04	No	6000	245	Foraging	No Pile Activity	No Take		Observed foraging in the area before moving south.
Monday, October 31, 2022	Alki	Overcast, Light Rain	HP	1	9:05	9:15	No	3000	245	Swimming	No Pile Activity	No Take		
Monday, October 31, 2022	Alki	Overcast, Light Rain	CSL	1	9:30	9:50	No	2800	240	Swimming	No Pile Activity	No Take		
Monday, October 31, 2022	Alki	Light Wind, Whitecaps, Other	CSL	1	11:06	11:31	No	4500	240	Foraging	No Pile Activity	No Take		
Monday, October 31, 2022	Alki	Light Wind, Whitecaps, Other	HS	1	13:41	14:09	No	4500	240	Resting	No Pile Activity	No Take		Observed resting on a log for a short time before swimming away.
Tuesday, November 1, 2022	Alki	Sunny	CSL	1	10:50	11:30	No	3500	250	Foraging	No Pile Activity	No Take		
Tuesday, November 1, 2022	Alki	Sunny	HS	1	11:00	11:30	No	3500	247	Resting	No Pile Activity	No Take		
Tuesday, November 1, 2022	Alki	Sunny	CSL	1	12:10	12:15	No	3500	247	Foraging	No Pile Activity	No Take		
Tuesday, November 1, 2022	Magnolia	Sunny	CSL	1	11:48	11:48	No	4750	302	Swimming	No Pile Activity	No Take		Observed swimming along the shoreline.
Tuesday, November 1, 2022	Magnolia	Sunny	CSL	1	11:48	11:48	No	4750	302	Swimming	No Pile Activity	No Take		Observed swimming along the shoreline.
Tuesday, November 1, 2022	Magnolia	Sunny	CSL	1	12:20	12:25	No	4750	302	Swimming	No Pile Activity	No Take		Observed swimming along the shoreline.
Tuesday, November 1, 2022	Magnolia	Sunny	CSL	1	12:20	12:25	No	4750	302	Swimming	No Pile Activity	No Take		Observed swimming along the shoreline.
Tuesday, November 1, 2022	Magnolia	Sunny	HS	1	12:51	12:55	No	4600	302	Intermittent	No Pile Activity	No Take		
Tuesday, November 1, 2022	Magnolia	Sunny	HS	1	12:51	12:55	No	4600	302	Intermittent	No Pile Activity	No Take		
Tuesday, November 1, 2022	Magnolia	Sunny	HS	1	13:43	13:44	No	4800	303	Swimming	No Pile Activity	No Take		Observed swimming along the shoreline.
Tuesday, November 1, 2022	Magnolia	Sunny	HS	1	13:43	13:44	No	4800	303	Swimming	No Pile Activity	No Take		Observed swimming along the shoreline.
Wednesday, November 2, 2022	Alki	Overcast	HS	1	8:00	8:00	No	3200	240	Resting	No Pile Activity	No Take		The seal appeared to be interested in a fisherman in the area.
Wednesday, November 2, 2022	Alki	Overcast	HS	1	8:18	8:25	No	3200	240	Swimming	No Pile Activity	No Take		
Wednesday, November 2, 2022	Alki	Overcast	CSL	1	8:20	8:26	No	3000	240	Swimming	No Pile Activity	No Take		
Wednesday, November 2, 2022	Alki	Overcast	CSL	1	8:20	8:26	No	3000	240	Swimming	No Pile Activity	No Take		
Wednesday, November 2, 2022	Alki	Overcast	CSL	1	8:37	8:39	No	3250	242	Swimming	No Pile Activity	No Take		
Wednesday, November 2, 2022	Alki	Overcast	CSL	1	8:48	8:48	No	3250	242	Swimming	No Pile Activity	No Take		
Wednesday, November 2, 2022	Alki	Overcast	HS	1	8:49	8:49	No	3250	240	Swimming	No Pile Activity	No Take		
Wednesday, November 2, 2022	Alki	Overcast	CSL	1	8:52	8:57	No	3250	241	Foraging	No Pile Activity	No Take		

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Wednesday, November 2, 2022	Alki	Overcast	HS	1	8:55	8:58	No	3200	241	Swimming	No Pile Activity	No Take		Appears to be a juvenile.
Wednesday, November 2, 2022	Alki	Overcast	CSL	1	8:56	8:56	No	3000	240	Swimming	No Pile Activity	No Take		
Wednesday, November 2, 2022	Alki	Overcast	CSL	2	9:01	9:03	No	3250	243	Swimming	No Pile Activity	No Take		
Wednesday, November 2, 2022	Alki	Overcast	SSL	1	9:47	9:47	No	3250	243	Swimming	No Pile Activity	No Take		
Wednesday, November 2, 2022	Alki	Overcast	CSL	1	9:48	9:50	No	3250	242	Foraging	No Pile Activity	No Take		
Wednesday, November 2, 2022	Alki	Overcast	CSL	1	10:08	10:09	No	3200	243	Swimming	No Pile Activity	Level B		
Wednesday, November 2, 2022	Alki	Overcast	HS	1	10:31	10:35	No	3200	242	Resting	No Pile Activity	Level B		
Wednesday, November 2, 2022	Alki	Overcast	HS	1	10:45	10:47	No	3000	241	Swimming	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	Previously observed recorded as a take of the day.
Wednesday, November 2, 2022	Alki	Overcast	HS	1	10:50	10:52	No	3000	241	Swimming	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	Previously observed recorded as a take of the day.
Wednesday, November 2, 2022	Alki	Overcast	CSL	1	11:08	11:08	No	3250	242	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Wednesday, November 2, 2022	Alki	Overcast	HS	1	11:09	11:16	No	3250	241	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Wednesday, November 2, 2022	Alki	Overcast	HS	1	11:26	11:26	No	3100	241	Swimming	No Pile Activity	Level B		
Wednesday, November 2, 2022	Alki	Overcast	HS	1	12:43	12:43	No	3250	241	Resting	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, November 2, 2022	Alki	Overcast	CSL	1	12:48	12:50	No	3200	241	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, November 2, 2022	Alki	Overcast	CSL	1	12:48	12:50	No	3200	241	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, November 2, 2022	Alki	Overcast	CSL	1	13:25	13:25	No	3200	244	Swimming	No Pile Activity	No Take		
Wednesday, November 2, 2022	Alki	Overcast	CSL	1	13:25	13:25	No	3200	244	Swimming	No Pile Activity	No Take		
Wednesday, November 2, 2022	Alki	Overcast	CSL	1	13:25	13:25	No	3200	244	Swimming	No Pile Activity	No Take		
Wednesday, November 2, 2022	Alki	Overcast	CSL	1	13:28	13:31	No	3250	242	Foraging	No Pile Activity	No Take		
Wednesday, November 2, 2022	Pier 58	Overcast	CSL	1	11:18	11:19	No	120	270	Swimming	No Pile Activity	Level B		
Wednesday, November 2, 2022	Pier 63	Overcast, Light Rain, Light Wind	CSL	2	11:30	11:45	No	120	235	Swimming	No Pile Activity	Level B		One individual in the group observed foraging.
Wednesday, November 2, 2022	Ferry	Overcast, Light Wind	CSL	1	9:20	9:22	No	6000	270	Swimming	No Pile Activity	No Take		
Wednesday, November 2, 2022	Ferry	Overcast, Light Wind	HS	1	10:35	10:40	No	9600	270	Swimming	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	
Wednesday, November 2, 2022	Ferry	Overcast, Light Wind	HS	1	12:30	12:31	No	9600	270	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, November 2, 2022	Ferry	Overcast, Light Wind	HS	1	12:50	12:50	No	1200	270	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, November 2, 2022	Ferry	Overcast, Light Wind	HS	2	14:12	14:14	No	10600	270	Swimming	No Pile Activity	No Take		
Wednesday, November 2, 2022	Ferry	Sunny	HS	1	14:24	14:25	No	6500	265	Swimming	No Pile Activity	Level B		
Wednesday, November 2, 2022	Magnolia	Moderate Wind, Overcast, Whitecaps	HS	1	8:00	8:00	No	5000	303	Swimming	No Pile Activity	No Take		
Wednesday, November 2, 2022	Magnolia	Moderate Wind, Overcast, Whitecaps	HS	1	8:09	8:10	No	5000	303	Swimming	No Pile Activity	No Take		
Wednesday, November 2, 2022	Magnolia	Moderate Wind, Overcast, Whitecaps	HS	1	8:12	8:12	No	5000	303	Swimming	No Pile Activity	No Take		
Wednesday, November 2, 2022	Magnolia	Moderate Wind, Overcast, Whitecaps	CSL	1	8:30	8:31	No	5000	303	Foraging	No Pile Activity	No Take		Observed barking at a group of harassing seagulls.
Wednesday, November 2, 2022	Magnolia	Moderate Wind, Overcast, Whitecaps	HS	1	8:56	8:56	No	5000	303	Swimming	No Pile Activity	No Take		

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Wednesday, November 2, 2022	Magnolia	Overcast, Moderate Wind, Whitecaps, Light Rain, Heavy Rain, Light Wind	HS	1	8:58	8:59	No	5000	303	Swimming	No Pile Activity	No Take		
Wednesday, November 2, 2022	Magnolia	Overcast, Moderate Wind, Whitecaps, Light Rain, Heavy Rain, Light Wind	HS	1	9:43	9:44	No	5000	300	Swimming	No Pile Activity	No Take		
Wednesday, November 2, 2022	Magnolia	Overcast, Moderate Wind, Whitecaps, Light Rain, Heavy Rain, Light Wind	HS	1	10:27	10:29	No	5000	300	Swimming	No Pile Activity	Level B		
Wednesday, November 2, 2022	Magnolia	Overcast, Moderate Wind, Whitecaps, Light Rain, Heavy Rain, Light Wind	HS	1	10:31	10:31	No	5000	300	Swimming	No Pile Activity	No Take		Previously observed recorded as a take of the day.
Wednesday, November 2, 2022	Magnolia	Overcast, Moderate Wind, Whitecaps, Light Rain, Heavy Rain, Light Wind	HS	1	10:38	10:39	No	5000	300	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Wednesday, November 2, 2022	Magnolia	Heavy Rain, Overcast	HS	1	11:01	11:02	No	5000	300	Swimming	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	Previously observed recorded as a take of the day.
Wednesday, November 2, 2022	Magnolia	Heavy Rain, Overcast	HS	1	11:09	11:09	No	5000	300	Swimming	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	Previously observed recorded as a take of the day.
Wednesday, November 2, 2022	Magnolia	Heavy Rain, Overcast	HS	1	11:44	11:45	No	5000	300	Swimming	No Pile Activity	No Take		
Wednesday, November 2, 2022	Magnolia	Heavy Rain, Overcast	HS	1	13:00	13:00	No	5000	300	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, November 2, 2022	Magnolia	Heavy Rain, Overcast	HS	1	13:04	13:05	No	5000	300	Intermittent	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, November 2, 2022	Magnolia	Overcast	HS	1	13:11	13:12	No	5000	300	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, November 2, 2022	Magnolia	Overcast	HS	1	13:22	13:23	No	5000	300	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, November 2, 2022	Magnolia	Overcast	HS	1	14:02	14:03	No	5000	300	Swimming	No Pile Activity	Level B		
Wednesday, November 2, 2022	Magnolia	Overcast	HS	1	14:10	14:10	No	5000	300	Swimming	No Pile Activity	No Take		Previously observed recorded as a take of the day.
Wednesday, November 2, 2022	Magnolia	Overcast	HS	1	14:40	14:40	No	5000	300	Swimming	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	Previously observed recorded as a take of the day.
Thursday, November 3, 2022	Alki	Overcast	HS	1	11:20	11:43	No	3250	242	Intermittent	No Pile Activity	No Take		Observed swimming back and forth along the shoreline while foraging.
Thursday, November 3, 2022	Alki	Overcast	HS	1	12:16	12:18	No	3200	250	Resting	No Pile Activity	No Take		
Thursday, November 3, 2022	Alki	Overcast	HS	1	12:46	12:51	No	3100	242	Resting	No Pile Activity	Level B		Observed resting in the water before swimming to a new location.
Thursday, November 3, 2022	Alki	Overcast	HS	1	13:02	13:06	No	3250	243	Resting	No Pile Activity	Level B		
Thursday, November 3, 2022	Alki	Overcast	HS	1	13:22	13:37	No	3100	241	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	Appears to be an adult.
Thursday, November 3, 2022	Alki	Overcast, Light Rain	CSL	1	13:30	13:32	No	3300	255	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	Appears to be a female.

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Thursday, November 3, 2022	Alki	Overcast, Light Rain	CSL	1	13:41	13:41	No	3250	253	Swimming	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	Previously observed recorded as a take of the day.
Thursday, November 3, 2022	Alki	Overcast, Light Rain	CSL	1	13:44	13:47	No	3250	241	Foraging	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Thursday, November 3, 2022	Alki	Overcast, Light Rain	CSL	1	13:50	14:13	No	3250	244	Foraging	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	Observed foraging for a long time in same general area.
Thursday, November 3, 2022	Alki	Overcast, Light Rain	CSL	1	13:59	14:00	No	3500	250	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Thursday, November 3, 2022	Alki	Overcast, Light Rain	HS	1	15:28	15:29	No	3250	243	Resting	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Thursday, November 3, 2022	Alki	Overcast, Light Rain	HS	1	15:51	15:51	No	3250	241	Swimming	No Pile Activity	Level B		
Thursday, November 3, 2022	Pier 63	Overcast, Light Wind	CSL	1	10:26	10:28	No	1000	285	Swimming	No Pile Activity	No Take		Observed moving south.
Thursday, November 3, 2022	Pier 58	Overcast, Light Rain, Moderate Wind, Light Wind, Whitecaps	CSL	1	11:32	11:34	No	150	300	Swimming	No Pile Activity	No Take		
Thursday, November 3, 2022	Ferry	Overcast	CSL	1	11:34	11:34	No	2200	265	Swimming	No Pile Activity	No Take		
Thursday, November 3, 2022	Magnolia	Overcast	HS	1	8:35	8:36	No	5000	303	Swimming	No Pile Activity	No Take		
Thursday, November 3, 2022	Magnolia	Overcast	HS	1	8:37	8:38	No	5000	303	Swimming	No Pile Activity	No Take		
Thursday, November 3, 2022	Magnolia	Overcast	HS	4	8:40	8:41	No	5000	303	Foraging	No Pile Activity	No Take		
Thursday, November 3, 2022	Magnolia	Overcast	HS	1	8:46	8:46	No	5000	303	Swimming	No Pile Activity	No Take		
Thursday, November 3, 2022	Magnolia	Overcast	HS	1	10:39	10:40	No	5100	300	Swimming	No Pile Activity	No Take		
Thursday, November 3, 2022	Magnolia	Overcast, Light Wind, Moderate Wind, Whitecaps, Light Rain, Heavy Rain	HS	2	10:41	10:43	No	5000	300	Swimming	No Pile Activity	No Take		
Thursday, November 3, 2022	Magnolia	Overcast, Light Wind, Moderate Wind, Whitecaps, Light Rain, Heavy Rain	HS	1	13:01	13:02	No	5000	300	Swimming	No Pile Activity	Level B		
Thursday, November 3, 2022	Magnolia	Overcast, Light Wind, Moderate Wind, Whitecaps, Light Rain, Heavy Rain	HS	1	13:10	13:10	No	5000	300	Foraging	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	Observed successfully catching a fish.
Thursday, November 3, 2022	Magnolia	Overcast, Light Wind, Moderate Wind, Whitecaps, Light Rain, Heavy Rain	HS	1	13:13	13:13	No	5000	300	Foraging	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	Previously observed and recorded as a take of the day.
Friday, November 4, 2022	Alki	Overcast, Moderate Wind	HS	1	8:07	8:08	No	3250	243	-	No Pile Activity	No Take		
Friday, November 4, 2022	Alki	Overcast, Moderate Wind	HS	1	8:28	8:46	No	3250	245	Swimming	No Pile Activity	No Take		Swimming around, occasionally popping head up.
Friday, November 4, 2022	Alki	Overcast, Moderate Wind	HS	1	9:03	9:03	No	3350	247	Resting	No Pile Activity	No Take		Pops head up intermittently.
Friday, November 4, 2022	Alki	Overcast, Moderate Wind	HS	1	9:13	9:19	No	3350	247	Resting	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Friday, November 4, 2022	Alki	Overcast, Moderate Wind	CSL	1	9:19	9:22	No	325	242	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Friday, November 4, 2022	Alki	Moderate Wind, Overcast, Light Rain	HS	1	9:33	9:43	No	3350	247	Resting	No Reaction Observed	No Take	Impact Install Steel 30-inch	Pops head up intermittently

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Friday, November 4, 2022	Alki	Moderate Wind, Overcast, Light Rain	HS	1	9:51	10:02	No	3300	247	Resting	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Friday, November 4, 2022	Alki	Moderate Wind, Overcast, Light Rain	HS	1	11:10	11:10	No	3100	242	Resting	No Pile Activity	No Take		
Friday, November 4, 2022	Alki	Moderate Wind, Overcast, Light Rain	CSL	2	12:00	12:50	No	3000	230	Resting	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	Observed resting on a mooring buoy.
Friday, November 4, 2022	Alki	Moderate Wind, Overcast, Light Rain	HS	1	12:43	12:45	No	3250	240	Swimming	No Pile Activity	Level B		Splashing around briefly, may have been foraging, but unsure.
Friday, November 4, 2022	Alki	Light Wind, Light Rain, Overcast	CSL	1	14:46	14:51	No	3250	242	Foraging	No Pile Activity	No Take		Possibly observed earlier in the day resting on a buoy, now swimming.
Friday, November 4, 2022	Magnolia	Heavy Wind, Whitecaps, Overcast	HS	1	9:09	9:09	No	5000	300	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Friday, November 4, 2022	Magnolia	Heavy Wind, Whitecaps, Overcast	HS	1	10:03	10:05	No	5000	300	Swimming	No Pile Activity	No Take		
Friday, November 4, 2022	Magnolia	Heavy Wind, Whitecaps, Overcast	HS	1	10:14	10:14	No	5000	300	Swimming	No Pile Activity	No Take		
Friday, November 4, 2022	Magnolia	Heavy Wind, Whitecaps, Overcast	HS	1	12:10	12:11	No	5000	300	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Monday, November 7, 2022	Alki	Overcast, Light Rain	KW	6	8:02	8:57	No	10000	260	Swimming	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	
Monday, November 7, 2022	Alki	Overcast, Light Rain	HS	1	9:18	9:20	No	3750	255	Foraging	No Pile Activity	Level B		
Monday, November 7, 2022	Alki	Overcast, Light Rain	HS	1	9:27	9:27	No	3500	255	Foraging	No Pile Activity	Level B		
Monday, November 7, 2022	Alki	Overcast, Light Rain	HS	1	10:55	11:05	No	3500	250	Foraging	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Monday, November 7, 2022	Alki	Overcast	CSL	1	11:07	11:11	No	2500	245	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Monday, November 7, 2022	Alki	Overcast	HS	1	11:48	12:05	No	1250	255	Foraging	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Monday, November 7, 2022	Alki	Overcast	HS	1	12:07	12:30	No	4000	255	Foraging	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Monday, November 7, 2022	Alki	Overcast, Light Rain	HS	1	12:55	13:31	No	3250	250	Intermittent	No Pile Activity	No Take		
Monday, November 7, 2022	Alki	Overcast, Light Rain	HS	2	14:48	14:49	No	3500	250	Foraging	No Pile Activity	No Take		Previously observed and recorded as a take of the day.
Monday, November 7, 2022	Pier 58	Overcast, Light Wind	CSL	1	10:12	10:12	No	100	240	Swimming	No Pile Activity	No Take		
Monday, November 7, 2022	Pier 58	Overcast, Light Wind, Light Rain	HS	1	11:06	11:06	No	50	300	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Monday, November 7, 2022	Pier 63	Overcast, Light Wind, Fog	CSL	1	13:13	13:16	No	150	260	Swimming	No Pile Activity	No Take		
Monday, November 7, 2022	Pier 58	Overcast, Light Wind	CSL	1	13:58	13:58	No	100	240	Swimming	No Pile Activity	No Take		
Monday, November 7, 2022	Pier 63	Overcast, Light Wind, Fog	CSL	2	14:12	14:17	No	100	270	Swimming	No Pile Activity	No Take		
Monday, November 7, 2022	Pier 58	Overcast, Light Rain, Light Wind	CSL	1	15:32	15:32	No	100	300	Swimming	No Pile Activity	Level B		
Monday, November 7, 2022	Ferry	Overcast, Fog, Light Rain	KW	7	7:25	8:20	No	10000	270	Swimming	No Pile Activity	No Take		

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Monday, November 7, 2022	Ferry	Overcast, Fog, Light Rain	KW	2	9:00	9:08	No	13000	240	Swimming	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	
Monday, November 7, 2022	Ferry	Overcast, Fog, Light Rain	KW	10	9:55	10:13	Yes	7000	270	Swimming	No Pile Activity	No Take		
Monday, November 7, 2022	Ferry	Overcast, Fog, Light Rain	HS	1	11:55	11:56	No	5000	270	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Monday, November 7, 2022	Magnolia	Light Wind, Light Rain, Fog	HS	1	7:20	9:16	No	5000	303	Foraging	No Pile Activity	Level B		Stayed in the area for a while, observed foraging around flock of seabirds.
Monday, November 7, 2022	Magnolia	Light Wind, Light Rain, Fog	HS	1	7:20	9:16	No	5000	303	Foraging	No Pile Activity	Level B		Stayed in the area for a while, observed foraging around flock of seabirds.
Monday, November 7, 2022	Magnolia	Light Wind, Light Rain, Fog	KW	4	7:28	8:42	No	12000	280	Foraging	No Pile Activity	No Take		Pod seen near Bainbridge, then moved south individually.
Monday, November 7, 2022	Magnolia	Light Wind, Light Rain, Fog	HS	1	8:24	8:54	No	5250	303	Foraging	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	Swimming and foraging with other observed harbor seal.
Monday, November 7, 2022	Magnolia	Light Wind, Light Rain, Fog	HS	1	9:33	9:37	No	6000	302	Swimming	No Pile Activity	Level B		Observed swimming west out of the bay.
Monday, November 7, 2022	Magnolia	Light Wind, Light Rain, Fog	KW	2	10:21	10:38	No	13000	310	Swimming	No Pile Activity	No Take		Swam north till out of sight.
Monday, November 7, 2022	Magnolia	Light Wind, Light Rain, Fog	KW	2	10:21	10:38	No	14000	310	Swimming	No Pile Activity	No Take		Swam north till out of sight.
Monday, November 7, 2022	Magnolia	Light Wind, Light Rain	HS	2	11:09	12:15	No	5100	303	Foraging	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	Two individuals foraging around the area in front of Magnolia.
Monday, November 7, 2022	Magnolia	Light Wind, Light Rain	CSL	1	12:44	12:54	No	4500	300	Swimming	No Pile Activity	No Take		Observed swimming into Elliot Bay.
Monday, November 7, 2022	Magnolia	Light Wind, Light Rain	CSL	1	12:57	13:02	No	5500	290	Swimming	No Pile Activity	No Take		Observed swimming southwest.
Monday, November 7, 2022	Magnolia	Light Wind, Light Rain	CSL	1	12:57	13:02	No	5500	290	Swimming	No Pile Activity	No Take		Observed swimming southwest.
Monday, November 7, 2022	Magnolia	Light Wind, Light Rain	HS	1	13:09	13:53	No	5000	303	Swimming	No Pile Activity	No Take		
Monday, November 7, 2022	Magnolia	Light Wind, Light Rain	HS	2	13:48	13:53	No	4500	300	Swimming	No Pile Activity	No Take		Observed meeting group before swimming towards the marina together.
Monday, November 7, 2022	Magnolia	Light Rain, Fog, Light Wind	CSL	1	15:08	15:15	No	5000	300	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	Observed swimming northwest out of the bay.
Monday, November 7, 2022	Magnolia	Light Rain, Fog, Light Wind	HS	1	15:39	15:50	No	5100	303	Swimming	No Pile Activity	Level B		Observed swimming east.
Monday, November 7, 2022	Magnolia	Light Rain, Fog, Light Wind	HS	1	15:46	15:50	No	5000	300	Swimming	No Pile Activity	Level B		
Tuesday, November 8, 2022	Alki	Heavy Wind, Whitecaps, Sunny	CSL	1	7:23	7:23	No	3100	240	Swimming	No Pile Activity	No Take		
Tuesday, November 8, 2022	Alki	Heavy Wind, Whitecaps, Sunny	HS	1	7:45	7:45	No	3050	241	Resting	No Pile Activity	No Take		

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Tuesday, November 8, 2022	Alki	Sunny, Heavy Wind, Whitecaps	HS	1	8:00	15:56	No	3250	233	Resting	No Pile Activity	No Take		Baby harbor seal has been resting on the boat ramp since this morning. A veterinarian came to check him out and said that he looked fine. Volunteers reported the seal has been on the beach for at least a full day now. Recently weaned pup.
Tuesday, November 8, 2022	Alki	Heavy Wind, Whitecaps, Sunny	CSL	1	8:25	8:29	No	3100	240	Swimming	No Pile Activity	No Take		Observed swimming west.
Tuesday, November 8, 2022	Alki	Heavy Wind, Whitecaps, Sunny	CSL	1	8:38	8:39	No	3500	250	Resting	No Pile Activity	No Take		Previously observed swimming west earlier in the day.
Tuesday, November 8, 2022	Alki	Heavy Wind, Whitecaps, Sunny	CSL	1	9:08	9:20	No	3100	240	Swimming	No Pile Activity	No Take		
Tuesday, November 8, 2022	Alki	Sunny, Heavy Wind, Whitecaps	HS	1	9:28	9:43	No	3150	241	Resting	No Pile Activity	No Take		Swimming around and occasionally popping head up.
Tuesday, November 8, 2022	Alki	Sunny, Heavy Wind, Whitecaps	HS	1	11:52	11:52	No	3500	248	Swimming	No Pile Activity	No Take		
Tuesday, November 8, 2022	Alki	Sunny, Heavy Wind, Whitecaps	CSL	1	14:09	14:09	No	3350	246	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	Observed swimming west.
Tuesday, November 8, 2022	Pier 63	Overcast	CSL	1	9:15	9:17	No	80	240	Swimming	No Pile Activity	No Take		
Tuesday, November 8, 2022	Ferry	Sunny, Moderate Wind	KW	2	8:10	8:16	No	9000	240	Swimming	No Pile Activity	No Take		
Tuesday, November 8, 2022	Ferry	Sunny, Moderate Wind	HS	1	8:37	8:45	No	1280	308	Resting	No Pile Activity	No Take		
Tuesday, November 8, 2022	Magnolia	Overcast, Light Wind	HS	3	7:18	7:19	No	5000	300	Swimming	No Pile Activity	No Take		
Tuesday, November 8, 2022	Magnolia	Overcast, Light Wind	HS	1	7:38	7:38	No	5000	300	Swimming	No Pile Activity	No Take		
Tuesday, November 8, 2022	Magnolia	Overcast, Light Wind	HS	1	7:57	7:58	No	5000	300	Swimming	No Pile Activity	No Take		
Tuesday, November 8, 2022	Magnolia	Overcast, Light Wind	HS	1	8:00	8:02	No	5000	300	Swimming	No Pile Activity	No Take		
Tuesday, November 8, 2022	Magnolia	Overcast, Light Wind	HS	1	8:11	8:11	No	5000	300	Swimming	No Pile Activity	No Take		
Tuesday, November 8, 2022	Magnolia	Overcast, Light Wind, Sunny	HS	2	8:30	8:31	No	5000	300	Swimming	No Pile Activity	No Take		
Tuesday, November 8, 2022	Magnolia	Overcast, Light Wind, Sunny	HS	1	8:43	8:44	No	5000	300	Swimming	No Pile Activity	No Take		
Tuesday, November 8, 2022	Magnolia	Overcast, Light Wind, Sunny	HS	1	10:11	10:12	No	5000	300	Swimming	No Pile Activity	No Take		
Tuesday, November 8, 2022	Magnolia	Overcast, Light Wind, Sunny	HS	1	10:15	10:15	No	5000	300	Swimming	No Pile Activity	No Take		Previously observed and recorded as a take of the day.
Tuesday, November 8, 2022	Magnolia	Overcast, Light Wind, Sunny	KW	7	10:45	10:46	Yes	7300	300	Swimming	No Pile Activity	No Take		Difficult to accurately count the number of individuals; very hard to see with the intense whitecaps and wind.
Tuesday, November 8, 2022	Magnolia	Sunny, Overcast, Whitecaps, Moderate Wind	KW	8	10:54	10:55	Yes	7300	300	Swimming	No Pile Activity	No Take		Difficult to accurately count the number of individuals; very hard to see with the intense whitecaps and wind. The group did not enter the exclusion zone until after pile work had ended.

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Tuesday, November 8, 2022	Magnolia	Sunny, Overcast, Whitecaps, Moderate Wind	HS	1	11:51	11:52	No	5000	300	Swimming	No Pile Activity	No Take		
Tuesday, November 8, 2022	Magnolia	Sunny, Overcast, Whitecaps, Moderate Wind	HS	1	12:23	12:24	No	5000	300	Swimming	No Pile Activity	No Take		
Tuesday, November 8, 2022	Magnolia	Sunny, Overcast, Whitecaps, Moderate Wind	HS	1	15:01	15:01	No	5000	300	Swimming	No Pile Activity	No Take		
Wednesday, November 9, 2022	Alki	Light Wind, Sunny	HS	1	7:16	7:31	No	3750	250	Intermittent	No Pile Activity	No Take		
Wednesday, November 9, 2022	Alki	Sunny	HS	1	8:01	8:08	No	3500	250	Resting	No Pile Activity	No Take		
Wednesday, November 9, 2022	Alki	Sunny	CSL	2	8:14	8:15	No	3250	255	Swimming	No Pile Activity	No Take		Observed swimming south.
Wednesday, November 9, 2022	Alki	Sunny	CSL	1	8:25	8:57	No	3750	250	Intermittent	Reaction Observed	Level B	Vibratory Install Steel 30-inch	Was resting and slowly floating east until hammer turned on, then began swimming east.
Wednesday, November 9, 2022	Alki	Sunny	KW	10	9:35	10:28	No	8500	235	Swimming	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	Observed swimming east out of the bay.
Wednesday, November 9, 2022	Alki	Sunny	HS	1	10:29	10:31	No	5000	250	Foraging	No Pile Activity	No Take		
Wednesday, November 9, 2022	Alki	Sunny	HS	1	10:49	11:00	No	3750	250	Foraging	No Pile Activity	No Take		
Wednesday, November 9, 2022	Alki	Sunny	HS	1	11:54	12:14	No	3750	250	Resting	No Pile Activity	No Take		
Wednesday, November 9, 2022	Alki	Sunny	CSL	1	13:25	13:52	No	4000	250	Foraging	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Wednesday, November 9, 2022	Alki	Sunny	HS	1	14:21	14:22	No	3100	245	Resting	No Pile Activity	Level B		
Wednesday, November 9, 2022	Alki	Sunny	HS	1	15:19	15:42	No	3750	250	Resting	No Pile Activity	Level B		
Wednesday, November 9, 2022	Alki	Sunny	KW	5	15:27	15:45	No	9000	245	Swimming	No Pile Activity	No Take		
Wednesday, November 9, 2022	Pier 63	Sunny, Light Wind	CSL	1	7:16	7:23	No	75	210	Swimming	No Pile Activity	No Take		Observed swimming south out of vision.
Wednesday, November 9, 2022	Pier 58	Sunny	CSL	1	7:22	7:23	No	120	270	Swimming	No Pile Activity	No Take		
Wednesday, November 9, 2022	Pier 63	Sunny, Light Wind	CSL	1	8:14	8:16	No	80	180	Swimming	No Pile Activity	No Take		
Wednesday, November 9, 2022	Pier 63	Sunny, Light Wind	HS	1	8:34	8:36	No	100	255	Swimming	No Pile Activity	Level B		
Wednesday, November 9, 2022	Pier 63	Sunny, Light Wind	CSL	1	9:43	9:44	No	200	300	Swimming	No Pile Activity	Level B		Observed swimming south.
Wednesday, November 9, 2022	Pier 58	Sunny	HS	1	10:26	10:28	No	100	180	Intermittent	No Pile Activity	No Take		
Wednesday, November 9, 2022	Ferry	Sunny	CSL	1	8:54	8:54	No	500	180	Swimming	No Pile Activity	Level B		
Wednesday, November 9, 2022	Ferry	Sunny	KW	20	9:41	10:08	Yes	4000	285	Swimming	No Pile Activity	No Take		Killer whales heading southbound. Multiple individuals (20+). Mainly stayed outside of Exclusion Zone but spotted within the zone after work ended. Very spread out.
Wednesday, November 9, 2022	Magnolia	Sunny	HS	1	7:26	7:28	No	5000	303	Swimming	No Pile Activity	No Take		
Wednesday, November 9, 2022	Magnolia	Sunny	HS	1	7:45	7:50	No	5000	303	Swimming	No Pile Activity	No Take		
Wednesday, November 9, 2022	Magnolia	Sunny	HS	1	9:05	9:05	No	5000	300	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Wednesday, November 9, 2022	Magnolia	Sunny	KW	4	9:40	9:44	Yes	7500	255	Swimming	No Pile Activity	No Take		
Wednesday, November 9, 2022	Magnolia	Sunny	HS	2	9:43	9:45	No	5000	303	Swimming	No Pile Activity	Level B		
Wednesday, November 9, 2022	Magnolia	Sunny	HS	1	12:07	12:08	No	5000	303	Swimming	No Pile Activity	No Take		
Wednesday, November 9, 2022	Magnolia	Sunny	HS	1	12:23	12:24	No	5000	303	Swimming	No Pile Activity	No Take		
Wednesday, November 9, 2022	Magnolia	Sunny	HS	1	14:46	14:48	No	5000	300	Swimming	No Pile Activity	Level B		
Wednesday, November 9, 2022	Magnolia	Sunny	HS	1	15:26	15:26	No	5000	303	Swimming	No Pile Activity	Level B		
Thursday, November 10, 2022	Alki	Overcast	CSL	2	7:12	7:47	No	3500	250	Resting	No Pile Activity	No Take		

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Thursday, November 10, 2022	Alki	Overcast	KW	4	7:26	7:35	No	7000	240	Swimming	No Pile Activity	No Take		
Thursday, November 10, 2022	Alki	Overcast	HS	1	8:10	8:12	No	3100	245	Resting	No Pile Activity	No Take		
Thursday, November 10, 2022	Alki	Overcast	CSL	2	8:16	9:34	No	3500	250	Intermittent	No Reaction Observed	No Take	Impact Install Steel 30-inch	Previously observed and recorded as a take of the day.
Thursday, November 10, 2022	Alki	Overcast	CSL	1	8:24	10:10	No	3900	247	Intermittent	No Pile Activity	Level B		
Thursday, November 10, 2022	Alki	Overcast	HS	1	8:38	8:40	No	3500	250	Swimming	No Pile Activity	No Take		
Thursday, November 10, 2022	Alki	Overcast	HS	1	9:20	9:24	No	3600	248	Swimming	No Pile Activity	No Take		
Thursday, November 10, 2022	Alki	Overcast, Sunny	CSL	1	9:25	9:31	No	3500	255	Swimming	No Pile Activity	No Take		
Thursday, November 10, 2022	Alki	Overcast	KW	3	9:51	10:32	No	9000	250	Swimming	No Pile Activity	No Take		
Thursday, November 10, 2022	Alki	Overcast	CSL	1	10:44	10:52	No	4200	245	Resting	No Pile Activity	No Take		
Thursday, November 10, 2022	Alki	Overcast	CSL	2	10:52	10:52	No	3500	250	Resting	No Pile Activity	Level B		Previously observed and recorded as a take of the day.
Thursday, November 10, 2022	Alki	Overcast	CSL	2	12:10	12:39	No	3750	250	Swimming	No Pile Activity	No Take		Observed swimming west along shore to where another California Sea Lion was observed. Previously observed and recorded as a take of the day.
Thursday, November 10, 2022	Alki	Overcast	CSL	1	12:29	15:25	No	4000	247	Intermittent	No Pile Activity	No Take		Observed mostly rested in the area with some foraging. Previously observed and recorded as a take of the day.
Thursday, November 10, 2022	Alki	Overcast	HS	1	12:29	12:39	No	4000	247	Resting	No Pile Activity	No Take		
Thursday, November 10, 2022	Alki	Overcast	CSL	1	12:54	12:59	No	3100	255	Swimming	No Pile Activity	Level B		
Thursday, November 10, 2022	Alki	Overcast	CSL	2	14:21	14:21	No	3750	250	Swimming	No Pile Activity	No Take		Observed swimming northeast into Elliott Bay. Previously observed and recorded as a take of the day.
Thursday, November 10, 2022	Alki	Overcast	HS	1	14:21	14:40	No	3100	245	Swimming	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	Observed moving from resting point to the boat launch ramp. Previously observed and recorded as a take of the day.
Thursday, November 10, 2022	Pier 58	Overcast	HS	1	13:45	13:46	No	100	290	Swimming	No Pile Activity	Level B		
Thursday, November 10, 2022	Pier 58	Overcast	HS	1	15:16	15:18	No	80	275	Swimming	No Pile Activity	Level B		
Thursday, November 10, 2022	Ferry	Overcast, Sunny	KW	2	7:18	7:24	Yes	7000	255	Swimming	No Pile Activity	No Take		Killer whale network reported a large pod traveling south, but I only saw a few of them.
Thursday, November 10, 2022	Ferry	Overcast, Sunny	KW	8	9:50	10:05	No	9000	250	Foraging	No Pile Activity	No Take		Observed a lot of big splashes, so may have been foraging or playing. Heading north.
Thursday, November 10, 2022	Ferry	Overcast, Sunny	KW	5	10:53	11:07	No	8000	312	Swimming	No Pile Activity	No Take		Same killer whales from earlier coming north. Spotted over by discovery. I saw about 5, but there's probably more spread out. I think this is the trailing group, so the rest might be further north.

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Thursday, November 10, 2022	Ferry	Overcast, Sunny	HS	1	13:50	13:50	No	2000	255	Swimming	No Pile Activity	Level B		
Thursday, November 10, 2022	Magnolia	Sunny	HS	1	7:18	7:19	No	5000	303	Swimming	No Pile Activity	No Take		
Thursday, November 10, 2022	Magnolia	Sunny	HS	1	8:03	8:03	No	5000	303	Swimming	No Pile Activity	No Take		
Thursday, November 10, 2022	Magnolia	Sunny	HS	1	9:02	9:02	No	5000	303	Swimming	No Pile Activity	No Take		
Thursday, November 10, 2022	Magnolia	Sunny	HS	1	10:07	10:07	No	5000	303	Swimming	No Pile Activity	Level B		
Thursday, November 10, 2022	Magnolia	Sunny	HS	2	11:24	11:26	No	5000	303	Swimming	No Pile Activity	Level B		
Thursday, November 10, 2022	Magnolia	Sunny	HS	5	11:25	11:27	No	5000	303	Swimming	No Pile Activity	Level B		
Thursday, November 10, 2022	Magnolia	Sunny	HS	1	14:38	14:38	No	5000	303	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Friday, November 11, 2022	Alki	Light Wind, Overcast	CSL	1	7:47	7:51	No	3250	255	Swimming	No Pile Activity	No Take		
Friday, November 11, 2022	Alki	Light Wind, Overcast	CSL	2	8:17	8:17	No	3500	250	Swimming	No Pile Activity	No Take		Spotted swimming west.
Friday, November 11, 2022	Alki	Light Wind, Overcast	CSL	1	8:17	8:29	No	3100	250	Foraging	No Pile Activity	No Take		
Friday, November 11, 2022	Alki	Overcast, Light Wind	HS	1	8:39	9:56	No	3400	247	Intermittent	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Friday, November 11, 2022	Alki	Light Wind, Overcast	CSL	1	9:59	10:34	No	3500	250	Resting	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Friday, November 11, 2022	Alki	Overcast, Light Wind	HS	1	10:24	10:27	No	3750	253	Resting	No Pile Activity	No Take		
Friday, November 11, 2022	Alki	Overcast, Light Wind	HS	1	10:52	11:37	No	3100	245	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Friday, November 11, 2022	Ferry	Overcast	HS	1	7:24	7:25	No	80	280	-	No Pile Activity	No Take		
Friday, November 11, 2022	Ferry	Overcast	HS	1	9:25	9:27	No	500	225	Swimming	No Pile Activity	No Take		
Friday, November 11, 2022	Magnolia	Overcast	HS	1	10:22	10:24	No	5000	304	Swimming	No Pile Activity	No Take		
Monday, November 14, 2022	Alki	Sunny, Light Wind, Moderate Wind	CSL	1	8:50	10:24	No	3200	250	Intermittent	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Monday, November 14, 2022	Alki	Sunny, Light Wind, Moderate Wind	CSL	1	13:18	13:23	No	2000	240	Foraging	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Monday, November 14, 2022	Alki	Sunny, Light Wind, Moderate Wind	HS	1	14:25	14:27	No	3000	245	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Monday, November 14, 2022	Pier 58	Sunny	CSL	1	7:34	7:36	No	300	270	Swimming	No Pile Activity	No Take		
Monday, November 14, 2022	Pier 58	Sunny	CSL	1	7:39	7:39	No	200	290	Swimming	No Pile Activity	No Take		
Monday, November 14, 2022	Pier 58	Sunny	CSL	1	8:08	8:10	No	150	260	Swimming	No Pile Activity	No Take		
Monday, November 14, 2022	Ferry	Sunny, Overcast, Heavy Wind	CSL	1	9:15	9:16	No	6900	270	Foraging	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Monday, November 14, 2022	Magnolia	Sunny	HS	2	7:26	7:26	No	5000	300	Swimming	No Pile Activity	No Take		
Monday, November 14, 2022	Magnolia	Sunny	HS	1	7:37	7:37	No	5000	300	Swimming	No Pile Activity	No Take		
Monday, November 14, 2022	Magnolia	Sunny	HS	1	7:45	7:46	No	5000	300	Swimming	No Pile Activity	No Take		
Monday, November 14, 2022	Magnolia	Sunny	HS	1	7:48	7:49	No	5000	300	Swimming	No Pile Activity	No Take		
Monday, November 14, 2022	Magnolia	Sunny	CSL	1	10:26	10:26	No	5000	300	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Monday, November 14, 2022	Magnolia	Sunny	HS	1	12:34	12:35	No	5000	300	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Tuesday, November 15, 2022	Alki	Sunny, Moderate Wind	HS	1	8:01	8:03	No	3100	245	Swimming	No Pile Activity	Level B		
Tuesday, November 15, 2022	Alki	Sunny, Moderate Wind	CSL	1	10:17	10:25	No	3000	250	Swimming	No Pile Activity	Level B		
Tuesday, November 15, 2022	Alki	Sunny, Moderate Wind	CSL	1	10:54	11:28	No	3250	245	Foraging	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Tuesday, November 15, 2022	Alki	Sunny, Moderate Wind	CSL	1	12:50	13:04	No	3500	250	Foraging	No Pile Activity	No Take		Previously observed earlier in the day.
Tuesday, November 15, 2022	Alki	Sunny, Moderate Wind	CSL	1	12:55	13:04	No	3500	250	Swimming	No Pile Activity	No Take		Observed entering area to forage with another California sea lion that was already present.

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Tuesday, November 15, 2022	Pier 63	Sunny	HS	1	7:19	7:24	No	200	165	Swimming	No Pile Activity	No Take		
Tuesday, November 15, 2022	Pier 63	Sunny	CSL	1	9:11	9:12	No	350	300	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	Swam out from under Pier 62, then swam southwest.
Tuesday, November 15, 2022	Pier 63	Sunny	HS	1	10:18	10:19	No	350	240	Swimming	No Pile Activity	Level B		Appeared once and did not resurface again.
Tuesday, November 15, 2022	Pier 58	Sunny, Light Wind	CSL	1	14:35	14:35	No	100	265	Swimming	Reaction Observed	Level B	Impact Install Steel 30-inch	Observed breaching whilst leaving the Level B zone while the impact hammer was on.
Tuesday, November 15, 2022	Ferry	Sunny	HS	1	7:34	7:38	No	11279	270	Swimming	No Pile Activity	No Take		
Tuesday, November 15, 2022	Magnolia	Sunny, Whitecaps	HS	1	7:22	7:26	No	5000	303	Swimming	No Pile Activity	No Take		Very curious about person swimming.
Tuesday, November 15, 2022	Magnolia	Sunny, Whitecaps	HS	1	7:33	7:42	No	5100	303	Swimming	No Pile Activity	No Take		Occasionally pops head out of water and looks at swimmers.
Tuesday, November 15, 2022	Magnolia	Sunny, Whitecaps	HS	1	7:41	7:42	No	5050	302	Swimming	No Pile Activity	No Take		Swam slowly across my line of sight, just hanging out and stretching some.
Tuesday, November 15, 2022	Magnolia	Sunny, Whitecaps	HS	1	7:46	7:46	No	5000	303	Swimming	No Pile Activity	No Take		Popped head up to look at paddleboarder.
Tuesday, November 15, 2022	Magnolia	Sunny, Whitecaps	CSL	1	7:48	8:12	No	5050	302	Swimming	No Pile Activity	Level B		Swam slowly across my line of sight, just hanging out and stretching some.
Tuesday, November 15, 2022	Magnolia	Sunny	HS	1	8:01	8:01	No	5000	303	Swimming	No Pile Activity	Level B		Popped head up to look at paddleboarder.
Tuesday, November 15, 2022	Magnolia	Sunny	HS	1	8:35	8:35	No	5050	303	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Tuesday, November 15, 2022	Magnolia	Sunny	HS	1	8:47	8:47	No	5000	303	Swimming	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	Previously observed and recorded as a take of the day.
Tuesday, November 15, 2022	Magnolia	Sunny	HS	1	9:43	9:43	No	5100	303	Swimming	No Pile Activity	No Take		
Tuesday, November 15, 2022	Magnolia	Sunny	HS	1	12:50	12:51	No	5100	303	Resting	No Pile Activity	No Take		Popped head up to look at paddleboarder.
Wednesday, November 16, 2022	Alki	Sunny, Light Wind	HS	1	8:02	8:09	No	3500	250	Foraging	No Pile Activity	Level B		
Wednesday, November 16, 2022	Alki	Sunny, Light Wind	CSL	1	8:12	8:16	No	3200	245	Foraging	No Pile Activity	Level B		
Wednesday, November 16, 2022	Alki	Sunny, Light Wind	HS	1	8:29	8:31	No	4000	247	Resting	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	Previously observed and recorded as a take of the day.
Wednesday, November 16, 2022	Alki	Sunny, Light Wind	CSL	1	9:25	10:01	No	3500	250	Foraging	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	Previously observed and recorded as a take of the day.
Wednesday, November 16, 2022	Alki	Sunny, Light Wind	CSL	1	9:42	9:55	No	3250	250	Foraging	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Wednesday, November 16, 2022	Alki	Sunny, Light Wind	CSL	1	12:05	12:17	No	3500	250	Resting	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, November 16, 2022	Alki	Sunny, Light Wind	CSL	1	12:12	12:15	No	3250	250	Foraging	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, November 16, 2022	Pier 63	Sunny	HS	1	10:27	10:28	No	320	300	Swimming	No Pile Activity	Level B		Surfaced once before diving and not appearing again.

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Wednesday, November 16, 2022	Pier 63	Sunny	CSL	1	11:47	11:49	No	200	240	Swimming	No Reaction Observed	Level B	Impact Install Steel 30-inch	Surfaced out of water and "porpoised" a few times. Headed south-southwest.
Wednesday, November 16, 2022	Ferry	Sunny, Moderate Wind	HS	1	8:27	8:27	No	3000	270	Resting	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	Observed resting on the surface, and then diving underwater as the ferry moved past.
Wednesday, November 16, 2022	Ferry	Sunny, Moderate Wind	HS	1	10:11	10:11	No	500	210	Resting	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	Looked really small, perhaps a juvenile. Stayed on the surface for a while and then went under when the ferry got closer.
Wednesday, November 16, 2022	Magnolia	Sunny	HS	1	7:25	8:08	No	5000	300	Swimming	No Pile Activity	Level B		
Wednesday, November 16, 2022	Magnolia	Sunny	CSL	2	10:47	10:49	No	5000	300	Swimming	No Pile Activity	No Take		
Wednesday, November 16, 2022	Magnolia	Sunny	CSL	1	12:13	12:14	No	5000	300	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, November 16, 2022	Magnolia	Sunny	HS	1	12:17	12:22	No	5000	300	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, November 16, 2022	Magnolia	Sunny	HS	1	12:45	12:50	No	5000	300	Intermittent	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Thursday, November 17, 2022	Alki	Sunny	CSL	1	7:56	7:59	No	3500	250	Foraging	No Pile Activity	No Take		
Thursday, November 17, 2022	Alki	Sunny	HS	1	8:33	8:35	No	4000	255	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Thursday, November 17, 2022	Alki	Sunny	CSL	1	9:16	9:17	No	3500	248	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Thursday, November 17, 2022	Alki	Sunny	CSL	1	13:10	13:11	No	4000	255	Swimming	No Pile Activity	No Take		
Thursday, November 17, 2022	Pier 58	Sunny	HS	1	8:11	8:11	No	100	280	-	No Pile Activity	Level B		
Thursday, November 17, 2022	Ferry	Sunny	CSL	1	9:46	9:48	No	12500	278	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Thursday, November 17, 2022	Ferry	Sunny	CSL	3	11:00	11:03	No	10000	270	-	No Pile Activity	No Take		
Thursday, November 17, 2022	Ferry	Sunny	HS	1	11:57	11:58	No	2000	255	-	No Pile Activity	No Take		
Thursday, November 17, 2022	Magnolia	Sunny	HS	1	8:26	8:30	No	5000	300	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Friday, November 18, 2022	Alki	Sunny, Light Wind	HS	1	7:27	8:06	No	3400	250	Swimming	No Pile Activity	No Take		
Friday, November 18, 2022	Alki	Sunny, Light Wind	HS	1	8:46	11:21	No	4000	245	Resting	No Pile Activity	No Take		
Friday, November 18, 2022	Alki	Sunny, Light Wind	CSL	1	10:18	10:20	No	3200	250	Swimming	No Pile Activity	No Take		
Friday, November 18, 2022	Pier 58	Sunny	HS	1	8:42	8:42	No	100	240	Swimming	No Pile Activity	No Take		
Friday, November 18, 2022	Pier 58	Sunny	HS	1	9:56	9:59	No	100	270	Swimming	No Pile Activity	No Take		
Friday, November 18, 2022	Pier 58	Sunny	HS	1	11:28	11:29	No	100	270	Swimming	No Pile Activity	No Take		
Friday, November 18, 2022	Pier 58	Sunny	HS	1	11:52	0:02	No	80	245	Intermittent	No Pile Activity	No Take		Diving and resurfacing.
Friday, November 18, 2022	Ferry	Sunny, Heavy Wind	CSL	1	12:25	12:26	No	500	150	Swimming	No Pile Activity	No Take		
Friday, November 18, 2022	Magnolia	Sunny	HS	1	7:19	7:48	No	5000	303	Swimming	No Pile Activity	No Take		Observed swimming west then back to Magnolia/marina to forage.
Friday, November 18, 2022	Magnolia	Sunny	HS	1	7:27	7:46	No	4500	304	Swimming	No Pile Activity	No Take		Observed foraging and swimming in front of magnolia with another harbor seal.
Friday, November 18, 2022	Magnolia	Sunny	HS	1	7:54	8:30	No	4800	300	Foraging	No Pile Activity	No Take		Entered area from west, foraged, then swam west out of sight

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Friday, November 18, 2022	Magnolia	Sunny	CSL	1	8:06	8:43	No	5000	290	Swimming	No Pile Activity	No Take		Observed swimming east to marina then back west out of bay, surfaced often while foraging.
Friday, November 18, 2022	Magnolia	Sunny	HS	1	8:54	8:57	No	4500	304	Swimming	No Pile Activity	No Take		Observed swimming west.
Friday, November 18, 2022	Magnolia	Sunny	CSL	1	10:06	10:10	No	6000	290	Swimming	No Pile Activity	No Take		
Monday, November 21, 2022	Alki	Overcast	HS	1	7:39	13:29	No	3400	250	Intermittent	No Pile Activity	No Take		
Monday, November 21, 2022	Alki	Overcast	CSL	4	7:55	9:33	No	3200	250	Swimming	No Pile Activity	No Take		Spent time resting and foraging while swimming around the area.
Monday, November 21, 2022	Alki	Overcast	HS	1	8:27	8:29	No	3000	245	Swimming	No Pile Activity	No Take		
Monday, November 21, 2022	Alki	Overcast	CSL	3	9:47	10:54	No	3750	250	Intermittent	No Pile Activity	No Take		Same group as initially observed, however one member of the group left and was no longer visible in the area.
Monday, November 21, 2022	Alki	Overcast	CSL	2	13:18	13:42	No	3750	250	Resting	No Pile Activity	No Take		Both were resting and were part of the California sea lion group observed previously.
Monday, November 21, 2022	Ferry	Overcast	CSL	1	11:25	11:26	No	10000	280	Swimming	No Pile Activity	No Take		
Monday, November 21, 2022	Ferry	Overcast	HS	1	11:44	11:46	No	1000	270	Swimming	No Pile Activity	No Take		
Monday, November 21, 2022	Ferry	Overcast	HS	1	13:09	13:11	No	12500	278	Swimming	No Pile Activity	No Take		
Monday, November 21, 2022	Ferry	Overcast	CSL	1	13:21	13:22	No	11100	278	Swimming	No Pile Activity	No Take		
Monday, November 21, 2022	Magnolia	Sunny	HS	1	7:39	8:17	No	5000	300	Intermittent	No Pile Activity	No Take		
Monday, November 21, 2022	Magnolia	Sunny	HS	1	7:52	8:11	No	5100	300	Intermittent	No Pile Activity	No Take		
Monday, November 21, 2022	Magnolia	Sunny	HS	1	8:06	8:12	No	5000	300	Swimming	No Pile Activity	No Take		
Monday, November 21, 2022	Magnolia	Sunny	CSL	1	8:56	11:53	No	6000	300	Intermittent	No Pile Activity	No Take		
Monday, November 21, 2022	Magnolia	Sunny	HS	1	8:57	10:53	No	6000	300	Swimming	No Pile Activity	No Take		
Tuesday, November 22, 2022	Alki	Heavy Rain, Overcast	HS	1	10:02	10:02	No	2500	255	Resting	No Pile Activity	No Take		
Tuesday, November 22, 2022	Alki	Heavy Rain, Overcast	CSL	1	11:13	11:15	No	3500	255	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Tuesday, November 22, 2022	Alki	Heavy Rain, Overcast	CSL	1	13:13	13:24	No	3000	250	Intermittent	No Reaction Observed	No Take	Impact Install Steel 30-inch	May have been foraging because there were some big splashes, but it didn't stay in the area so may have just been passing through.
Tuesday, November 22, 2022	Alki	Heavy Rain, Overcast	HS	1	13:17	13:17	No	3375	249	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Tuesday, November 22, 2022	Pier 58	Light Rain, Overcast	CSL	1	9:08	9:10	No	100	270	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Tuesday, November 22, 2022	Pier 63	Light Rain, Heavy Rain, Fog	CSL	1	9:09	9:12	No	300	165	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	Observed swimming south toward ferry dock.
Tuesday, November 22, 2022	Pier 63	Light Rain, Heavy Rain, Fog	CSL	1	13:14	13:16	No	500	285	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	Observed swimming west out of the bay.
Tuesday, November 22, 2022	Ferry	Fog, Light Rain, Overcast	HS	1	8:24	8:26	No	10800	255	Swimming	No Pile Activity	No Take		
Wednesday, November 23, 2022	Alki	Overcast	HS	1	7:32	8:45	No	3500	250	Intermittent	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, November 23, 2022	Alki	Overcast	CSL	1	8:49	8:51	No	3750	255	Foraging	No Reaction Observed	No Take	Impact Install Steel 30-inch	

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Wednesday, November 23, 2022	Alki	Overcast	CSL	1	9:39	9:45	No	2800	240	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, November 23, 2022	Pier 58	Sunny	HS	1	8:30	8:31	No	65	315	Swimming	No Reaction Observed	Level B	Impact Install Steel 30-inch	
Monday, November 28, 2022	Alki	Overcast, Light Rain, Snow/Sleet/Hail	CSL	1	8:03	11:18	No	3250	250	Intermittent	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Monday, November 28, 2022	Alki	Overcast, Light Rain, Snow/Sleet/Hail	CSL	2	9:04	11:34	No	3000	240	Intermittent	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Monday, November 28, 2022	Alki	Overcast, Light Rain, Snow/Sleet/Hail	HS	1	10:22	10:24	No	3100	245	Resting	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Monday, November 28, 2022	Pier 58	Light Rain	HS	1	8:10	8:13	No	10	270	Swimming	No Pile Activity	No Take		
Tuesday, November 29, 2022	Alki	Overcast, Snow/Sleet/Hail, Light Rain, Moderate Wind	HS	1	9:04	13:10	No	3100	245	Intermittent	No Reaction Observed	No Take	Impact Install Steel 30-inch	Intermittent viewing. Either resting or foraging.
Tuesday, November 29, 2022	Alki	Overcast, Snow/Sleet/Hail, Light Rain, Moderate Wind	CSL	1	9:15	12:11	No	3250	250	Foraging	No Reaction Observed	No Take	Impact Install Steel 30-inch	Intermittent viewing. Either resting or foraging.
Tuesday, November 29, 2022	Pier 58	Light Rain, Fog, Snow/Sleet/Hail	CSL	1	7:58	7:59	No	100	265	Swimming	No Pile Activity	Level B		
Tuesday, November 29, 2022	Ferry	Snow/Sleet/Hail, Overcast, Fog, Light Rain	HS	1	10:58	10:58	No	120	160	Swimming	No Pile Activity	Level B		
Tuesday, November 29, 2022	Magnolia	Moderate Wind, Snow/Sleet/Hail, Whitecaps, Fog	HS	1	9:40	9:41	No	6000	303	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Tuesday, November 29, 2022	Magnolia	Moderate Wind, Snow/Sleet/Hail, Whitecaps, Fog	HS	1	11:55	11:57	No	6000	303	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, November 30, 2022	Alki	Overcast, Light Wind, Snow/Sleet/Hail	CSL	2	7:56	8:30	No	3000	240	Foraging	No Pile Activity	No Take		
Wednesday, November 30, 2022	Alki	Overcast, Light Wind, Snow/Sleet/Hail	CSL	1	9:12	9:24	No	3750	250	-	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, November 30, 2022	Alki	Overcast, Light Wind, Snow/Sleet/Hail	CSL	1	9:35	9:42	No	3000	240	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, November 30, 2022	Alki	Overcast, Light Wind, Snow/Sleet/Hail	CSL	1	11:54	13:12	No	3500	250	Intermittent	No Pile Activity	No Take		
Wednesday, November 30, 2022	Alki	Overcast, Light Wind, Snow/Sleet/Hail	CSL	1	12:43	12:45	No	3500	250	Foraging	No Pile Activity	No Take		
Wednesday, November 30, 2022	Alki	Overcast, Light Rain	CSL	2	13:21	13:31	No	3250	250	Swimming	No Pile Activity	No Take		
Wednesday, November 30, 2022	Ferry	Overcast, Moderate Wind, Fog, Light Rain	CSL	1	8:05	8:06	No	11600	270	Foraging	No Pile Activity	No Take		
Wednesday, November 30, 2022	Ferry	Overcast, Moderate Wind, Fog, Light Rain	CSL	1	12:04	12:07	No	800	155	Swimming	No Pile Activity	No Take		
Wednesday, November 30, 2022	Magnolia	Light Wind	HS	1	7:57	7:58	No	5000	302	Swimming	No Pile Activity	No Take		Observed swimming towards the marina.
Wednesday, November 30, 2022	Magnolia	Light Wind	HS	1	8:42	8:44	No	5200	303	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Thursday, December 1, 2022	Alki	Moderate Wind, Whitecaps	HS	1	8:40	8:51	No	3100	245	Foraging	No Reaction Observed	Level B	Impact Install Steel 30-inch	
Thursday, December 1, 2022	Pier 58	Overcast	CSL	2	8:01	8:02	No	100	270	Swimming	No Pile Activity	Level B		
Thursday, December 1, 2022	Magnolia	Overcast, Light Wind	HS	2	7:44	7:49	No	5000	300	Swimming	No Pile Activity	No Take		
Thursday, December 1, 2022	Magnolia	Overcast, Light Wind	CSL	1	7:51	7:56	No	5000	300	Swimming	No Pile Activity	No Take		
Friday, December 2, 2022	Alki	Sunny	HS	1	9:34	12:11	No	3000	240	Intermittent	No Pile Activity	No Take		
Friday, December 2, 2022	Ferry	Overcast	HS	1	10:54	10:54	No	2000	270	Resting	No Pile Activity	No Take		
Friday, December 2, 2022	Ferry	Overcast	HS	1	10:58	10:58	No	500	210	Resting	No Pile Activity	No Take		
Monday, December 5, 2022	Alki	Overcast	CSL	1	7:47	8:07	No	3500	250	Swimming	No Pile Activity	No Take		
Monday, December 5, 2022	Alki	Overcast	KW	6	10:51	12:08	No	7000	255	Swimming	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	Were confirmed outside of Exclusion Zone when the vibe was on. Entered the Exclusion zone after pile work ended.
Monday, December 5, 2022	Alki	Overcast	HS	1	11:08	11:08	No	3500	250	Foraging	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Monday, December 5, 2022	Alki	Overcast	CSL	1	12:40	12:43	No	3100	245	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Monday, December 5, 2022	Alki	Overcast	CSL	1	14:01	14:06	No	3750	252	Foraging	No Pile Activity	Level B		
Monday, December 5, 2022	Pier 58	Overcast	CSL	1	8:16	8:16	No	100	245	Swimming	No Pile Activity	No Take		
Monday, December 5, 2022	Pier 58	Overcast	CSL	1	8:27	8:27	No	150	275	Swimming	No Pile Activity	No Take		
Monday, December 5, 2022	Ferry	Overcast, Light Wind, Whitecaps	HS	1	8:25	8:28	No	1500	225	Intermittent	No Pile Activity	No Take		
Monday, December 5, 2022	Ferry	Overcast, Light Wind, Whitecaps	HS	1	8:31	8:32	No	1200	255	Swimming	No Pile Activity	No Take		
Monday, December 5, 2022	Ferry	Overcast, Light Wind, Whitecaps	HS	2	9:32	9:34	No	3000	270	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Monday, December 5, 2022	Ferry	Overcast, Light Wind, Whitecaps	KW	4	11:30	11:40	No	6000	242	Swimming	No Pile Activity	No Take		
Monday, December 5, 2022	Ferry	Overcast, Light Wind, Whitecaps	KW	3	11:43	11:52	Yes	5500	255	Swimming	No Pile Activity	No Take		
Monday, December 5, 2022	Magnolia	Overcast	HS	1	7:55	7:57	No	5000	300	Swimming	No Pile Activity	No Take		
Monday, December 5, 2022	Magnolia	Overcast	HS	2	8:09	8:11	No	5000	300	Swimming	No Pile Activity	No Take		
Monday, December 5, 2022	Magnolia	Overcast	HS	1	11:14	11:16	No	5000	300	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Tuesday, December 6, 2022	Alki	Overcast, Light Wind	CSL	1	7:44	12:42	No	3100	240	Intermittent	No Reaction Observed	No Take	Impact Install Steel 30-inch	Observed swimming away.
Tuesday, December 6, 2022	Alki	Overcast, Light Wind	CSL	1	7:53	11:13	No	3100	240	Intermittent	No Pile Activity	No Take		Observed farther away in morning.
Tuesday, December 6, 2022	Alki	Overcast, Light Wind	HS	1	9:18	12:15	No	2000	240	Intermittent	No Reaction Observed	Level B	Vibratory and Impact Install Steel 30-inch	Observed as far as 3750 m. Distance/bearing closest observed.
Tuesday, December 6, 2022	Alki	Overcast, Light Wind	HS	1	10:33	10:35	No	4200	253	Resting	No Pile Activity	Level B		
Tuesday, December 6, 2022	Alki	Overcast, Light Wind	HS	1	14:35	14:41	No	3750	253	Swimming	No Pile Activity	No Take		Previously observed and recorded as a take of the day.
Tuesday, December 6, 2022	Ferry	Overcast	HS	1	8:40	8:44	No	8700	242	Swimming	No Pile Activity	No Take		
Tuesday, December 6, 2022	Ferry	Overcast	HS	1	10:06	10:08	No	10400	270	Swimming	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	
Tuesday, December 6, 2022	Ferry	Overcast	HS	1	12:25	12:27	No	11400	278	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Tuesday, December 6, 2022	Ferry	Overcast	SSL	3	12:30	12:33	No	10621	270	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Tuesday, December 6, 2022	Magnolia	Overcast	HS	1	10:36	10:37	No	5000	300	Swimming	No Pile Activity	Level B		
Wednesday, December 7, 2022	Alki	Sunny, Overcast	HS	1	9:08	9:10	No	4000	253	Foraging	No Pile Activity	No Take		
Wednesday, December 7, 2022	Alki	Sunny, Overcast	SSL	1	13:58	14:05	No	3000	240	Foraging	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, December 7, 2022	Alki	Sunny, Overcast	CSL	1	15:24	15:41	No	3250	250	Foraging	No Pile Activity	Level B		
Wednesday, December 7, 2022	Alki	Sunny, Overcast	CSL	1	15:37	15:41	No	3750	252	Foraging	No Pile Activity	Level B		
Wednesday, December 7, 2022	Pier 58	Overcast	CSL	1	11:28	11:29	No	100	270	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Wednesday, December 7, 2022	Ferry	Overcast, Light Wind, Whitecaps, Sunny	CSL	1	9:26	9:28	No	700	240	Swimming	No Pile Activity	No Take		
Wednesday, December 7, 2022	Ferry	Overcast, Light Wind, Whitecaps, Sunny	CSL	1	10:31	10:32	No	12200	280	Swimming	No Pile Activity	No Take		
Wednesday, December 7, 2022	Ferry	Overcast, Light Wind, Whitecaps, Sunny	HS	1	13:12	13:14	No	500	230	Resting	No Pile Activity	No Take		
Wednesday, December 7, 2022	Magnolia	Overcast	HS	1	8:13	8:16	No	5000	304	Intermittent	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, December 7, 2022	Magnolia	Overcast	HS	2	8:21	8:21	No	5050	304	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	One swimming with head above water, and one just popped its head up. Hanging out together.
Wednesday, December 7, 2022	Magnolia	Overcast	CSL	1	9:25	9:31	No	5100	304	Swimming	No Pile Activity	No Take		
Wednesday, December 7, 2022	Magnolia	Overcast	CSL	1	10:17	10:18	No	5100	303	Swimming	No Pile Activity	Level B		
Wednesday, December 7, 2022	Magnolia	Overcast	HS	1	11:43	11:43	No	5050	304	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Wednesday, December 7, 2022	Magnolia	Overcast, Moderate Wind, Whitecaps	HS	1	15:38	15:38	No	5000	304	Resting	No Pile Activity	Level B		Surfaced briefly to look around.
Thursday, December 8, 2022	Alki	Overcast	CSL	3	7:57	8:37	No	3500	250	Foraging	Reaction Observed	Level B	Vibratory Install Steel 30-inch	The group of three California sea lions briefly separated around the time the vibe hammer was turned on. Were back to interacting with each other and foraging within a few minutes.
Thursday, December 8, 2022	Alki	Overcast	SSL	1	8:39	8:45	No	3500	255	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Thursday, December 8, 2022	Alki	Overcast	CSL	2	9:04	9:07	No	3250	250	Swimming	No Pile Activity	Level B		
Thursday, December 8, 2022	Alki	Overcast	HS	1	9:52	10:14	No	3100	245	Resting	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Thursday, December 8, 2022	Alki	Overcast	CSL	2	13:38	13:42	No	3750	252	Swimming	No Pile Activity	No Take		Previously observed and recorded as a take of the day.
Thursday, December 8, 2022	Alki	Overcast	CSL	1	13:38	14:12	No	3250	250	Foraging	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	Previously observed and recorded as a take of the day.
Thursday, December 8, 2022	Alki	Overcast	HS	1	13:43	14:09	No	3250	250	Resting	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Thursday, December 8, 2022	Alki	Overcast	CSL	1	14:45	14:54	No	3500	250	Swimming	No Pile Activity	No Take		Previously observed and recorded as a take of the day.
Thursday, December 8, 2022	Magnolia	Light Rain, Overcast, Heavy Wind	HS	1	11:58	11:59	No	5000	300	Swimming	No Pile Activity	No Take		

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Friday, December 9, 2022	Alki	Overcast	CSL	2	8:07	9:36	No	3250	250	Foraging	No Reaction Observed	No Take	Impact Install Steel 30-inch	Intermittent viewing. Mostly foraging. Both males.
Friday, December 9, 2022	Alki	Overcast	CSL	4	9:47	10:08	No	3000	235	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	Observed swimming away from the rest of the group. Seemed to be foraging when they reached the entered bearing/distance. All four females.
Friday, December 9, 2022	Alki	Overcast	HS	1	10:12	10:16	No	3100	245	Resting	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Friday, December 9, 2022	Alki	Overcast	CSL	1	10:29	10:31	No	3500	250	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	One of the males from first observation
Friday, December 9, 2022	Alki	Overcast	KW	4	11:09	11:28	No	8000	250	Swimming	No Pile Activity	No Take		
Friday, December 9, 2022	Alki	Overcast, Light Rain	CSL	2	13:16	13:22	No	3500	250	Swimming	No Pile Activity	Level B		Both were females. So, not the two individuals that were takes earlier, but maybe from the group of four observed during a non-take time.
Friday, December 9, 2022	Alki	Overcast, Light Rain	CSL	1	14:17	14:19	No	3100	245	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	One of the males from earlier. Already a take.
Friday, December 9, 2022	Pier 58	Overcast, Sunny	HS	1	12:20	12:21	No	80	310	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Friday, December 9, 2022	Pier 58	Overcast, Sunny	CSL	1	14:40	14:42	No	200	275	Swimming	No Pile Activity	Level B		
Friday, December 9, 2022	Ferry	Whitecaps, Moderate Wind, Light Wind	KW	3	9:57	10:00	No	7000	270	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	Observed porpoising very close to the ferry.
Friday, December 9, 2022	Ferry	Whitecaps, Moderate Wind, Light Wind	HS	1	12:49	12:49	No	2000	255	Resting	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	Observed resting before diving as the ferry came by.
Friday, December 9, 2022	Ferry	Whitecaps, Moderate Wind, Light Wind	HS	1	13:20	13:20	No	2100	255	Resting	No Pile Activity	Level B		
Friday, December 9, 2022	Magnolia	Moderate Wind, Whitecaps, Light Wind, Overcast	HS	1	8:16	8:18	No	5100	304	Swimming	No Pile Activity	No Take		Observed swimming northwest.
Friday, December 9, 2022	Magnolia	Moderate Wind, Whitecaps, Light Wind, Overcast	HS	1	8:59	9:02	No	5000	304	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	Surfaced several times to rest.
Friday, December 9, 2022	Magnolia	Moderate Wind, Whitecaps, Light Wind, Overcast	HS	1	10:01	10:16	No	5050	304	Foraging	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Monday, December 12, 2022	Alki	Overcast, Light Rain, Moderate Wind, Whitecaps	CSL	1	12:27	12:33	No	3250	250	Foraging	No Pile Activity	No Take		
Monday, December 12, 2022	Ferry	Light Rain, Overcast, Heavy Wind	HS	1	9:42	9:42	No	11600	270	Swimming	No Pile Activity	No Take		
Monday, December 12, 2022	Ferry	Light Rain, Overcast, Heavy Wind	HS	1	10:13	10:14	No	400	190	Foraging	No Pile Activity	Level B		
Monday, December 12, 2022	Ferry	Light Rain, Overcast, Heavy Wind	HS	1	10:17	10:18	No	350	190	Intermittent	No Pile Activity	No Take		Previously observed and recorded as a take of the day.

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Monday, December 12, 2022	Magnolia	Overcast, Light Wind, Light Rain, Sunny	HS	1	7:59	8:31	No	5100	304	Foraging	No Pile Activity	No Take		Foraged in front of beach for a while. would disappear underwater for long periods.
Monday, December 12, 2022	Magnolia	Overcast, Light Wind, Light Rain, Sunny	CSL	1	9:56	9:58	No	5000	300	Swimming	No Pile Activity	Level B		
Monday, December 12, 2022	Magnolia	Overcast, Light Wind, Light Rain, Sunny	HS	1	10:33	10:34	No	5000	304	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	Observed watched beachgoers before diving underwater.
Tuesday, December 13, 2022	Alki	Overcast	CSL	1	8:13	8:33	No	3100	245	Foraging	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Tuesday, December 13, 2022	Alki	Overcast	CSL	1	8:34	8:37	No	3000	240	Foraging	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Tuesday, December 13, 2022	Alki	Overcast	CSL	1	8:52	9:05	No	3100	245	Swimming	No Pile Activity	No Take		
Tuesday, December 13, 2022	Ferry	Overcast	HS	1	7:58	8:00	No	60	300	Swimming	No Pile Activity	Level B		
Wednesday, December 14, 2022	Alki	Sunny, Overcast	HS	1	8:28	8:40	No	3250	250	Swimming	No Pile Activity	No Take		
Wednesday, December 14, 2022	Pier 58	Sunny	CSL	1	8:28	8:31	No	80	295	Swimming	No Pile Activity	No Take		
Wednesday, December 14, 2022	Ferry	Sunny, Overcast, Moderate Wind	CSL	1	9:39	9:39	No	520	165	Swimming	No Pile Activity	Level B		
Wednesday, December 14, 2022	Ferry	Sunny, Overcast, Moderate Wind	HS	1	10:16	10:16	No	10601	270	Swimming	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	
Wednesday, December 14, 2022	Ferry	Sunny, Overcast, Moderate Wind	CSL	1	11:26	11:27	No	600	165	Swimming	No Pile Activity	Level B		
Wednesday, December 14, 2022	Ferry	Sunny, Overcast, Moderate Wind	CSL	1	11:34	11:34	No	4000	260	Foraging	No Pile Activity	Level B		
Wednesday, December 14, 2022	Magnolia	Overcast	HS	1	7:58	7:58	No	5000	300	Swimming	No Pile Activity	No Take		
Wednesday, December 14, 2022	Magnolia	Overcast	HS	1	8:30	8:31	No	5000	300	Swimming	No Pile Activity	No Take		
Wednesday, December 14, 2022	Magnolia	Overcast	HS	1	9:56	9:56	No	5000	300	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Wednesday, December 14, 2022	Magnolia	Overcast	HS	1	10:02	10:02	No	5000	300	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Wednesday, December 14, 2022	Magnolia	Overcast	HS	1	11:30	11:31	No	5000	300	Swimming	No Pile Activity	Level B		
Wednesday, December 14, 2022	Magnolia	Overcast	CSL	2	13:09	13:11	No	5000	300	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Thursday, December 15, 2022	Alki	Sunny, Overcast	CSL	2	8:28	8:46	No	4000	253	Resting	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Thursday, December 15, 2022	Alki	Sunny, Overcast	CSL	1	9:17	9:21	No	3250	250	Swimming	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	One of the two from previous observation. Previously observed and recorded as a take of the day.
Thursday, December 15, 2022	Alki	Sunny, Overcast	CSL	1	9:31	9:31	No	4000	253	Foraging	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	Other individual from first observation. Previously taken.
Thursday, December 15, 2022	Alki	Sunny, Overcast	CSL	1	10:08	10:10	No	3000	240	Foraging	No Pile Activity	Level B		
Thursday, December 15, 2022	Ferry	Sunny	HS	1	8:10	8:10	No	500	185	Resting	No Pile Activity	Level B		Surfaced briefly.
Thursday, December 15, 2022	Magnolia	Sunny, Overcast	HS	1	8:01	8:05	No	5000	304	Swimming	No Pile Activity	Level B		
Thursday, December 15, 2022	Magnolia	Sunny, Overcast	HS	1	8:57	9:09	No	5100	304	Foraging	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	Observed a lot of surfacing and diving.
Thursday, December 15, 2022	Magnolia	Sunny, Overcast	CSL	1	9:05	9:13	No	4100	305	Foraging	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	Observed foraging near the shore by the marina before swimming northwest.
Friday, December 16, 2022	Alki	Sunny	HS	1	9:17	9:19	No	3100	270	Swimming	No Pile Activity	No Take		

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Friday, December 16, 2022	Ferry	Overcast	HS	1	8:13	8:14	No	1000	270	Swimming	No Pile Activity	No Take		
Friday, December 16, 2022	Ferry	Overcast	HS	1	9:14	9:15	No	2000	270	Swimming	No Pile Activity	No Take		
Friday, December 16, 2022	Magnolia	Sunny	HS	1	8:00	8:08	No	5000	304	Intermittent	No Pile Activity	No Take		Adult.
Friday, December 16, 2022	Magnolia	Sunny	HS	1	8:25	8:25	No	5000	304	Swimming	No Pile Activity	No Take		
Friday, December 16, 2022	Magnolia	Sunny	HS	2	8:38	8:38	No	5000	304	Swimming	No Pile Activity	No Take		Two adults, possibly previously observed in the area.
Friday, December 16, 2022	Magnolia	Sunny	HS	1	8:49	8:51	No	5000	303	Swimming	No Pile Activity	No Take		Possibly the same observation as before.
Friday, December 16, 2022	Magnolia	Sunny	HS	1	9:03	9:03	No	5050	304	Swimming	No Pile Activity	No Take		
Monday, December 19, 2022	Alki	Overcast, Snow/Sleet/Hail	HS	1	8:19	10:31	No	3750	252	Foraging	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	Intermittent viewing. Initially resting. Predominantly foraging.
Monday, December 19, 2022	Alki	Overcast, Snow/Sleet/Hail	HS	1	12:11	12:20	No	3100	245	Foraging	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Monday, December 19, 2022	Alki	Overcast, Snow/Sleet/Hail	HS	1	14:12	14:17	No	4200	253	Resting	No Reaction Observed	No Take	Impact Install Steel 30-inch	Previously observed and recorded as a take of the day.
Monday, December 19, 2022	Pier 58	Snow/Sleet/Hail, Overcast	CSL	1	11:26	11:27	No	100	300	Swimming	Reaction Observed	Level B	Impact Install Steel 30-inch	Observed breaching whilst leaving the Level B zone while the impact hammer was on.
Monday, December 19, 2022	Ferry	Snow/Sleet/Hail, Moderate Wind, Overcast, Fog	HS	1	9:11	9:11	No	3500	270	Swimming	No Pile Activity	Level B		
Monday, December 19, 2022	Ferry	Snow/Sleet/Hail, Moderate Wind, Overcast, Fog	HS	1	13:18	13:18	No	5000	270	Swimming	No Pile Activity	Level B		
Monday, December 19, 2022	Ferry	Snow/Sleet/Hail, Moderate Wind, Overcast, Fog	HS	1	14:11	14:11	No	11600	270	Resting	No Pile Activity	No Take		
Monday, December 19, 2022	Magnolia	Overcast, Snow/Sleet/Hail	HS	1	8:23	8:55	No	5000	304	Foraging	No Pile Activity	Level B		
Monday, December 19, 2022	Magnolia	Overcast, Snow/Sleet/Hail	CSL	2	9:22	9:23	No	5000	300	Other	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	Observed surfacing to rest, before continuing to swim.
Monday, December 19, 2022	Magnolia	Overcast, Snow/Sleet/Hail	HS	1	9:54	9:55	No	5000	304	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Monday, December 19, 2022	Magnolia	Overcast, Snow/Sleet/Hail	HS	1	10:43	10:44	No	5100	304	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Monday, December 19, 2022	Magnolia	Overcast, Snow/Sleet/Hail	HS	1	13:44	13:45	No	5100	304	Other	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	Observed surfacing to rest, before continuing to swim.
Monday, December 19, 2022	Magnolia	Overcast	HS	2	14:18	14:19	No	5200	303	Other	No Reaction Observed	No Take	Impact Install Steel 30-inch	Observed swimming with another harbor seal. Previously observed and recorded as a take of the day.
Tuesday, December 20, 2022	Alki	Overcast, Heavy Wind, Whitecaps, Snow/Sleet/Hail, Fog	CSL	2	11:51	11:58	No	3750	252	Foraging	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Tuesday, December 20, 2022	Alki	Overcast, Heavy Wind, Whitecaps, Snow/Sleet/Hail, Fog	HS	1	13:50	14:01	No	3000	240	Resting	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Tuesday, December 20, 2022	Alki	Overcast, Heavy Wind, Whitecaps, Snow/Sleet/Hail, Fog	CSL	1	14:01	14:04	No	3100	245	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	1st of 2 California sea lions from first observation.
Tuesday, December 20, 2022	Alki	Overcast, Heavy Wind, Whitecaps, Snow/Sleet/Hail, Fog	CSL	1	14:11	14:12	No	3000	240	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	2nd individual from observation.
Tuesday, December 20, 2022	Ferry	Light Rain, Light Wind, Overcast	HS	1	8:25	8:27	No	7700	240	Other	No Pile Activity	No Take		
Tuesday, December 20, 2022	Magnolia	Heavy Rain, Snow/Sleet/Hail	HS	1	8:35	8:35	No	4900	303	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Tuesday, December 20, 2022	Magnolia	Heavy Rain, Snow/Sleet/Hail	HS	1	11:10	11:11	No	4900	303	Swimming	No Pile Activity	Level B		
Tuesday, December 20, 2022	Magnolia	Heavy Rain, Snow/Sleet/Hail	HS	1	11:42	11:42	No	4850	303	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Wednesday, December 21, 2022	Alki	Overcast, Moderate Wind, Whitecaps	HS	1	8:14	8:16	No	3500	250	Swimming	No Pile Activity	Level B		
Wednesday, December 21, 2022	Alki	Overcast, Moderate Wind, Whitecaps	CSL	1	8:37	8:48	No	3750	252	Foraging	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Wednesday, December 21, 2022	Pier 58	Overcast, Sunny	HS	1	11:35	11:46	No	100	285	Foraging	No Pile Activity	Level B		Appeared in area shortly after last hammer strike and swam closer to pile where gulls were eating dead fish.
Wednesday, December 21, 2022	Magnolia	Overcast, Sunny	HS	1	7:55	7:56	No	5000	304	Swimming	No Pile Activity	No Take		
Wednesday, December 21, 2022	Magnolia	Overcast, Sunny	HS	4	8:48	9:00	No	4950	303	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	All look like juveniles or adults. Initially spotted at 4950 m, and then gradually swam west along the shoreline.
Thursday, December 22, 2022	Alki	Sunny, Overcast	HS	1	10:18	10:28	No	3550	253	Intermittent	No Reaction Observed	No Take	Impact Install Steel 30-inch	Adult, swimming west.
Thursday, December 22, 2022	Alki	Sunny, Overcast	HS	1	10:24	10:24	No	2750	250	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Thursday, December 22, 2022	Alki	Sunny, Overcast	HS	1	12:35	12:36	No	3350	253	Swimming	No Pile Activity	Level B		
Thursday, December 22, 2022	Alki	Sunny, Overcast	HS	1	13:19	13:19	No	3750	252	Resting	No Pile Activity	Level B		
Thursday, December 22, 2022	Ferry	Sunny	CSL	1	9:32	9:37	No	80	294	Foraging	No Pile Activity	Level B		
Thursday, December 22, 2022	Ferry	Sunny	CSL	1	11:31	11:32	No	1800	245	Foraging	No Pile Activity	No Take		
Thursday, December 22, 2022	Magnolia	Sunny, Overcast	HS	3	7:58	8:08	No	5100	304	Swimming	No Pile Activity	No Take		Observed pair resting together before swimming out of the area together.
Thursday, December 22, 2022	Magnolia	Sunny, Overcast	CSL	1	8:23	8:25	No	5000	300	Swimming	No Pile Activity	No Take		Observed swimming east toward the marina.
Thursday, December 22, 2022	Magnolia	Sunny, Overcast	HS	1	9:37	9:40	No	5000	304	Swimming	No Pile Activity	No Take		
Tuesday, January 3, 2023	Pier 58	Overcast	CSL	1	8:30	9:21	No	3750	252	Foraging	No Pile Activity	No Take		
Tuesday, January 3, 2023	Pier 58	Overcast	HS	1	9:02	9:11	No	3750	252	Resting	No Pile Activity	No Take		
Tuesday, January 3, 2023	Pier 58	Overcast	CSL	1	9:24	9:41	No	3000	240	Swimming	No Pile Activity	No Take		

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Monday, January 30, 2023	Pier 58	Sunny	CSL	1	8:28	8:32	No	3250	250	Swimming	No Reaction Observed	Level B	Vibratory Removal Steel 30-inch	
Monday, January 30, 2023	Pier 58	Sunny	CSL	1	10:08	10:10	No	3250	250	Resting	No Pile Activity	No Take		
Monday, January 30, 2023	Pier 58	Sunny, Moderate Wind	HS	1	9:33	9:36	No	5000	300	Swimming	No Pile Activity	No Take		Observed swimming around very quickly.
Wednesday, February 1, 2023	Pier 58	Sunny, Overcast	HS	1	11:58	12:00	No	3250	250	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Wednesday, February 1, 2023	Pier 58	Sunny, Overcast	HS	1	14:12	14:19	No	3000	240	Foraging	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, February 1, 2023	Pier 58	Sunny, Overcast	CSL	1	8:40	8:41	No	100	290	Swimming	No Pile Activity	No Take		
Wednesday, February 1, 2023	Pier 58	Sunny, Overcast	CSL	1	11:44	11:45	No	80	285	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Wednesday, February 1, 2023	Pier 58	Sunny, Overcast	CSL	1	9:33	9:45	No	2000	280	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Wednesday, February 1, 2023	Pier 58	Sunny, Overcast	HS	1	9:50	9:55	No	2500	280	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Wednesday, February 1, 2023	Pier 58	Sunny, Overcast	HS	1	11:00	11:10	No	4000	290	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Wednesday, February 1, 2023	Pier 58	Sunny, Overcast	HS	1	12:00	12:05	No	1000	285	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Wednesday, February 1, 2023	Pier 58	Light Wind, Sunny	HS	2	7:36	7:56	No	5000	300	Foraging	No Pile Activity	No Take		Observed foraging since before sunrise before swimming around and leaving the area.
Wednesday, February 1, 2023	Pier 58	Light Wind, Sunny	HS	1	8:06	8:46	No	5000	304	Foraging	No Pile Activity	No Take		
Wednesday, February 1, 2023	Pier 58	Light Wind, Sunny	HS	1	11:19	11:39	No	4950	300	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Monday, February 6, 2023	Pier 58	Heavy Wind, Overcast, Light Rain	HS	1	9:06	9:32	No	4900	304	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Monday, February 6, 2023	Pier 58	Heavy Wind, Overcast, Light Rain	HS	1	9:29	9:37	No	5000	300	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	Observed standing up in waves and look out at water.
Monday, February 6, 2023	Pier 58	Heavy Wind, Overcast, Light Rain	HS	1	10:00	22:04	No	4900	304	Foraging	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	Observed near shore diving into water (in water whole time). Previously observed and recorded as a take of the day.
Tuesday, February 7, 2023	Pier 58	Overcast, Light Rain	HS	1	8:14	8:21	No	3750	252	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Tuesday, February 7, 2023	Pier 58	Overcast, Light Rain	CSL	1	9:40	9:56	No	4000	255	Foraging	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Tuesday, February 7, 2023	Pier 58	Overcast, Light Rain	HS	1	10:32	10:39	No	3750	252	Resting	No Pile Activity	No Take		
Tuesday, February 7, 2023	Pier 58	Overcast, Light Rain	CSL	1	10:59	11:47	No	3400	250	Resting	No Pile Activity	Level B		
Tuesday, February 7, 2023	Pier 58	Sunny, Heavy Wind, Whitecaps	HS	1	14:04	14:17	No	3100	245	Resting	No Pile Activity	No Take		
Tuesday, February 7, 2023	Pier 58	Sunny, Heavy Wind, Whitecaps	CSL	1	14:54	15:42	No	3500	250	Resting	No Pile Activity	No Take		Previously observed and recorded as a take of the day.

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Tuesday, February 7, 2023	Pier 58	Whitecaps, Heavy Rain, Overcast, Heavy Wind	HS	1	8:47	8:52	No	5000	302	Swimming	No Reaction Observed	Level B	Impact Install Steel 30-inch	
Tuesday, February 7, 2023	Pier 58	Whitecaps, Heavy Rain, Overcast, Heavy Wind	HS	1	9:29	9:29	No	5000	304	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, February 8, 2023	Pier 58	Sunny, Overcast	CSL	1	7:47	9:17	No	3400	250	Intermittent	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Wednesday, February 8, 2023	Pier 58	Sunny, Overcast	HS	1	10:47	10:51	No	3100	245	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Wednesday, February 8, 2023	Pier 58	Sunny, Overcast	CSL	1	12:07	12:33	No	3250	250	Swimming	No Pile Activity	Level B		
Wednesday, February 8, 2023	Pier 58	Overcast, Moderate Wind	CSL	1	9:00	9:02	No	200	270	Swimming	No Reaction Observed	Level B	Impact Install Steel 30-inch	
Wednesday, February 8, 2023	Pier 58	Overcast	HS	1	10:40	10:41	No	400	271	Intermittent	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	Observed leisurely swimming away from pile activity
Wednesday, February 8, 2023	Pier 58	Sunny	HS	1	7:35	7:35	No	5000	302	Intermittent	No Pile Activity	No Take		
Wednesday, February 8, 2023	Pier 58	Sunny	HS	2	10:59	11:00	No	4900	302	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Wednesday, February 8, 2023	Pier 58	Sunny	HS	1	12:08	12:09	No	5000	300	Intermittent	No Pile Activity	Level B		
Thursday, February 9, 2023	Pier 58	Sunny, Overcast	HS	1	8:11	8:27	No	3000	245	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Thursday, February 9, 2023	Pier 58	Sunny, Overcast	CSL	2	11:27	11:30	No	3100	245	Foraging	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Thursday, February 9, 2023	Pier 58	Sunny, Overcast	CSL	1	11:51	11:55	No	3750	252	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Thursday, February 9, 2023	Pier 58	Sunny, Overcast	CSL	3	13:53	14:01	No	3500	250	Swimming	No Reaction Observed	No Take	Vibratory Install Steel 30-inch	Previously observed and recorded as a take of the day.
Thursday, February 9, 2023	Pier 58	Overcast	HS	1	7:35	7:40	No	50	220	Swimming	No Pile Activity	Level B		Observed leaving level A take zone before the start of pile activity.
Thursday, February 9, 2023	Pier 58	Overcast	HS	1	10:00	10:02	No	50	225	Swimming	Reaction Observed	Level B	Vibratory Install Steel 30-inch	Changed swimming directions as it entered the Level B zone during impact installation.
Thursday, February 9, 2023	Pier 58	Overcast	CSL	1	14:38	14:39	No	100	270	Swimming	Reaction Observed	Level B	Impact Install Steel 30-inch	Breaches while swimming past the active pile.
Thursday, February 9, 2023	Pier 58	Light Rain, Overcast, Sunny	CSL	1	9:58	9:59	No	9600	271	Swimming	No Pile Activity	No Take		
Thursday, February 9, 2023	Pier 58	Light Rain, Overcast, Sunny	HS	1	10:54	10:55	No	400	271	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Thursday, February 9, 2023	Pier 58	Overcast, Light Rain	HS	2	7:49	7:51	No	5000	303	Swimming	No Pile Activity	No Take		
Thursday, February 9, 2023	Pier 58	Overcast, Light Rain	HS	1	8:49	8:50	No	5000	303	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Thursday, February 9, 2023	Pier 58	Overcast, Light Rain	HS	1	8:58	9:01	No	5000	303	Intermittent	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Thursday, February 9, 2023	Pier 58	Overcast, Light Rain	HS	1	9:32	9:33	No	5000	303	Swimming	No Pile Activity	Level B		
Thursday, February 9, 2023	Pier 58	Overcast, Light Rain	HS	1	11:46	11:58	No	5000	303	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Friday, February 10, 2023	Pier 58	Sunny	CSL	1	8:16	8:26	No	3400	250	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Friday, February 10, 2023	Pier 58	Sunny	CSL	1	10:02	10:04	No	3500	255	Foraging	No Pile Activity	No Take		

Table A-2
Waterfront Park Daily Observations

Date	Monitoring Site	Weather Conditions	Species	Number of Individuals	Observation Start Time	Observation End Time	Stop Work?	Distance from Pile (m)	Bearing from Pile (absolute)	Behavior	Reaction to Pile Activity	Takes	Activity at Time of Sighting	Notes
Friday, February 10, 2023	Pier 58	Sunny	CSL	1	12:26	13:23	No	3750	252	Resting	No Pile Activity	Level B		
Friday, February 10, 2023	Pier 58	Sunny	CSL	1	13:11	13:15	No	3250	250	Swimming	No Pile Activity	Level B		
Friday, February 10, 2023	Pier 58	Sunny	HS	1	13:41	13:46	No	4000	250	Resting	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Friday, February 10, 2023	Pier 58	Sunny, Light Wind	CSL		11:32	11:34	No	150	235	Swimming	No Pile Activity	No Take		
Friday, February 10, 2023	Pier 58	Sunny, Light Wind	HS	1	12:27	12:28	No	100	300	Swimming	No Pile Activity	No Take		
Friday, February 10, 2023	Pier 58	Sunny, Light Wind	HS	1	13:36	13:37	No	80	240	Swimming	No Pile Activity	Level B		
Friday, February 10, 2023	Pier 58	Overcast, Light Wind, Sunny	HS	1	14:34	14:34	No	5000	300	Swimming	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Friday, February 10, 2023	Pier 58	Overcast, Light Wind, Sunny	HS	1	15:44	15:44	No	5000	300	Swimming	No Pile Activity	Level B		
Monday, February 13, 2023	Pier 58	Overcast, Light Rain	CSL	1	7:31	7:33	No	3000	240	Swimming	No Pile Activity	No Take		
Monday, February 13, 2023	Pier 58	Overcast, Light Rain	CSL	1	8:15	8:17	No	3200	240	Swimming	No Reaction Observed	Level B	Impact Install Steel 30-inch	
Monday, February 13, 2023	Pier 58	Overcast, Light Rain	CSL	1	11:17	11:19	No	4000	255	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Monday, February 13, 2023	Pier 58	Sunny, Overcast	HS	2	7:27	7:28	No	5000	302	Swimming	No Pile Activity	No Take		
Monday, February 13, 2023	Pier 58	Sunny, Overcast	HS	1	8:05	8:06	No	5300	302	Intermittent	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Monday, February 13, 2023	Pier 58	Sunny, Overcast	HS	1	9:37	9:37	No	4900	302	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Monday, February 13, 2023	Pier 58	Sunny, Overcast	HS	1	11:20	11:20	No	4900	302	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Monday, February 13, 2023	Pier 58	Sunny, Overcast	CSL	2	11:22	11:24	No	4900	300	Swimming	No Reaction Observed	No Take	Impact Install Steel 30-inch	
Tuesday, February 14, 2023	Pier 58	Sunny, Overcast, Whitecaps	CSL	2	12:46	13:09	No	3750	252	Foraging	No Reaction Observed	Level B	Vibratory Install Steel 30-inch	
Tuesday, February 14, 2023	Pier 58	Sunny, Whitecaps, Moderate Wind	CSL	1	8:10	8:20	No	850	271	Foraging	No Pile Activity	No Take		Observed successfully catching and eating fish near the dock.
Tuesday, February 14, 2023	Pier 58	Sunny	HS	1	7:28	7:30	No	5000	302	Swimming	No Pile Activity	No Take		
Tuesday, February 14, 2023	Pier 58	Sunny	HS	1	7:42	7:45	No	5000	302	Swimming	No Pile Activity	No Take		
Tuesday, February 14, 2023	Pier 58	Sunny	HS	2	8:17	8:17	No	5100	302	Swimming	No Pile Activity	No Take		
Tuesday, February 14, 2023	Pier 58	Sunny	HS	1	8:21	8:21	No	4900	302	Swimming	No Pile Activity	No Take		
Tuesday, February 14, 2023	Pier 58	Sunny	HS	1	12:01	12:01	No	5000	302	Intermittent	No Pile Activity	No Take		
Wednesday, February 15, 2023	Pier 58	Sunny	CSL	1	7:26	8:57	No	3500	250	Resting	No Pile Activity	No Take		
Wednesday, February 15, 2023	Pier 58	Sunny	HS	1	7:59	7:59	No	50	300	Swimming	No Pile Activity	No Take		
Wednesday, February 15, 2023	Pier 58	Sunny	CSL	3	8:23	8:25	No	10000	260	Swimming	No Pile Activity	No Take		

Notes:
CSL: California sea lion (otariids/eared)
HS: harbor seal (phocids/earless)
HP: harbor porpoise (high-frequency cetaceans)
SSL: Steller sea lion (otariid/eared)
KW: killer whale (mid-frequency cetaceans)
m: meter

Table A-3
Daily Summary of California Seal Lion Level B Takes, Observations with No Takes, and Totals

Date	California Sea Lion Level B Takes					California Sea Lion Observations with No Takes				
	Construction Site	Alki	Magnolia	Ferry	Level B Total	Construction Site	Alki	Magnolia	Ferry	No Take Total
Monday, October 3, 2022	3	0	0	0	**3**	0	5	0	0	**5**
Tuesday, October 4, 2022	7	0	0	0	**7**	8	5	0	0	**13**
Wednesday, November 2, 2022	3	2	0	0	**5**	0	14	1	1	**16**
Thursday, November 3, 2022	0	3	0	0	**3**	2	2	0	1	**5**
Friday, November 4, 2022	0	2	0	0	**2**	0	2	0	0	**2**
Monday, November 7, 2022	1	1	1	0	**3**	5	0	3	0	**8**
Tuesday, November 8, 2022	0	1	0	0	**1**	1	4	0	0	**5**
Wednesday, November 9, 2022	1	2	0	1	**4**	3	2	0	0	**5**
Thursday, November 10, 2022	0	4	0	0	**4**	0	11	0	0	**11**
Friday, November 11, 2022	0	0	0	0	**0**	0	5	0	0	**5**
Monday, November 14, 2022	0	2	1	1	**4**	3	0	0	0	**3**
Tuesday, November 15, 2022	2	2	1	0	**5**	0	2	0	0	**2**
Wednesday, November 16, 2022	1	2	0	0	**3**	0	3	3	0	**6**
Thursday, November 17, 2022	0	0	0	0	**0**	0	3	0	4	**7**
Tuesday, November 22, 2022	2	0	0	0	**2**	1	2	0	0	**3**
Wednesday, November 23, 2022	0	0	0	0	**0**	0	2	0	0	**2**
Monday, November 28, 2022	0	0	0	0	**0**	0	3	0	0	**3**
Tuesday, November 29, 2022	1	0	0	0	**1**	0	1	0	0	**1**
Wednesday, November 30, 2022	0	0	0	0	**0**	0	8	0	2	**10**
Thursday, December 1, 2022	2	0	0	0	**2**	0	0	1	0	**1**
Monday, December 5, 2022	0	1	0	0	**1**	2	2	0	0	**4**
Tuesday, December 6, 2022	0	0	0	0	**0**	0	2	0	0	**2**
Wednesday, December 7, 2022	1	2	1	0	**4**	0	0	1	2	**3**
Thursday, December 8, 2022	0	5	0	0	**5**	0	4	0	0	**4**
Friday, December 9, 2022	1	2	0	0	**3**	0	8	0	0	**8**
Monday, December 12, 2022	0	0	1	0	**1**	0	1	0	0	**1**
Tuesday, December 13, 2022	0	0	0	0	**0**	0	3	0	0	**3**
Wednesday, December 14, 2022	0	0	0	3	**3**	1	0	2	0	**3**
Thursday, December 15, 2022	0	3	1	0	**4**	0	2	0	0	**2**
Monday, December 19, 2022	1	0	2	0	**3**	0	0	0	0	**0**
Tuesday, December 20, 2022	0	2	0	0	**2**	0	2	0	0	**2**
Wednesday, December 21, 2022	0	1	0	0	**1**	0	0	0	0	**0**
Thursday, December 22, 2022	0	0	0	1	**1**	0	0	1	1	**2**
Tuesday, January 3, 2023	0	0	0	0	**0**	0	2	0	0	**2**
Monday, January 30, 2023	0	1	0	0	**1**	0	1	0	0	**1**
Wednesday, February 1, 2023	1	0	0	1	**2**	1	0	0	0	**1**
Tuesday, February 7, 2023	0	1	0	0	**1**	0	2	0	0	**2**
Wednesday, February 8, 2023	1	1	0	0	**2**	0	1	0	0	**1**
Thursday, February 9, 2023	1	3	0	0	**4**	0	3	0	1	**4**
Friday, February 10, 2023	0	2	0	0	**2**	0	2	0	0	**2**
Monday, February 13, 2023	0	1	0	0	**1**	0	2	2	0	**4**
Tuesday, February 14, 2023	0	2	0	0	**2**	0	0	0	1	**1**
Wednesday, February 15, 2023	0	0	0	0	**0**	0	1	0	3	**4**
Total	**29**	**48**	**8**	**7**	**92**	**27**	**112**	**14**	**16**	**169**

Table A-4
Daily Summary of Harbor Seal Level B Takes, Observations with No Takes, and Totals

Date	Harbor Seal Level B Takes					Harbor Seal Observations with No Takes				
	Construction Site	Alki	Magnolia	Ferry	Level B Total	Construction Site	Alki	Magnolia	Ferry	No Take Total
Tuesday, October 4, 2022	0	0	0	0	**0**	0	1	0	0	**1**
Wednesday, October 5, 2022	0	0	0	0	**0**	0	2	0	0	**2**
Wednesday, November 2, 2022	0	3	3	1	**7**	0	7	16	5	**28**
Thursday, November 3, 2022	0	5	2	0	**7**	0	2	11	0	**13**
Friday, November 4, 2022	0	1	1	0	**2**	0	7	3	0	**10**
Monday, November 7, 2022	1	5	8	1	**15**	0	3	3	0	**6**
Tuesday, November 8, 2022	0	0	0	0	**0**	0	4	15	1	**20**
Wednesday, November 9, 2022	1	2	5	0	**8**	1	5	4	0	**10**
Thursday, November 10, 2022	2	0	9	1	**12**	0	5	3	0	**8**
Friday, November 11, 2022	0	0	0	0	**0**	0	3	1	2	**6**
Monday, November 14, 2022	0	1	1	0	**2**	0	0	5	0	**5**
Tuesday, November 15, 2022	1	1	2	0	**4**	1	0	7	1	**9**
Wednesday, November 16, 2022	1	1	1	2	**5**	0	1	2	0	**3**
Thursday, November 17, 2022	1	0	0	0	**1**	0	1	1	1	**3**
Tuesday, November 22, 2022	0	0	0	0	**0**	0	2	0	1	**3**
Wednesday, November 23, 2022	1	0	0	0	**1**	0	1	0	0	**1**
Monday, November 28, 2022	0	0	0	0	**0**	1	1	0	0	**2**
Tuesday, November 29, 2022	0	0	0	1	**1**	0	1	2	0	**3**
Wednesday, November 30, 2022	0	0	0	0	**0**	0	0	2	0	**2**
Thursday, December 1, 2022	0	1	0	0	**1**	0	0	2	0	**2**
Friday, December 2, 2022	0	0	0	0	**0**	0	1	0	2	**3**
Monday, December 5, 2022	0	1	1	2	**4**	0	0	3	2	**5**
Tuesday, December 6, 2022	0	2	1	0	**3**	0	1	0	3	**4**
Wednesday, December 7, 2022	0	0	2	0	**2**	0	1	3	1	**5**
Thursday, December 8, 2022	0	1	0	0	**1**	0	1	1	0	**2**
Friday, December 9, 2022	1	0	1	2	**4**	0	1	2	0	**3**
Monday, December 12, 2022	0	0	1	1	**2**	0	0	1	2	**3**
Tuesday, December 13, 2022	0	0	0	1	**1**	0	0	0	0	**0**
Wednesday, December 14, 2022	0	0	3	0	**3**	0	1	2	1	**4**
Thursday, December 15, 2022	0	0	2	1	**3**	0	0	0	0	**0**
Friday, December 16, 2022	0	0	0	0	**0**	0	1	6	2	**9**
Monday, December 19, 2022	0	1	4	2	**7**	0	2	2	1	**5**
Tuesday, December 20, 2022	0	0	3	0	**3**	0	1	0	1	**2**
Wednesday, December 21, 2022	1	1	4	0	**6**	0	0	1	0	**1**
Thursday, December 22, 2022	0	2	0	0	**2**	0	2	4	0	**6**
Tuesday, January 3, 2023	0	0	0	0	**0**	0	1	0	0	**1**
Monday, January 30, 2023	0	0	0	0	**0**	0	0	1	0	**1**
Wednesday, February 1, 2023	0	1	1	3	**5**	0	1	3	0	**4**
Monday, February 6, 2023	0	0	2	0	**2**	0	0	1	0	**1**
Tuesday, February 7, 2023	0	1	1	0	**2**	0	2	1	0	**3**
Wednesday, February 8, 2023	0	1	3	1	**5**	0	0	1	0	**1**
Thursday, February 9, 2023	2	0	2	1	**5**	0	1	4	0	**5**
Friday, February 10, 2023	1	1	2	0	**4**	1	0	0	0	**1**
Monday, February 13, 2023	0	0	0	0	**0**	0	0	5	0	**5**
Tuesday, February 14, 2023	0	0	0	0	**0**	0	0	6	0	**6**
Wednesday, February 15, 2023	0	0	0	0	**0**	1	0	0	0	**1**
Total	**13**	**32**	**65**	**20**	**130**	**5**	**63**	**124**	**26**	**218**

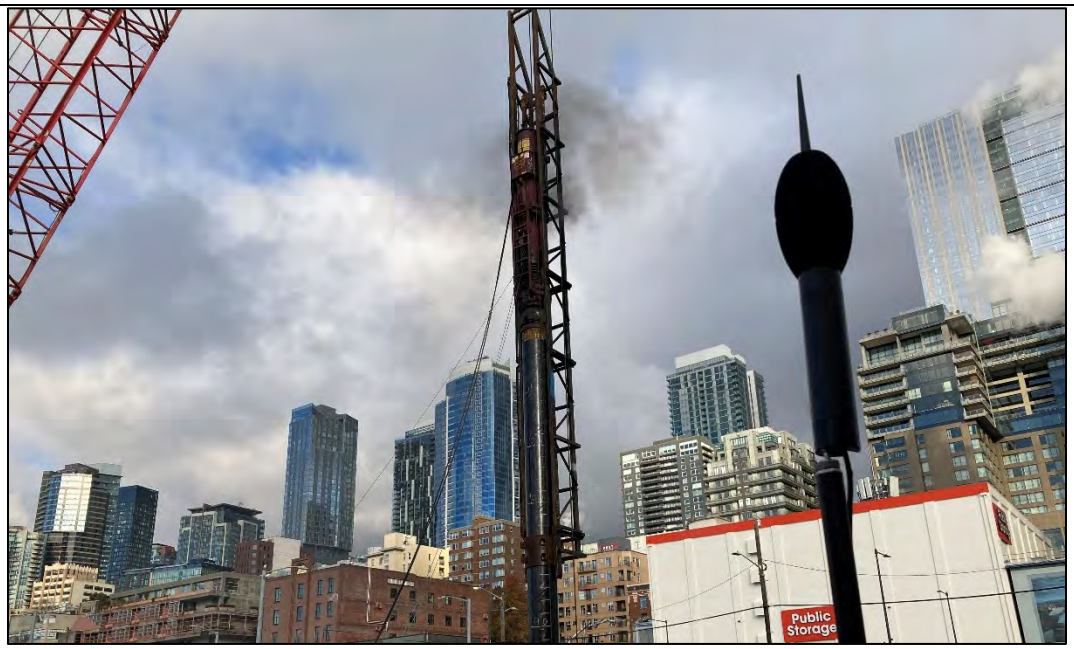
Table A-5
Daily Summary of Steller Sea Lion Level B Takes, Observations with No Takes, and Totals

Date	Steller Sea Lion Level B Takes					Steller Sea Lion Observations with No Takes				
	Construction Site	Alki	Magnolia	Ferry	Level B Total	Construction Site	Alki	Magnolia	Ferry	No Take Total
Wednesday, November 2, 2022	0	0	0	0	**0**	0	1	0	0	**1**
Tuesday, December 6, 2022	0	0	0	0	**0**	0	0	0	3	**3**
Wednesday, December 7, 2022	0	0	0	0	**0**	0	1	0	0	**1**
Thursday, December 8, 2022	0	1	0	0	**1**	0	0	0	0	**0**
Total	**0**	**1**	**0**	**0**	**1**	**0**	**2**	**0**	**3**	**5**

Table A-6
Daily Summary of Killer Whale Level B Takes, Observations with No Takes, and Totals

	Killer Whale Level B Takes					Killer Whale Observations with No Takes				
Date	**Construction Site**	**Alki**	**Magnolia**	**Ferry**	**Level B Total**	**Construction Site**	**Alki**	**Magnolia**	**Ferry**	**No Take Total**
Monday, November 7, 2022	0	0	0	0	**0**	0	6	8	19	**33**
Tuesday, November 8, 2022	0	0	0	0	**0**	0	0	15	2	**17**
Wednesday, November 9, 2022	0	0	0	0	**0**	0	15	4	20	**39**
Thursday, November 10, 2022	0	0	0	0	**0**	0	7	0	15	**22**
Monday, December 5, 2022	0	0	0	0	**0**	0	6	0	7	**13**
Friday, December 9, 2022	0	0	0	0	**0**	0	4	0	3	**7**
Total	**0**	**0**	**0**	**0**	**0**	**0**	**38**	**27**	**66**	**131**

Attachment 2
Waterfront Park Construction Project
Acoustic Monitoring Report (Season 1)



WATERFRONT PARK RECONSTRUCTION PROJECT
ACOUSTIC MONITORING REPORT

February 28, 2023

Prepared For:

City of Seattle Department of Transportation

Prepared By:

THE GREENBUSCH GROUP, INC.

1900 West Nickerson Street Suite 201
Seattle, Washington 98119

Table of Contents

List of Tables

List of Figures

1.0 EXECUTIVE SUMMARY

This Acoustic Monitoring Report (Report) presents the results of airborne and underwater sound levels measured during the removal of eight steel H-piles with an APE Model 150 Vibratory Driver/Extractor, the installation of four 30-inch steel pile piles with an Antaeus 325-6 vibratory hammer and eight 30-inch steel pipe piles with an APE Model D62-22 diesel impact hammer, as part of the Waterfront Park Reconstruction Project (Project).

Unweighted underwater 10-second root mean squared (RMS) sound levels measured by the near field hydrophone 33 feet (10 meters) from the removal of the steel H-piles ranged from 139 to 150 decibels (dB) re: 1 micropascal (μPa). Ranges of underwater sound levels for each marine mammal hearing group and unweighted sound levels during the removal of the steel H-piles are summarized in Table 1.1. The daily cSEL was 176 dB re: 1 μPa (unweighted). The median unweighted 1-second RMS airborne sound level 50 feet (15.24 meters) from the piles was 97 dB re: 20 μPa.

Table 1.1 Underwater Sound Levels – H-Pile Removal, min-max (median) dB re: 1 μPa

Metric	Unweighted	Cetaceans			Pinnipeds	
		Low-Frequency	Mid-Frequency	High-Frequency	Phocid	Otariid
Peak	151-169 (156)	142-163 (148)	144-166 (150)	145-166 (150)	139-164 (145)	138-163 (145)
RMS	139-150 (142)	126-140 (133)	132-144 (135)	133-144 (136)	124-135 (129)	122-134 (127)
SEL	149-160 (152)	136-150 (143)	142-154 (145)	143-154 (146)	134-145 (139)	132-144 (137)

Note: Sound levels are normalized to 33 feet (10 meters) from piles

Based on the daily cSEL and median RMS underwater sound levels measured during the removal of the steel H-piles, up to 24 feet (7.2 meters) may be necessary for underwater sound levels to dissipate to below the Level A marine mammal thresholds and up to 386 feet (117 meters) may be needed to reach Level B marine mammal thresholds.

Underwater unweighted RMS sound levels measured during the installation of four 30-inch steel pipe piles with the vibratory hammer ranged from 133 to 181 dB re: 1 μPa. The ranges of underwater sound levels for each marine mammal hearing group and unweighted sound levels measured during vibratory pile driving are shown in Table 1.2. The highest daily unweighted cSEL measured during vibratory pile driving was 206 dB re: 1 μPa. The measured median airborne RMS sound level was 100 dB re: 20 μPa.

Table 1.2 Underwater Sound Levels – Vibratory Pile Driving, min-max (median) dB re: 1 μPa

Metric	Unweighted	Cetaceans			Pinnipeds	
		Low-Frequency	Mid-Frequency	High-Frequency	Phocid	Otariid
Peak	150-218 (189)	138-212 (184)	145-216 (185)	145-216 (185)	140-214 (184)	138-214 (184)
RMS	133-181 (170)	123-175 (165)	127-176 (165)	128-176 (165)	123-174 (163)	123-175 (164)
SEL	143-191 (180)	133-185 (175)	137-186 (175)	138-186 (175)	133-184 (173)	133-185 (174)

Note: Sound levels are normalized to 33 feet (10 meters) from piles

Using the highest daily cSEL and median RMS levels measured during vibratory pile driving, up to 2,646 feet (806 meters) may be necessary for sound levels to dissipate to below the Level A marine mammal thresholds for high-frequency cetaceans and between 2 feet (0.6 meters) and 58 feet (18 meters) for other marine mammal hearing groups. Up to 33,617 feet (10,246 meters) may be needed to reach Level B thresholds.

During impact pile driving of the 30-inch diameter steel pipe piles, underwater RMS_{90} sound levels ranged from 151 to 209 dB re: 1 μPa and the highest daily unweighted cSEL was 209 dB re: 1 μPa. The median duration of the portion of the pile strike containing 90% of the acoustical energy was 37.6 milliseconds. The ranges and median underwater sound levels for each marine mammal hearing group and unweighted sound levels are shown in Table 1.3. The median 1-second airborne RMS sound level measured during impact pile driving was 107 dB re: 20 μPa at 50 feet (15.24 meters) from the piles.

Table 1.3 Underwater Sound Levels – Impact Pile Driving, min-max (median) dB re: 1 μPa

Metric	Unweighted	Cetaceans			Pinnipeds	
		Low-Frequency	Mid-Frequency	High-Frequency	Phocid	Otariid
Peak	167-218 (201)	162-213 (196)	161-216 (196)	162-215 (196)	159-213 (193)	160-213 (194)
RMS_{90}	151-209 (187)	147-202 (182)	145-202 (181)	146-203 (181)	143-202 (179)	144-202 (180)
SEL	142-199 (172)	136-184 (167)	136-192 (166)	137-193 (167)	132-184 (164)	133-182 (165)

Note: Sound levels are normalized to 33 feet (10 meters) from piles

Based on the underwater sound levels measured during impact pile driving, it is estimated that 58,310 feet (17,772 meters) may be necessary for underwater sound levels to reach Level A marine mammal thresholds for high-frequency cetaceans and between 26 feet (8 meters) and 760 feet (232 meters) for other marine mammal hearing groups. Underwater sound levels are estimated to reach Level B marine mammal thresholds 967 feet (295 meters) from the piles.

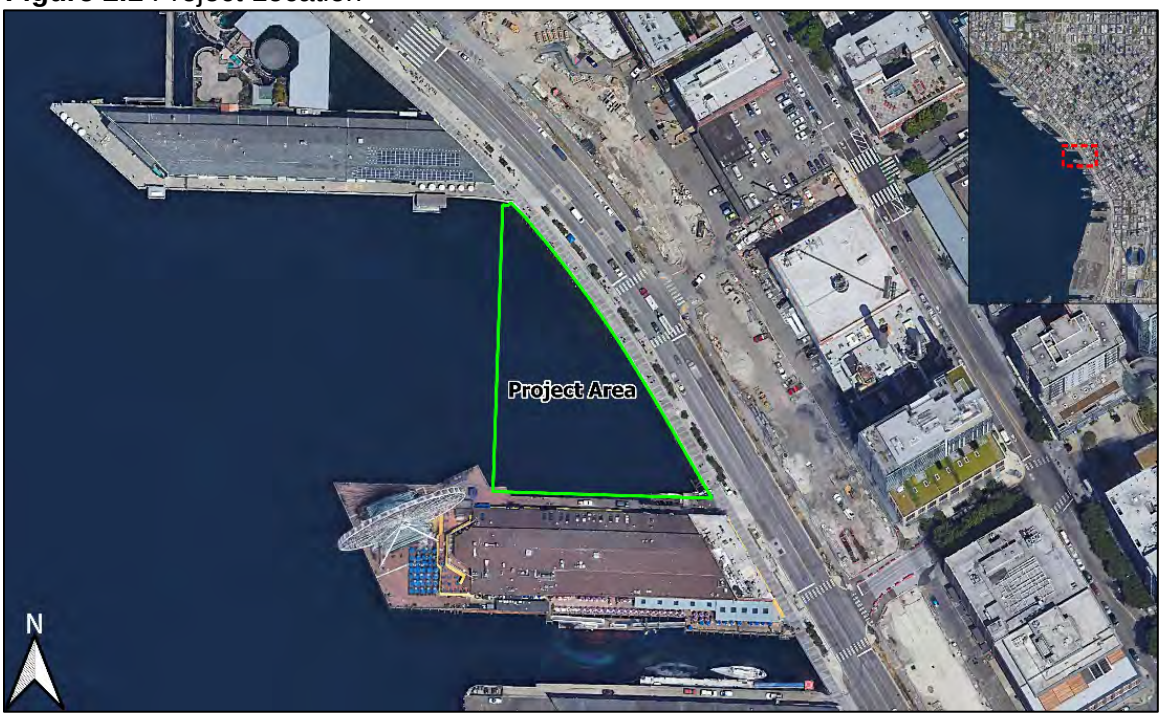
2.0 INTRODUCTION

This Report summarizes the results of airborne and underwater sound levels measured during the removal of steel H-piles with a vibratory pile extractor and during installation of 30-inch steel pipe piles with a vibratory pile driver and diesel impact hammer. Measurements were made between October and December 2022.

The Marine Mammal Monitoring Plan for this Project specifies requirements for the number of days acoustic monitoring would be conducted, the number of measurement locations, signal processing, and reporting. This Report fulfills the Project's acoustic monitoring and reporting requirements.

The Project is located west of Alaskan Way, between University Street and Pike Street in Seattle, Washington. The Seattle Aquarium on Pier 59 is located directly north of the Project and Miners Landing on Pier 57 is south of the Project. The Project location is shown in Figure 2.1.

Figure 2.1 Project Location



3.0 NOMENCLATURE

The auditory response to sound is a complex process that occurs over a wide range of frequencies and intensities. Decibel levels, or "dB," are a form of shorthand that compresses this broad range of levels with a convenient, logarithmic scale.

Decibels are defined as the squared ratio of the sound pressure level (SPL) with a reference sound pressure. The reference pressure for airborne sound is 20 micropascals (μPa) and for underwater sound the reference pressure is 1 μPa. The use of 20 μPa in air is convenient because 1 dB re: 20 μPa correlates to the human threshold for hearing. It is important to note that because of these different reference pressures, airborne and underwater sound levels cannot be directly compared.

The following metrics are referenced in this Report:

- **Peak**

  The peak sound pressure level is the instantaneous absolute maximum pressure observed during a measured event. Peak pressure can be presented as a pressure or dB referenced to a standard pressure (20 μPa for airborne and 1 μPa for underwater).

- **Root Mean Square (RMS)**

  The RMS level is the square root of the average squared pressure over a given time period. In hydroacoustics, the RMS level has been used by the National Marine Fisheries Service (NMFS) in criteria for assessing sound pressure impact on marine mammals.

- **90% Root Mean Square (RMS_{90})**

  The RMS_{90} level is used for the analysis of impact pile driving and is the RMS level containing 90 percent of the energy in a pile strike. The RMS_{90} energy is established between the 5% and 95% of the pile energy and is calculated for each pile strike.

- **Sound Exposure Level (SEL)**

  The SEL is the squared sound pressure integrated or summed over time, referenced to a standard pressure squared (20 μPa for airborne and 1 μPa for underwater), normalized to one second, and converted to decibels.

- **Cumulative Sound Exposure Level (cSEL)**

  The cSEL is the SEL accumulated over time. In this report cSEL is calculated by combining the single strike SEL values for each pile.

4.0 REGULATORY CRITERIA

Anticipated underwater sound levels 33 feet (10 meters) from pile activities are listed in the Project's Marine Mammal Monitoring Plan (MMM Plan) and are shown in Table 4.1.

Table 4.1 Anticipated Underwater Sound Levels, RMS dB re: 1 μPa

Type	Method	Source Sound Level
Timber and 14-inch steel H-piles	Vibratory Removal	152
30-inch steel piles	Vibratory Installation	163
30-inch steel piles	Impact Installation	180

The MMM Plan specifies the following acoustic monitoring and reporting requirements:

- Up to four days of acoustic monitoring will be conducted with a goal of collecting data from each type of pile related activity.
- Measurements will be made with at least two hydrophones and one microphone to record airborne sound levels. A direct line of acoustic transmission between the hydrophones and pile activities should be maintained, whenever possible.
- One hydrophone will be located 33 feet (10 meters) from the pile activities and the other hydrophone will be located approximately 3H, where H is the water depth at the pile or demolition activity. Due to site access and safety constraints, measurement distances may exceed 10 meters (33 feet) from the piles. Both hydrophones will be deployed at least 3 feet (1 meter) below the surface and 3 feet (1 meter) above the seafloor at mid-water depth.
- Results from measurements not made at 10 meters (33 feet) from the piles will be normalized to 10 meters (33 feet) using the Practical Spreading Model.
- Record sound levels continuously throughout pile installation during the monitoring period.
- Prior to monitoring, water depth will be measured to ensure the hydrophones will not drag on the bottom during tidal changes.
- Configure the hydrophones, signal conditioning, and recording equipment to acquire data without clipping.

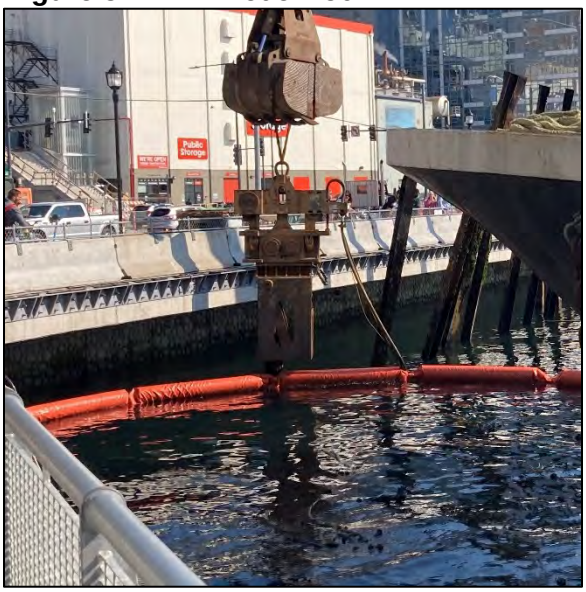
- Underwater data will be post processed to calculate the range, logarithmic average, median, and standard deviation of peak, RMS, RMS_{90}, and SEL sound levels. The 24-hour cSEL for each day of pile driving will be reported and the frequency spectrum will be provided for each functional hearing group. All underwater source levels will be standardized to a reference distance of 33 feet (10 meters).
- Post analysis of airborne sound levels will include the range and average of unweighted RMS values for each recorded pile. The average values will be used to determine the extent of the airborne isopleths relative to species specific criteria. The airborne frequency spectrum will be provided from 20 Hz to 20 kHz and all airborne source levels will be normalized to 50 feet (15 meters).
- Perform acoustic monitoring using a standardized methodology that will facilitate comparisons with other studies.

5.0 PILE INSTALLATION AND DEMOLITION EQUIPMENT INFORMATION

Removal of the steel H-piles during the acoustic monitoring was accomplished with a vibratory extractor. The vibratory extractor was used to extract the piles several feet before the piles were removed by an excavator. The vibratory extractor was used between 110 and 310 seconds per pile. The steel H-piles were embedded approximately 40 feet (12 meters) into the substrate.

An APE Model 150 Vibratory Driver/Extractor was used to remove eight steel H-piles during the monitoring period on October 3, 2022. The APE Model 150 has a driving force of 85 tons, an operating frequency of 0 to 1,650 VPM, and has a maximum line pull of 108 tons. A cut sheet of the APE Model 150 is provided in the Appendix and a photo of the APE Model 150 is shown in Figure 5.1.

Figure 5.1 APE Model 150



Piles installed during the monitoring period were driven to refusal with a vibratory pile driver, then with an impact hammer for the remainder of the pile drive. The steel pipe piles were 30-inches in diameter and between 92 and 121 feet in length. The substrate the piles were driven into was generally hard, rocky, and covered with silt and marine debris. A photo of the typical seafloor is provided in Figure 5.2.

Figure 5.2 Seafloor Near Pier 58

During the acoustic monitoring, vibratory pile driving was completed using an Antaeus 325-6 Vibratory Pile Driver and Extractor. The Antaeus 325-6 operates at a maximum frequency of 1,650 VPM with a maximum driving force of 270 tons and has a suspended weight of 19,450 pounds. A cut sheet of the Antaeus 325-6 can be found in the Appendix of this Report.

After the piles were driven to refusal with the vibratory hammer, an APE Model D62-22 single acting diesel impact hammer was used to drive the piles to embedment. The APE Model D62-22 has an energy rating of 78,956 to 153,770 foot-pounds, a piston weight of 13,669 pounds, and a stroke length of 11.24 feet. A cut sheet of the APE Model D62-22 diesel impact hammer can be found in the Appendix.

Photos of the Antaeus 325-6 Vibratory Pile Driver and Extractor and APE Model D62-22 are shown in Figure 5.3 and Figure 5.4.

Figure 5.3 Antaeus 325-6

Figure 5.4 APE D62-22

An unconfined bubble curtain was used during all impact pile driving. Design drawings of the bubble curtain are provided in the Appendix and photos of the bubble curtain are shown in Figure 5.5 and Figure 5.6.

Figure 5.5 Bubble Curtain

Figure 5.6 Bubble Curtain Operational

A summary of the piles installed during the acoustic monitoring are shown in Table 5.1, which includes the date the pile was driven, driving method, type of sound attenuation used, water depth at the pile, approximate embedment depth, and duration or number of pile strikes for the pile drive. Additional information about the piles can be found in the Appendix.

Table 5.1 Pile Summary, Feet (Meters)

Pile ID	Date	Driving Method	Sound Attenuation	Water Depth	Embedment[1]	Duration (seconds)[2]	Number of Strikes[3]
D-11	11/3/22	Impact	Bubble Curtain	21 (6)	73 (22)	-	888
X-5		Vibratory	None	14 (4)	72 (22)	2,500	-
X-6	11/28/22	Impact	Bubble Curtain	17 (5)	72 (22)	-	342
X-7		Impact	Bubble Curtain	17 (5)	72 (22)	-	720
X-8		Impact	Bubble Curtain	14 (4)	72 (22)	-	709
Y-13A		Impact	Bubble Curtain	5 (1.5)	71 (22)	-	646
F-1	12/6/22	Vibratory	None	28 (9)	72 (22)	690	-
G-4		Impact	Bubble Curtain	24 (7)	70 (21)	-	367
G-5		Vibratory	None	23 (7)	70 (21)	790	-
		Impact	Bubble Curtain			-	807
G-6		Vibratory	None	20 (6)	77 (23)	640	-
		Impact	Bubble Curtain			-	1,107

1. Embedment depth is based on information shown in the Project's design drawings.
2. Duration of pile drive is based on the hydroacoustic analysis and may differ from information in the pile logs.
3. Number of pile strikes are based on the hydroacoustic results and may differ from those included in the pile logs.

6.0 MEASUREMENT METHODOLOGY

The hydroacoustic and airborne monitoring equipment used during the measurements is identified in Table 6.1 and

Table 6.2.

Table 6.1 Hydroacoustic Monitoring Equipment

Make and Model	Quantity	Description	Serial Number
Brüel & Kjaer Type 2250	1	Sound Level Analyzer	3006756
Reson TC-4013	2	Hydrophone	2513032
			0712213
Brüel & Kjaer Type 2647-A	2	Charge Converter (1 mV/pC)	2582112
			2638259
Brüel & Kjaer 1704-A-002	1	Signal Conditioner	101161
G.R.A.S. Type 42AC	1	Pistonphone	201835
Tascam DR-100MKIII	1	Digital Audio Recorder	1690316

Table 6.2 Airborne Monitoring Equipment

Make and Model	Quantity	Description	Serial Number
Svantek 979	1	Sound Level Analyzer	46177
PCB 426E01	1	Preamplifier	53673
G.R.A.S. 40 AE	1	Microphone	258193
Larson Davis CAL200	1	Acoustic Calibrator	16828

Calibration tones were recorded before and after each day of monitoring for verification of calibration factors used during post-processing. Hydrophones were calibrated using the G.R.A.S. pistonphone and the microphone was calibrated with the Larson Davis CAL200 acoustic calibrator.

Underwater sound levels were measured using Reson TC-4013 hydrophones and Brüel & Kjaer Type 2647-A charge converters that were connected to a Brüel & Kjaer 1704-A-002 signal conditioner. The signal conditioner was connected to the Tascam DR-100KMIII digital audio recorder, which recorded the signals as WAV files at a sample rate of 48,000 samples per second for subsequent signal analysis. The Brüel & Kjaer Type 2250 allowed for real-time approximations of peak and cSEL sound levels while the measurements were being performed.

Airborne sound levels were measured using the Svantek 979 sound level analyzer, which meets the requirements for an ANSI Type 1 sound level analyzer. The airborne equipment recorded a WAV file at a sample rate of 48,000 samples per second for subsequent signal analysis as well as logged 1-second unweighted L_{eq} and L_{max} sound levels. Spectral data was also recorded at 1-second intervals at 1/3 octave band resolution.

Photographs of the monitoring equipment are provided in Figure 6.1 and Figure 6.2.

Figure 6.1 Hydroacoustic Equipment

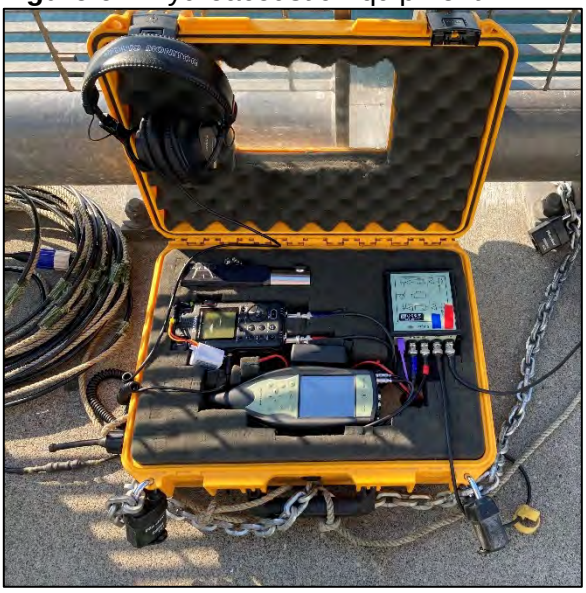


Figure 6.2 Airborne Equipment

Two hydrophones were used to measure underwater sound levels generated by pile installation and extraction activities. One hydrophone was located mid water depth as close to the activity being monitored as feasible (near-field), which was greater than 33 feet (10 meters) away. A far-

field hydrophone was deployed at mid water depth at least 3H from the activity, where H was the water depth at the location of the pile. Whenever possible, the hydrophones were positioned with a clear acoustic transmission path between the hydrophones and the activity.

The hydrophones were suspended from portions of the adjacent piers (Pier 57 and Pier 59). Due to safety concerns and site access limitations, the hydrophone closest to the pile installation and extraction activities was located greater than 33 feet (10 meters) away. During pile extraction activities, the near-field hydrophone was position between 66 and 110 feet (20 and 34 meters) from the H-piles. During pile installation, the near-field hydrophone was positioned between 21 and 202 feet (6 and 62 meters) from the piles.

Distances between the microphone and pile extraction ranged from 180 to 220 feet (55 and 67 meters) and from 12 to 202 feet (4 and 62 meters) during pile installation. The microphone was located approximately 6 feet above the deck and at least 6 feet from any acoustically reflective surfaces. A direct acoustic transmission path was maintained between the microphone and pile activities throughout the measurements.

The distances between the monitoring locations and the piles were calculated using Project drawings and GPS coordinates of the monitoring equipment. Water depth at the hydroacoustic monitoring locations was measured prior to deploying the hydrophones. In addition to the water depth measurements, tidal information was obtained from NOAA Station #9447130 and was used to track tidal changes throughout the measurements. Additional information about the hydrophone locations, including the water depth at the hydrophones, depth of the hydrophones, and distances from hydrophones to piles can be found in the Appendix.

Figures illustrating the pile locations and measurement locations are provided Figure 6.3 and Figure 6.4.

Figure 6.3 Pile and Measurement Locations during Pile Extraction

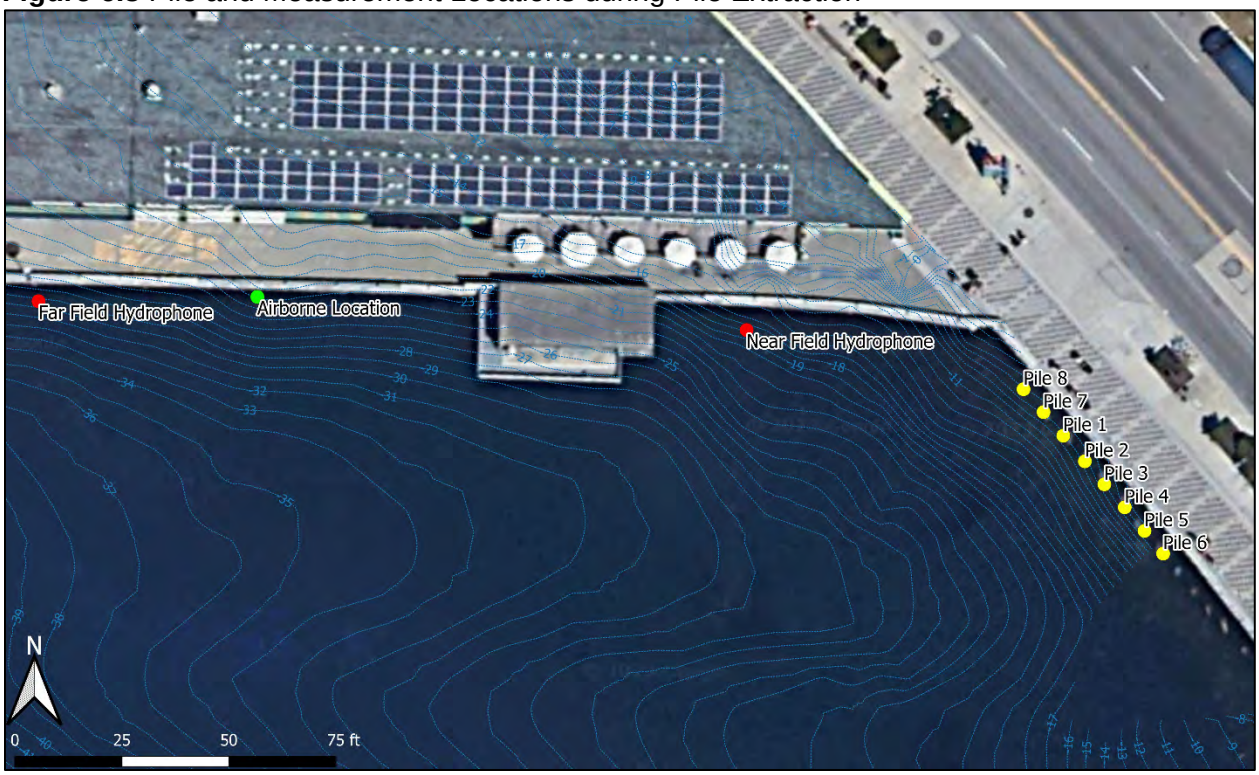


Figure 6.4 Pile and Measurement Locations during Pile Installation

7.0 PILE EXTRACTION AND INSTALLATION ANALYSIS AND RESULTS

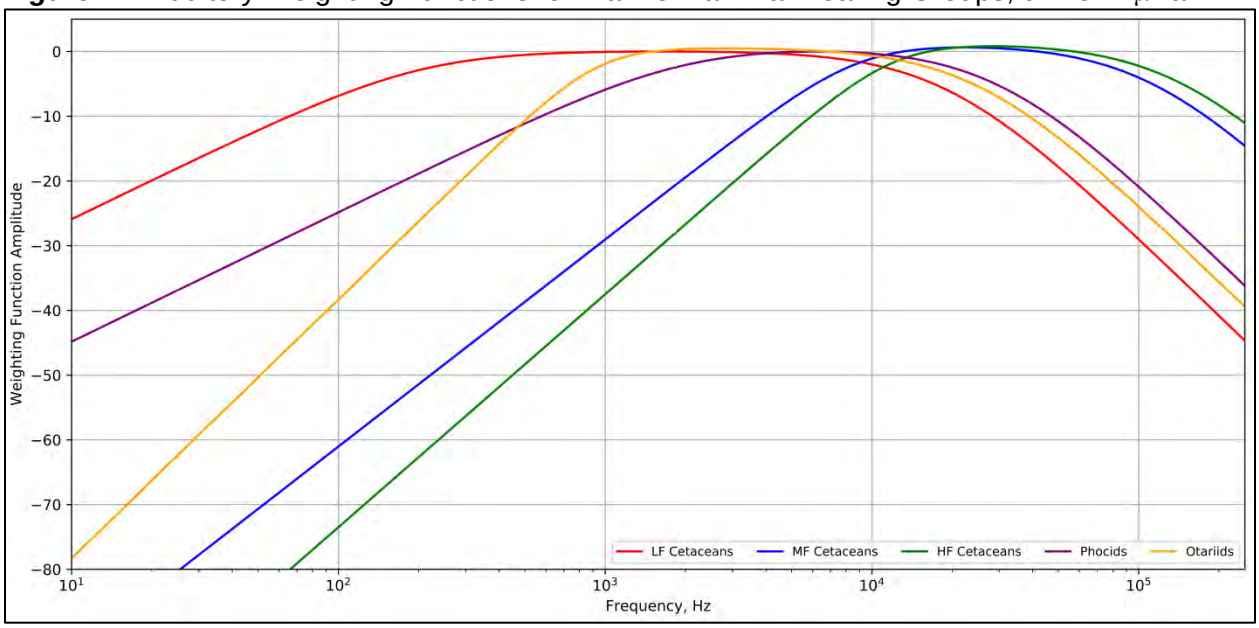
During post-processing, the hydroacoustic data were frequency-weighted for each of the marine mammal hearing groups defined in the NOAA technical guidance document titled "Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing" dated April 2018. This Technical Guidance divides marine mammals into five hearing groups, as summarized in Table 7.1.

Table 7.1 Marine Mammal Hearing Groups

Hearing Group	Generalized Hearing Frequency Range
Low-frequency (LF) cetaceans (baleen whales)	7 Hz – 35 kHz
Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whaled, bottlenose whales)	150 Hz – 160 kHz
High-frequency (HF) cetaceans (true porpoise, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger & L. australis*)	275 Hz – 160 kHz
Phocid pinnipeds (PW) (underwater) (true seals)	50 Hz – 86 kHz
Otariid pinnipeds (OW) (underwater) (sea lions and fur seals)	60 Hz -39 kHz

The auditory weighting functions for each of the marine mammal hearing groups are illustrated in Figure 7.1.

Figure 7.1 Auditory Weighting Functions for Marine Mammal Hearing Groups, dB re: 1 µPa



Underwater sound levels measured by the hydrophones have been normalized to 33 feet (10 meters) from pile activities using the practical spreading model. For additional information on the practical spreading model please see Section 8.0 of this Report.

Hydroacoustic data collected during vibratory pile extraction and vibratory pile driving were analyzed to determine the range, mean, median, and standard deviation of 10-second peak, RMS, and SEL values for each pile. Standard deviation and median sound levels were

calculated from decibel values and mean sound levels were calculated from sound pressure levels in pascals. RMS and SEL values were calculated from unweighted data and for each marine mammal hearing group. Peak sound levels are unweighted. cSEL values from each pile were calculated by combining individual SEL values from each pile. The resulting cSEL values from each pile were then combined to produce daily cSEL values. Periods when pile activities were not occurring were excluded from the analysis.

Underwater sound levels collected during impact pile driving were analyzed to calculate the range, mean, median, and standard deviation of peak, RMS_{90}, and SEL values for each marine mammal functional hearing group. The RMS_{90} was established over the portion of each pile strike containing 90% of the acoustical energy. SEL values were calculated for each pile strike over the portion of the strike used to calculate the RMS_{90} using the following formula:

$$\mathrm{SEL} = \mathrm{RMS(dB)} + 10\log_{10}(\tau)$$

Where τ is the time interval containing 90% of the acoustic energy in each pile strike.

No weighting functions were applied to the airborne data during post-processing. Reported airborne sound levels have been normalized to 50 feet (15 meters).

7.1 Vibratory Pile Extraction

Hydroacoustic and airborne sound levels were measured on October 3, 2022, during vibratory extraction of eight steel H-piles that were installed near northeast corner of the site. Unobstructed paths between the piles and sensors were maintained during all pile extraction activities.

During the extraction of Pile 1, a sea lion was seen approximately 500 feet (151 meters) west of the pile. During this time, a tugboat brought an additional materials barge to the site. The tugboat continued to move the barge during the measurements of Pile 1 and Pile 2, and the tugboat left the site without the barge during measurements of Pile 3. Sound originating from pile extraction was isolated from sound originating from the barge and tugboat so that only sound levels during periods of pile extraction were included in the analysis.

The ranges, means, and median underwater sound levels from both hydrophones during vibratory pile extraction are shown in Table 7.2. Sound level summaries and underwater frequency spectrum from each pile are provided in the Appendix.

Table 7.2 Range of Underwater Sound Levels during Vibratory Extraction, dB re: 1 μPa

Frequency Range	Peak				RMS				SEL			
	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med
Near-Field Hydrophone												
Unweighted	169	151	158	156	150	139	143	142	160	149	153	152
LF Cetacean					140	126	134	133	150	136	144	143
MF Cetacean					144	132	136	135	154	142	146	145
HF Cetacean					144	133	137	136	154	143	147	146
PW					135	124	130	129	145	134	140	139
OW					134	122	128	127	144	132	138	137
Far-Field Hydrophone												
Unweighted	173	149	160	155	155	134	144	141	165	144	154	151
LF Cetacean					149	125	137	133	159	135	147	143
MF Cetacean					149	128	138	135	159	138	148	145
HF Cetacean					150	129	138	135	160	139	148	145
PW					145	123	133	129	155	133	143	139
OW					144	121	133	127	154	131	143	137

Note: Sound levels are normalized to 33 feet (10 meters) from piles

Airborne RMS sound levels calculated 50 feet (15 meters) from vibratory pile extraction ranged from 91 to 103 dB re: 20 μPa and median RMS sound levels were 97 dB re: 20 μPa. Broadband and 1/3 octave band sound levels from each pile are provided in the Appendix.

7.2 Vibratory Pile Driving

Airborne and underwater sound levels were measured on November 3, 2022, and December 6, 2022, during vibratory pile driving of four 30-inch steel pipe piles. The piles were driven with an Antaeus 325-6 Vibratory Pile Driver and Extractor. Unobstructed acoustic paths were maintained between the sensors and piles throughout the measurements. Data was processed using the same methodology used for vibratory extraction.

Pile X-5 was initially driven partway on November 3, 2022, but was later extracted and reinstalled. Sound levels measured during the initial pile drive, removal, and reinstallation are all included in the reported sound levels for Pile X-5.

The hydrophones remained in the same locations during all pile driving activities on November 3, 2022, and December 6, 2022, except during the drive of Pile F-1. Because of the proximity of Pile F-1 to the near-field hydrophone location, the near-field hydrophone was relocated approximately 10 feet (3 meters) further west to better approximate the 33 feet (10 meter) distance from the pile. Measurement locations are shown in Figure 6.4.

The ranges, means, and median underwater sound levels from both hydrophones during vibratory pile driving are shown in Table 7.3. Sound level summaries and underwater frequency spectrum from each pile are provided in the Appendix.

Table 7.3 Range of Underwater Sound Levels during Vibratory Driving, dB re: 1 μPa

Frequency Range	Peak				RMS				SEL			
	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med
Near-Field Hydrophone												
Unweighted	218	150	194	189	181	133	171	170	191	143	181	180
LF Cetacean					175	123	166	165	185	133	176	175
MF Cetacean					176	127	167	165	186	137	177	175
HF Cetacean					176	128	167	165	186	138	177	175
PW					174	123	165	163	184	133	175	173
OW					175	123	166	164	185	133	176	174
Far-Field Hydrophone												
Unweighted	198	149	187	185	175	134	169	169	185	144	179	179
LF Cetacean					170	125	163	163	180	135	173	173
MF Cetacean					170	128	164	163	180	138	174	173
HF Cetacean					170	129	164	163	180	139	174	173
PW					169	124	163	161	179	134	173	171
OW					170	123	163	162	180	133	173	172

Note: Sound levels are normalized to 33 feet (10 meters) from piles

Airborne RMS sound levels from vibratory pile driving ranged from 77 to 109 dB re: 20 μPa and median sound levels were 100 dB re: 20 μPa at 50 feet (15 meters) from the piles. Broadband and 1/3 octave band sound levels from each pile driven with a vibratory hammer are provided in the Appendix.

7.3 Impact Pile Driving

Sound levels were measured during impact pile driving on November 3, 2022, November 20, 2022, and December 6, 2022. Impact pile driving occurred after the piles had been driven to refusal by the vibratory hammer. The APE Model D62-22 was used for all impact pile driving and unobstructed paths between the sensors and piles were maintained throughout each pile drive.

Soft starts occurred at the beginning of impact pile driving each day and were repeated if pile driving had ceased for greater than 30 minutes. Soft starts were done for Pile D-11 on November 3, 2022, Pile Y-13A and Pile X-7 on November 28, 2022, and Pile G-6 on December 6, 2022.

Different energy settings were used on the impact hammer during the measurements. Energy settings on the APE Model D62-22 range from 1 (lowest energy setting) to 4 (highest energy setting). Energy setting 3 was used during impact driving of Pile D-11 on November 3, 2022. During the first pile drive on November 28, 2022, which was Pile Y-13A, the impact hammer was initially set to energy setting 4 during the first portion of the pile drive between 8:55 a.m. 9:03 a.m. After a short break the energy setting was reduced to 3 for the remainder of the pile drive. Measured underwater sound levels were similar for the two energy settings. The impact hammer energy setting was then reset to 4 for the remainder of impact pile driving on November 28, 2022. Energy setting 4 was used during all impact pile driving on December 6, 2022.

On November 28, 2022, during the installation of Pile X-6, the bubble curtain was operating at a reduced airflow during approximately the first 30 pile strikes. This was caught and corrected by the construction crew, who promptly increased the airflow. Although not an official test of the effectiveness of the bubble curtain, peak underwater sound levels were observed to reduce by approximately 7 dB after the airflow was increased. Additionally, the duration of the 90% energy increased by approximately 9-milliseconds after the airflow was increased.

The ranges, means, and median underwater sound levels from both hydrophones during impact pile driving are shown in Table 7.4. The underwater sound levels recorded over the duration of each pile drive, the waveform of the strike which generated the absolute highest peak sound pressure level, the portion of the strike containing 90% of the acoustic energy, and the average underwater frequency spectrum from all the strikes from each pile are provided in the Appendix.

Table 7.4 Range of Underwater Sound Levels during Impact Driving, dB re: 1 μPa

Frequency Range	Peak				RMS_{90}				SEL			
	Max	**Min**	**Mean**	**Med**	**Max**	**Min**	**Mean**	**Med**	**Max**	**Min**	**Mean**	**Med**
Near-Field Hydrophone												
Unweighted	218	167	203	201	209	151	188	187	199	142	173	172
LF Cetacean					202	147	183	182	184	136	168	167
MF Cetacean					202	145	182	181	192	136	167	166
HF Cetacean					203	146	182	181	193	137	168	167
PW					202	143	179	179	184	132	165	164
OW					202	144	180	180	182	133	166	165
Far-Field Hydrophone												
Unweighted	209	175	201	200	196	160	186	186	181	149	172	171
LF Cetacean					191	156	181	181	176	143	167	166
MF Cetacean					190	154	180	180	175	143	166	165
HF Cetacean					191	155	181	180	176	144	166	166
PW					186	152	178	177	172	140	163	163
OW					188	153	179	178	172	141	165	164

Note: Sound levels are normalized to 33 feet (10 meters) from piles

Airborne RMS sound levels calculated 50 feet (15 meters) from impact pile driving ranged from 98 to 112 dB re: 20 μPa and median RMS sound levels were 107 dB re: 20 μPa. Broadband and 1/3 octave band sound levels from each pile driven with the impact hammer are provided in the Appendix.

8.0 DISTANCE TO MARINE MAMMAL DISTURBANCE AND INJURY THRESHOLDS

Data collected during pile extraction and installation were used to estimate the distances required for underwater sound levels to reach the disturbance (Level B) and injury thresholds (Level A) for marine mammals.

The distances were calculated using the "practical spreading model" currently used by NOAA. The practical spreading formula is provided below.

$$\mathrm{SPL_{D2}} = \mathrm{SPL_{D1}} + \beta * \log_{10}\left(\frac{\mathrm{D_1}}{\mathrm{D_2}}\right)$$

Where $\mathrm{SPL_{D1}}$ is the sound pressure measured at distance, D_1 and $\mathrm{SPL_{D2}}$ is the estimated sound pressure at distance, D_2. β is the attenuation factor resulting from acoustic spreading over distance. The California Department of Transportation (Caltrans) reported in the "Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish" dated November 2015, that β can range between 5 and 30 depending upon site specific conditions such as water depth, pile type, pile length and the substrate the pile is driven into. Currently NOAA uses the practical spreading model with β equaling 15, which results in a 4.5 dB reduction in underwater sound levels for each doubling of distance.

The formula provided above was also used to calculate the distances for airborne noise to reach the disturbance levels for harbor seals and other pinnipeds. In the case of airborne noise β is equal to 20, which is consistent information provided in the WSDOT document "Biological Assessment Preparation for Transportation Projects-Advanced Training Manual-Version 2020" for sound propagation from a point source over hard soil.

The distances required for underwater noise to reach the disturbance and injury thresholds for marine mammals are estimated by solving the practical spreading formula for D_2, resulting in the following:

$$\mathrm{D_2} = \mathrm{D_1} * 10^{\left(\frac{\mathrm{SPL_{D1}} - \mathrm{SPL_{D2}}}{15}\right)}$$

To estimate the distances required for underwater sound from pile activities to reach the Level A and Level B thresholds, sound levels were normalized to 33 feet (10 meters) to allow for comparison of measured sound levels. After calculating the sound levels at 33 feet (10 meters), the highest daily cSEL values, median peak, RMS, and RMS_{90} sound levels from pile extraction and installation were used to calculate the distances to the marine mammal thresholds.

The median 1-second RMS sound level was used to calculate the distances for airborne sound to reach disturbance thresholds for harbor seals and other pinnipeds.

8.1 Marine Mammal Threshold Distances

The results of the acoustic monitoring and analysis were used to estimate the distances required for underwater sound levels to reach the marine mammal injury (Level A) and disturbance (Level B) thresholds.

In April 2018, NOAA issued updated technical guidance for determining the effects of underwater sound on marine mammals titled "Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing". The Technical Guidance utilizes dual threshold criteria for injury from impulsive sounds, such as impact pile driving. These criteria are

peak sound pressure and cSEL values accumulated over a 24-hour period. The peak sound pressure criteria are unweighted and the cSEL values are frequency-weighted for each marine mammal hearing group. Injury criteria from non-impulsive sounds, such as vibratory pile driving and extraction, include only the 24-hour cSEL criteria. Injury thresholds provided in the Technical Guidance are summarized in Table 8.1.

Table 8.1 Injury Thresholds, dB re: 1 μPa

Hearing Group	Impulsive		Non-Impulsive
	Peak (unweighted)	cSEL (weighted)	cSEL (weighted)
Low-frequency (LF) cetaceans	219	183	199
Mid-frequency (MF) cetaceans	230	185	198
High-frequency (HF) cetaceans	202	155	173
Phocid pinnipeds (PW) (underwater)	218	185	201
Otariid pinnipeds (OW) (underwater)	232	203	219

Source: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing, April 2018

Marine mammal disturbance thresholds (Level B) from underwater sound are based on RMS sound levels from previous guidance and are shown in Table 8.2.

Table 8.2 Disturbance Thresholds (RMS), dB re: 1 μPa

Marine Mammal	Disturbance Threshold	
	Pile Extraction	Concrete Demolition
Cetaceans	120	160
Pinnipeds		

Source: National Marine Fisheries Service

Disturbance thresholds from airborne noise are the same for impulsive and non-impulsive sounds and are based on RMS sound levels. The disturbance thresholds from airborne noise are provided in Table 8.3.

Table 8.3 Airborne Disturbance Thresholds, RMS dB re: 20 μPa

Marine Mammal	Disturbance Threshold (Level B)
Harbor Seal	90
Other Pinnipeds	100

The resulting distances for underwater sound from pile activities to reach the marine mammal thresholds are shown in Table 8.4 through Table 8.6.

Table 8.4 Distances to Marine Mammal Thresholds from Vibratory Pile Extraction, Feet (Meters)

Hearing Group	Measured Sound Level, dB		Marine Mammal Threshold, dB		Distance to Threshold	
	cSEL	RMS	Level A, cSEL	Level B, RMS	Level A	Level B
LF Cetaceans	169	133	199	120	0.35 (0.11)	239 (73)
MF Cetaceans	170	135	198		0.47 (0.14)	348 (106)
HF Cetaceans	171	136	173		23.7 (7.2)	386 (117)
Pinnipeds (Phocids)	165	129	201		0.14 (0.04)	125 (38)
Pinnipeds (Otariids)	165	127	219		0.01 (0.008)	102 (31)

Table 8.5 Distances to Marine Mammal Thresholds from Vibratory Pile Driving, Feet (Meters)

Hearing Group	Measured Sound Level, dB		Marine Mammal Threshold, dB		Distance to Threshold	
	cSEL	RMS	Level A, cSEL	Level B, RMS	Level A	Level B
LF Cetaceans	200	165	199	120	40 (12)	30,946 (9,432)
MF Cetaceans	202	165	198		58 (18)	32,372 (9,866)
HF Cetaceans	202	165	173		2,646 (806)	33,617 (10,246)
Pinnipeds (Phocids)	200	163	201		29 (8.8)	24,438 (7,448)
Pinnipeds (Otariids)	201	164	219		2 (0.6)	28,176 (8,588)

Table 8.6 Distances to Marine Mammal Thresholds from Impact Pile Driving, Feet (Meters)

Hearing Group	Measured Sound Level, dB			Marine Mammal Threshold, dB			Distance to Threshold		
				Level A		Level B	Level A		Level B
	Peak[1]	cSEL	RMS_{90}	Peak	cSEL	RMS_{90}	Peak	cSEL	RMS_{90}
LF Cetaceans	201	203	182	219	183	160	2.2 (0.68)	760 (232)	967 (295)
MF Cetaceans		203	181	230	185		0.4 (0.13)	541 (165)	812 (248)
HF Cetaceans		204	181	202	155		30 (9.3)	58,310 (17,772)	871 (266)
Pinnipeds (Phocids)		200	179	218	185		2.6 (0.79)	346 (105)	584 (178)
Pinnipeds (Otariids)		201	180	232	203		0.3 (0.09)	26 (8)	714 (218)

1. All peak values shown in this table are unweighted peak levels.

As shown in Table 8.4, the estimated distances required for underwater sound produced by the removal of the steel H-piles to reach the 120 dB RMS marine mammal Level B threshold is up to 331 feet (117 meters) from the piles. Approximately 24 feet (7 meters) may be required for sound to dissipate below the Level A thresholds.

Underwater sound created from the vibratory pile driving were higher than those generated during pile removal. Up to 33,617 feet (10,246 meters) may be needed for underwater sound levels from vibratory pile driving to dissipate to below the Level B marine mammal threshold and up to 2,646 feet (806 meters) may be needed to reach the Level A thresholds, as shown in Table 8.5.

Up to 967 feet (295 meters) may be needed for underwater sound resulting from impact pile driving to fall below the Level B marine mammal threshold. Although the daily cSEL values from vibratory pile driving and impact driving were similar, the Level A cSEL thresholds are lower for impact pile driving, which results in greater distances for sound to dissipate below Level A thresholds. Up to 58,310 feet (17,772 meters) may be needed for underwater sound levels to reach Level A thresholds for high-frequency cetaceans. Distances to Level A thresholds for other cetaceans range from 541 feet (165 meters) to 760 feet (232 meters) and 26 feet (8 meters) to 346 feet (105 meters) for pinnipeds.

The distances required for airborne sound levels to reach the disturbance levels for harbor seals and other pinnipeds are shown in Table 8.7. Sound levels used to calculate the distances from pile activities are based on the median 1-second RMS sound level measured during each activity.

Table 8.7 Airborne Marine Mammal Threshold Distances, Feet (Meters)

Marine Mammal	Disturbance Threshold (Level B)	Vibratory Pile Extraction	Vibratory Pile Driving	Impact Pile Driving
Harbor Seal	90	111 (34)	156 (48)	345 (105)
Other Pinnipeds	100	35 (11)	49 (15)	109 (33)

8.2 Distance to Background Sound Levels

Distances needed to reach background sound levels were calculated using the median daytime background sound levels measured for each marine mammal hearing group between March 19 and March 22, 2018, during Season 1 of the Pier 62 Project. Pier 62 is located approximately 1,000 feet (305 meters) north of Pier 58. Background sound levels for each marine mammal hearing group and distances to reach these background sound levels are shown in Table 8.8.

Table 8.8 Distances to Background Sound Levels, Miles (Kilometers)

Hearing Group	Background Sound Level, dB	Median RMS or RMS_{90}, dB			Distance to Background		
		Pile Removal	Vibratory Pile Driving	Impact Pile Driving	Pile Removal	Vibratory Pile Driving	Impact Pile Driving
LF Cetaceans	118	133	165	182	0.06 (0.10)	8.0 (13)	116 (186)
MF Cetaceans	121	135	165	181	0.06 (0.09)	5.3 (8)	61 (99)
HF Cetaceans	121	136	165	181	0.06 (0.10)	5.5 (9)	66 (106)
Phocids	115	129	163	179	0.05 (0.08)	10.0 (16)	111 (178)
Otariids	115	127	164	180	0.04 (0.07)	11.5 (19)	135 (218)

8.3 Marine Mammal Monitoring

Monitors observed California sea lion, harbor seal, and Steller sea lion within the Level B Harassment Zone during pile driving and removal activities. One monitor reported on three separate instances of California sea lions and one instance of a harbor seal, all located approximately 100 meters away from the project site, changing their swimming direction to quickly the leave the area during impact installations. Additionally, another monitor observed two instances of California sea lions located approximately 3,600 meters away from the Project Site changing their swimming direction in response to the vibratory hammer being engaged. These instances were the only documented changes in behavior associated with pile removal or

demolition activities. No marine mammals were observed in the Level A Exclusion Zone during vibratory pile activity. Details and results of marine mammal monitoring are presented in a separate memorandum entitled “Waterfront Park Reconstruction Project (NWS-2019-703-WRD) Marine Mammal Monitoring Season 1 Report” (Anchor QEA 2023).

9.0 REFERENCES

Anchor QEA. "Waterfront Park Reconstruction Project Marine Mammal Monitoring Plan." September 2022.

Anchor QEA. "Waterfront Park Reconstruction Project (NWS-2019-703-WRD) Marine Mammal Monitoring Season 1 Report." March 2023.

California Department of Transportation. "Hydroacoustic Effects of Pile Driving on Fish." November 2015.

Madsen, P.T., M. Johnson, P.J.O. Miller, N. Aguilar Soto, J. Lynch, and P. Tyack. "Quantitative Measures of Air-Gun Pulses Recorded on Sperm Whales (Physeter macrocephalus) Using Acoustic Tags during Controlled Exposure Experiments." October 2006.

NMFS Northwest Region and Northwest Fisheries Science Center. "Guidance Document: Data Collection Methods to Characterize Impact and Vibratory Pile Driving Source Levels Relevant to Marine Mammals." January 31, 2012.

NOAA. "Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts." April 2018.

NOAA Fisheries National Marine Fisheries Service "Marine Mammal and Fish Injury and Disturbance Thresholds for Marine Construction Activity."

Washington State Department of Transportation. "Biological Assessment Preparation for Transportation Projects-Advanced Training Manual-Version 2015."

APPENDIX

Table of Contents

1.0 H-PILES EXTRACTED WITH VIBRATORY HAMMER

PILE – 1

October 3, 2022

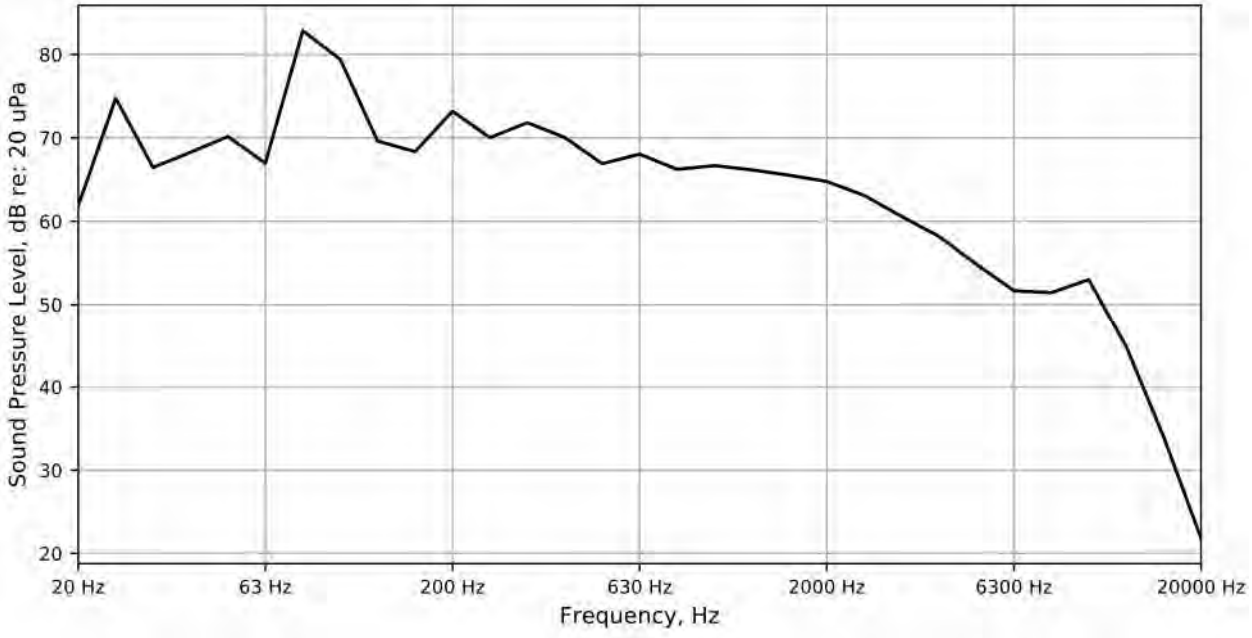
Hydrophone and Pile Information, Feet

Hydro Depth (Near/Far)	Distance			Water Depth	
	Between Hydros	Hydros to Pile (Near/Far)	Pile to Water's Edge	Hydros (Near/Far)	Pile
16/28	166	78/242	19	24/38	6

Airborne Sound Levels, dB re: 20 μPa

Median	Maximum	Minimum
98	103	93

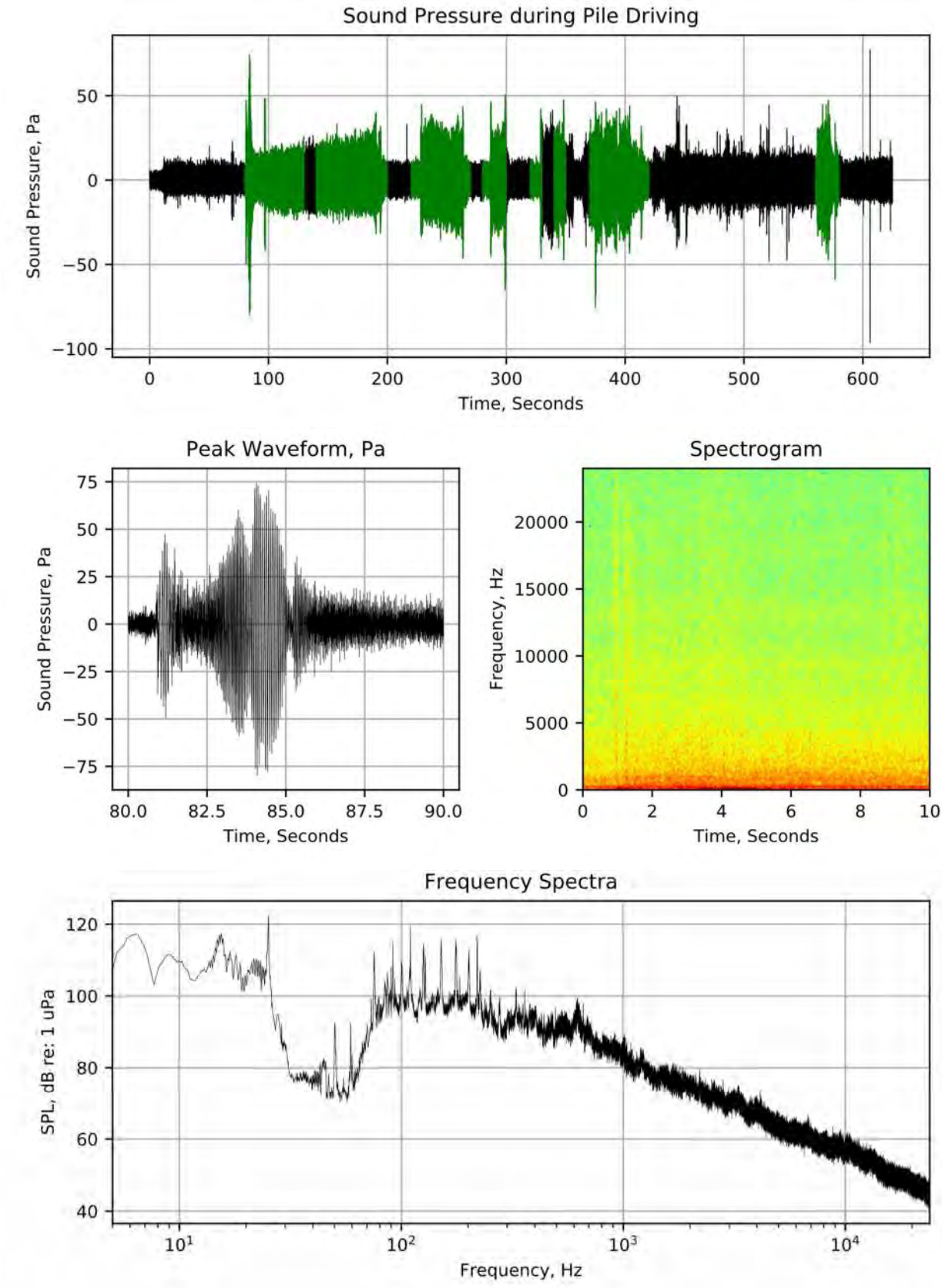
Airborne Frequency Spectrum



Underwater Sound Levels, dB re: 1 μPa

Frequency Range	Peak					RMS_{90}					SEL					cSEL
	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	
Near-Field Hydrophone																
Unweighted	164	152	2.8	158	158	150	140	2.2	143	143	160	150	2.2	153	153	168
LF Cetacean	155	144	3.1	150	150	138	128	2.6	134	134	148	138	2.6	144	144	159
MF Cetacean	158	146	2.8	152	152	144	134	2.2	137	137	154	144	2.2	147	147	162
HF Cetacean	158	146	2.8	153	153	144	134	2.2	138	137	154	144	2.2	148	147	163
PW	154	139	3.6	147	145	134	126	2.4	130	129	144	136	2.4	140	139	155
OW	154	138	4.3	146	143	133	124	2.8	128	127	143	134	2.8	138	137	153
Far-Field Hydrophone																
Unweighted	168	153	4.6	160	157	151	138	3.4	144	143	161	148	3.4	154	153	170
LF Cetacean	162	146	5.6	154	149	145	130	4.4	137	134	155	140	4.4	147	144	163
MF Cetacean	166	147	5.5	156	151	145	132	3.4	138	137	155	142	3.4	148	147	163
HF Cetacean	166	147	5.3	156	151	146	133	3.4	139	138	156	143	3.4	149	148	164
PW	163	142	6.2	152	147	141	126	4.3	133	130	151	136	4.3	143	140	158
OW	162	141	6.5	152	147	140	125	4.9	132	129	150	135	4.9	142	139	158

Note: Measurement distances normalized to 33 feet (10 meters)


Sound Pressure during Pile Driving
Sound Pressure, Pa
Time, Seconds
Peak Waveform, Pa
Sound Pressure, Pa
Time, Seconds
Spectrogram
Frequency, Hz
Time, Seconds
Frequency Spectra
SPL, dB re: 1 uPa
Frequency, Hz

PILE – 2

October 3, 2022

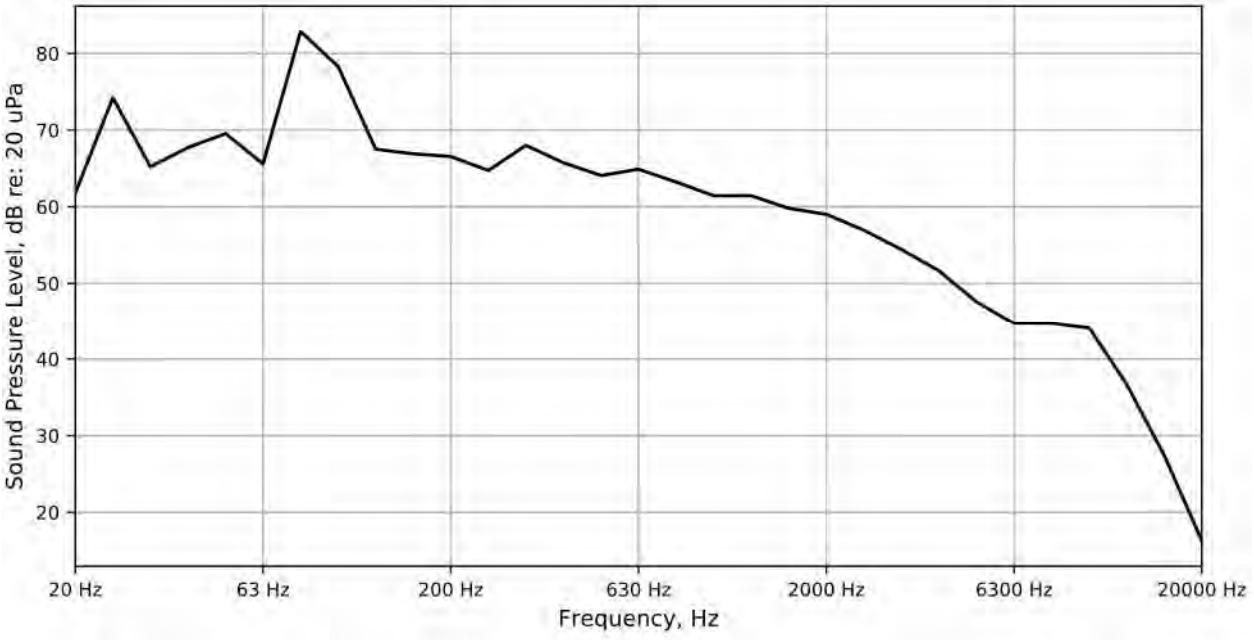
Hydrophone and Pile Information, Feet

Hydro Depth (Near/Far)	Distance			Water Depth	
	Between Hydros	Hydros to Pile (Near/Far)	Pile to Water's Edge	Hydros (Near/Far)	Pile
16/28	166	85/247	19	24/38	6

Airborne Sound Levels, dB re: 20 μPa

Median	Maximum	Minimum
97	102	92

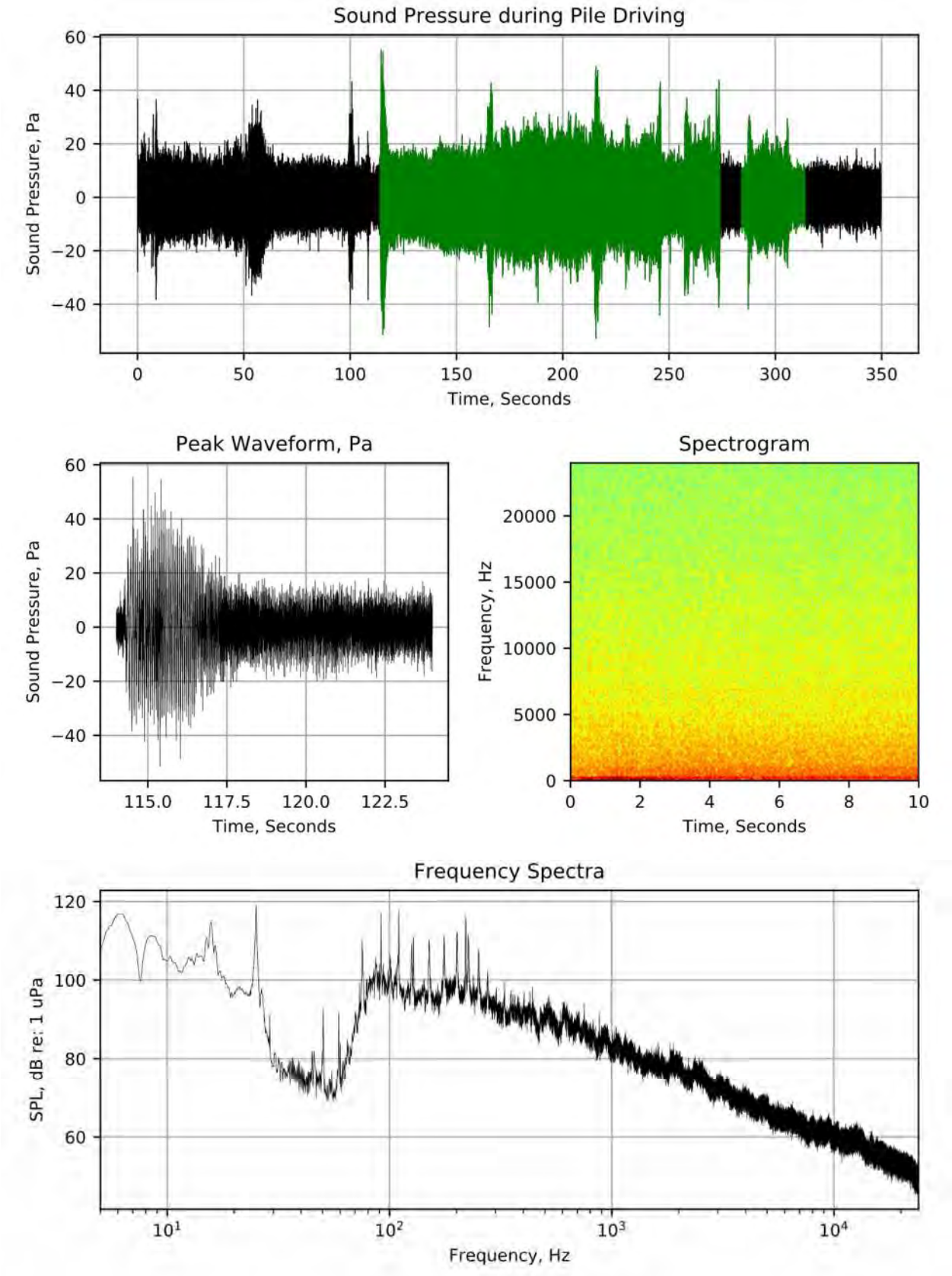
Airborne Frequency Spectrum



Underwater Sound Levels, dB re: 1 μPa

Frequency Range	Peak					RMS_{90}					SEL					cSEL
	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	
Near-Field Hydrophone																
Unweighted	161	153	2.3	157	156	146	140	1.5	143	143	156	150	1.5	153	153	166
LF Cetacean	153	144	2.4	149	148	137	129	1.9	134	134	147	139	1.9	144	144	157
MF Cetacean	155	147	2.6	151	152	139	134	1.5	137	136	149	144	1.5	147	146	159
HF Cetacean	156	147	2.5	152	152	140	135	1.5	137	137	150	145	1.5	147	147	160
PW	150	140	3.2	146	147	132	126	1.7	130	130	142	136	1.7	140	140	153
OW	149	139	3.5	146	145	132	125	1.9	129	129	142	135	1.9	139	139	152
Far-Field Hydrophone																
Unweighted	173	157	3.9	164	162	152	144	2.2	147	146	162	154	2.2	157	156	170
LF Cetacean	167	150	4.1	158	156	146	137	2.4	141	140	156	147	2.4	151	150	164
MF Cetacean	172	153	4.6	161	160	146	138	2.2	141	141	156	148	2.2	151	151	164
HF Cetacean	172	154	4.5	161	159	146	139	2.2	142	141	156	149	2.2	152	151	165
PW	170	150	4.7	159	157	142	134	2.3	137	136	152	144	2.3	147	146	161
OW	169	151	4.5	158	156	142	134	2.3	138	136	152	144	2.3	148	146	161

Note: Measurement distances normalized to 33 feet (10 meters)


Sound Pressure during Pile Driving
Sound Pressure, Pa
Time, Seconds
Peak Waveform, Pa
Sound Pressure, Pa
Time, Seconds
Spectrogram
Frequency, Hz
Time, Seconds
Frequency Spectra
SPL, dB re: 1 uPa
Frequency, Hz

PILE – 3

October 3, 2022

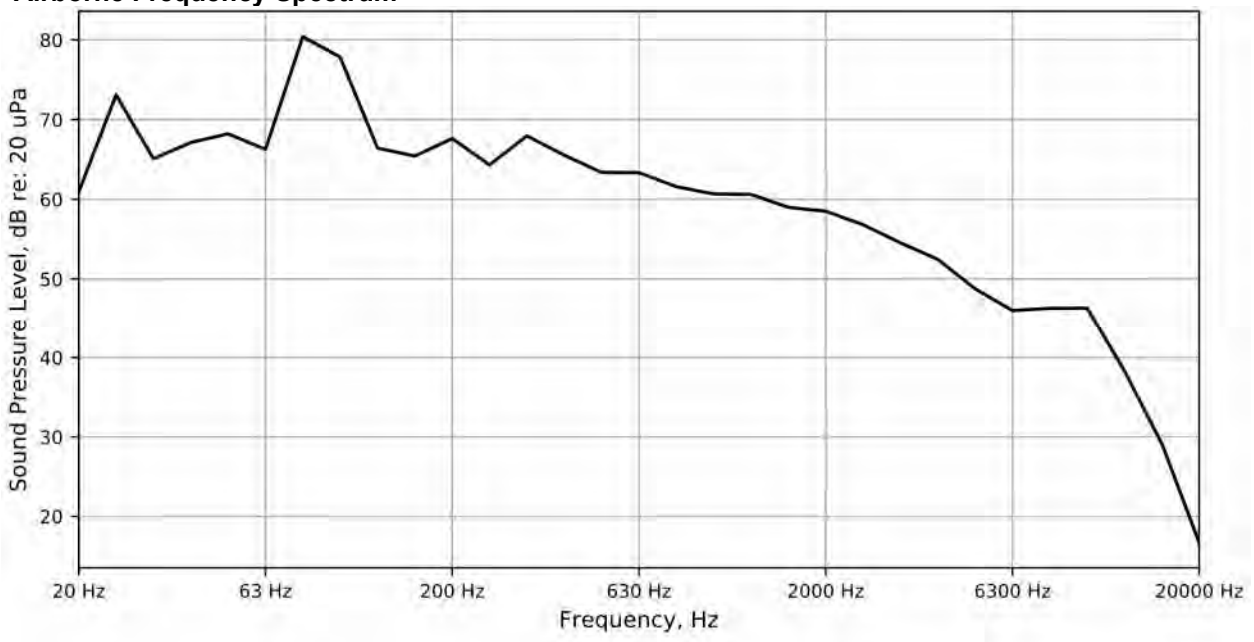
Hydrophone and Pile Information, Feet

Hydro Depth (Near/Far)	Distance			Water Depth	
	Between Hydros	Hydros to Pile (Near/Far)	Pile to Water's Edge	Hydros (Near/Far)	Pile
16/28	166	91/253	19	24/38	4

Airborne Sound Levels, dB re: 20 μPa

Median	Maximum	Minimum
96	100	92

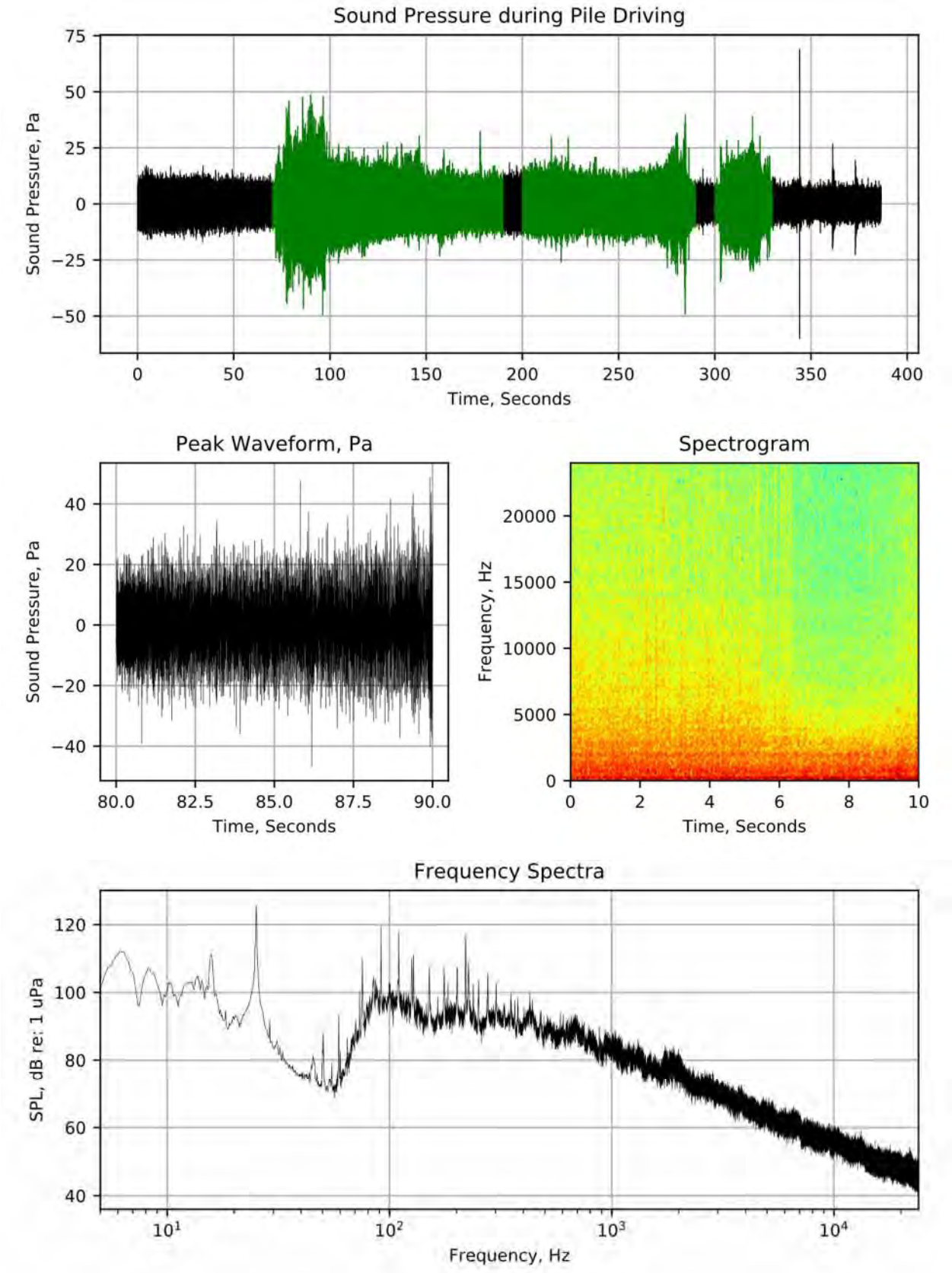
Airborne Frequency Spectrum



Underwater Sound Levels, dB re: 1 μPa

Frequency Range	Peak					RMS_{90}					SEL					cSEL
	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	
Near-Field Hydrophone																
Unweighted	161	152	2.5	156	156	146	139	2.2	142	140	156	149	2.2	152	150	166
LF Cetacean	154	145	2.6	149	149	137	131	1.8	133	132	147	141	1.8	143	142	157
MF Cetacean	158	145	3.2	151	150	140	132	2.2	135	134	150	142	2.2	145	144	160
HF Cetacean	158	146	3.0	151	150	141	133	2.2	136	135	151	143	2.2	146	145	160
PW	156	141	4.1	147	145	134	126	2.2	129	128	144	136	2.2	139	138	153
OW	156	140	4.3	147	146	134	125	2.6	128	127	144	135	2.6	138	137	152
Far-Field Hydrophone																
Unweighted	172	153	5.1	160	156	155	140	4.4	144	141	165	150	4.4	154	151	170
LF Cetacean	167	146	5.6	154	149	149	132	4.8	137	133	159	142	4.8	147	143	163
MF Cetacean	167	147	5.5	154	150	149	133	4.4	138	135	159	143	4.4	148	145	164
HF Cetacean	167	147	5.3	155	151	150	134	4.4	139	135	160	144	4.4	149	145	165
PW	164	141	6.1	151	146	145	127	4.9	133	129	155	137	4.9	143	139	159
OW	164	140	6.4	150	145	144	126	5.4	132	128	154	136	5.4	142	138	159

Note: Measurement distances normalized to 33 feet (10 meters)


Sound Pressure during Pile Driving
Sound Pressure, Pa
Time, Seconds
Peak Waveform, Pa
Sound Pressure, Pa
Time, Seconds
Spectrogram
Frequency, Hz
Time, Seconds
Frequency Spectra
SPL, dB re: 1 uPa
Frequency, Hz

PILE – 4

October 3, 2022

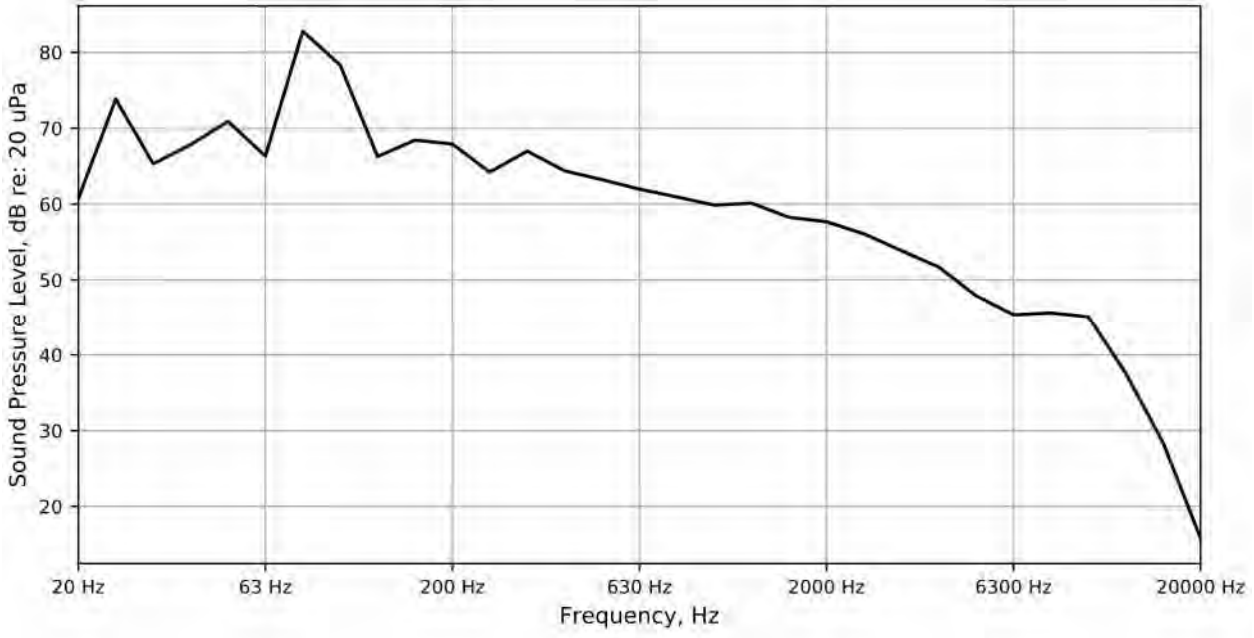
Hydrophone and Pile Information, Feet

Hydro Depth (Near/Far)	Distance			Water Depth	
	Between Hydros	Hydros to Pile (Near/Far)	Pile to Water's Edge	Hydros (Near/Far)	Pile
16/28	166	98/258	19	24/38	3

Airborne Sound Levels, dB re: 20 μPa

Median	Maximum	Minimum
98	101	94

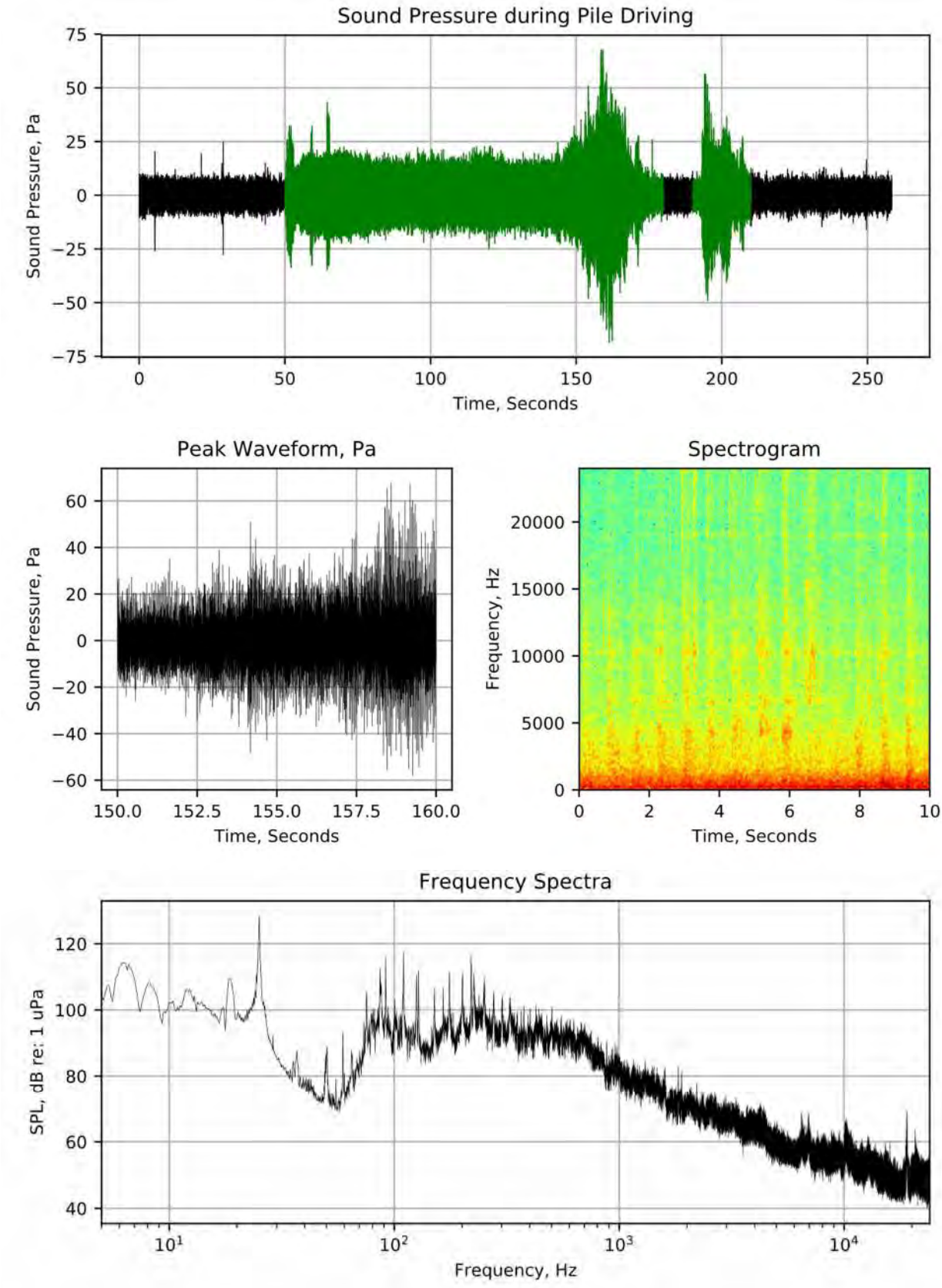
Airborne Frequency Spectrum



Underwater Sound Levels, dB re: 1 μPa

Frequency Range	Peak					RMS_{90}					SEL					cSEL
	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	
Near-Field Hydrophone																
Unweighted	164	153	3.7	158	157	147	141	1.8	144	143	157	151	1.8	154	153	166
LF Cetacean	159	145	4.6	151	150	140	127	3.2	135	133	150	137	3.2	145	143	157
MF Cetacean	158	147	3.8	152	151	141	135	1.9	138	137	151	145	1.9	148	147	160
HF Cetacean	159	148	3.8	152	151	142	136	1.9	138	138	152	146	1.9	148	148	160
PW	154	141	4.8	147	145	135	126	2.4	131	130	145	136	2.4	141	140	153
OW	154	139	5.2	147	144	134	124	2.7	129	128	144	134	2.7	139	138	151
Far-Field Hydrophone																
Unweighted	165	151	3.9	158	155	148	137	2.7	143	142	158	147	2.7	153	152	165
LF Cetacean	159	140	4.9	152	150	141	126	3.6	135	133	151	136	3.6	145	143	157
MF Cetacean	159	145	4.0	152	152	142	131	2.7	137	136	152	141	2.7	147	146	159
HF Cetacean	160	146	4.0	153	152	142	132	2.7	137	137	152	142	2.7	147	147	160
PW	155	142	4.3	148	147	136	124	2.9	130	129	146	134	2.9	140	139	153
OW	155	140	4.6	148	146	134	122	3.0	129	127	144	132	3.0	139	137	151

Note: Measurement distances normalized to 33 feet (10 meters)


Sound Pressure during Pile Driving
Sound Pressure, Pa
Time, Seconds
Peak Waveform, Pa
Sound Pressure, Pa
Time, Seconds
Spectrogram
Frequency, Hz
Time, Seconds
Frequency Spectra
SPL, dB re: 1 uPa
Frequency, Hz

PILE – 5

October 3, 2022

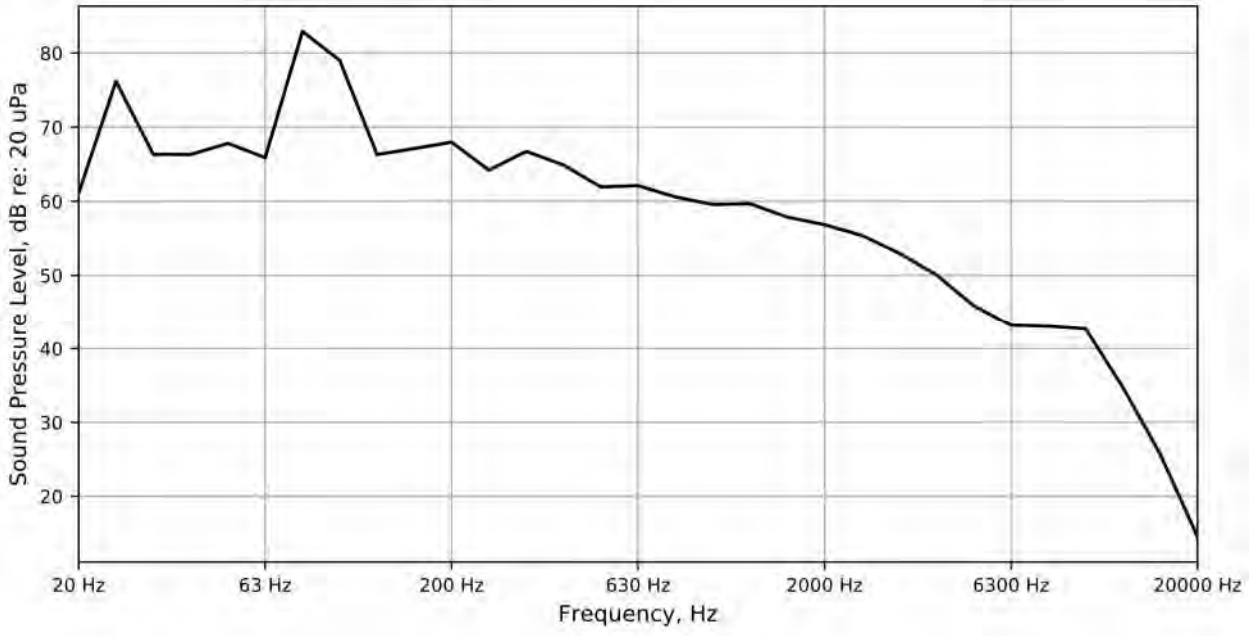
Hydrophone and Pile Information, Feet

Hydro Depth (Near/Far)	Distance			Water Depth	
	Between Hydros	Hydros to Pile (Near/Far)	Pile to Water's Edge	Hydros (Near/Far)	Pile
16/28	166	104/264	19	24/38	3

Airborne Sound Levels, dB re: 20 μPa

Median	Maximum	Minimum
98	102	94

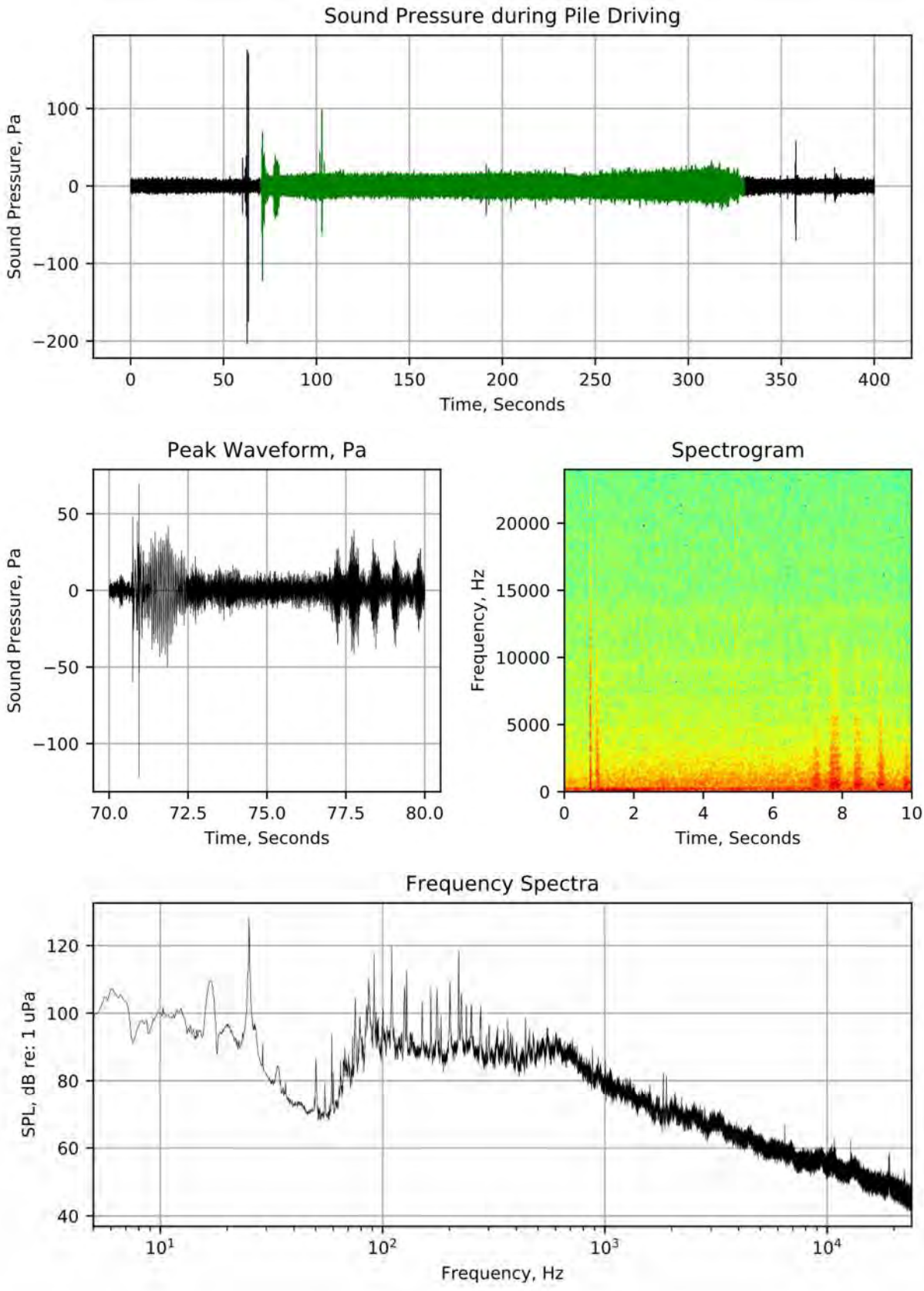
Airborne Frequency Spectrum



Underwater Sound Levels, dB re: 1 μPa

Frequency Range	Peak					RMS_{90}					SEL					cSEL
	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	
Near-Field Hydrophone																
Unweighted	169	151	4.0	157	155	146	140	1.1	142	142	156	150	1.1	152	152	166
LF Cetacean	163	143	4.6	150	148	136	131	1.3	133	132	146	141	1.3	143	142	157
MF Cetacean	166	146	4.6	153	150	139	134	1.1	136	136	149	144	1.1	146	146	160
HF Cetacean	166	146	4.5	153	150	140	135	1.1	136	136	150	145	1.1	146	146	161
PW	164	140	5.5	149	145	132	127	1.3	129	128	142	137	1.3	139	138	153
OW	163	139	5.8	149	145	131	125	1.6	127	126	141	135	1.6	137	136	152
Far-Field Hydrophone																
Unweighted	169	152	3.6	156	155	146	138	2.1	141	140	156	148	2.1	151	150	165
LF Cetacean	164	144	3.9	150	148	138	131	2.0	133	132	148	141	2.0	143	142	158
MF Cetacean	163	146	3.7	151	149	139	132	2.0	135	133	149	142	2.0	145	143	159
HF Cetacean	164	146	3.7	151	150	140	133	2.0	135	134	150	143	2.0	145	144	160
PW	159	141	4.2	147	146	133	127	1.9	129	128	143	137	1.9	139	138	153
OW	158	140	4.4	147	145	132	126	1.9	128	127	142	136	1.9	138	137	152

Note: Measurement distances normalized to 33 feet (10 meters)


Sound Pressure during Pile Driving
Sound Pressure, Pa
Time, Seconds
Peak Waveform, Pa
Sound Pressure, Pa
Time, Seconds
Spectrogram
Frequency, Hz
Time, Seconds
Frequency Spectra
SPL, dB re: 1 uPa
Frequency, Hz

PILE – 6

October 3, 2022

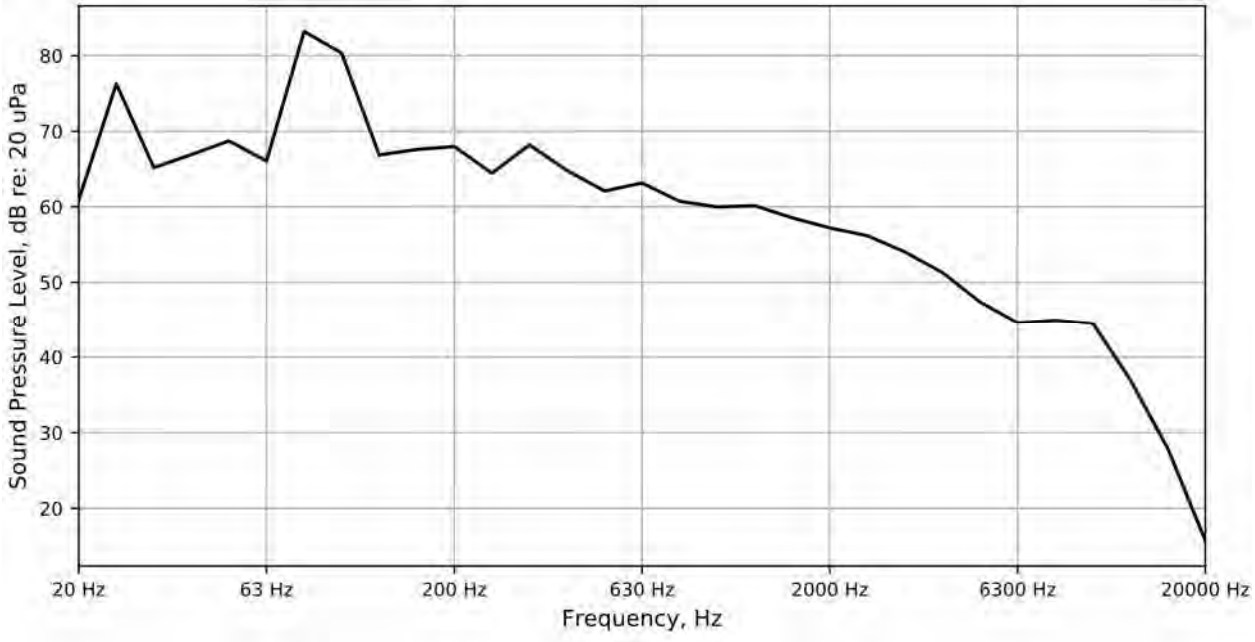
Hydrophone and Pile Information, Feet

Hydro Depth (Near/Far)	Distance			Water Depth	
	Between Hydros	Hydros to Pile (Near/Far)	Pile to Water's Edge	Hydros (Near/Far)	Pile
16/28	166	110/269	19	24/38	4

Airborne Sound Levels, dB re: 20 μPa

Median	Maximum	Minimum
99	103	94

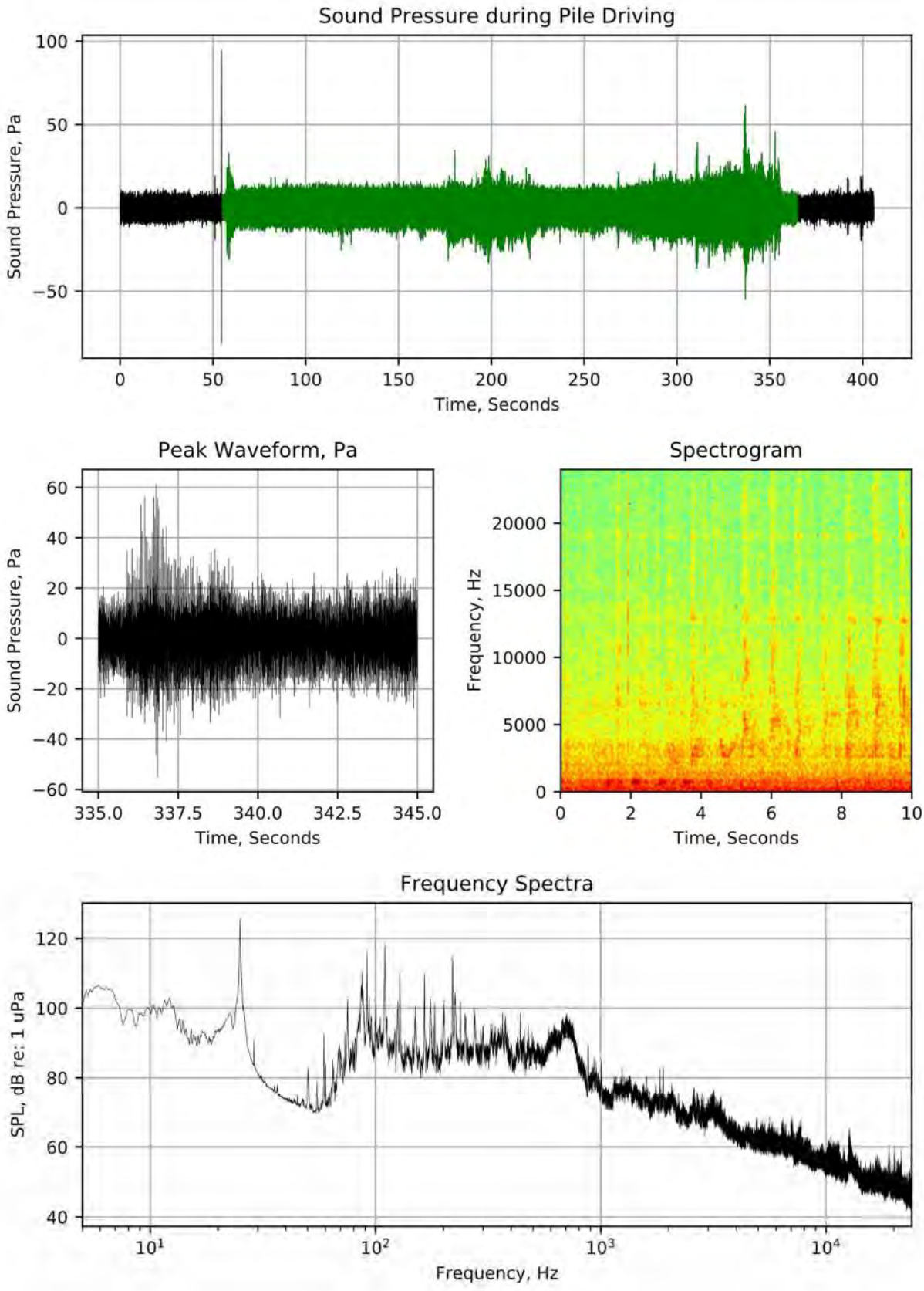
Airborne Frequency Spectrum



Underwater Sound Levels, dB re: 1 μPa

Frequency Range	Peak					RMS_{90}					SEL					cSEL
	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	
Near-Field Hydrophone																
Unweighted	163	151	3.1	156	155	146	139	1.6	142	141	156	149	1.6	152	151	167
LF Cetacean	158	143	3.5	149	148	138	128	2.4	133	132	148	138	2.4	143	142	158
MF Cetacean	158	145	3.3	151	150	139	133	1.7	135	135	149	143	1.7	145	145	160
HF Cetacean	158	145	3.2	151	151	140	134	1.7	136	135	150	144	1.7	146	145	161
PW	155	139	3.8	147	146	134	125	2.2	129	128	144	135	2.2	139	138	154
OW	154	138	4.0	147	146	134	123	2.7	128	127	144	133	2.7	138	137	154
Far-Field Hydrophone																
Unweighted	163	149	4.3	157	155	146	136	2.8	140	139	156	146	2.8	150	149	166
LF Cetacean	158	142	4.7	150	148	139	126	3.2	133	131	149	136	3.2	143	141	158
MF Cetacean	162	144	5.2	152	150	140	130	2.7	134	133	150	140	2.7	144	143	160
HF Cetacean	162	144	5.1	153	151	140	131	2.7	135	134	150	141	2.7	145	144	160
PW	158	139	5.6	149	145	135	124	2.7	129	128	145	134	2.7	139	138	154
OW	157	139	5.4	148	145	134	123	2.6	128	127	144	133	2.6	138	137	153

Note: Measurement distances normalized to 33 feet (10 meters)


Sound Pressure during Pile Driving
Sound Pressure, Pa
Time, Seconds
Peak Waveform, Pa
Sound Pressure, Pa
Time, Seconds
Spectrogram
Frequency, Hz
Time, Seconds
Frequency Spectra
SPL, dB re: 1 uPa
Frequency, Hz

PILE – 7

October 3, 2022

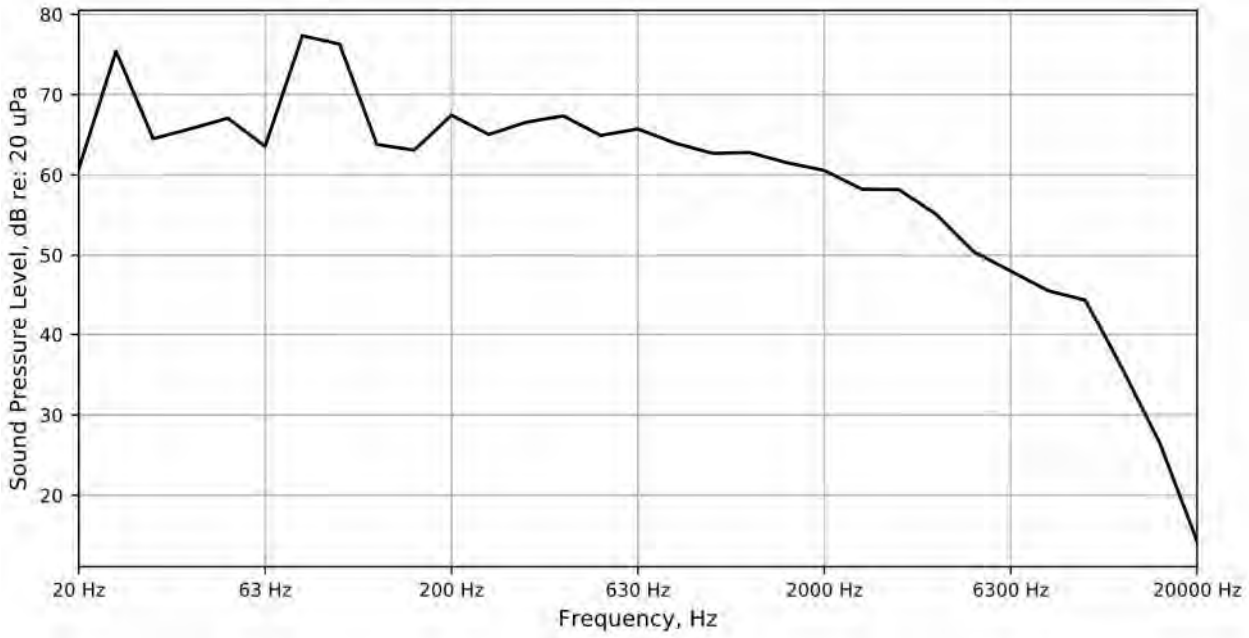
Hydrophone and Pile Information, Feet

Hydro Depth (Near/Far)	Distance			Water Depth	
	Between Hydros	Hydros to Pile (Near/Far)	Pile to Water's Edge	Hydros (Near/Far)	Pile
16/28	166	72/236	19	24/38	6

Airborne Sound Levels, dB re: 20 μPa

Median	Maximum	Minimum
94	99	92

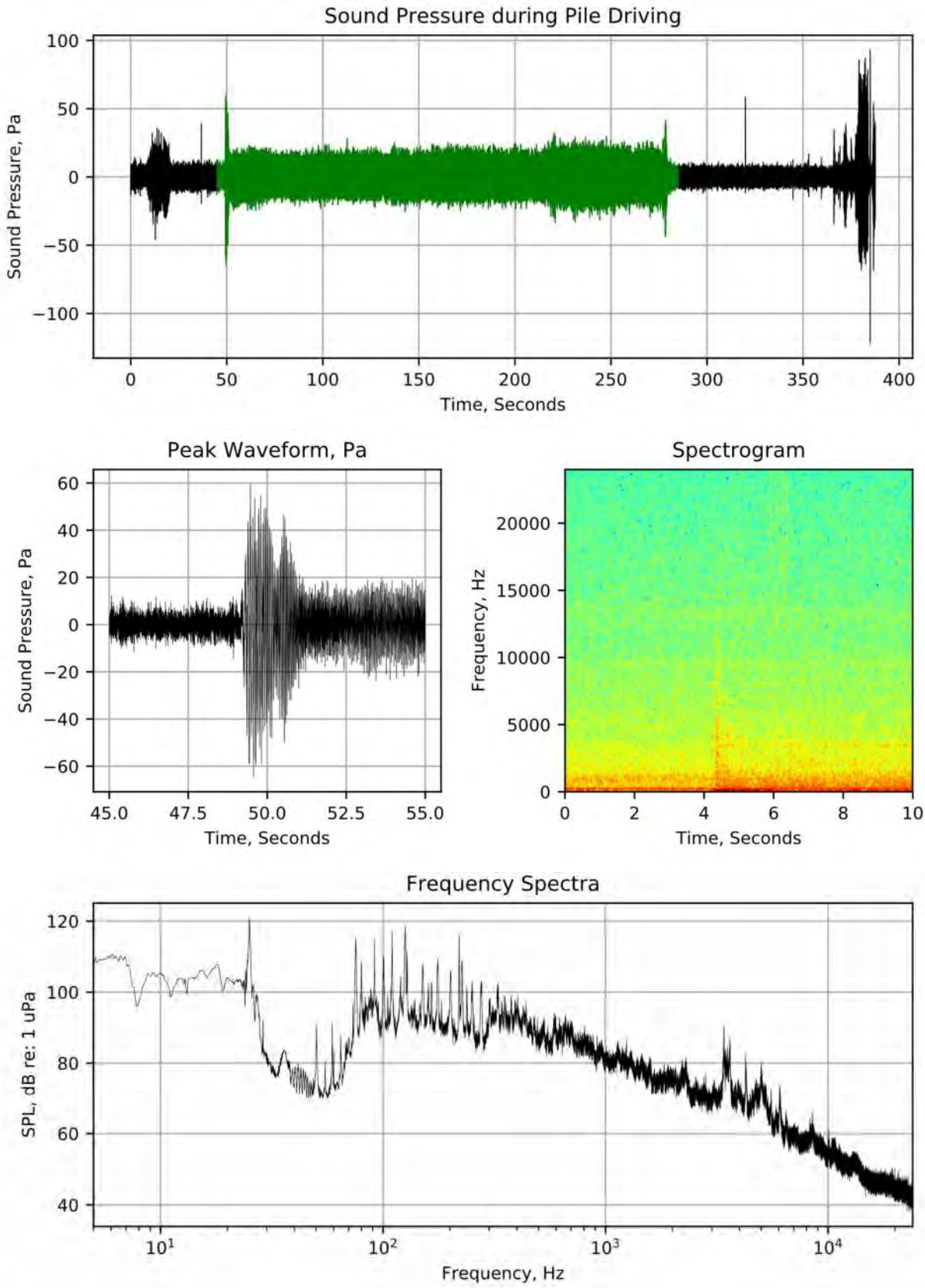
Airborne Frequency Spectrum



Underwater Sound Levels, dB re: 1 μPa

Frequency Range	Peak					RMS_{90}					SEL					cSEL
	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	
Near-Field Hydrophone																
Unweighted	163	151	2.3	154	153	145	139	1.3	141	141	155	149	1.3	151	151	165
LF Cetacean	155	142	2.4	147	146	135	127	1.5	133	132	145	137	1.5	143	142	156
MF Cetacean	157	145	2.4	149	148	139	133	1.3	135	135	149	143	1.3	145	145	159
HF Cetacean	157	146	2.4	149	148	140	134	1.3	135	135	150	144	1.3	145	145	159
PW	153	141	2.8	145	144	131	126	1.2	129	128	141	136	1.2	139	138	152
OW	153	140	2.9	145	144	130	125	1.6	127	127	140	135	1.6	137	137	151
Far-Field Hydrophone																
Unweighted	160	150	2.2	154	153	141	137	1.0	139	139	151	147	1.0	149	149	163
LF Cetacean	155	142	2.6	147	146	135	127	1.5	132	132	145	137	1.5	142	142	156
MF Cetacean	159	145	2.7	148	147	135	131	1.0	133	133	145	141	1.0	143	143	157
HF Cetacean	158	145	2.6	149	148	136	132	1.0	134	134	146	142	1.0	144	144	158
PW	156	140	3.0	145	144	130	125	1.2	128	128	140	135	1.2	138	138	152
OW	156	139	3.1	144	143	129	124	1.4	127	126	139	134	1.4	137	136	151

Note: Measurement distances normalized to 33 feet (10 meters)


Sound Pressure during Pile Driving
Sound Pressure, Pa
Time, Seconds
Peak Waveform, Pa
Sound Pressure, Pa
Time, Seconds
Spectrogram
Frequency, Hz
Time, Seconds
Frequency Spectra
SPL, dB re: 1 uPa
Frequency, Hz

PILE – 8

October 3, 2022

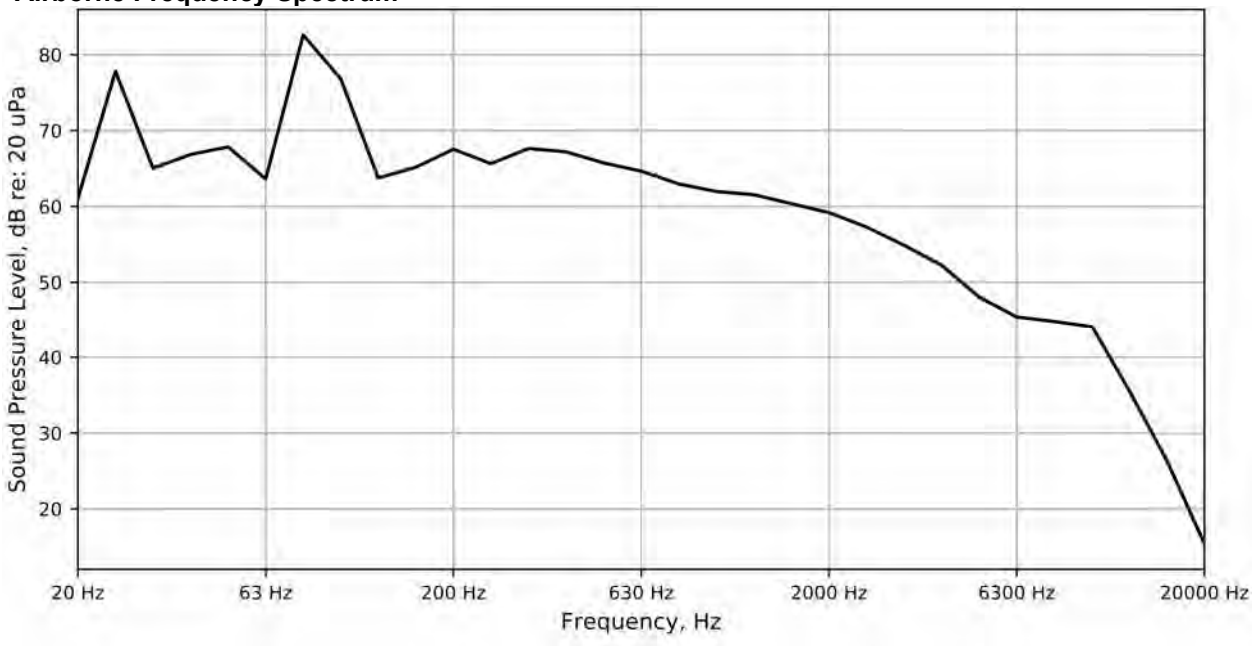
Hydrophone and Pile Information, Feet

Hydro Depth (Near/Far)	Distance			Water Depth	
	Between Hydros	Hydros to Pile (Near/Far)	Pile to Water's Edge	Hydros (Near/Far)	Pile
16/28	166	66/231	19	24/38	5

Airborne Sound Levels, dB re: 20 μPa

Median	Maximum	Minimum
97	99	91

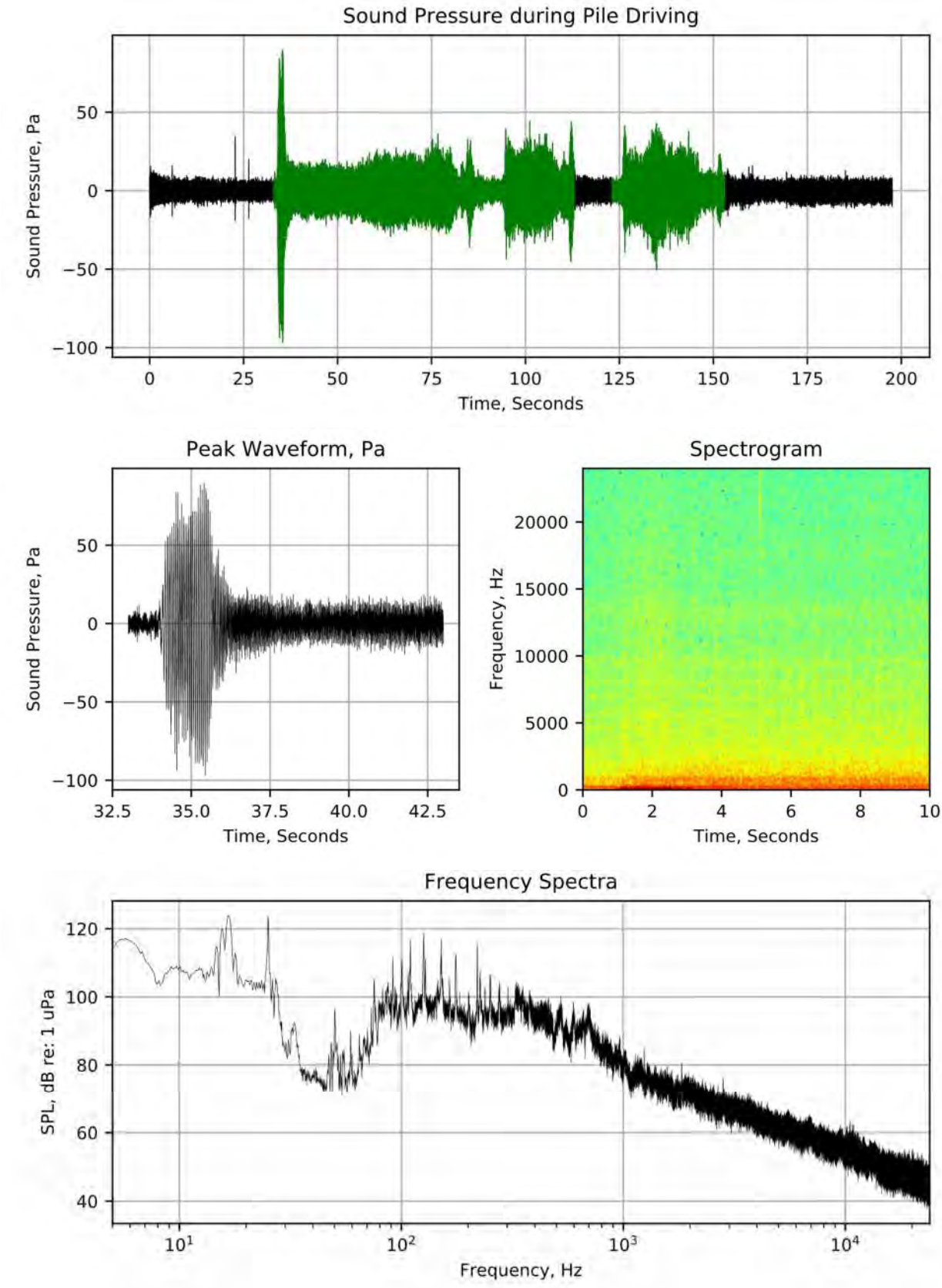
Airborne Frequency Spectrum



Underwater Sound Levels, dB re: 1 μPa

Frequency Range	Peak					RMS_{90}					SEL					cSEL
	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	
Near-Field Hydrophone																
Unweighted	164	151	3.4	157	156	150	139	2.9	143	142	160	149	2.9	153	152	164
LF Cetacean	151	144	2.5	148	149	137	126	2.7	133	133	147	136	2.7	143	143	154
MF Cetacean	158	144	3.4	151	150	144	133	2.9	137	135	154	143	2.9	147	145	158
HF Cetacean	159	145	3.4	151	150	144	134	2.9	137	136	154	144	2.9	147	146	158
PW	149	139	3.0	144	144	134	124	2.6	129	129	144	134	2.6	139	139	150
OW	147	138	2.9	143	143	132	122	2.5	127	127	142	132	2.5	137	137	148
Far-Field Hydrophone																
Unweighted	157	149	2.2	154	154	142	134	2.1	139	139	152	144	2.1	149	149	160
LF Cetacean	150	143	2.1	146	146	136	125	2.5	132	132	146	135	2.5	142	142	152
MF Cetacean	151	143	2.0	148	148	136	128	2.0	133	133	146	138	2.0	143	143	154
HF Cetacean	151	144	2.1	148	148	136	129	2.0	134	134	146	139	2.0	144	144	154
PW	145	138	2.0	143	142	131	123	1.9	127	127	141	133	1.9	137	137	148
OW	145	138	1.9	142	141	129	121	1.8	126	126	139	131	1.8	136	136	146

Note: Measurement distances normalized to 33 feet (10 meters)


Sound Pressure during Pile Driving
Sound Pressure, Pa
Time, Seconds
Peak Waveform, Pa
Sound Pressure, Pa
Time, Seconds
Spectrogram
Frequency, Hz
Time, Seconds
Frequency Spectra
SPL, dB re: 1 uPa
Frequency, Hz

2.0 VIBRATORY PILE DRIVING

PILE X-5

November 3, 2022

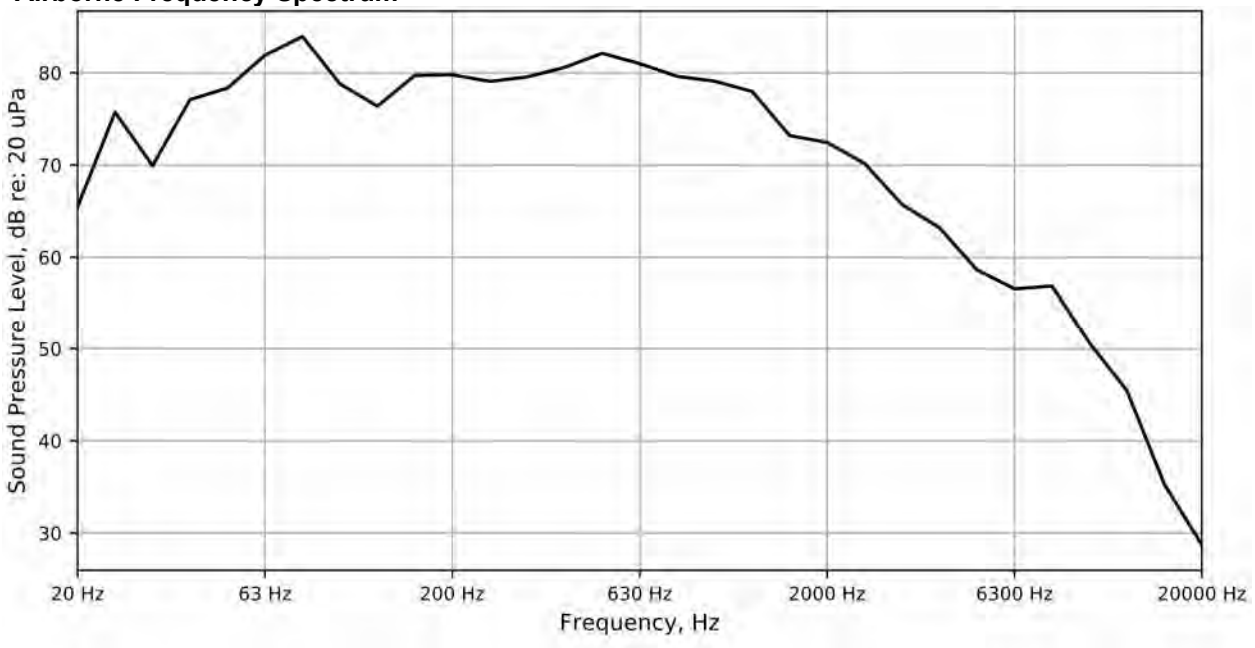
Hydrophone and Pile Information, Feet

Hydro Depth (Near/Far)	Distance			Water Depth	
	Between Hydros	Hydros to Pile (Near/Far)	Pile to Water's Edge	Hydros (Near/Far)	Pile
25/33	144	86/204	22	33/41	24

Airborne Sound Levels, dB re: 20 μPa

Median	Maximum	Minimum
99	107	90

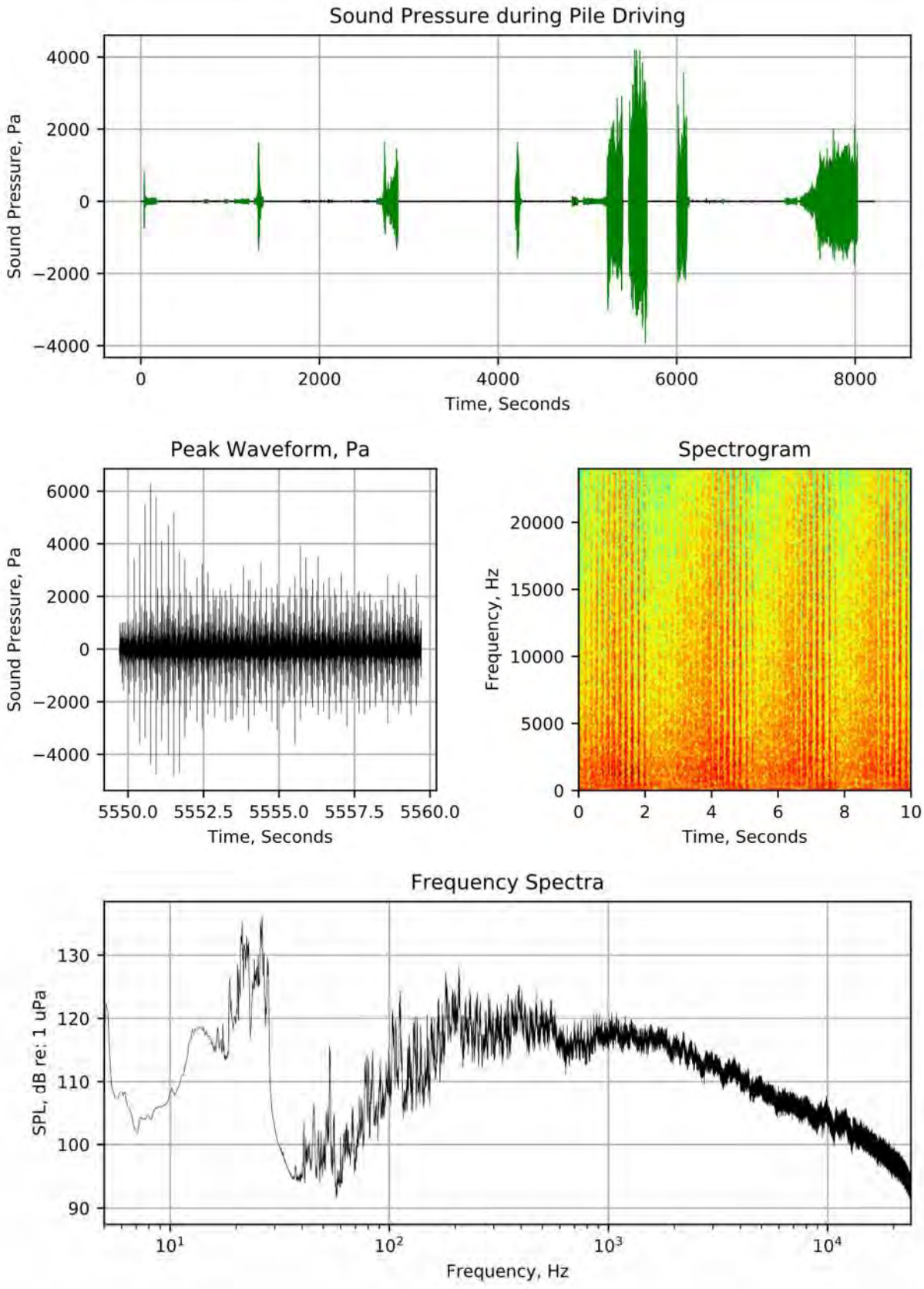
Airborne Frequency Spectrum



Underwater Sound Levels, dB re: 1 μPa

Frequency Range	Peak					RMS_{90}					SEL					cSEL
	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	
Near-Field Hydrophone																
Unweighted	202	150	14.2	187	177	176	133	11.7	166	162	186	143	11.7	176	172	203
LF Cetacean	197	138	14.8	181	172	171	123	12.7	161	156	181	133	12.7	171	166	198
MF Cetacean	199	145	15.2	183	172	173	127	12.3	162	156	183	137	12.3	172	166	199
HF Cetacean	199	145	15.0	183	172	172	128	12.1	162	156	182	138	12.1	172	166	199
PW	198	140	16.1	182	169	171	123	13.5	160	152	181	133	13.5	170	162	197
OW	198	138	16.2	182	170	171	123	13.8	161	152	181	133	13.8	171	162	198
Far-Field Hydrophone																
Unweighted	198	149	13.8	182	175	175	134	11.9	164	160	185	144	11.9	174	170	201
LF Cetacean	193	141	14.5	177	170	170	125	12.8	158	154	180	135	12.8	168	164	195
MF Cetacean	193	146	14.0	178	169	170	128	12.3	159	154	180	138	12.3	169	164	196
HF Cetacean	193	146	13.9	178	170	170	129	12.1	159	155	180	139	12.1	169	165	196
PW	192	141	15.1	177	167	169	124	13.6	157	150	179	134	13.6	167	160	195
OW	193	140	15.4	177	168	170	123	14.0	158	150	180	133	14.0	168	160	195

Note: Measurement distances normalized to 33 feet (10 meters)


Sound Pressure during Pile Driving
Sound Pressure, Pa
Time, Seconds
Peak Waveform, Pa
Sound Pressure, Pa
Time, Seconds
Spectrogram
Frequency, Hz
Time, Seconds
Frequency Spectra
SPL, dB re: 1 uPa
Frequency, Hz

PILE F-1

December 6, 2022

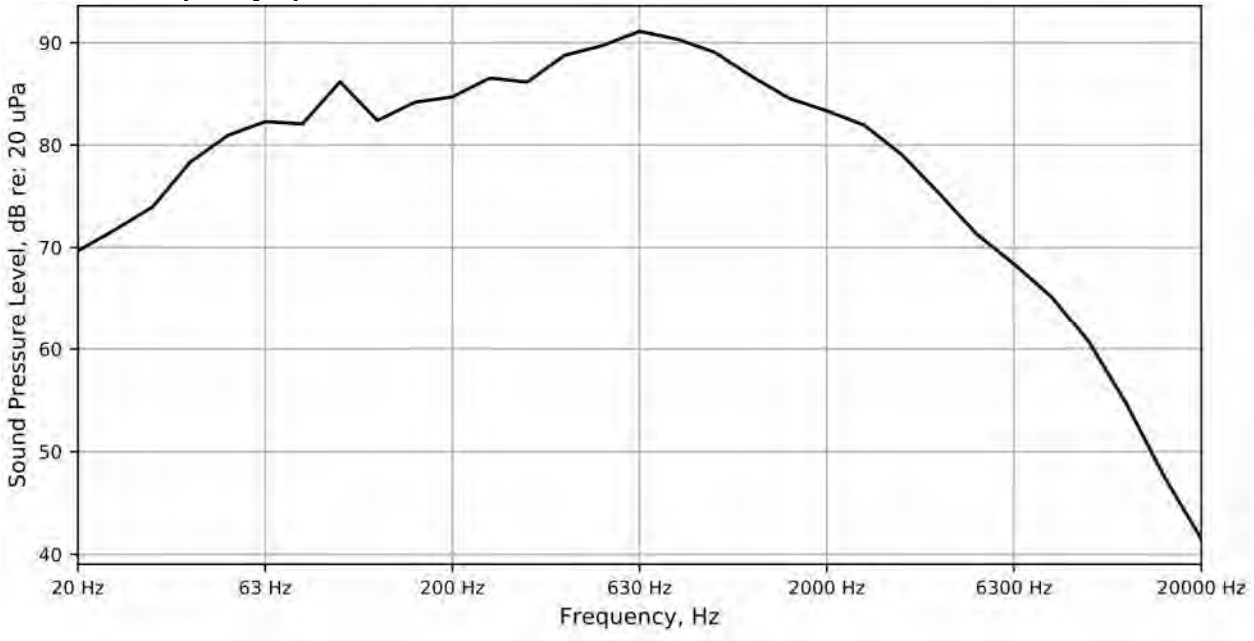
Hydrophone and Pile Information, Feet

Hydro Depth (Near/Far)	Distance			Water Depth	
	Between Hydros	Hydros to Pile (Near/Far)	Pile to Water's Edge	Hydros (Near/Far)	Pile
23/33	152	21/139	97	33/43	35

Airborne Sound Levels, dB re: 20 μPa

Median	Maximum	Minimum
90	96	77

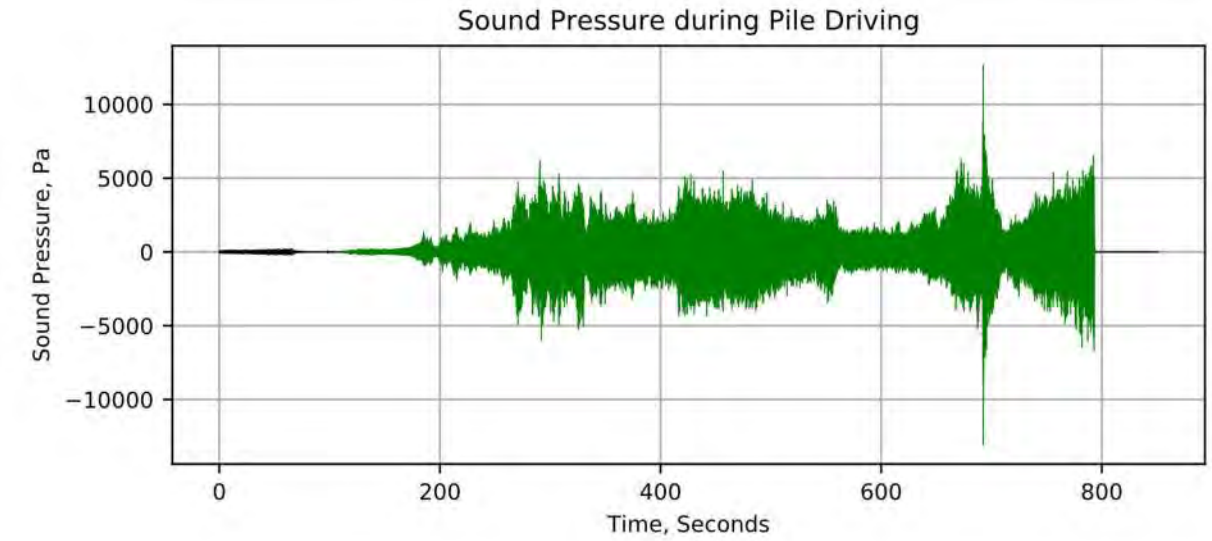
Airborne Frequency Spectrum

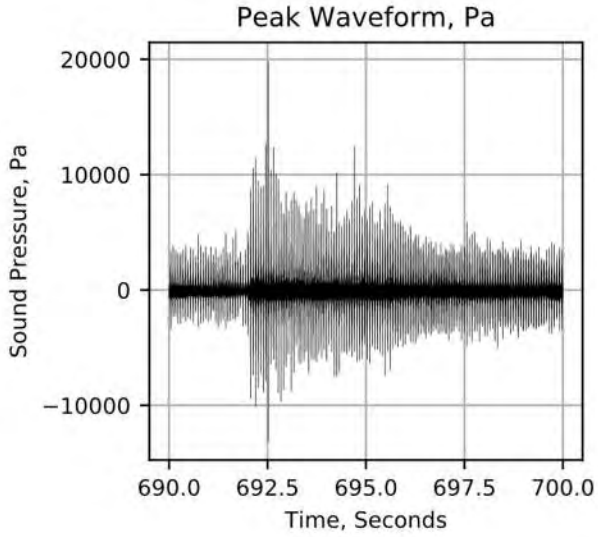


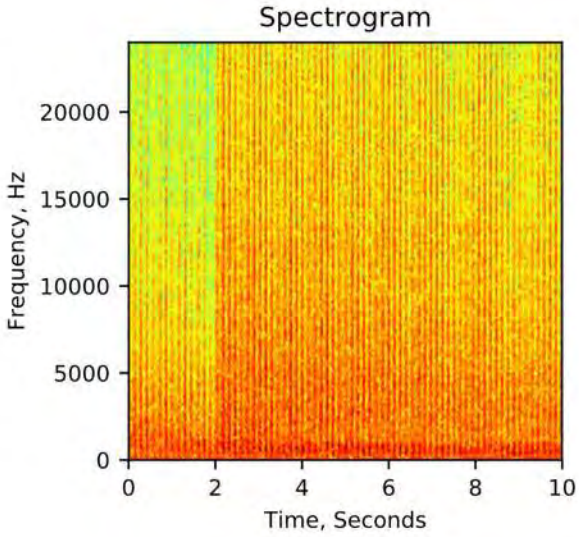
Underwater Sound Levels, dB re: 1 μPa

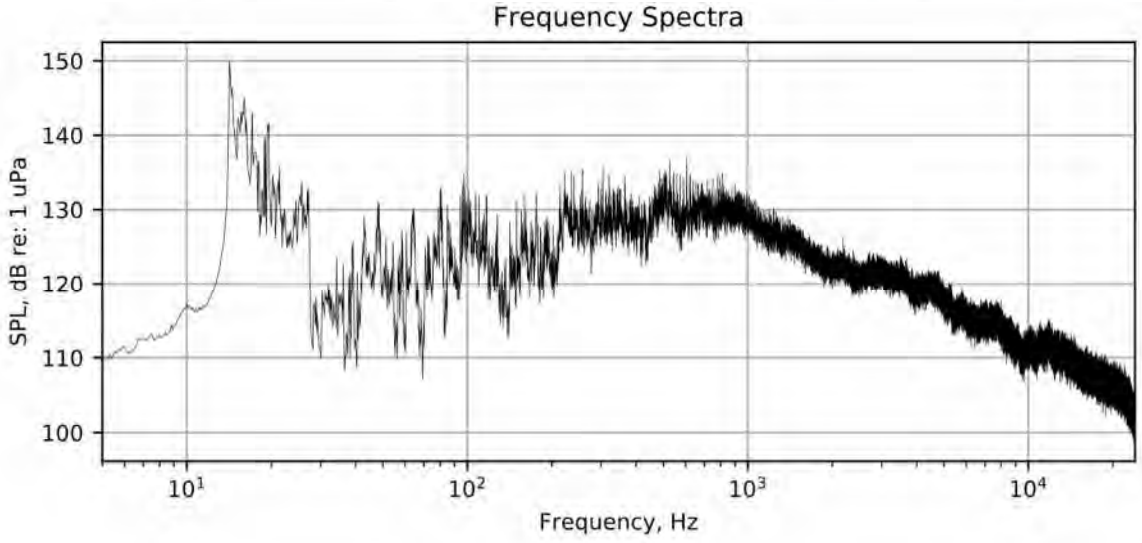
Frequency Range	Peak					RMS_{90}					SEL					cSEL
	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	
Near-Field Hydrophone																
Unweighted	203	160	8.4	189	188	175	143	6.5	169	169	185	153	6.5	179	179	198
LF Cetacean	197	154	8.7	183	182	169	136	7.3	163	164	179	146	7.3	173	174	192
MF Cetacean	200	154	9.4	185	184	171	137	7.1	164	165	181	147	7.1	174	175	193
HF Cetacean	200	155	9.1	185	184	171	137	6.9	164	165	181	147	6.9	174	175	193
PW	199	151	9.9	184	182	169	133	8.0	162	162	179	143	8.0	172	172	192
OW	198	152	9.6	184	183	169	134	8.0	163	163	179	144	8.0	173	173	192
Far-Field Hydrophone																
Unweighted	195	159	7.6	186	186	175	142	7.0	169	169	185	152	7.0	179	179	198
LF Cetacean	190	153	7.7	180	181	169	135	7.3	162	163	179	145	7.3	172	173	192
MF Cetacean	190	153	8.0	181	181	170	136	7.3	163	164	180	146	7.3	173	174	192
HF Cetacean	190	154	7.9	181	181	170	137	7.2	163	164	180	147	7.2	173	174	192
PW	189	149	8.6	179	180	169	132	8.0	161	161	179	142	8.0	171	171	190
OW	189	149	8.6	180	181	169	132	8.1	162	162	179	142	8.1	172	172	191

Note: Measurement distances normalized to 33 feet (10 meters)


Sound Pressure during Pile Driving
Sound Pressure, Pa
10000
5000
0
−5000
−10000
0
200
400
600
800
Time, Seconds


Peak Waveform, Pa
Sound Pressure, Pa
20000
10000
0
−10000
690.0
692.5
695.0
697.5
700.0
Time, Seconds


Spectrogram
Frequency, Hz
20000
15000
10000
5000
0
0
2
4
6
8
10
Time, Seconds


Frequency Spectra
SPL, dB re: 1 uPa
150
140
130
120
110
100
10^1
10^2
10^3
10^4
Frequency, Hz

PILE G-5

December 6, 2022

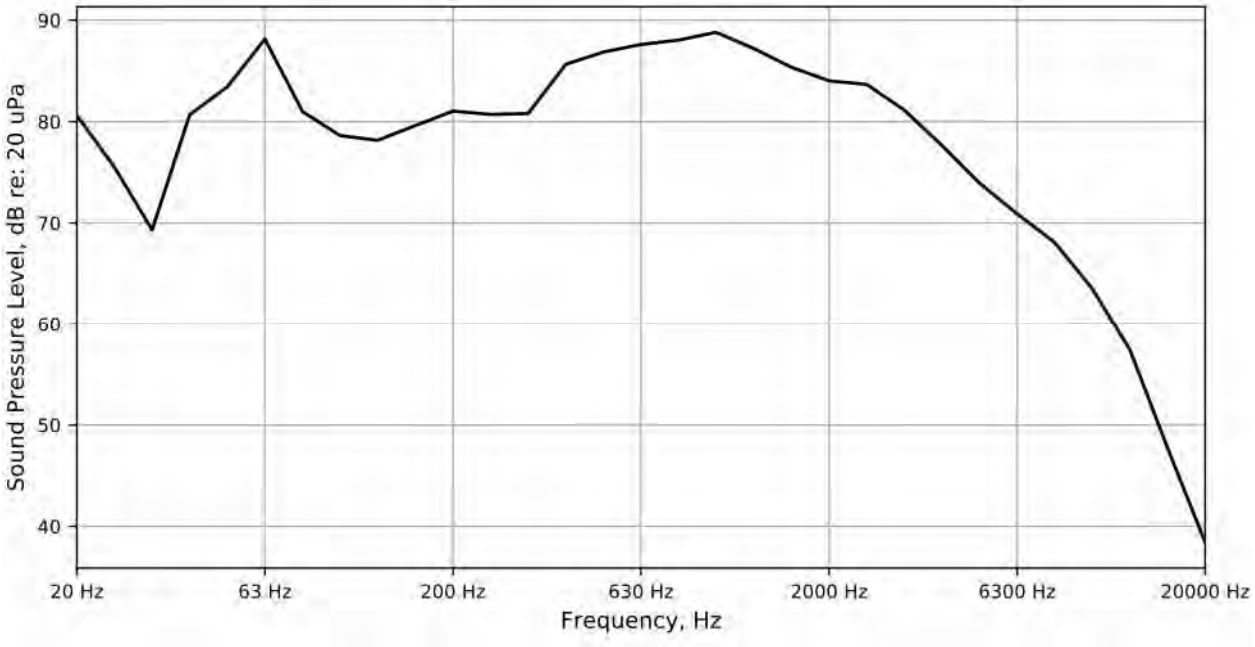
Hydrophone and Pile Information, Feet

Hydro Depth (Near/Far)	Distance			Water Depth	
	Between Hydros	Hydros to Pile (Near/Far)	Pile to Water's Edge	Hydros (Near/Far)	Pile
20/30	144	77/185	39	30/40	26

Airborne Sound Levels, dB re: 20 μPa

Median	Maximum	Minimum
103	105	99

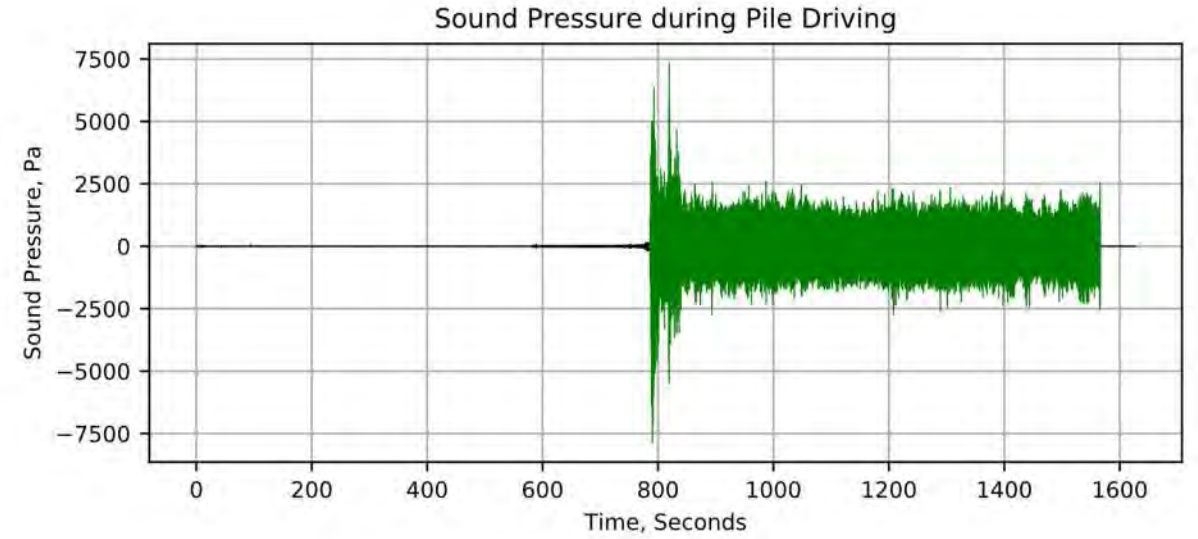
Airborne Frequency Spectrum

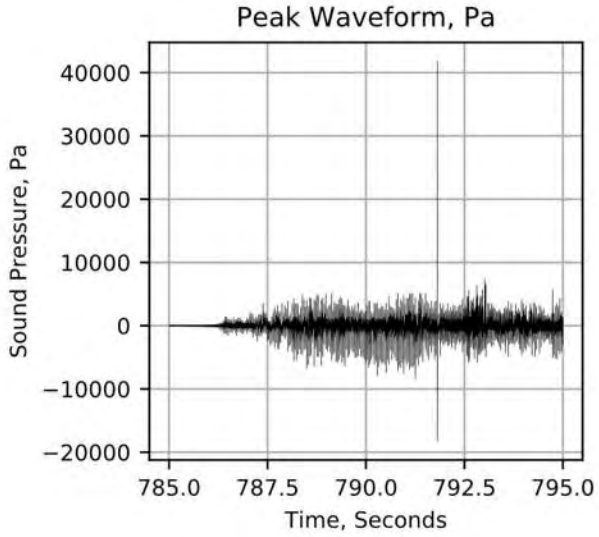


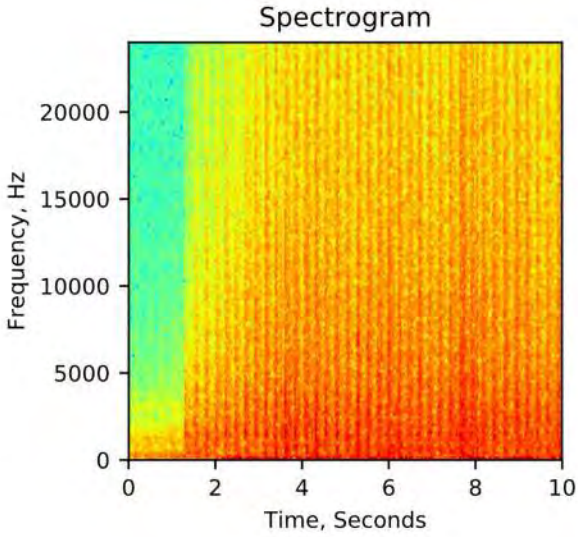
Underwater Sound Levels, dB re: 1 μPa

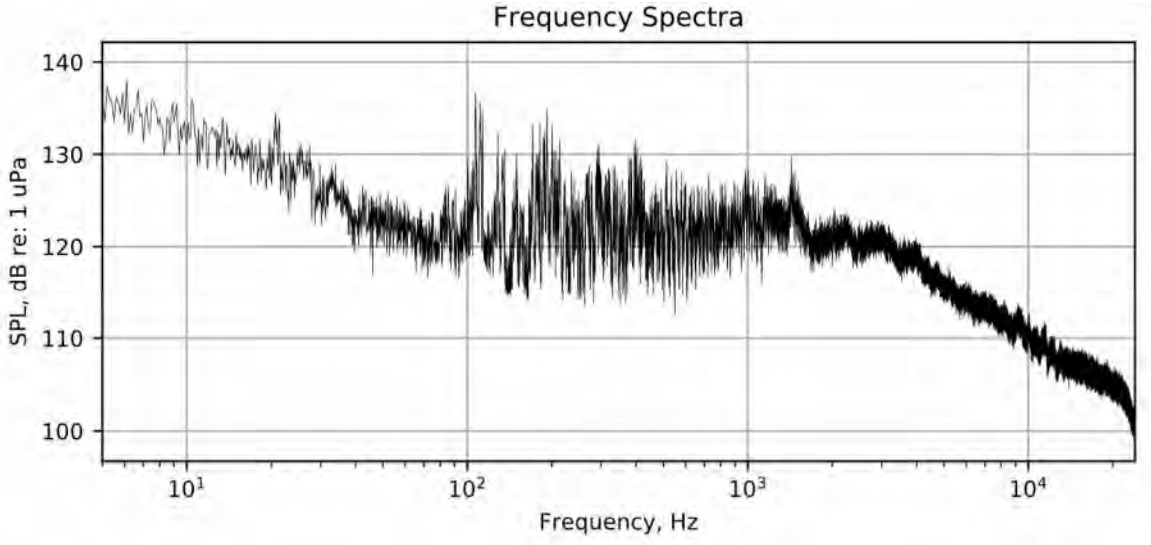
Frequency Range	Peak					RMS_{90}					SEL					cSEL
	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	
Near-Field Hydrophone																
Unweighted	218	189	3.6	195	193	181	166	1.6	175	174	191	176	1.6	185	184	204
LF Cetacean	212	184	3.5	190	187	175	161	1.4	169	169	185	171	1.4	179	179	198
MF Cetacean	216	186	3.7	192	190	176	162	1.5	171	170	186	172	1.5	181	180	200
HF Cetacean	216	186	3.7	192	189	176	162	1.5	171	170	186	172	1.5	181	180	200
PW	214	185	3.6	191	188	174	161	1.4	169	169	184	171	1.4	179	179	198
OW	214	185	3.5	191	188	175	161	1.4	170	169	185	171	1.4	180	179	199
Far-Field Hydrophone																
Unweighted	195	184	1.8	188	188	174	163	1.3	172	171	184	173	1.3	182	181	201
LF Cetacean	190	179	1.8	183	183	169	158	1.3	166	166	179	168	1.3	176	176	195
MF Cetacean	193	181	1.9	185	184	170	159	1.3	167	167	180	169	1.3	177	177	196
HF Cetacean	193	181	1.9	185	184	170	159	1.3	167	167	180	169	1.3	177	177	196
PW	191	179	1.8	183	183	169	157	1.3	166	166	179	167	1.3	176	176	195
OW	190	179	1.8	184	183	169	157	1.4	166	166	179	167	1.4	176	176	195

Note: Measurement distances normalized to 33 feet (10 meters)


Sound Pressure during Pile Driving
Sound Pressure, Pa
7500
5000
2500
0
−2500
−5000
−7500
0
200
400
600
800
1000
1200
1400
1600
Time, Seconds


Peak Waveform, Pa
Sound Pressure, Pa
40000
30000
20000
10000
0
−10000
−20000
785.0
787.5
790.0
792.5
795.0
Time, Seconds


Spectrogram
Frequency, Hz
20000
15000
10000
5000
0
0
2
4
6
8
10
Time, Seconds


Frequency Spectra
SPL, dB re: 1 uPa
140
130
120
110
100
10^1
10^2
10^3
10^4
Frequency, Hz

PILE G-6

December 6, 2022

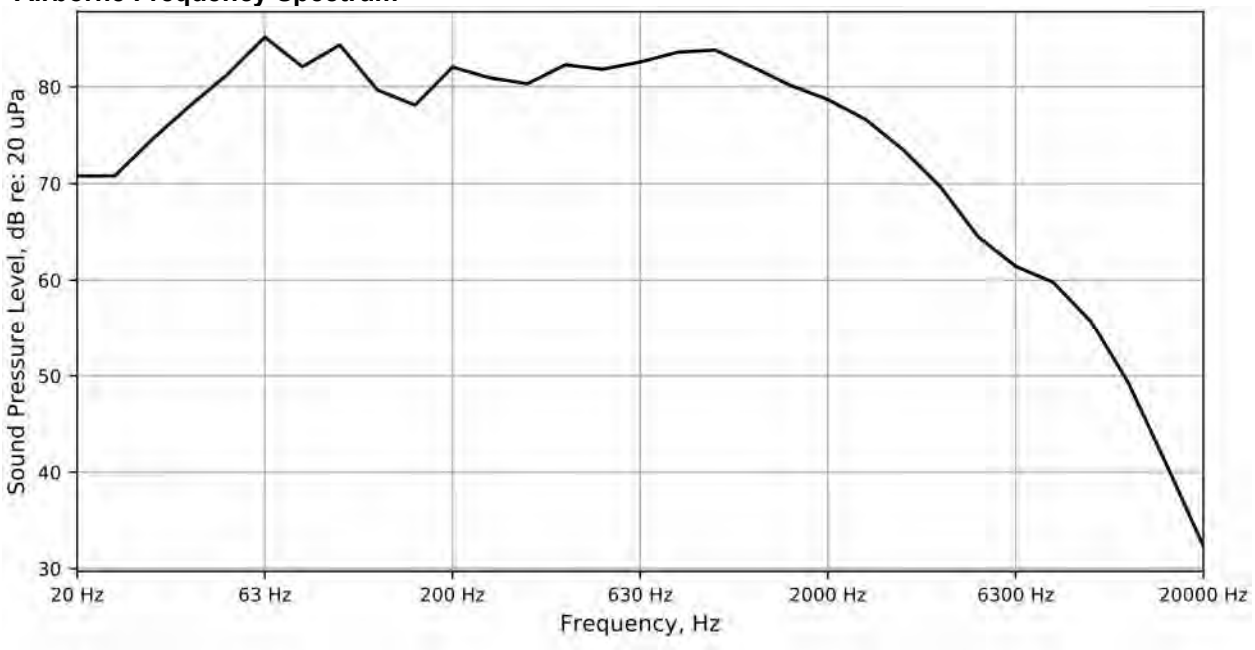
Hydrophone and Pile Information, Feet

Hydro Depth (Near/Far)	Distance			Water Depth	
	Between Hydros	Hydros to Pile (Near/Far)	Pile to Water's Edge	Hydros (Near/Far)	Pile
20/30	144	91/192	30	30/40	23

Airborne Sound Levels, dB re: 20 μPa

Median	Maximum	Minimum
101	109	94

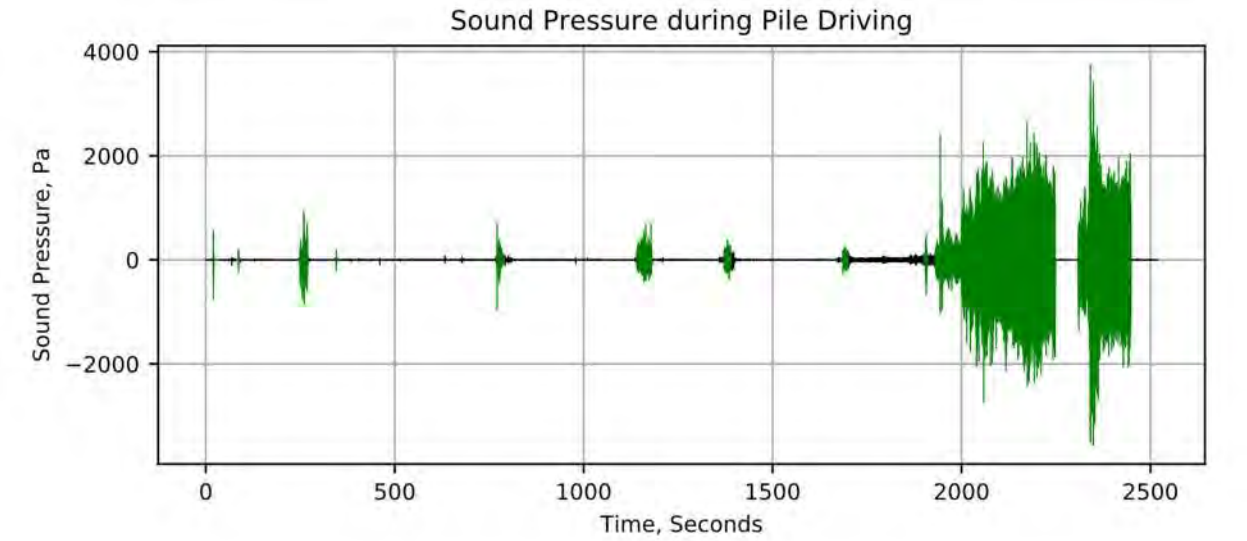
Airborne Frequency Spectrum

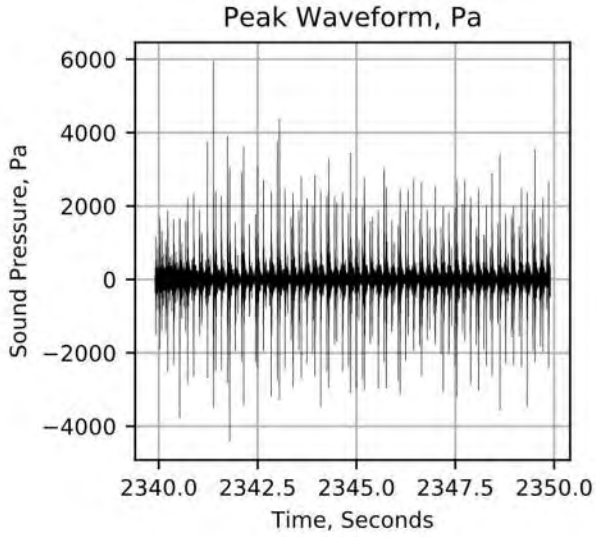


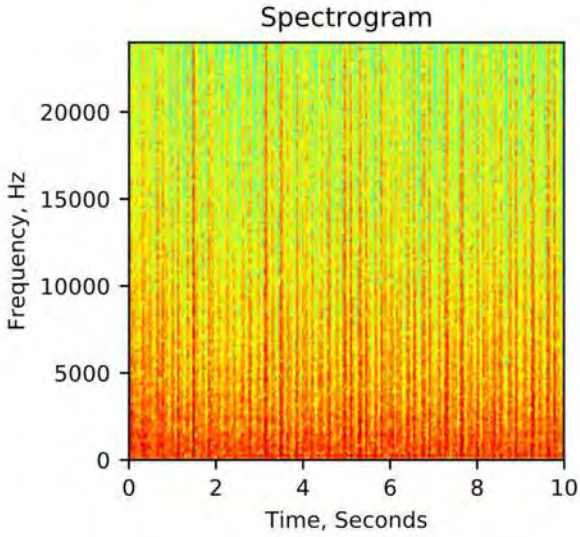
Underwater Sound Levels, dB re: 1 μPa

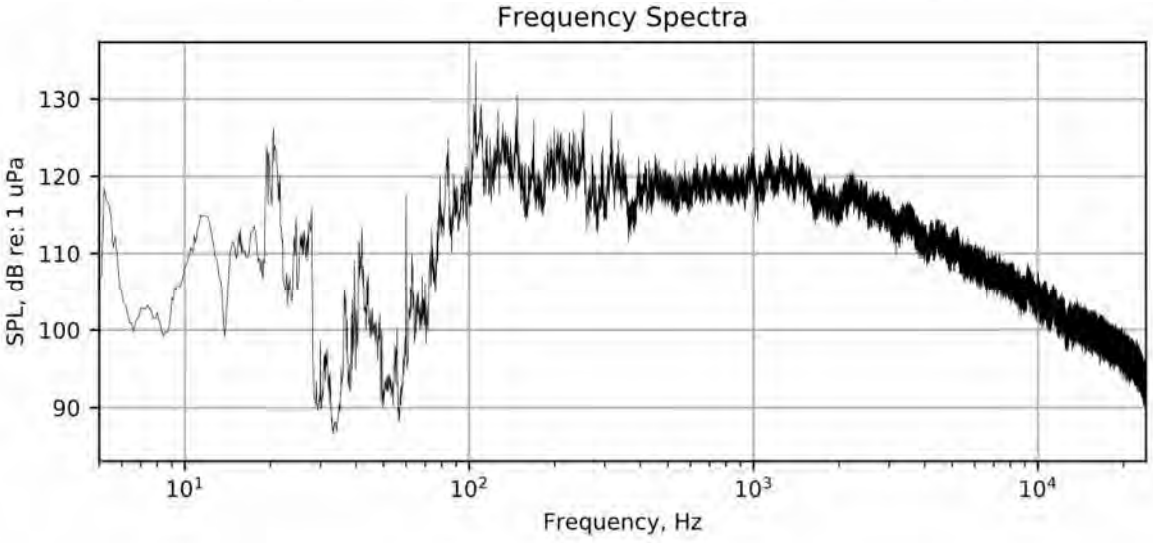
Frequency Range	Peak					RMS_{90}					SEL					cSEL
	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	
Near-Field Hydrophone																
Unweighted	202	173	6.7	191	192	175	136	8.8	170	172	185	146	8.8	180	182	199
LF Cetacean	197	166	7.0	186	187	170	130	9.4	165	167	180	140	9.4	175	177	194
MF Cetacean	199	167	7.6	188	189	171	131	9.3	166	167	181	141	9.3	176	177	195
HF Cetacean	199	168	7.4	188	188	171	131	9.1	166	167	181	141	9.1	176	177	195
PW	197	161	7.9	186	187	170	130	10.3	164	166	180	140	10.3	174	176	194
OW	197	162	7.7	186	187	170	131	10.7	165	167	180	141	10.7	175	177	194
Far-Field Hydrophone																
Unweighted	196	170	6.9	189	189	173	135	8.4	168	170	183	145	8.4	178	180	197
LF Cetacean	191	164	7.2	183	184	168	128	9.0	163	165	178	138	9.0	173	175	192
MF Cetacean	194	165	7.8	185	185	169	130	8.8	164	166	179	140	8.8	174	176	193
HF Cetacean	194	165	7.6	185	185	168	131	8.6	164	166	178	141	8.6	174	176	193
PW	193	161	8.2	184	185	167	128	9.9	162	164	177	138	9.9	172	174	191
OW	192	162	8.1	184	185	168	128	10.3	162	165	178	138	10.3	172	175	192

Note: Measurement distances normalized to 33 feet (10 meters)


Sound Pressure during Pile Driving
Sound Pressure, Pa
4000
2000
0
−2000
0
500
1000
1500
2000
2500
Time, Seconds


Peak Waveform, Pa
Sound Pressure, Pa
6000
4000
2000
0
−2000
−4000
2340.0
2342.5
2345.0
2347.5
2350.0
Time, Seconds


Spectrogram
Frequency, Hz
20000
15000
10000
5000
0
0
2
4
6
8
10
Time, Seconds


Frequency Spectra
SPL, dB re: 1 uPa
130
120
110
100
90
10^1
10^2
10^3
10^4
Frequency, Hz

3.0 IMPACT PILE DRIVING

PILE D-11

November 3, 2022

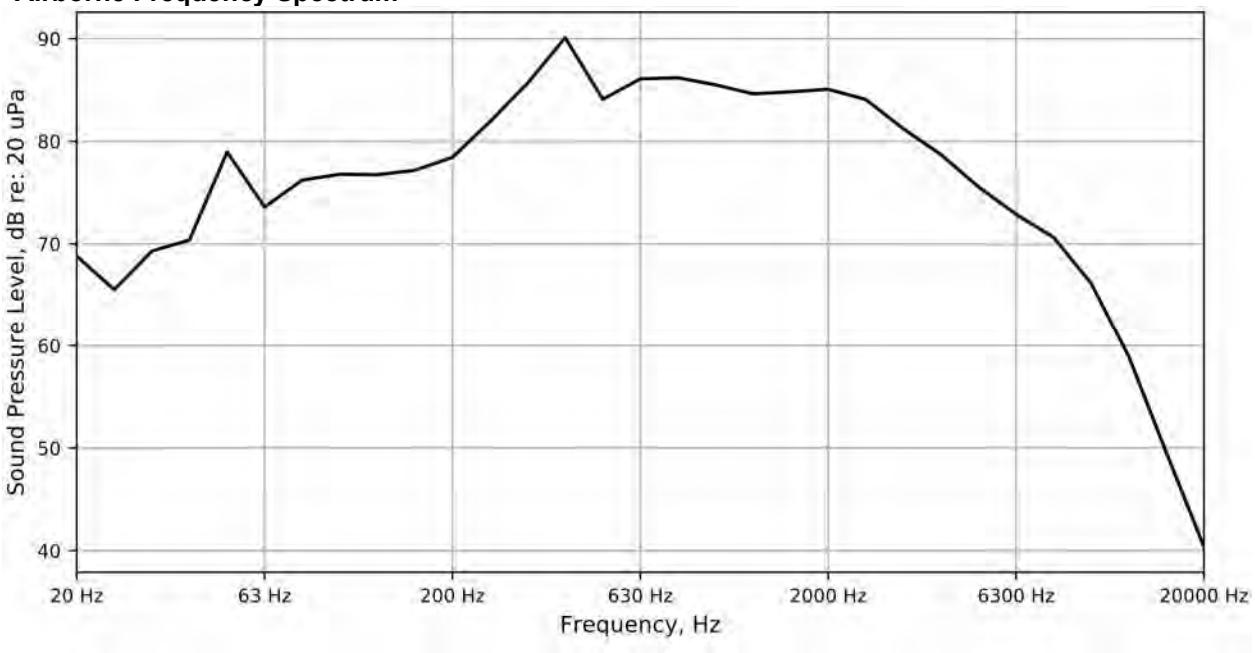
Hydrophone and Pile Information, Feet

Hydro Depth (Near/Far)	Distance			Water Depth	
	Between Hydros	Hydros to Pile (Near/Far)	Pile to Water's Edge	Hydros (Near/Far)	Pile
17/25	144	178/179	70	25/33	19

Airborne Sound Levels, dB re: 20 μPa

Median	Maximum	Minimum
108	112	106

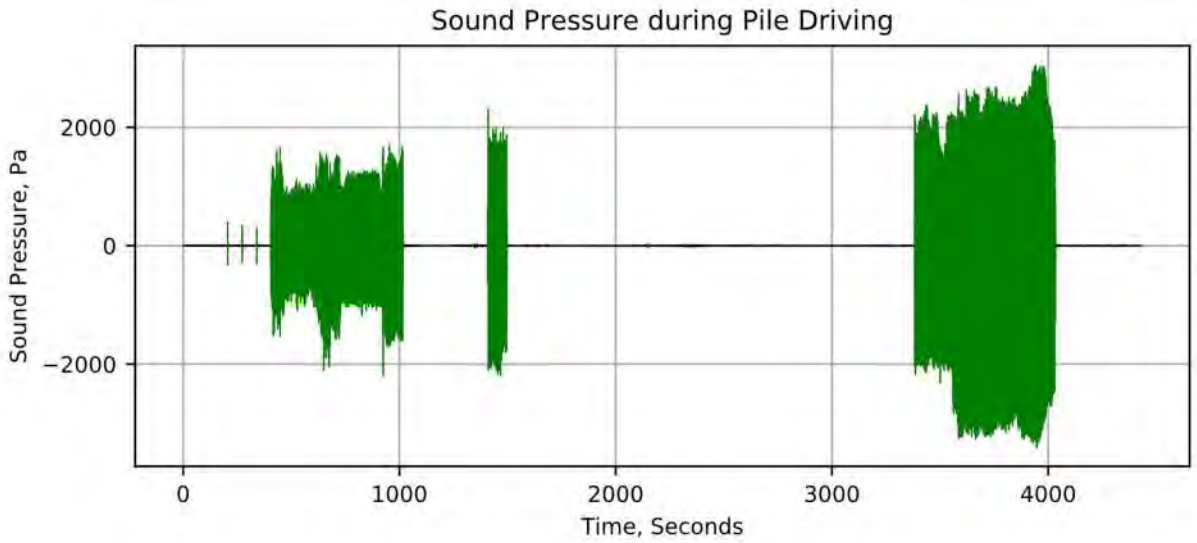
Airborne Frequency Spectrum

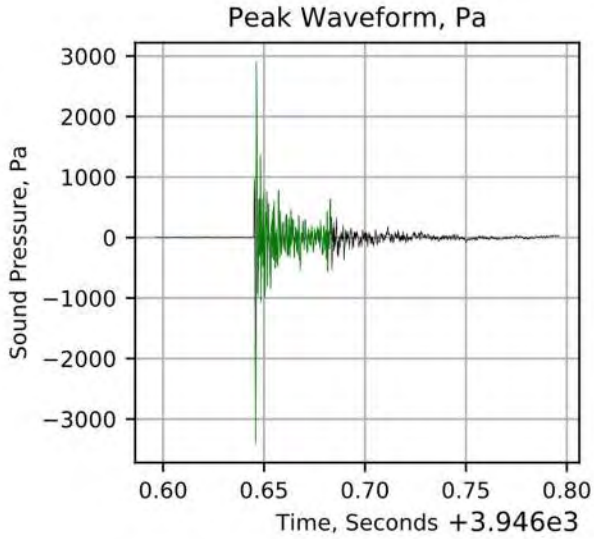


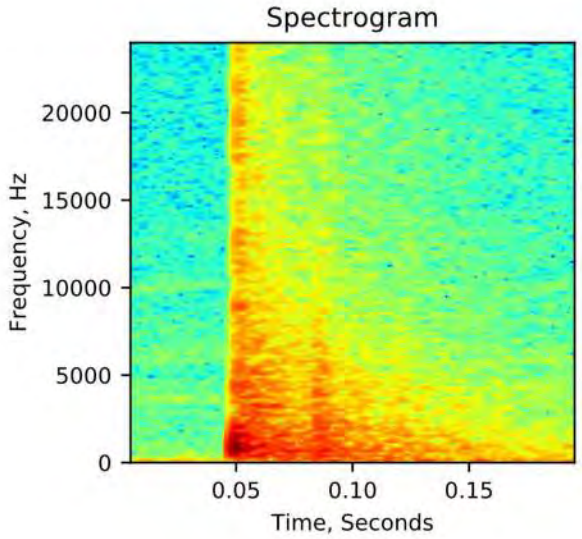
Underwater Sound Levels, dB re: 1 μPa

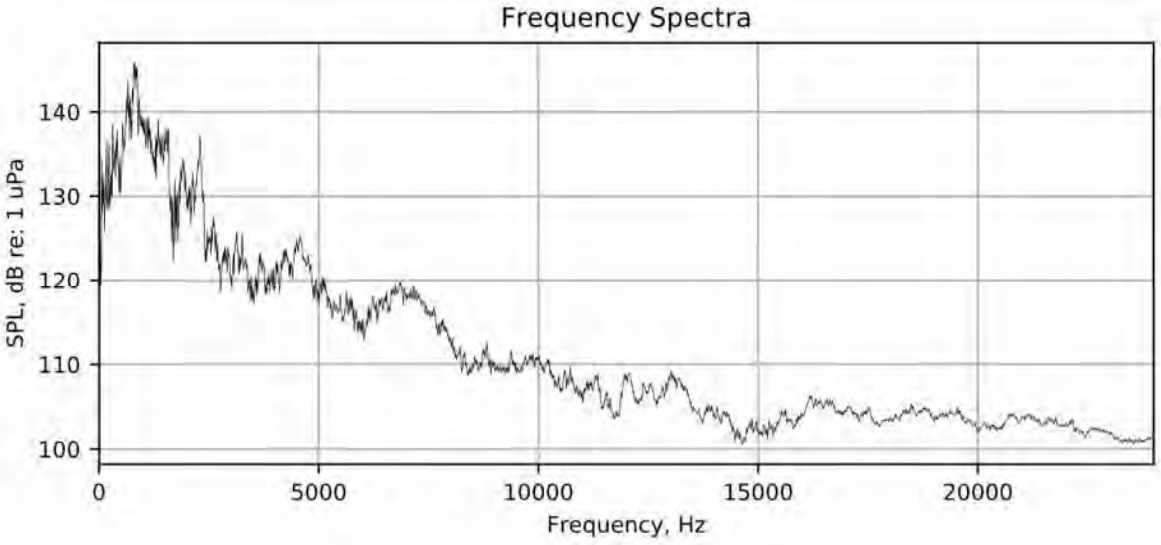
Frequency Range	Peak					RMS_{90}					SEL					cSEL
	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	
Near-Field Hydrophone																
Unweighted	197	167	5.1	191	190	181	151	5.0	175	174	167	142	3.4	162	162	192
LF Cetacean	192	162	5.2	186	185	176	147	4.5	170	170	162	136	3.6	157	157	187
MF Cetacean	192	161	4.6	186	185	175	145	4.7	169	169	161	136	3.2	157	157	187
HF Cetacean	192	162	4.7	186	185	176	146	4.8	170	169	162	137	3.3	157	157	187
PW	191	159	4.6	184	184	173	143	4.2	168	168	160	132	3.3	155	155	185
OW	192	160	4.9	186	185	175	144	4.4	170	169	161	133	3.5	156	156	186
Far-Field Hydrophone																
Unweighted	202	175	4.1	197	196	185	160	3.2	181	181	170	149	2.3	167	167	197
LF Cetacean	197	169	4.2	192	191	181	156	2.7	176	176	165	143	2.4	162	162	192
MF Cetacean	196	168	3.7	191	191	180	154	3.0	175	175	165	143	2.2	161	161	191
HF Cetacean	196	169	3.9	192	191	180	155	3.1	175	175	165	144	2.3	162	162	191
PW	194	166	3.6	190	190	177	152	2.5	174	173	163	140	2.2	160	160	189
OW	196	167	3.7	191	191	179	153	2.5	175	175	164	141	2.2	161	161	191

Note: Measurement distances normalized to 33 feet (10 meters)


Sound Pressure during Pile Driving
Sound Pressure, Pa
2000
0
−2000
0
1000
2000
3000
4000
Time, Seconds


Peak Waveform, Pa
Sound Pressure, Pa
3000
2000
1000
0
−1000
−2000
−3000
0.60
0.65
0.70
0.75
0.80
Time, Seconds +3.946e3


Spectrogram
Frequency, Hz
20000
15000
10000
5000
0
0.05
0.10
0.15
Time, Seconds


Frequency Spectra
SPL, dB re: 1 uPa
140
130
120
110
100
0
5000
10000
15000
20000
Frequency, Hz

PILE X-6

November 28, 2022

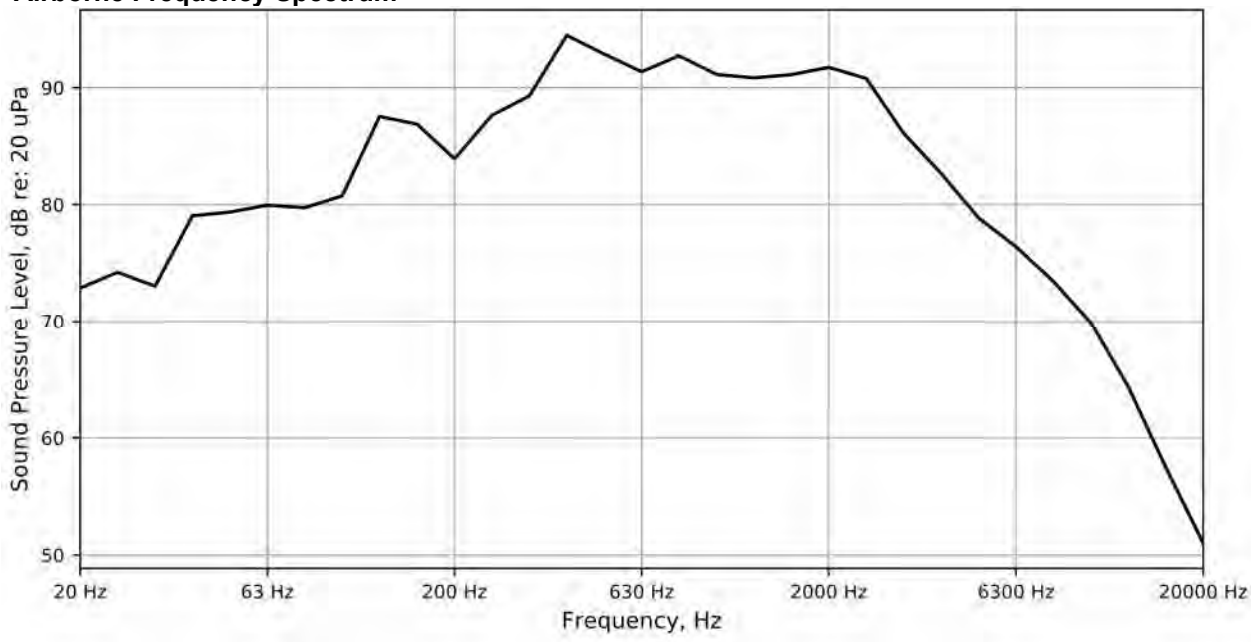
Hydrophone and Pile Information, Feet

Hydro Depth (Near/Far)	Distance			Water Depth	
	Between Hydros	Hydros to Pile (Near/Far)	Pile to Water's Edge	Hydros (Near/Far)	Pile
24/30	144	95/201	22	32/44	24

Airborne Sound Levels, dB re: 20 μPa

Median	Maximum	Minimum
108	111	105

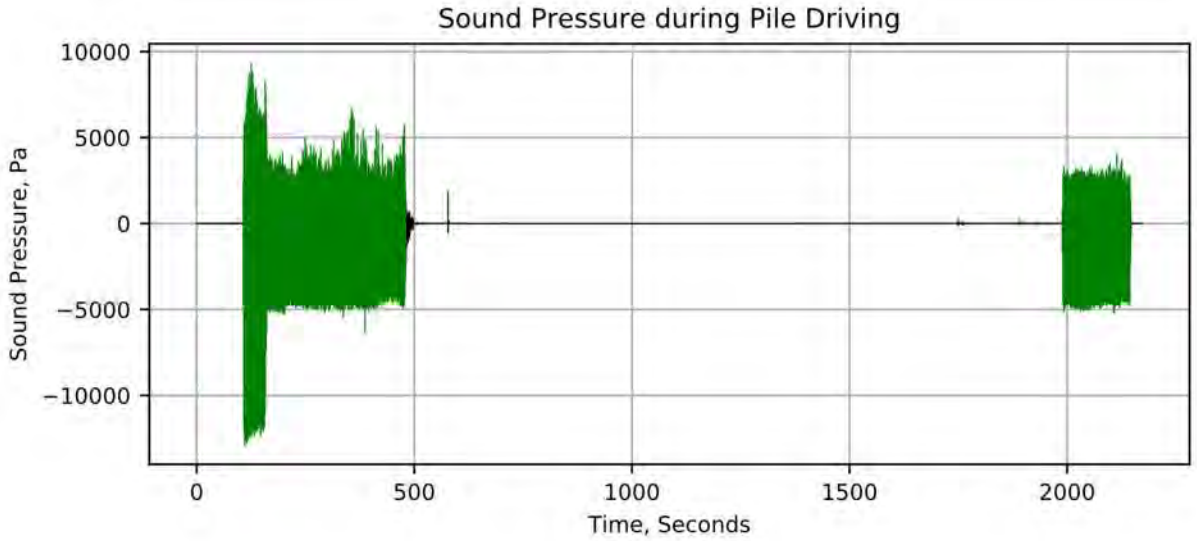
Airborne Frequency Spectrum

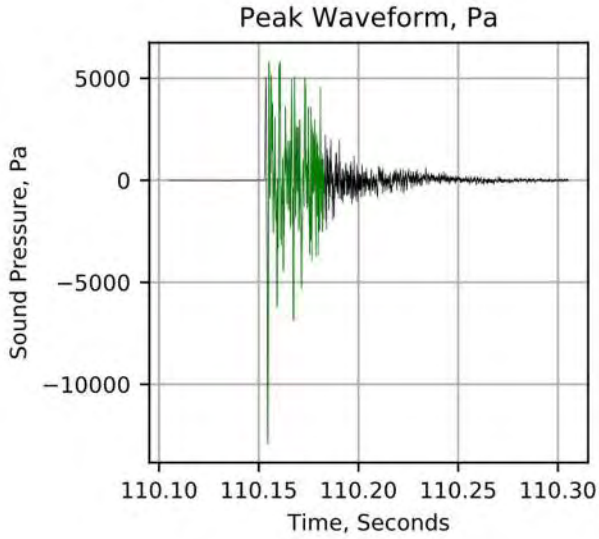


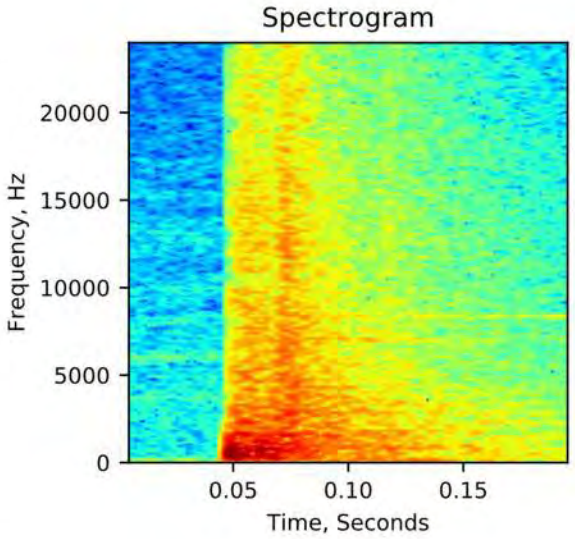
Underwater Sound Levels, dB re: 1 μPa

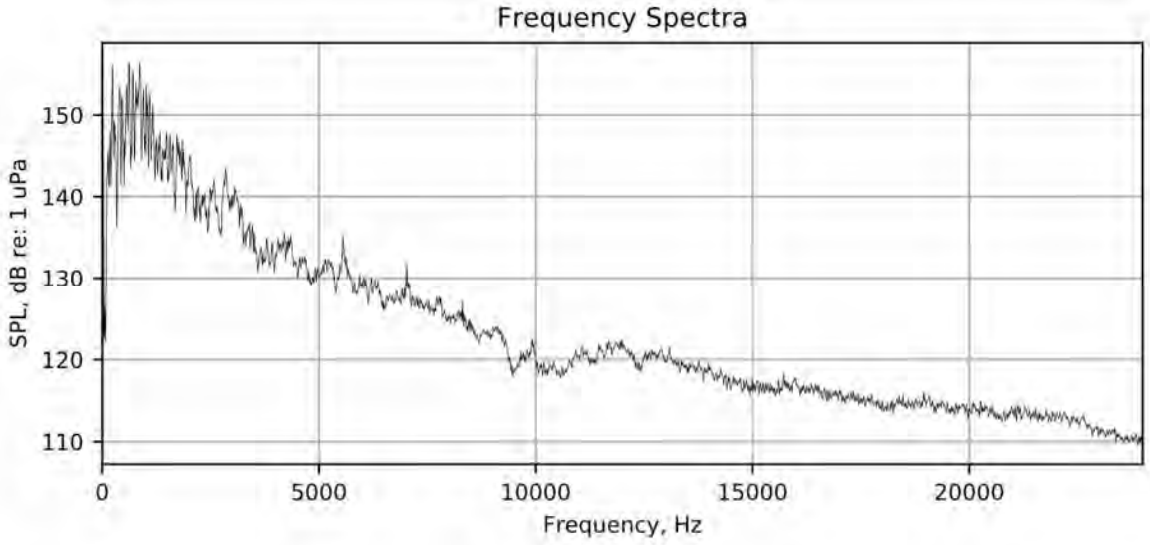
Frequency Range	Peak					RMS_{90}					SEL					cSEL
	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	
Near-Field Hydrophone																
Unweighted	209	194	2.5	202	201	196	180	2.7	188	187	181	165	2.5	174	173	200
LF Cetacean	204	189	2.4	197	195	191	175	2.5	183	182	176	159	2.5	169	168	195
MF Cetacean	203	188	2.5	196	195	190	174	2.6	182	181	175	159	2.5	168	168	194
HF Cetacean	204	189	2.5	196	195	190	174	2.7	183	182	176	159	2.5	169	168	195
PW	199	186	2.3	193	192	187	171	2.2	181	180	173	156	2.3	167	166	192
OW	200	187	2.0	194	193	188	172	2.1	182	181	173	157	2.2	168	167	193
Far-Field Hydrophone																
Unweighted	208	194	2.1	202	201	196	179	2.6	189	187	181	164	2.6	174	173	200
LF Cetacean	202	189	2.0	197	196	191	174	2.5	183	182	176	159	2.5	169	168	195
MF Cetacean	202	188	2.0	196	195	190	173	2.5	183	181	175	158	2.6	168	167	194
HF Cetacean	202	189	2.1	196	195	191	174	2.6	183	182	176	159	2.6	169	168	195
PW	198	185	1.7	193	192	186	170	2.1	180	179	172	155	2.3	166	166	192
OW	198	186	1.5	194	194	186	171	1.9	182	181	172	156	2.1	167	167	193

Note: Measurement distances normalized to 33 feet (10 meters)


Sound Pressure during Pile Driving
Sound Pressure, Pa
10000
5000
0
−5000
−10000
0
500
1000
1500
2000
Time, Seconds


Peak Waveform, Pa
Sound Pressure, Pa
5000
0
−5000
−10000
110.10
110.15
110.20
110.25
110.30
Time, Seconds


Spectrogram
Frequency, Hz
20000
15000
10000
5000
0
0.05
0.10
0.15
Time, Seconds


Frequency Spectra
SPL, dB re: 1 uPa
150
140
130
120
110
0
5000
10000
15000
20000
Frequency, Hz

PILE X-7

November 28, 2022

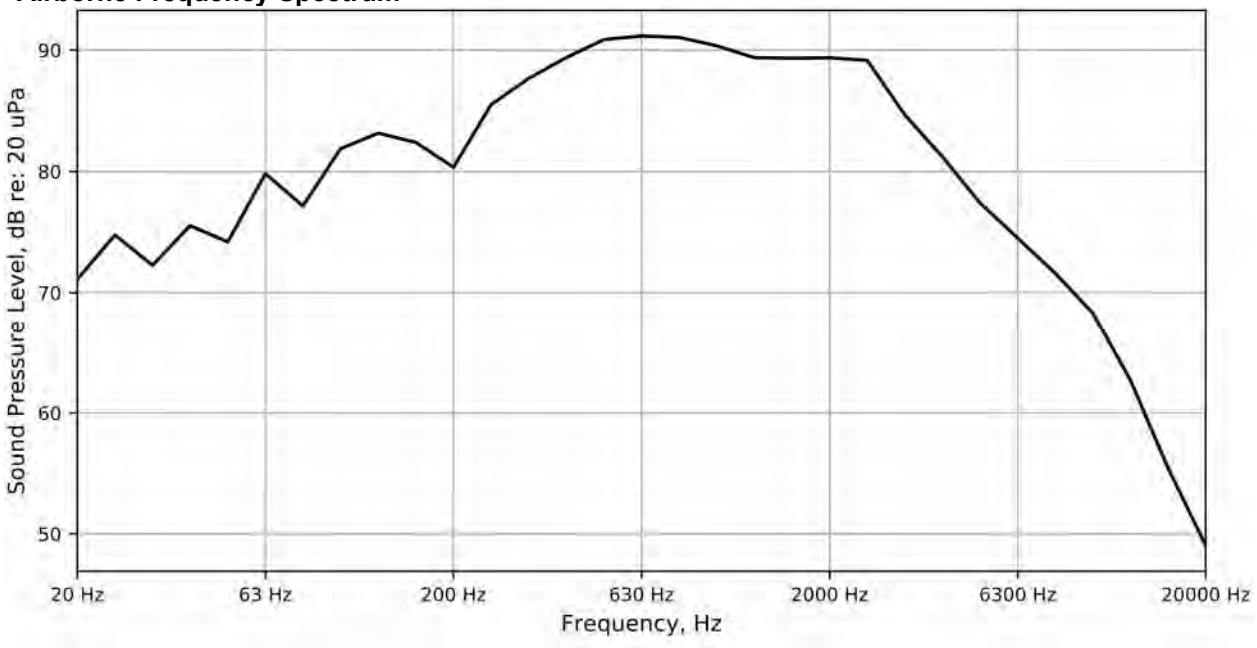
Hydrophone and Pile Information, Feet

Hydro Depth (Near/Far)	Distance			Water Depth	
	Between Hydros	Hydros to Pile (Near/Far)	Pile to Water's Edge	Hydros (Near/Far)	Pile
24/30	144	106/200	22	32/44	23

Airborne Sound Levels, dB re: 20 μPa

Median	Maximum	Minimum
107	110	98

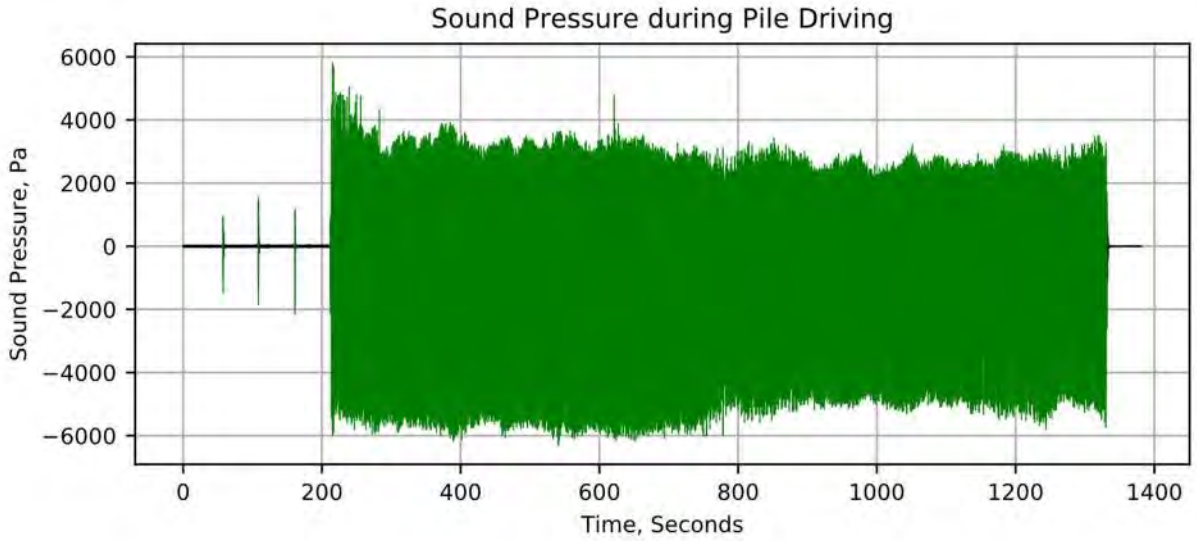
Airborne Frequency Spectrum

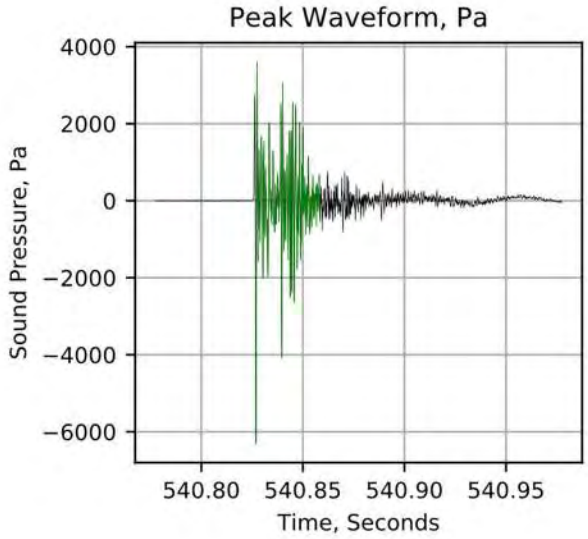


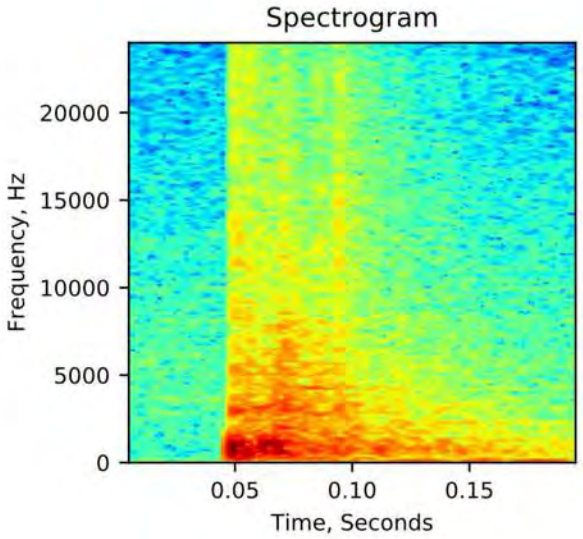
Underwater Sound Levels, dB re: 1 μPa

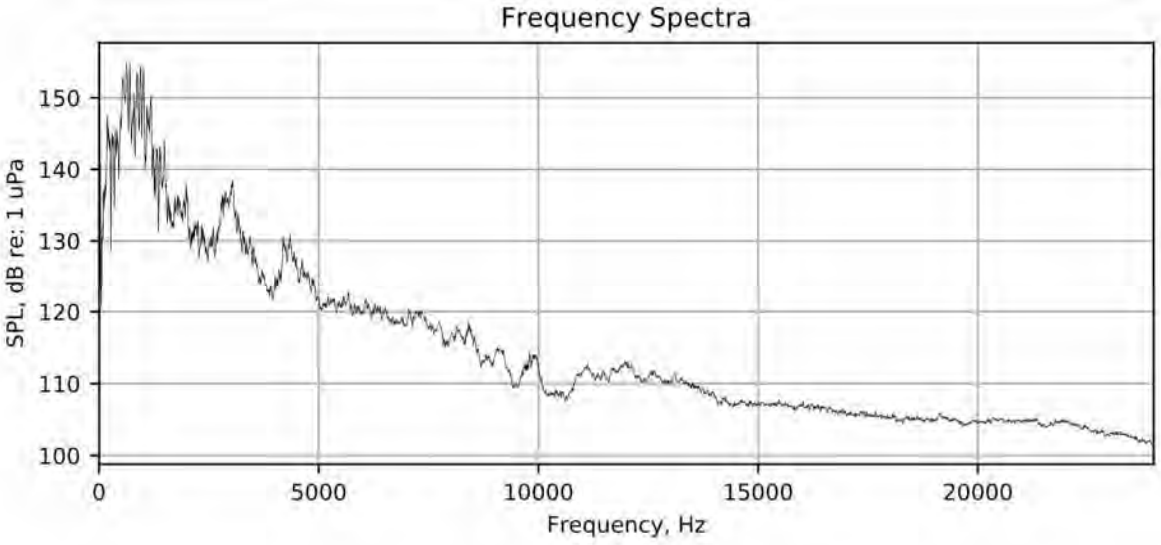
Frequency Range	Peak					RMS_{90}					SEL					cSEL
	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	
Near-Field Hydrophone																
Unweighted	204	191	1.0	202	202	190	176	1.4	187	187	176	162	1.6	173	172	201
LF Cetacean	198	186	1.0	197	197	186	172	1.3	183	182	171	157	1.6	167	167	196
MF Cetacean	198	185	0.9	196	196	184	170	1.4	181	181	170	156	1.6	167	166	195
HF Cetacean	198	186	0.9	197	197	185	170	1.4	182	182	170	157	1.6	167	167	196
PW	197	182	1.0	193	194	182	167	1.5	179	179	168	154	1.7	164	164	193
OW	198	183	1.0	195	195	184	168	1.5	180	180	169	155	1.7	165	165	194
Far-Field Hydrophone																
Unweighted	202	192	1.1	200	200	190	177	1.6	187	187	175	163	1.7	172	172	201
LF Cetacean	197	187	1.1	195	195	185	172	1.6	182	182	170	158	1.7	167	167	196
MF Cetacean	196	186	1.1	194	194	184	171	1.6	181	181	169	157	1.7	166	166	195
HF Cetacean	197	186	1.1	194	194	184	172	1.6	181	182	170	158	1.7	167	167	195
PW	194	183	1.2	191	191	181	169	1.6	178	179	167	154	1.8	164	164	192
OW	195	184	1.1	192	192	183	170	1.7	180	180	168	156	1.8	165	165	194

Note: Measurement distances normalized to 33 feet (10 meters)


Sound Pressure during Pile Driving
Sound Pressure, Pa
6000
4000
2000
0
−2000
−4000
−6000
0
200
400
600
800
1000
1200
1400
Time, Seconds


Peak Waveform, Pa
Sound Pressure, Pa
4000
2000
0
−2000
−4000
−6000
540.80
540.85
540.90
540.95
Time, Seconds


Spectrogram
Frequency, Hz
20000
15000
10000
5000
0
0.05
0.10
0.15
Time, Seconds


Frequency Spectra
SPL, dB re: 1 uPa
150
140
130
120
110
100
0
5000
10000
15000
20000
Frequency, Hz

PILE X-8

November 28, 2022

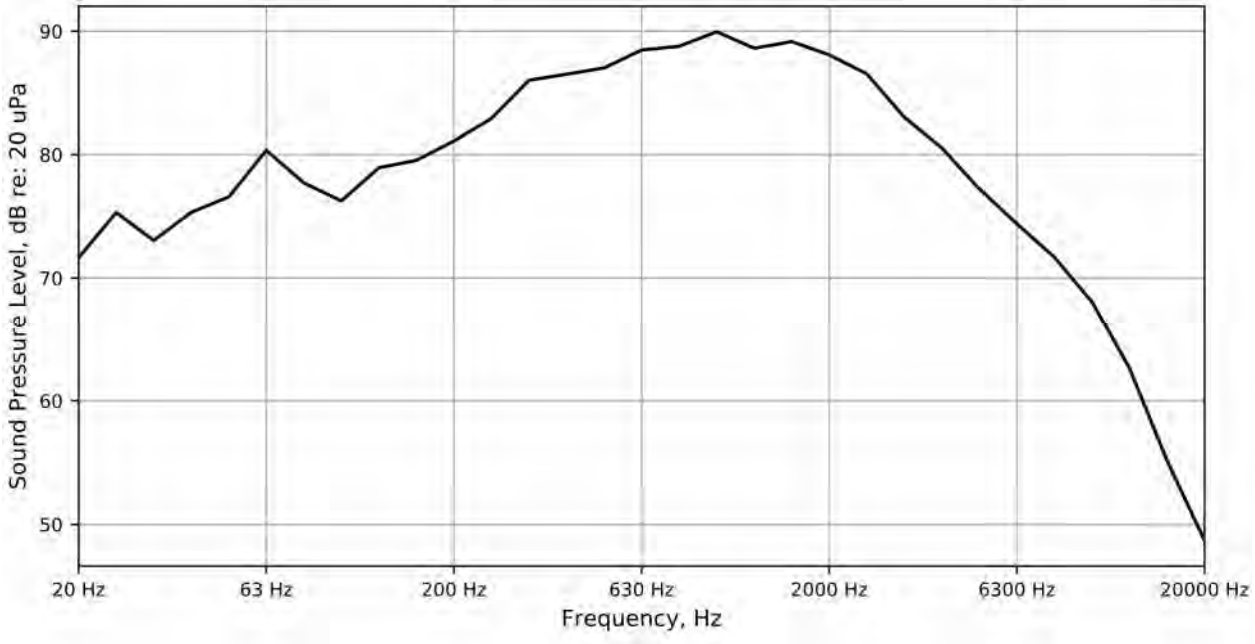
Hydrophone and Pile Information, Feet

Hydro Depth (Near/Far)	Distance			Water Depth	
	Between Hydros	Hydros to Pile (Near/Far)	Pile to Water's Edge	Hydros (Near/Far)	Pile
24/30	144	119/200	22	32/44	20

Airborne Sound Levels, dB re: 20 μPa

Median	Maximum	Minimum
107	109	104

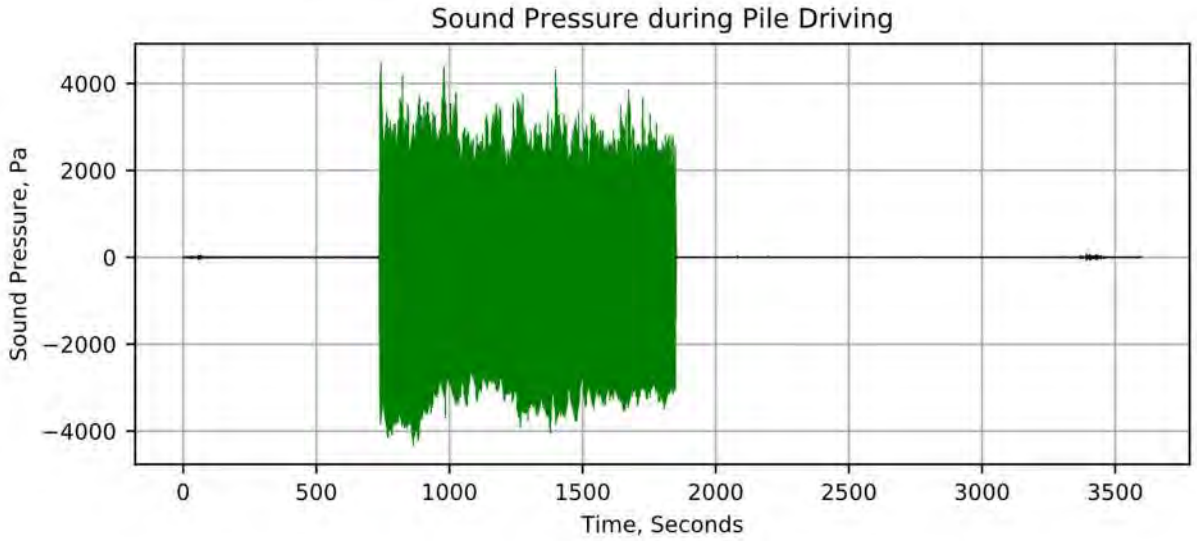
Airborne Frequency Spectrum

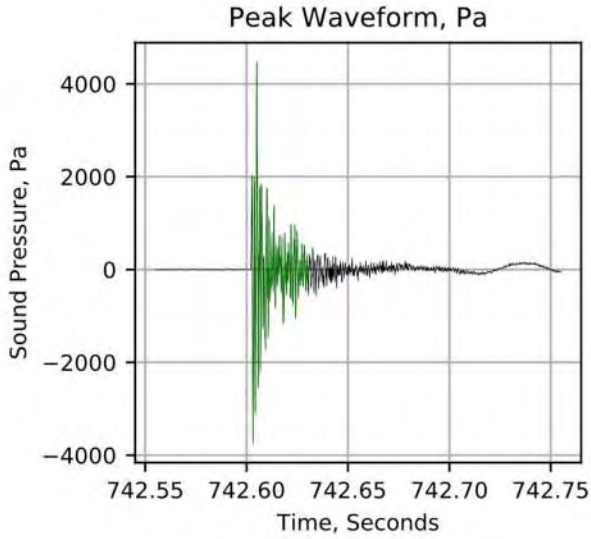


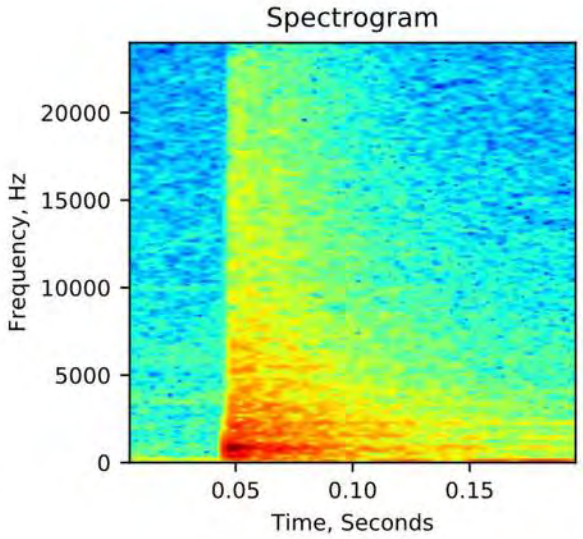
Underwater Sound Levels, dB re: 1 μPa

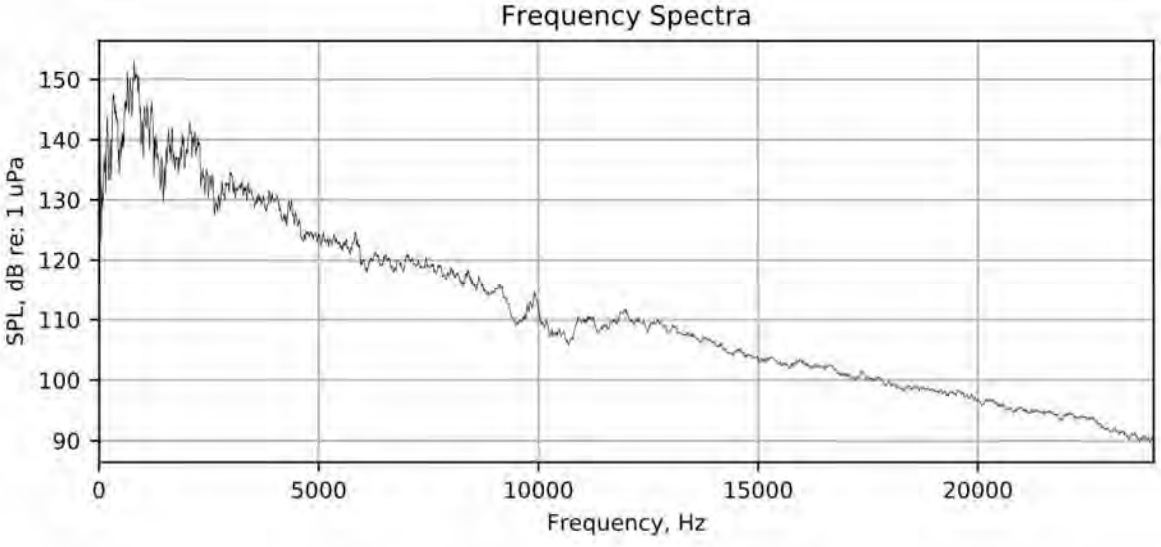
Frequency Range	Peak					RMS_{90}					SEL					cSEL
	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	
Near-Field Hydrophone																
Unweighted	201	192	0.9	199	199	189	178	1.1	186	186	174	163	1.0	171	171	200
LF Cetacean	196	186	1.0	194	193	184	174	1.1	182	181	169	158	1.0	166	166	195
MF Cetacean	197	186	1.0	193	193	184	172	1.1	180	180	168	157	1.0	165	165	194
HF Cetacean	197	186	1.0	193	193	184	172	1.1	181	181	168	158	1.0	166	166	194
PW	196	183	1.4	191	191	182	170	1.1	179	178	167	154	1.1	163	163	192
OW	197	184	1.3	192	192	183	171	1.1	180	180	168	155	1.1	165	164	193
Far-Field Hydrophone																
Unweighted	198	185	1.6	193	192	183	172	1.3	180	180	169	158	1.1	166	166	195
LF Cetacean	193	179	1.7	187	187	178	167	1.3	175	174	164	153	1.1	161	161	189
MF Cetacean	192	179	1.6	187	187	178	165	1.2	174	174	163	152	1.1	160	160	189
HF Cetacean	192	179	1.6	187	187	178	166	1.2	174	174	164	153	1.1	161	161	189
PW	192	175	1.9	184	184	175	163	1.3	171	171	161	149	1.2	158	158	187
OW	193	175	2.0	185	185	177	164	1.4	172	172	162	149	1.3	159	159	187

Note: Measurement distances normalized to 33 feet (10 meters)


Sound Pressure during Pile Driving
Sound Pressure, Pa
4000
2000
0
−2000
−4000
0
500
1000
1500
2000
2500
3000
3500
Time, Seconds


Peak Waveform, Pa
Sound Pressure, Pa
4000
2000
0
−2000
−4000
742.55
742.60
742.65
742.70
742.75
Time, Seconds


Spectrogram
Frequency, Hz
20000
15000
10000
5000
0
0.05
0.10
0.15
Time, Seconds


Frequency Spectra
SPL, dB re: 1 uPa
150
140
130
120
110
100
90
0
5000
10000
15000
20000
Frequency, Hz

PILE Y-13A

November 28, 2022

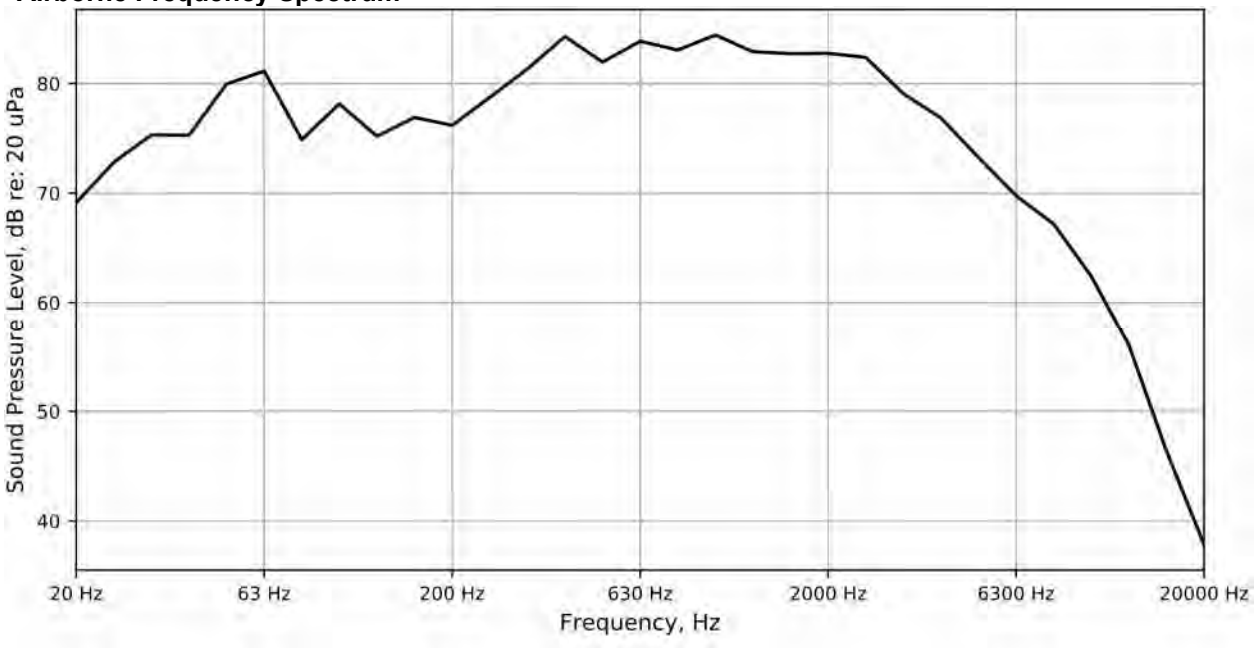
Hydrophone and Pile Information, Feet

Hydro Depth (Near/Far)	Distance			Water Depth	
	Between Hydros	Hydros to Pile (Near/Far)	Pile to Water's Edge	Hydros (Near/Far)	Pile
24/30	144	202/225	22	32/44	12

Airborne Sound Levels, dB re: 20 μPa

Median	Maximum	Minimum
107	110	100

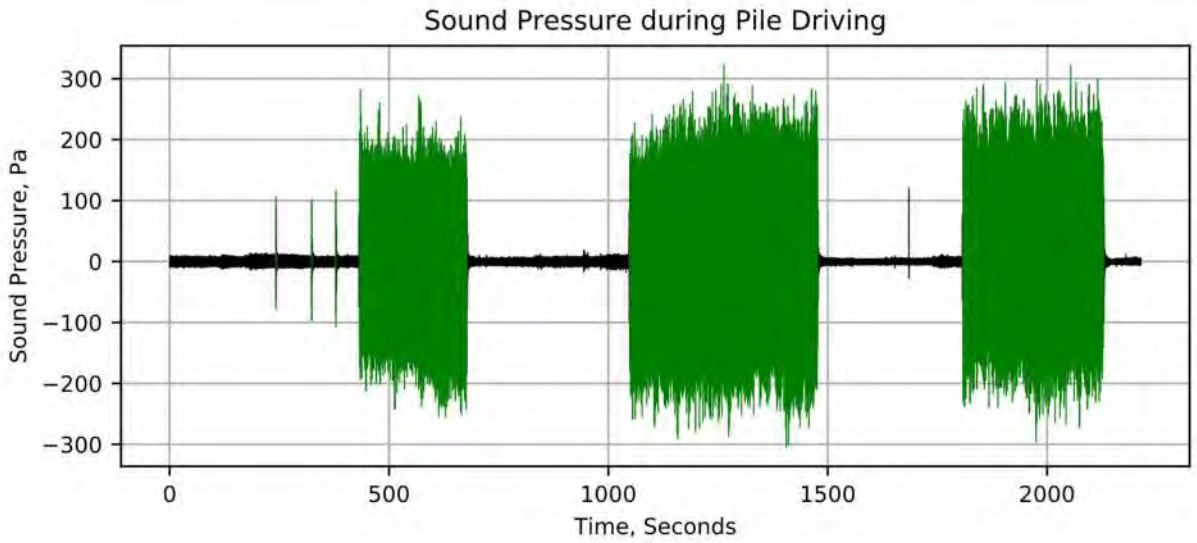
Airborne Frequency Spectrum

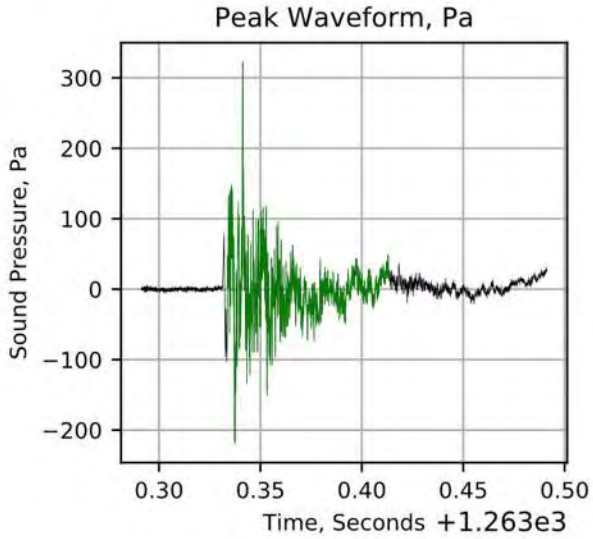


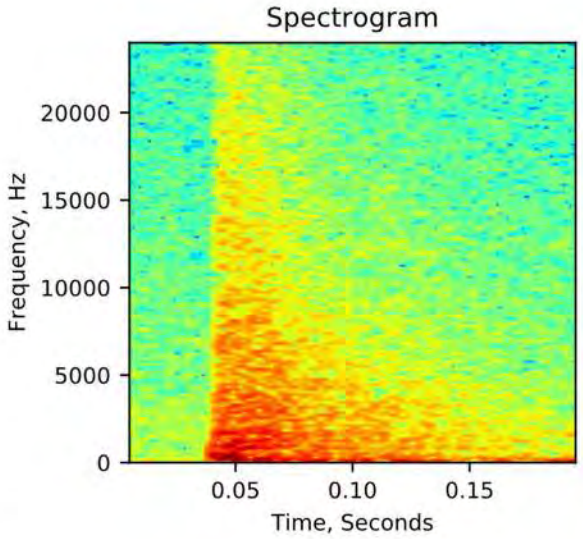
Underwater Sound Levels, dB re: 1 μPa

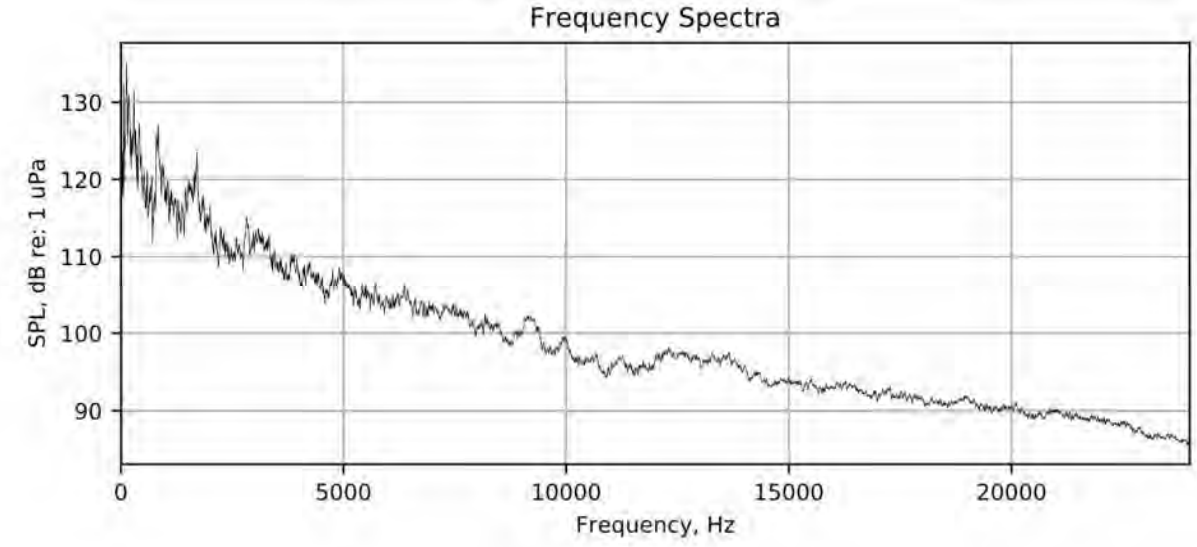
Frequency Range	Peak					RMS_{90}					SEL					cSEL
	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	
Near-Field Hydrophone																
Unweighted	182	172	1.2	179	179	166	156	0.9	164	165	155	147	0.7	154	154	182
LF Cetacean	176	165	1.3	173	173	162	151	1.1	159	159	149	139	0.8	147	147	175
MF Cetacean	177	167	1.3	174	174	161	150	1.0	159	159	150	141	0.7	148	148	176
HF Cetacean	177	167	1.3	174	174	161	150	1.0	159	159	150	142	0.7	148	148	176
PW	175	163	1.5	171	170	160	147	1.3	156	156	147	137	1.0	144	144	173
OW	175	162	1.5	171	171	161	147	1.4	157	157	147	137	1.1	145	145	173
Far-Field Hydrophone																
Unweighted	189	177	1.8	182	182	172	161	1.5	167	167	160	151	1.0	156	156	184
LF Cetacean	183	171	1.9	177	176	168	158	1.7	163	162	154	144	1.3	150	149	178
MF Cetacean	187	171	2.1	178	177	168	155	1.6	162	161	154	145	1.1	151	150	179
HF Cetacean	187	171	2.0	178	177	168	156	1.6	162	162	155	145	1.0	151	151	179
PW	185	169	2.3	175	175	166	154	1.9	160	160	152	141	1.5	148	147	176
OW	184	170	2.4	176	175	167	155	2.1	161	161	153	142	1.7	148	148	177

Note: Measurement distances normalized to 33 feet (10 meters)


Sound Pressure during Pile Driving
Sound Pressure, Pa
300
200
100
0
−100
−200
−300
0
500
1000
1500
2000
Time, Seconds


Peak Waveform, Pa
Sound Pressure, Pa
300
200
100
0
−100
−200
0.30
0.35
0.40
0.45
0.50
Time, Seconds +1.263e3


Spectrogram
Frequency, Hz
20000
15000
10000
5000
0
0.05
0.10
0.15
Time, Seconds


Frequency Spectra
SPL, dB re: 1 uPa
130
120
110
100
90
0
5000
10000
15000
20000
Frequency, Hz

PILE G-4

December 6, 2022

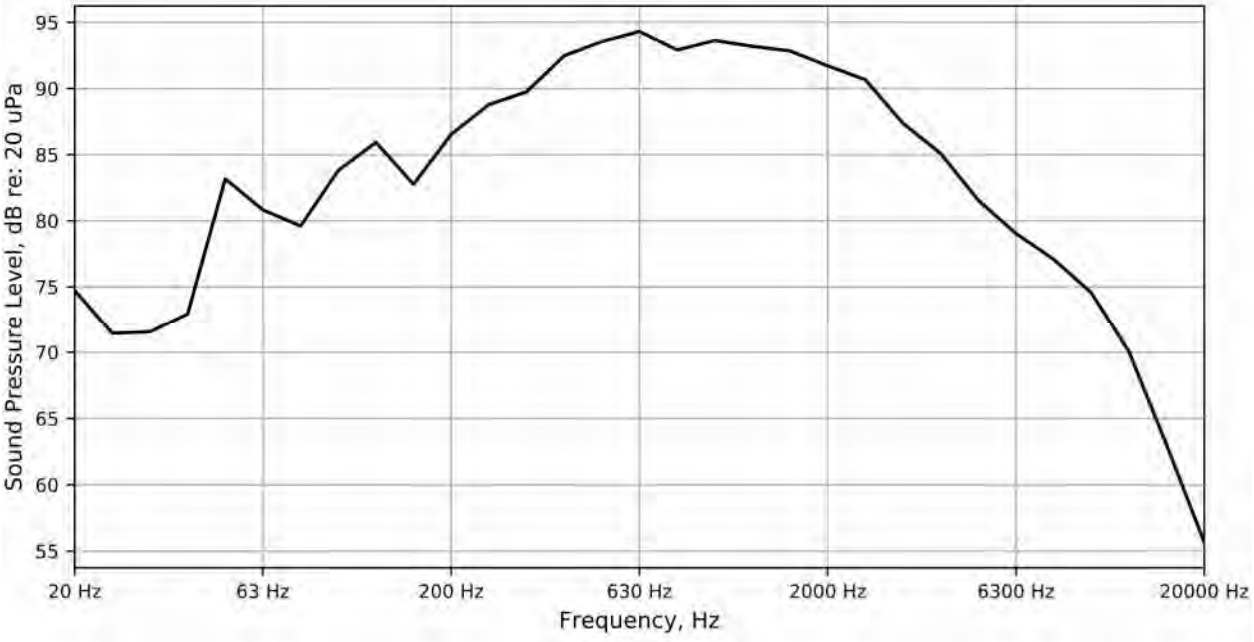
Hydrophone and Pile Information, Feet

Hydro Depth (Near/Far)	Distance			Water Depth	
	Between Hydros	Hydros to Pile (Near/Far)	Pile to Water's Edge	Hydros (Near/Far)	Pile
20/30	144	63/180	46	30/40	27

Airborne Sound Levels, dB re: 20 μPa

Median	Maximum	Minimum
106	108	102

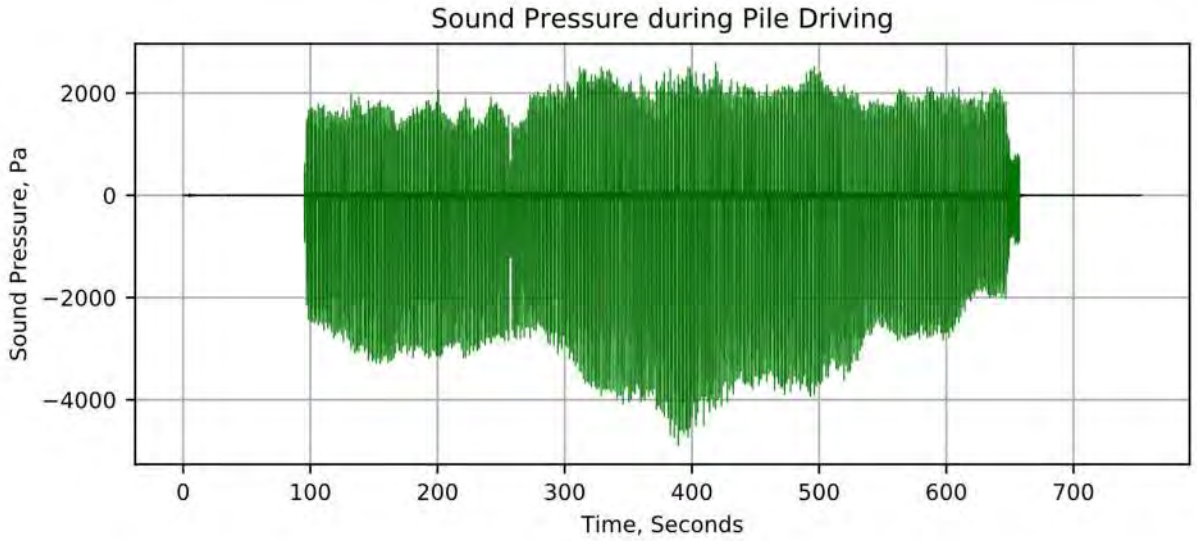
Airborne Frequency Spectrum

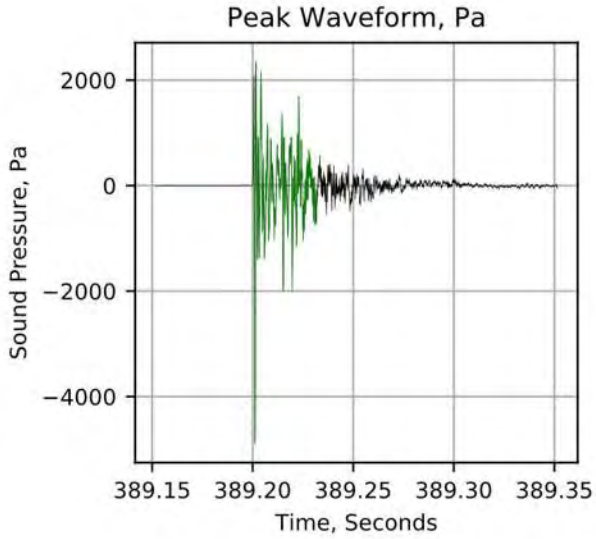


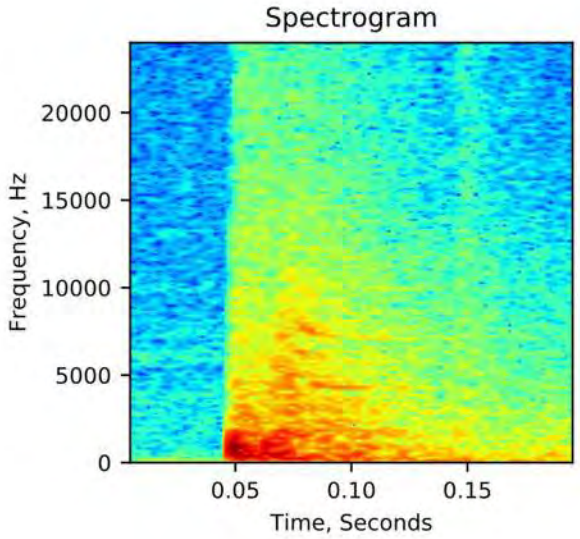
Underwater Sound Levels, dB re: 1 μPa

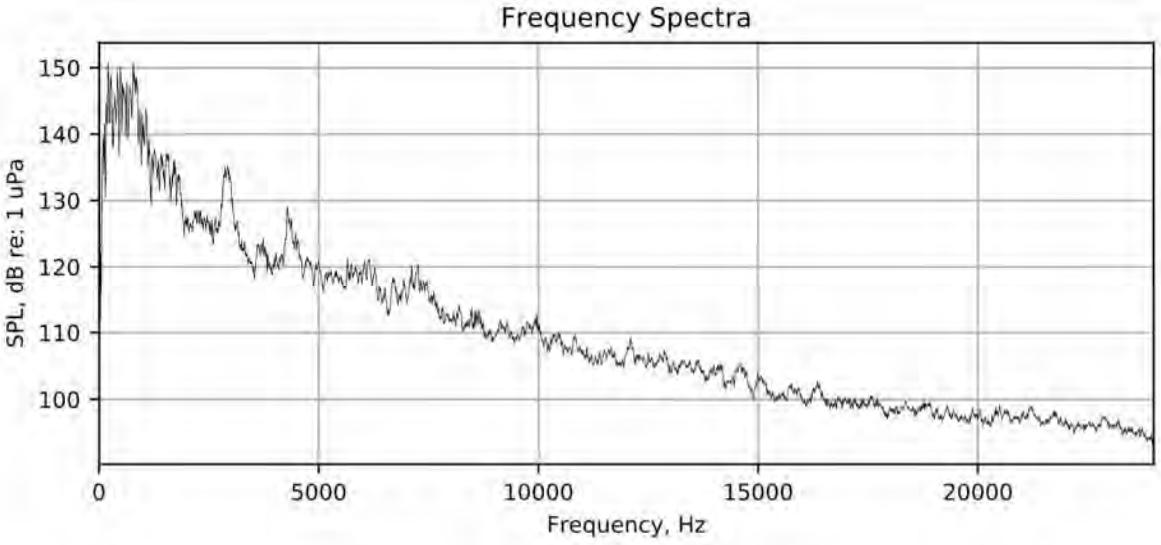
Frequency Range	Peak					RMS_{90}					SEL					cSEL
	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	
Near-Field Hydrophone																
Unweighted	218	193	1.5	206	206	209	177	1.8	190	190	199	165	1.8	176	176	203
LF Cetacean	209	189	1.4	200	201	193	173	1.5	185	185	184	159	1.5	170	170	196
MF Cetacean	214	188	1.5	200	200	202	171	1.7	184	184	192	159	1.8	170	170	197
HF Cetacean	214	188	1.5	200	200	203	171	1.8	185	185	193	159	1.8	171	170	198
PW	210	185	1.5	197	197	193	168	1.6	181	181	184	154	1.7	167	167	193
OW	209	185	1.6	197	198	191	168	1.6	181	182	182	154	1.7	167	167	193
Far-Field Hydrophone																
Unweighted	205	189	2.4	201	201	190	173	2.1	186	186	175	161	1.7	172	172	198
LF Cetacean	200	184	2.5	196	195	185	168	2.2	181	181	169	155	1.8	167	167	193
MF Cetacean	199	183	2.5	195	195	184	167	2.1	180	180	169	155	1.8	166	166	192
HF Cetacean	199	184	2.4	195	195	184	167	2.1	181	181	169	155	1.7	167	167	192
PW	196	180	2.7	192	192	181	163	2.3	177	177	166	151	2.1	163	163	189
OW	198	180	3.0	193	193	182	163	2.6	178	178	167	150	2.4	164	164	190

Note: Measurement distances normalized to 33 feet (10 meters)


Sound Pressure during Pile Driving
Sound Pressure, Pa
2000
0
−2000
−4000
0
100
200
300
400
500
600
700
Time, Seconds


Peak Waveform, Pa
Sound Pressure, Pa
2000
0
−2000
−4000
389.15
389.20
389.25
389.30
389.35
Time, Seconds


Spectrogram
Frequency, Hz
20000
15000
10000
5000
0
0.05
0.10
0.15
Time, Seconds


Frequency Spectra
SPL, dB re: 1 uPa
150
140
130
120
110
100
0
5000
10000
15000
20000
Frequency, Hz

PILE G-5

December 6, 2022

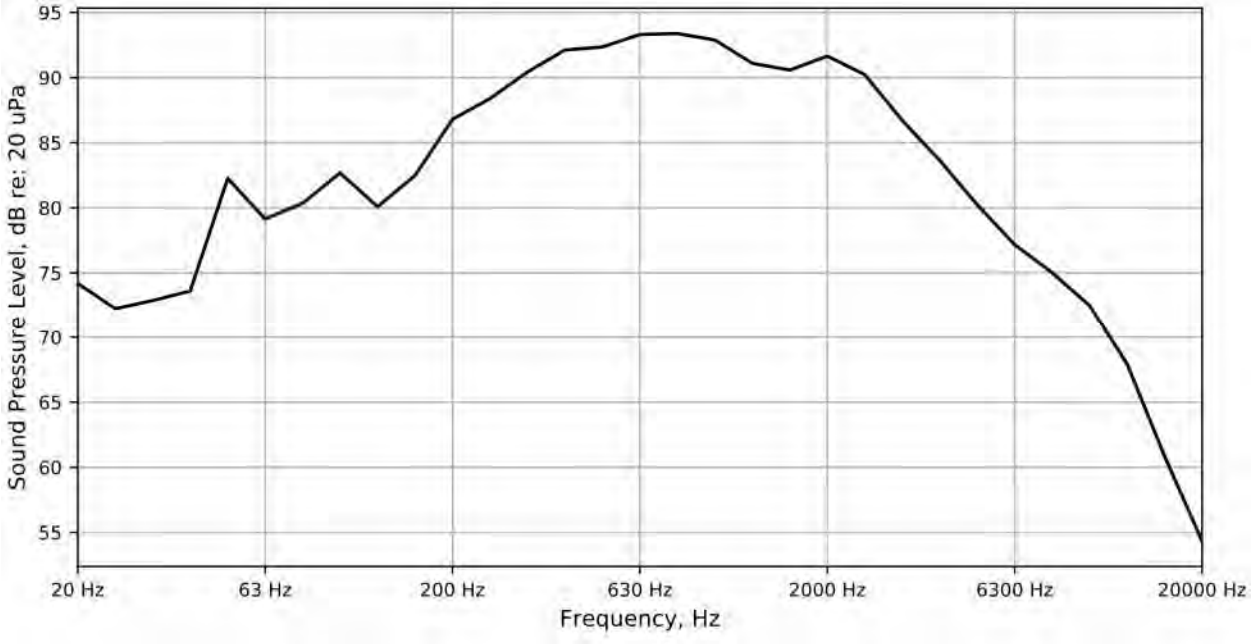
Hydrophone and Pile Information, Feet

Hydro Depth (Near/Far)	Distance			Water Depth	
	Between Hydros	Hydros to Pile (Near/Far)	Pile to Water's Edge	Hydros (Near/Far)	Pile
20/30	144	77/185	39	30/40	26

Airborne Sound Levels, dB re: 20 μPa

Median	Maximum	Minimum
107	110	104

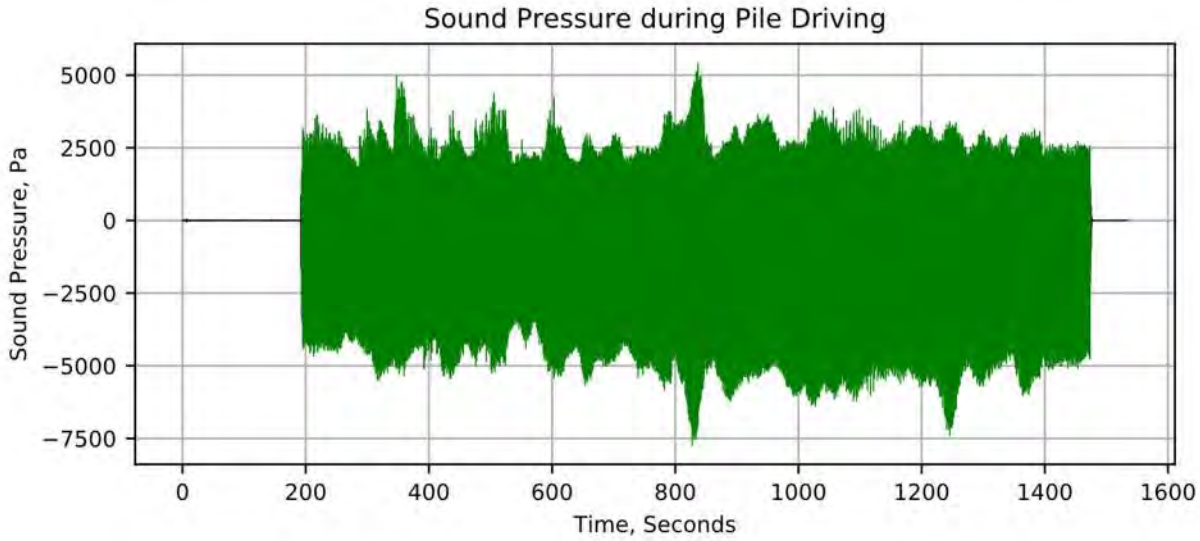
Airborne Frequency Spectrum

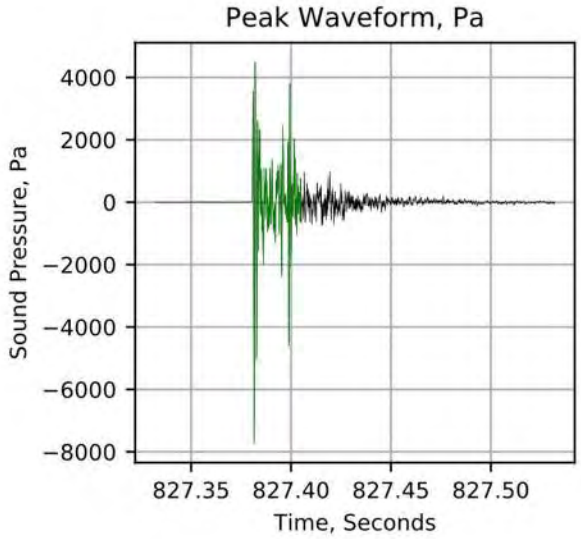


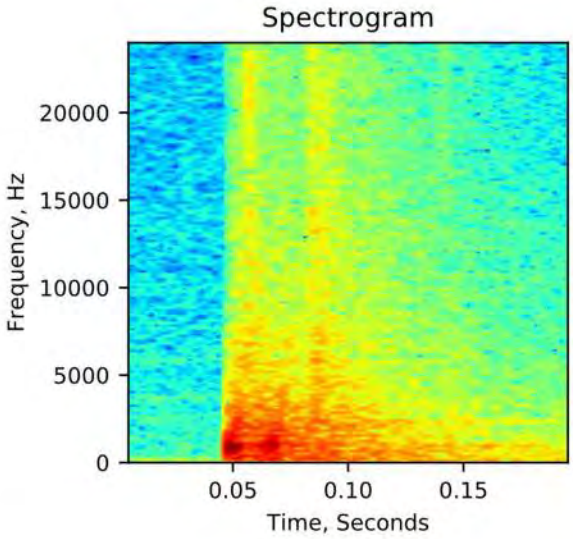
Underwater Sound Levels, dB re: 1 μPa

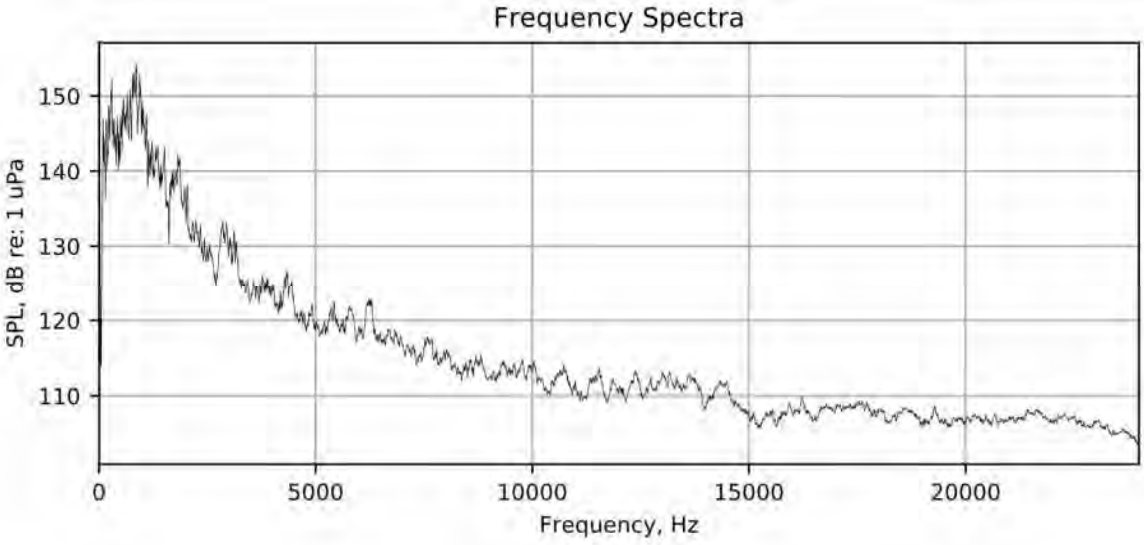
Frequency Range	Peak					RMS_{90}					SEL					cSEL
	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	
Near-Field Hydrophone																
Unweighted	218	199	1.0	207	207	203	183	0.9	191	191	182	170	0.7	177	177	206
LF Cetacean	213	194	1.0	202	202	202	177	1.0	186	186	176	164	0.7	171	171	201
MF Cetacean	216	195	1.2	201	201	202	177	0.9	185	185	177	164	0.7	171	171	200
HF Cetacean	215	194	1.2	202	202	199	177	0.9	186	186	177	164	0.7	171	171	200
PW	213	192	1.3	199	199	202	173	1.0	183	183	175	161	0.7	168	168	197
OW	213	192	1.3	200	200	202	172	1.1	184	184	176	162	0.7	169	169	199
Far-Field Hydrophone																
Unweighted	209	198	1.2	205	205	195	181	1.1	190	190	179	168	0.8	176	175	205
LF Cetacean	204	193	1.2	200	200	190	176	1.2	185	185	173	163	0.9	170	170	199
MF Cetacean	203	192	1.2	199	199	189	175	1.1	184	184	173	162	0.8	170	169	199
HF Cetacean	204	192	1.2	200	200	189	176	1.1	184	184	173	163	0.8	170	170	199
PW	201	189	1.3	197	197	186	171	1.2	181	181	170	159	0.9	167	167	196
OW	202	190	1.3	198	198	188	172	1.3	183	183	172	160	1.0	168	168	197

Note: Measurement distances normalized to 33 feet (10 meters)


Sound Pressure during Pile Driving
Sound Pressure, Pa
5000
2500
0
−2500
−5000
−7500
0
200
400
600
800
1000
1200
1400
1600
Time, Seconds


Peak Waveform, Pa
Sound Pressure, Pa
4000
2000
0
−2000
−4000
−6000
−8000
827.35
827.40
827.45
827.50
Time, Seconds


Spectrogram
Frequency, Hz
20000
15000
10000
5000
0
0.05
0.10
0.15
Time, Seconds


Frequency Spectra
SPL, dB re: 1 uPa
150
140
130
120
110
0
5000
10000
15000
20000
Frequency, Hz

PILE G-6

December 6, 2022

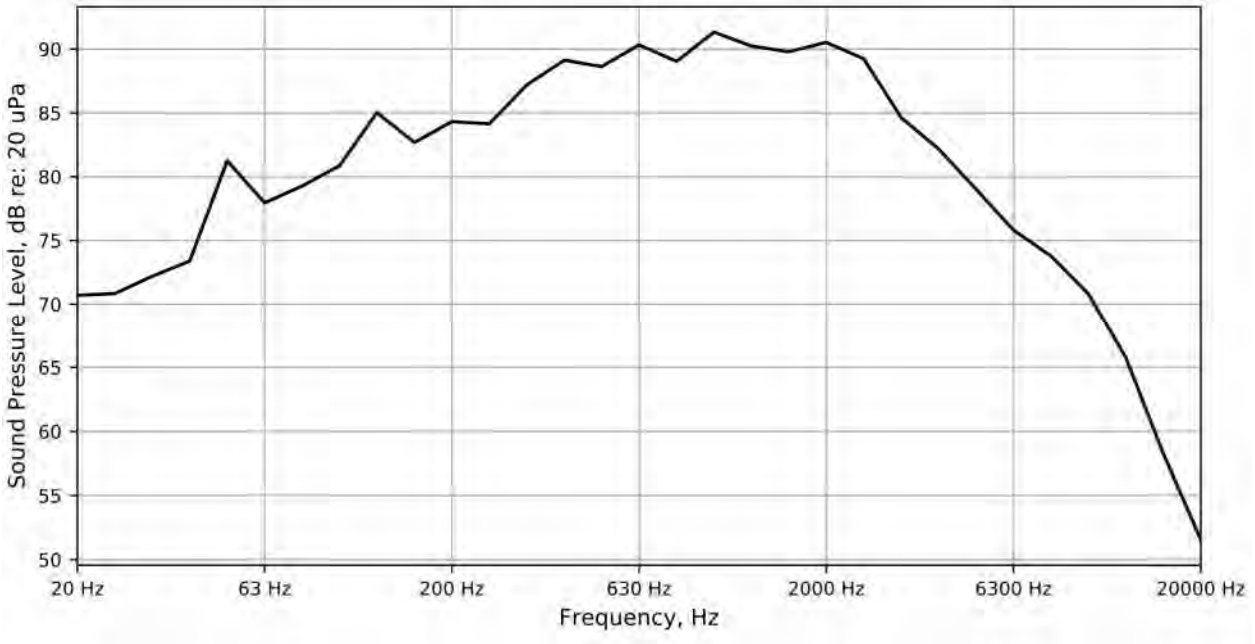
Hydrophone and Pile Information, Feet

Hydro Depth (Near/Far)	Distance			Water Depth	
	Between Hydros	Hydros to Pile (Near/Far)	Pile to Water's Edge	Hydros (Near/Far)	Pile
20/30	144	91/192	30	30/40	23

Airborne Sound Levels, dB re: 20 μPa

Median	Maximum	Minimum
106	111	103

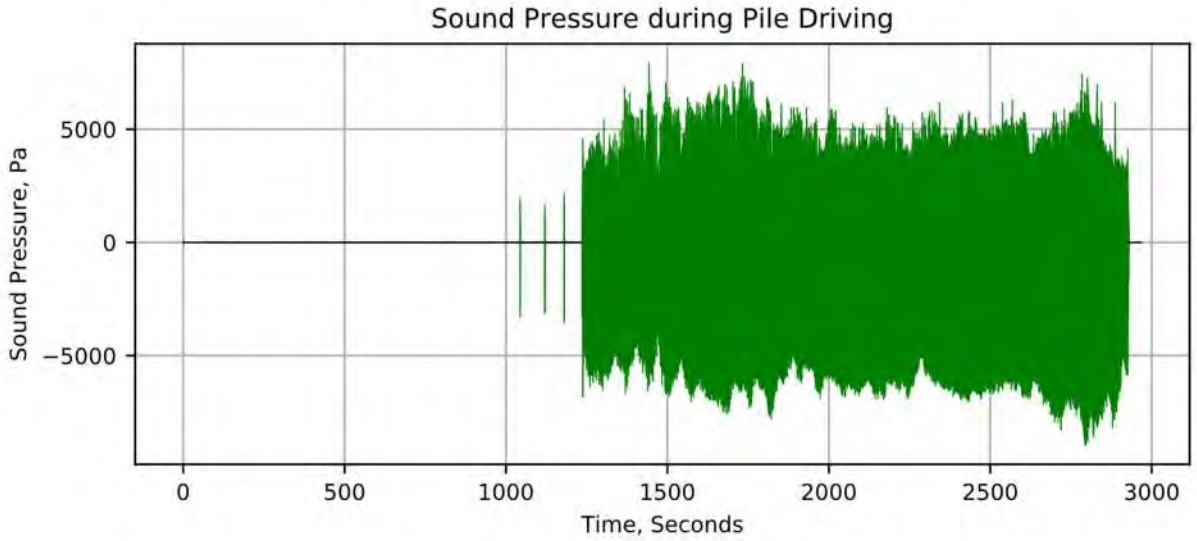
Airborne Frequency Spectrum

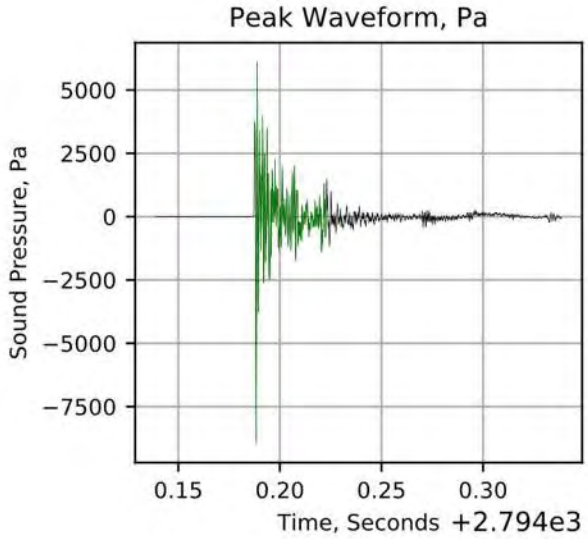


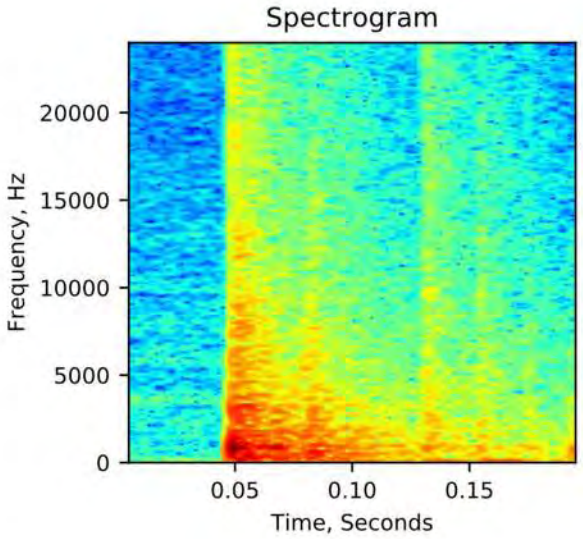
Underwater Sound Levels, dB re: 1 μPa

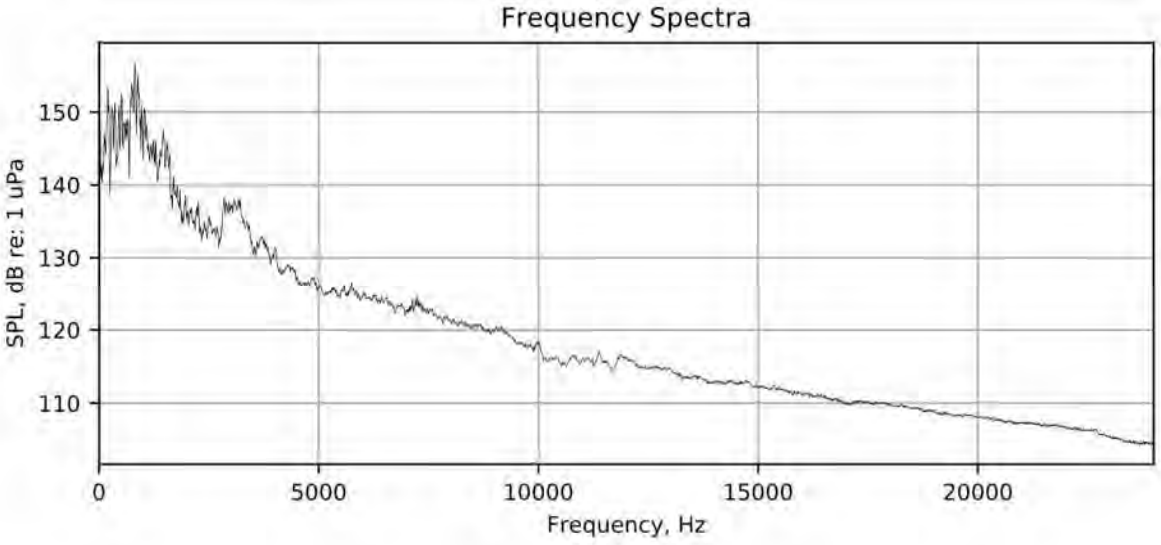
Frequency Range	Peak					RMS_{90}					SEL					cSEL
	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	Max	Min	SD	Mean	Med	
Near-Field Hydrophone																
Unweighted	206	192	1.2	203	203	191	176	1.2	187	187	176	162	1.1	173	173	204
LF Cetacean	201	187	1.2	198	198	186	171	1.2	182	182	171	156	1.1	168	168	198
MF Cetacean	201	186	1.3	197	197	185	170	1.2	181	181	170	156	1.1	167	167	198
HF Cetacean	201	186	1.2	197	197	185	170	1.2	182	182	171	156	1.1	168	168	198
PW	199	183	1.4	195	195	183	167	1.2	179	179	168	153	1.2	165	165	195
OW	200	184	1.4	196	196	184	169	1.2	181	180	169	154	1.2	166	166	196
Far-Field Hydrophone																
Unweighted	205	194	1.7	202	202	190	177	1.7	187	187	176	163	1.3	172	172	203
LF Cetacean	200	189	1.7	197	197	185	172	1.7	182	182	171	158	1.3	167	167	198
MF Cetacean	199	188	1.7	196	196	184	171	1.6	181	181	170	157	1.3	166	166	197
HF Cetacean	200	189	1.7	197	197	185	172	1.6	181	181	170	158	1.3	167	167	197
PW	198	186	1.7	194	194	182	169	1.6	178	178	168	155	1.4	164	164	195
OW	199	187	1.7	195	195	184	170	1.7	180	180	170	156	1.4	165	165	196

Note: Measurement distances normalized to 33 feet (10 meters)


Sound Pressure during Pile Driving
Sound Pressure, Pa
5000
0
−5000
0
500
1000
1500
2000
2500
3000
Time, Seconds


Peak Waveform, Pa
Sound Pressure, Pa
5000
2500
0
−2500
−5000
−7500
0.15
0.20
0.25
0.30
Time, Seconds +2.794e3


Spectrogram
Frequency, Hz
20000
15000
10000
5000
0
0.05
0.10
0.15
Time, Seconds


Frequency Spectra
SPL, dB re: 1 uPa
150
140
130
120
110
0
5000
10000
15000
20000
Frequency, Hz

4.0 PILE DRIVER INFORMATION

APE MODEL 150 VIBRATORY DRIVER/EXTRACTOR

APE Model 150 Vibratory Driver Extractor

The Worlds Largest Provider of Foundation Construction Equipment

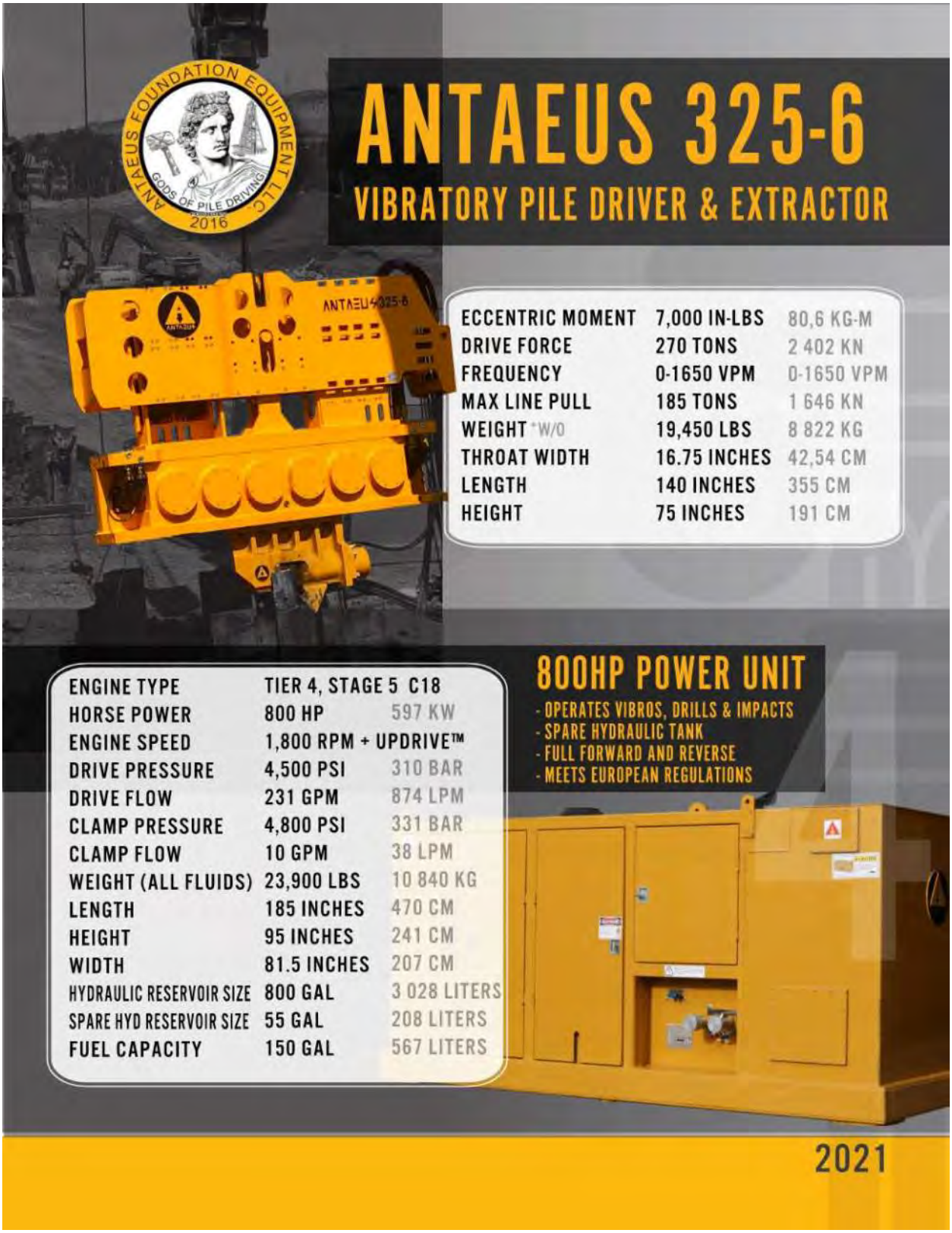
SPECIFICATIONS	DATA
Eccentric Moment	2,200 in-lbs (25.35 kgm)
Drive Force	85 tons (757 kN)
Frequency Maximum (VPM)	0 - 1,650 vpm
Max Line Pull	108 tons (961 kN)
Bare Hammer Weight w/o Clamp	8,330 lbs (3,778 kg)
Throat Width	14.25 in (36 cm)
Length	88.75 in (225 cm)
Height w/o Clamp	72.38 in (184 cm)

APE Model 375 Power Unit

SPECIFICATIONS	DATA
Engine Type	Caterpillar C9 Tier III
Horse Power	375 HP (276 kW)
Drive Pressure	0 - 4,500 psi (310 bar)
Drive Flow	120 gpm (454 lpm)
Clamp Pressure	4,800 psi (69,618 bar)
Clamp Flow	10 gpm (3 lpm)
Engine Speed	2,100 rpm
Weight	12,600 lbs (5,715 kg)
Length	137 in (347 cm)
Width	77 in (195 cm)
Height	82 in (208 cm)
Hydraulic Reservoir	300 gal (1,136 L)
Fuel Capacity	140 gal (530 L)

Specifications may vary due to site conditions, specific hammer conditions or product set up.
Specifications may change without notice.
Consult the factory for details on any specific product (800) 248-8498.

ANTAEUS 325-6 VIBRATORY DRIVER/EXTRACTOR



APE MODEL D62-22 SINGLE ACTING IMPACT HAMMER

APE Model D62-22 Single Acting Impact Hammer

operates on diesel or bio-diesel for all types of impact pile driving

Bottom drive system for large diameter piles

MODEL D62-22 (6.2 metric ton ram)

SPECIFICATIONS

Maximum Rated Energy	153,770 ft/lbs (208,484 Nm)
Minimum Rated Energy	78,956 ft/lbs (107,050 Nm)
Stroke at Rated Energy	11.24 ft (3.42 m)
Maximum Obtainable Stroke	12.5 ft (3.81 m)
Speed (blows per minute)	36-50

WEIGHTS (Approximate)

Piston	13,669 lbs (6,200 kg)
Anvil	2,833 lbs (1,285 kg)
Hammer Weight (includes trip device)	28,272 lbs (12,823 kg)
Hammer weight w/ DB-32 Drive Base	31,744 lbs (14,399 kg)
Typical Operating Weight w/ Drive Cap	Varies- consult factory

CAPACITIES

Fuel Tank (runs on diesel or bio-diesel)	25.89 gal (98 liter)
Oil Tank	8.32 gal (31.5 liter)

CONSUMPTION

Diesel or Bio-Diesel Fuel	5.28 gal/hour (20 liter/ hour)
Lubrication Oil	.84 gal/hour (3.2 liter/hour)
Grease	twice per day

DIMENSIONS OF HAMMER

a	Length overall	232.68 in (5,910 mm)
a	Length over cylinder extension	272 in (6,908 mm)
a	Length over trip tubes	308 in (7,823 mm)
b	Impact block diameter	27.91 in (709 mm)
c	Width over bolts	35.6 in (904 mm)
d	Hammer width overall	31.5 in (800 mm)
e	Width for guiding- face to face	32 in (812 mm)
f	Hammer center to pump guard	19.3 in (490 mm)
g	Hammer center to bolt center	15 in (381 mm)
h	Hammer depth overall	38.2 in (970 mm)
H	Minimum clearance for leads	19.7 in (500 mm)

Features

Fuel and lube pumps with 50% less parts than ICE
Hardened piston needs no high maintenance wear rings
Optional direct drive for high speed production on steel piles
Fuel pump mounted where heat will not harm it
Variable mechanical cam fuel pump- no air pistons or rings
Optional hydraulic variable fuel remote control
Heavy duty trip system for years of fault free operation
Chrome rings for super long life
Low maintenance and extremely low parts pricing
German design at a reasonable price
Two year APE warranty

AMERICAN PILEDRIVING EQUIPMENT, INC. APE

Corporate Offices
7032 South 196th
Kent, Washington 98032 USA
(800) 248-8498 & (253) 872-0141
(253) 872-8710 Fax

2/06

Visit our WEB site:
www.apevibro.com
e-mail: ape@apevibro.com

We reserve the right to modify specifications without notice. Contact APE directly for updated literature.

5.0 BUBBLE CURTAIN INFORMATION

Pacific Pile&Marine

BUBBLE CURTAIN DEPLOYMENT AND OPERATION

Prior to deploying the Unconfined Bubble Curtain (hereafter Bubble Curtain) it is inspected at the PPM storage facility and again once onboard the barge prior to deployment for operation.

This Inspection Includes:

- Compressors
- Manifolds
- Connector Fittings
- Pressure Guages
- Hoses
- Rings
- Ring Spacing
- Rollers
- Bubble Diffusers
- Nozzles
- Saddle Plate
- Globe Valve
- Hand Wheel

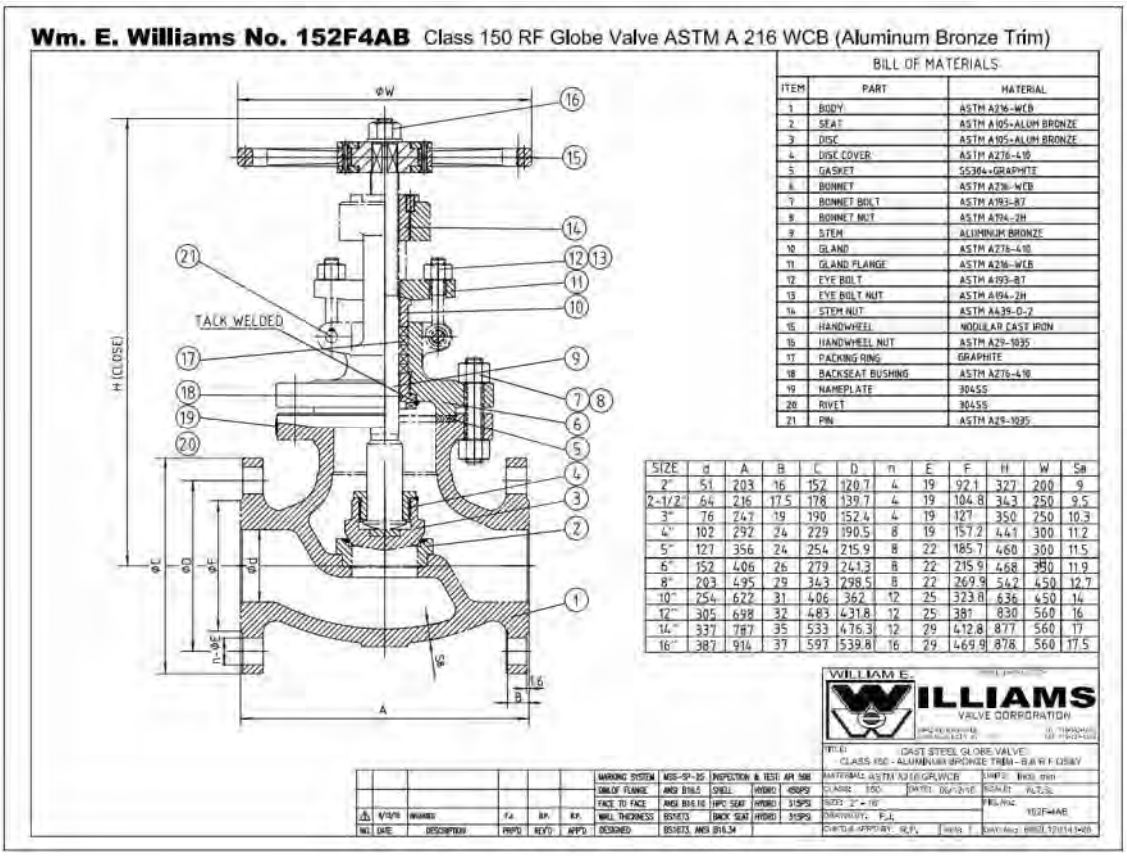
Deployment:

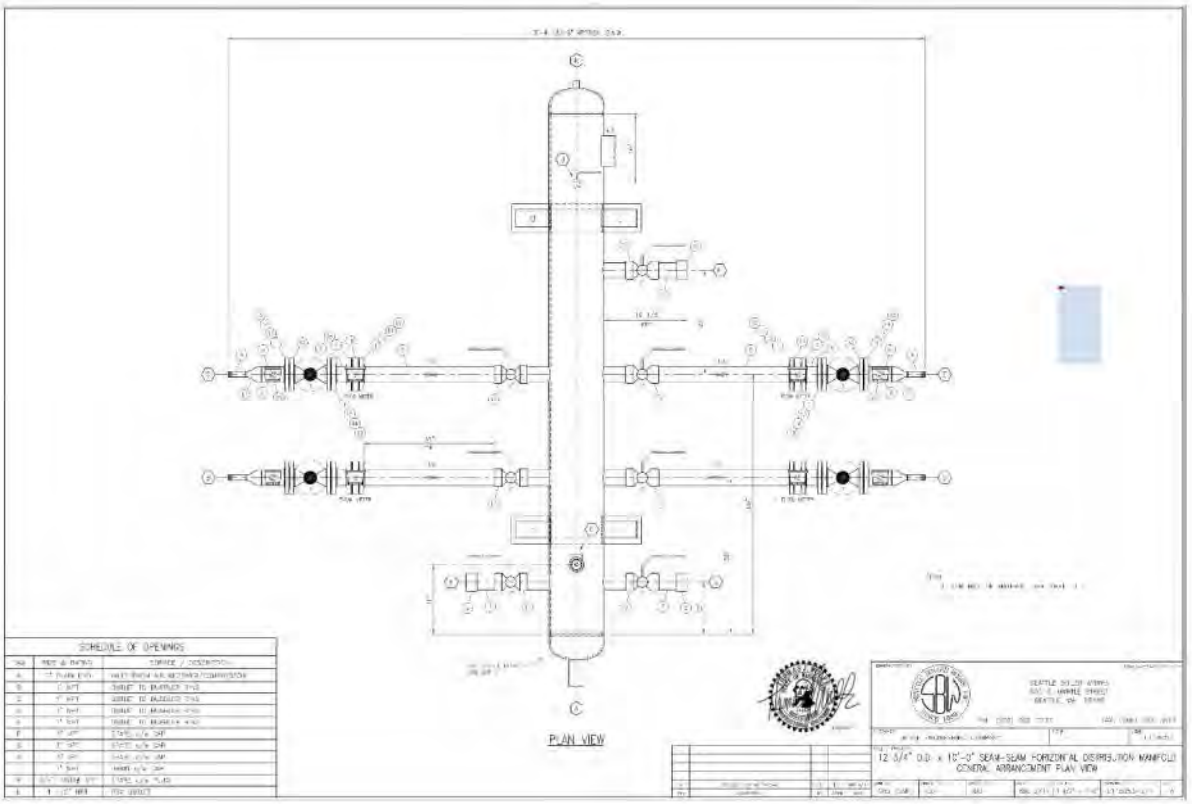
- Bubble Curtain Leads are attached to Hammer
- Hammer and Bubble Curtain are hoisted over the top of Pile
- Prior to lowering Bubble Curtain into Water Column Bubble Curtain is activated
- As Bubble Curtain is lowered into Water Column each ring is confirmed to operate correctly
- Spacing of Bubble Curtain Rings is confirmed by crew onsite
- Bubbles are confirmed to encircle pile prior to engaging in Impact Work

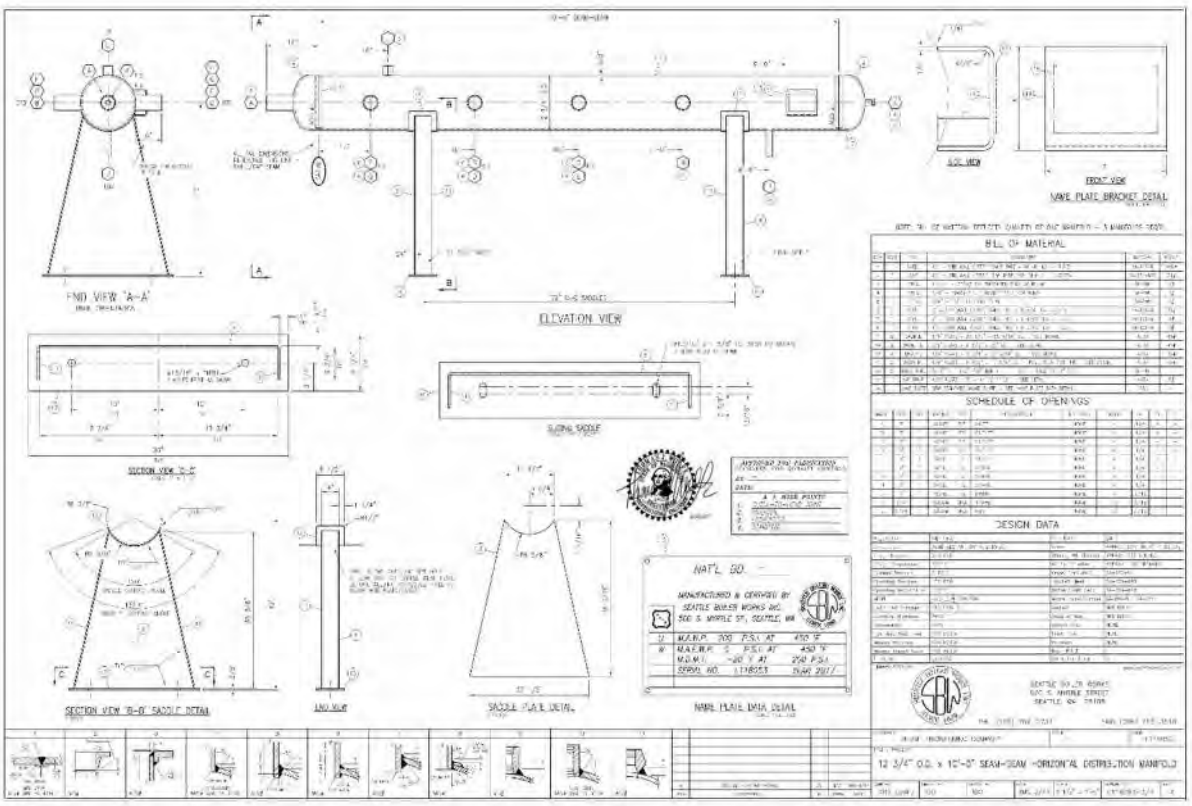
Operation:

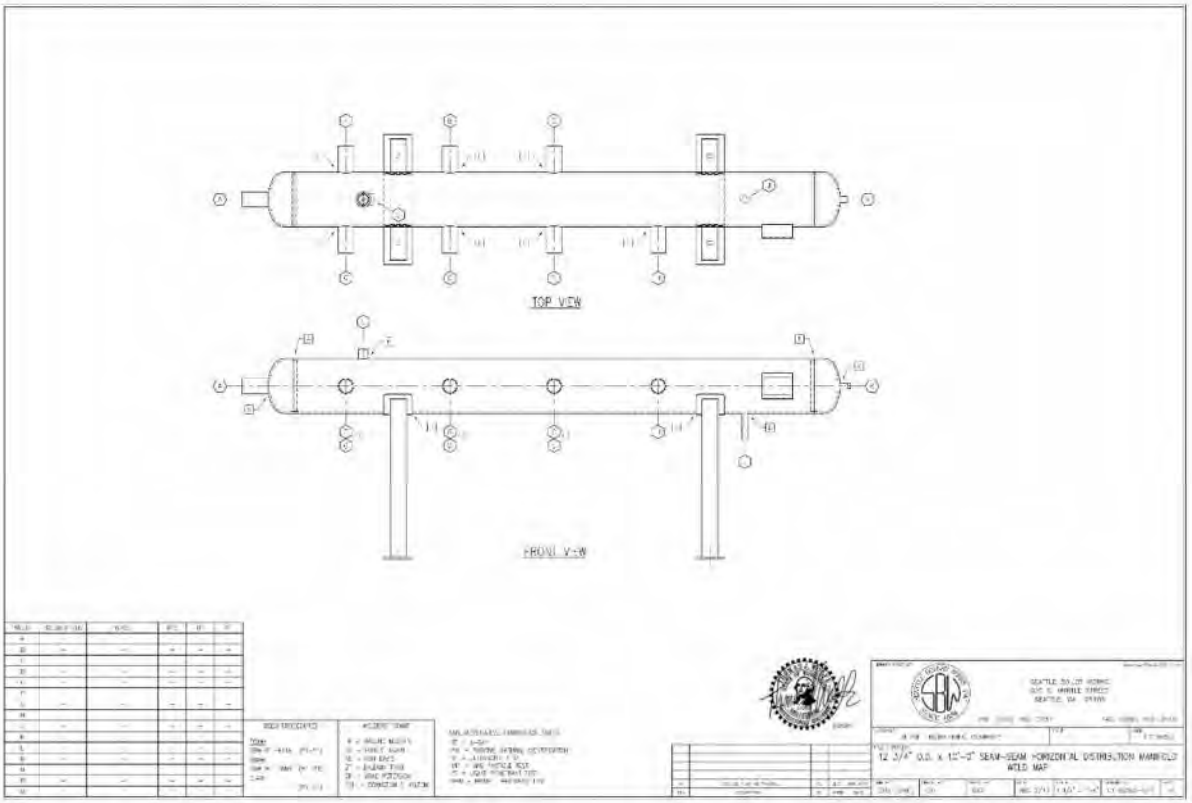
- In order for successful operation of Bubble Curtain it must be inspected regularly to confirm that it is clear of debris and that all Bubble Diffusers are operating correctly.
- Bubble Curtain is to remain active for approximately 30 seconds following completion of Impact Pile Driving Work before it is removed from the water column

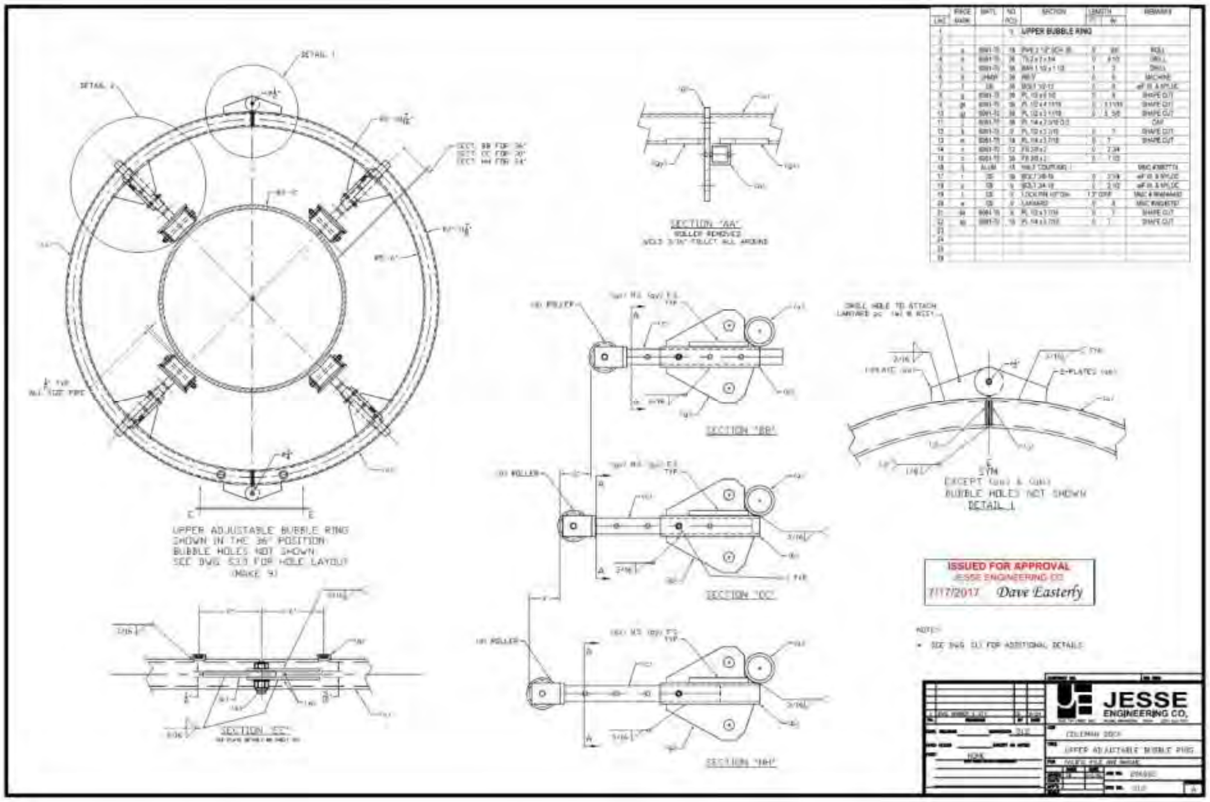
For further questions and specifics of operation Steven Spencer (Engineer) 425-861-6054 and Ryan Stewart (PPM Foreman) 360-535-0014 are available for consultation.

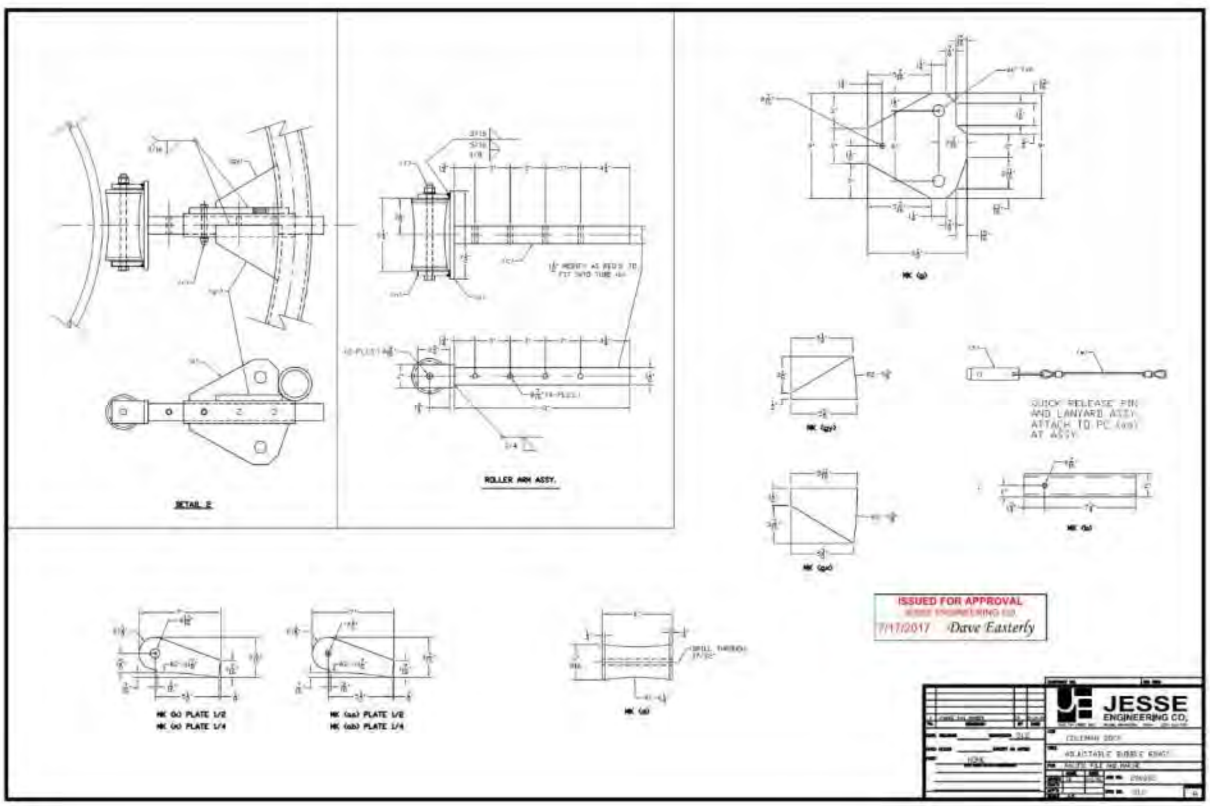

Wm. E. Williams No. 152F4AB Class 150 RF Globe Valve ASTM A 216 WCB (Aluminum Bronze Trim)
BILL OF MATERIALS
ITEM | PART | MATERIAL
1 | BODY | ASTM A216-WCB
2 | SEAT | ASTM A105+ALUM BRONZE
3 | DISC | ASTM A105+ALUM BRONZE
4 | DISC COVER | ASTM A276-410
5 | GASKET | SS304+GRAPHITE
6 | BONNET | ASTM A216-WCB
7 | BONNET BOLT | ASTM A193-B7
8 | BONNET NUT | ASTM A194-2H
9 | STEM | ALUMINUM BRONZE
10 | GLAND | ASTM A276-410
11 | GLAND FLANGE | ASTM A216-WCB
12 | EYE BOLT | ASTM A193-B7
13 | EYE BOLT NUT | ASTM A194-2H
14 | STEM NUT | ASTM A439-D-2
15 | HANDWHEEL | NODULAR CAST IRON
16 | HANDWHEEL NUT | ASTM A29-1035
17 | PACKING RING | GRAPHITE
18 | BACKSEAT BUSHING | ASTM A276-410
19 | NAMEPLATE | 304SS
20 | RIVET | 304SS
21 | PIN | ASTM A29-1035
TACK WELDED
H (CLOSE)
SIZE | d | A | B | C | D | n | E | F | H | W | Sa
2" | 51 | 203 | 16 | 152 | 120.7 | 4 | 19 | 92.1 | 327 | 200 | 9
2-1/2" | 64 | 216 | 17.5 | 178 | 139.7 | 4 | 19 | 104.8 | 343 | 250 | 9.5
3" | 76 | 241 | 19 | 190 | 152.4 | 4 | 19 | 127 | 350 | 250 | 10.3
4" | 102 | 292 | 24 | 229 | 190.5 | 8 | 19 | 157.2 | 441 | 300 | 11.2
5" | 127 | 356 | 24 | 254 | 215.9 | 8 | 22 | 185.7 | 460 | 300 | 11.5
6" | 152 | 406 | 26 | 279 | 241.3 | 8 | 22 | 215.9 | 468 | 350 | 11.9
8" | 203 | 495 | 29 | 343 | 298.5 | 8 | 22 | 269.9 | 542 | 450 | 12.7
10" | 254 | 622 | 31 | 406 | 362 | 12 | 25 | 323.8 | 636 | 450 | 14
12" | 305 | 698 | 32 | 483 | 431.8 | 12 | 25 | 381 | 830 | 560 | 16
14" | 337 | 787 | 35 | 533 | 476.3 | 12 | 29 | 412.8 | 877 | 560 | 17
16" | 387 | 914 | 37 | 597 | 539.8 | 16 | 29 | 469.9 | 878 | 560 | 17.5
WILLIAM E. WILLIAMS VALVE CORPORATION
CAST STEEL GLOBE VALVE
CLASS 150 - ALUMINUM BRONZE TRIM - BARE STEM

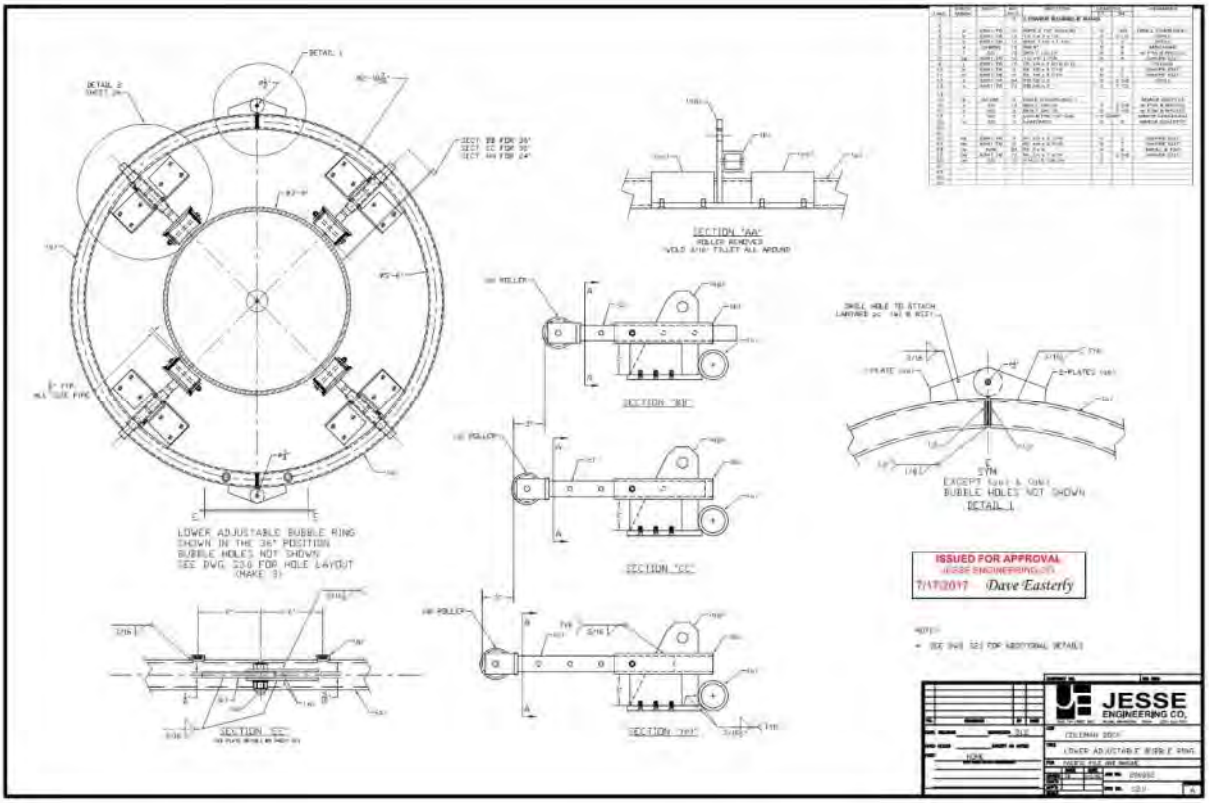

SCHEDULE OF OPENINGS
PLAN VIEW
12 3/4" O.D. x 10'-0" SEAM-SEAM HORIZONTAL DISTRIBUTION MANIFOLD
GENERAL ARRANGEMENT PLAN VIEW

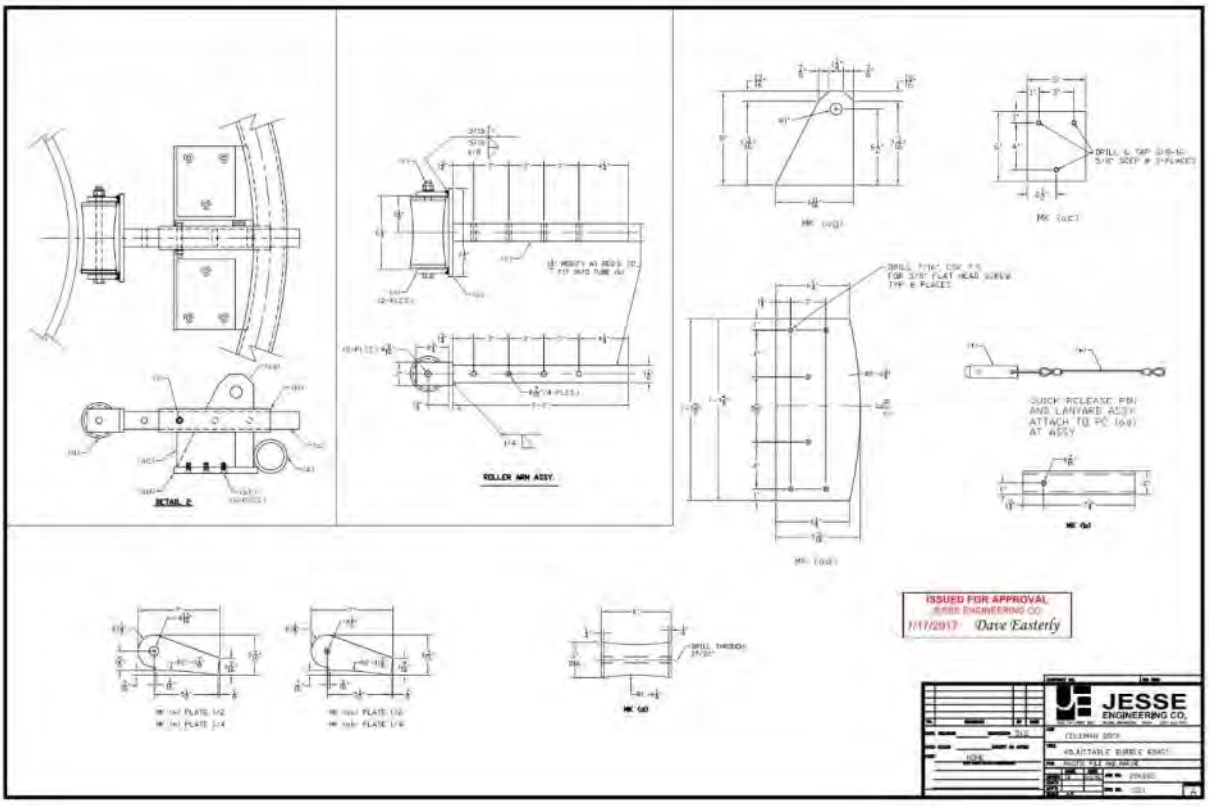

END VIEW "A-A"
ELEVATION VIEW
VANE PLATE BRACKET DETAIL
BILL OF MATERIAL
SCHEDULE OF OPENINGS
DESIGN DATA
SLIDING SADDLE
SECTION VIEW "B-B" SADDLE DETAIL
END VIEW
SADDLE PLATE DETAIL
NAME PLATE DATA DETAIL
NAT'L BD.
MANUFACTURED & CERTIFIED BY:
SEATTLE BOILER WORKS INC.
500 S. MYRTLE ST., SEATTLE, WA
12 3/4" O.D. x 12'-0" SEAM-SEAM HORIZONTAL DISTRIBUTION MANIFOLD

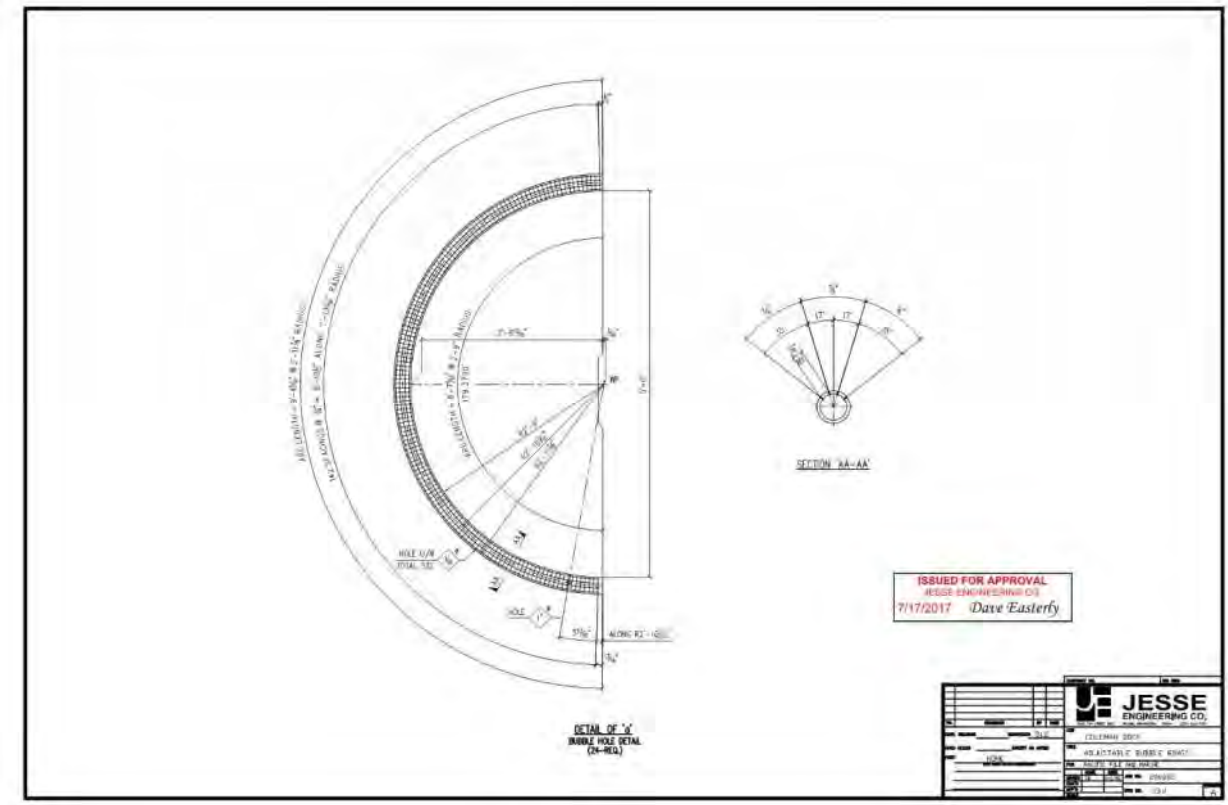

TOP VIEW
FRONT VIEW
12 3/4" O.D. x 12'-0" SEAM-SEAM HORIZONTAL DISTRIBUTION MANIFOLD
AS BUILT


UPPER BUBBLE RING
SECTION "AA"
SECTION "BB"
SECTION "CC"
SECTION "EE"
SECTION "HH"
DETAIL 1
UPPER ADJUSTABLE BUBBLE RING
SHOWN IN THE 36" POSITION
BUBBLE HOLES NOT SHOWN
SEE DWG S33 FOR HOLE LAYOUT
(MAKE 9)
EXCEPT (aa) & (ab)
BUBBLE HOLES NOT SHOWN
ISSUED FOR APPROVAL
JESSE ENGINEERING CO.
7/17/2017 Dave Easterly
JESSE
ENGINEERING CO.


DETAIL 2
ROLLER ARM ASSY.
QUICK RELEASE PIN
AND LANYARD ASSY.
ATTACH TO PC (aa)
AT ASSY.
ISSUED FOR APPROVAL
JESSE ENGINEERING CO.
7/17/2017 Dave Easterly
JESSE
ENGINEERING CO.


LOWER ADJUSTABLE BUBBLE RING
SHOWN IN THE 36" POSITION
BUBBLE HOLES NOT SHOWN
SEE DWG. 236 FOR HOLE LAYOUT
(MAKE 3)
SECTION "AA"
ROLLER REMOVES
WELD 3/16" FILLET ALL AROUND
SECTION "BB"
SECTION "CC"
SECTION "DD"
SECTION "EE"
DETAIL 1
EXCEPT BUBBLE HOLES NOT SHOWN
ISSUED FOR APPROVAL
7/17/2017 Dave Easterly
JESSE
ENGINEERING CO.


DETAIL 2
ROLLER ASM ASSY
QUICK RELEASE PIN
AND LANYARD ASSY
ATTACH TO PC (68)
AT ASSY
ISSUED FOR APPROVAL
1/11/2017 Dave Easterly
JESSE
ENGINEERING CO.



DETAIL OF 'a'
BUBBLE HOLE DETAIL
(24-REQ.)

Attachment 3
NMFS User Spreadsheet for Project Activities

E.1: IMPACT PILE DRIVING (STATIONARY SOURCE: Impulsive, Intermittent)

VERSION 2.0: 2018

KEY

	User Provided Information
	NMFS Provided Information (Technical Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Waterfront Park Reconstruction Project
PROJECT/SOURCE INFORMATION	Pier 58 Renewal IHA Attachment 4 – Waterfront Park Construction Project Acoustic Monitoring Report (Greenbusch 2023). Results from 30" steel impact.

Please include any assumptions

PROJECT CONTACT	See cover letter of IHA Application

STEP 2: WEIGHTING FACTOR ADJUSTMENT

		Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value
Weighting Factor Adjustment (kHz)¥	2	Relying on default due to lack of project-specific information

¥ Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 75), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

NOTE: Choose either E1-1 OR E.1-2 method to calculate isopleths (not required to fill in sage boxes for both)

E.1-1: METHOD TO CALCULATE PK AND SEL_{cum} (USING RMS SPL SOURCE LEVEL)

SEL_{cum}

Source Level (RMS SPL)	186.84
Number of piles per day	5
Strike Duration$^{\Delta}$ (seconds)	0.037583333
Number of strikes per pile	900
Duration of Sound Production (seconds)	169.125
10 Log (duration of sound production)	22.28
Propagation (xLogR)	15
Distance of source level measurement (meters)	10

$^{\Delta}$Window that makes up 90% of total cumulative energy (5%-95%) based on Madsen 2005

Unless otherwise specified, source levels are referenced 1 m from the source.

PK

Source Level (PK SPL)	201.5
Distance of source level measurement (meters)	10
Source level at 1 meter	216.5

Unless otherwise specified, source levels are referenced 1 m from the source.

NOTE: The User Spreadsheet tool provides a means to estimates distances associated with the Technical Guidance's PTS onset thresholds. Mitigation and monitoring requirements associated with a Marine Mammal Protection Act (MMPA) authorization or an Endangered Species Act (ESA) consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of the Technical Guidance and the User Spreadsheet tool.

RESULTANT ISOPLETHS*

*Impulsive sounds have dual metric thresholds (SELcum & PK). Metric producing largest isopleth should be used.

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS isopleth to threshold (meters)	**550.7**	**19.6**	**655.9**	**294.7**	**21.5**
PK Threshold	219	230	202	218	232
PTS PK isopleth to threshold (meters)	**NA**	**NA**	**9.3**	**NA**	**NA**

E.1-2: ALTERNATIVE METHOD TO CALCULATE PK AND SEL_{cum} (SINGLE STRIKE EQUIVALENT)

Unweighted $SEL_{cum\ (at\ measured\ distance)}$ = SEL_{ss} + 10 Log (# strikes)	**200.8**

SEL_{cum}

Source Level (Single Strike SEL)	167
Number of strikes per pile	800
Number of piles per day	3
Propagation (xLogR)	15
Distance of single strike SEL measurement (meters)	10

Unless otherwise specified, source levels are referenced 1 m from the source.

PK

Source Level (PK SPL)	195.9
Distance of source level measurement (meters)	10
Source level at 1 meter	210.9

Unless otherwise specified, source levels are referenced 1 m from the source.

RESULTANT ISOPLETHS*

*Impulsive sounds have dual metric thresholds (SELcum & PK). Metric producing largest isopleth should be used.

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS isopleth to threshold (meters)	**153.5**	**5.5**	**182.9**	**82.2**	**6.0**
PK Threshold	219	230	202	218	232
PTS PK isopleth to threshold (meters)	**NA**	**NA**	**3.9**	**NA**	**NA**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.01**	**-19.74**	**-26.87**	**-2.08**	**-1.15**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

A.1: Vibratory Pile Driving (STATIONARY SOURCE: Non-Impulsive, Continuous)

VERSION 2.0: 2018

KEY

	User Provided Information
	NMFS Provided Information (Technical Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Waterfront Park Reconstruction Project
PROJECT/SOURCE INFORMATION	Pier 58 Renewal IHA Attachment 4 – Waterfront Park Construction Project Acoustic Monitoring Report (Greenbusch 2023). Results from 30" steel vibe installation.

Please include any assumptions

PROJECT CONTACT	See cover letter of IHA Application

STEP 2: WEIGHTING FACTOR ADJUSTMENT

		Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value
Weighting Factor Adjustment (kHz)¥	2.5	Relying on default due to lack of project-specific information

¥ Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 48), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	170.05
Number of piles within 24-h period	4
Duration to drive a single pile (minutes)	45
Duration of Sound Production within 24-h period (seconds)	10800
10 Log (duration of sound production)	40.33
Propagation (xLogR)	15
Distance from source level measurement (meters)	10

Unless otherwise specified, source levels are referenced 1 m from the source.

NOTE: The User Spreadsheet tool provides a means to estimates distances associated with the Technical Guidance's PTS onset thresholds. Mitigation and monitoring

requirements associated with a Marine Mammal Protection Act (MMPA) authorization or an Endangered Species Act (ESA) consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of the Technical Guidance and the User Spreadsheet tool.

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**57.0**	**5.1**	**84.3**	**34.6**	**2.4**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-0.60**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

A.1: Vibratory Pile Driving (STATIONARY SOURCE: Non-Impulsive, Continuous)

VERSION 2.0: 2018

KEY

	User Provided Information
	NMFS Provided Information (Technical Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Waterfront Park Reconstruction Project
PROJECT/SOURCE INFORMATION	Prichard Lake Pumping Station Sacramento, CA Prichard Lake, vibratory installation of 18" steel pipe (Caltrans 2020)

Please include any assumptions

PROJECT CONTACT	See cover letter of IHA Application

STEP 2: WEIGHTING FACTOR ADJUSTMENT

		Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value
Weighting Factor Adjustment (kHz)¥	2.5	Relying on default due to lack of project-specific information

¥ Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 48), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	158
Number of piles within 24-h period	4
Duration to drive a single pile (minutes)	45
Duration of Sound Production within 24-h period (seconds)	10800
10 Log (duration of sound production)	40.33
Propagation (xLogR)	15
Distance from source level measurement (meters)	10

Unless otherwise specified, source levels are referenced 1 m from the source.

NOTE: The User Spreadsheet tool provides a means to estimates distances associated with the Technical Guidance's PTS onset thresholds. Mitigation and monitoring

requirements associated with a Marine Mammal Protection Act (MMPA) authorization or an Endangered Species Act (ESA) consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of the Technical Guidance and the User Spreadsheet tool.

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**9.0**	**0.8**	**13.3**	**5.4**	**0.4**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-0.60**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

A.1: Vibratory Pile Driving (STATIONARY SOURCE: Non-Impulsive, Continuous)

VERSION 2.0: 2018

KEY

	User Provided Information
	NMFS Provided Information (Technical Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Waterfront Park Reconstruction Project
PROJECT/SOURCE INFORMATION	Pier 63 Removal Project Acoustic Monitoring Report (Greenbusch 2023). Results from 12" timber vibe removal.

Please include any assumptions

PROJECT CONTACT	See cover letter of application

STEP 2: WEIGHTING FACTOR ADJUSTMENT

		Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value
Weighting Factor Adjustment (kHz)¥	2.5	Relying on default due to lack of project-specific information

¥ Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 48), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	144.8471
Number of piles within 24-h period	8
Duration to drive a single pile (minutes)	20
Duration of Sound Production within 24-h period (seconds)	9600
10 Log (duration of sound production)	39.82
Propagation (xLogR)	15
Distance from source level measurement (meters)	10

Unless otherwise specified, source levels are referenced 1 m from the source.

NOTE: The User Spreadsheet tool provides a means to estimates distances associated with the Technical Guidance's PTS onset thresholds. Mitigation and monitoring

requirements associated with a Marine Mammal Protection Act (MMPA) authorization or an Endangered Species Act (ESA) consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of the Technical Guidance and the User Spreadsheet tool.

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**1.1**	**0.1**	**1.6**	**0.7**	**0.0**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-0.60**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$