DEBRIS AND UTILITY IDENTIFICATION AND SURVEY REPORT
REVISION 1

REMEDIAL DESIGN SERVICES
SWAN ISLAND BASIN PROJECT AREA
CERCLA DOCKET NO. 10-2021-001

PORTLAND HARBOR SUPERFUND SITE
PORTLAND, MULTNOMAH COUNTY, OREGON

Prepared for:

Swan Island Basin Remedial Design Group

Prepared by:

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April 2024

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LIST OF ACRONYMS AND ABBREVIATIONS

ft	foot/feet
nT	nanotesla
EPA	U.S. Environmental Protection Agency
eTrac	eTrac Inc.
GIS	geographic information system
HGL	HydroGeoLogic, Inc.
LiDAR	light detection and ranging
MBES	Multibeam EchoSounder
MM	Mott MacDonald
MSC	Marine Salvage Consortium
NOAA	National Oceanic and Atmospheric Administration
OUNC	Oregon Utility Notification Center
PDI	Pre-Design Investigation
RA	Remedial Action
RD	Remedial Design
RM	River Mile
SIB	Swan Island Basin
SSS	side-scan sonar
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USN	U.S. Navy

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DEBRIS AND UTILITY IDENTIFICATION AND SURVEY REPORT
SWAN ISLAND BASIN PROJECT AREA
PORTLAND HARBOR SUPERFUND SITE
PORTLAND, MULTNOMAH COUNTY, OREGON

1.0 INTRODUCTION

This report summarizes the existing debris and utility identification surveys conducted in the Swan Island Basin (SIB) Project Area of the Portland Harbor Superfund Site in Portland, Multnomah County, Oregon. Mott MacDonald (MM) and eTrac Inc. (eTrac) performed the work in response to a request from HydroGeoLogic, Inc. (HGL) and on behalf of the SIB Remedial Design (RD) Group. The work was performed in accordance with the Survey and Quality Control Plan that was developed in response to U.S. Environmental Protection Agency (EPA) comments on the Pre-Design Investigation (PDI) Work Plan and provides details about the survey methodology and survey-specific data quality objectives (MM, 2022). The scope of work was conditionally approved by EPA on April 5, 2022. The scope of the surveys remained consistent with that detailed in the final PDI Work Plan that was fully approved in May 2022 (HGL 2022a). The goal of the survey was to address the data gaps identified in Section 3.8 of the PDI Work Plan. Utility and debris survey work met the data quality objectives as outlined in the Survey and Quality Control Plan, with no Field Change Requests or other deviations from the plan.

1.1 OBJECTIVES AND SCOPE

Information characterizing the location and nature of debris supports the development of the RD including material handling requirements and determining if and where large debris must be removed prior to Remedial Action (RA) implementation. Utility locations within the SIB Project Area must be clearly known to identify and either avoid or resolve conflicts between the RA and utility locations. The data gap analysis in the PDI Work Plan indicated that additional information on existing underground utilities, derelict marine structures, other in-water debris, and stormwater system outfall locations was needed to locate and document potential obstacles to be considered during the RD. Several methodologies were employed to garner the required information including conducting the following surveys:

- Mobile terrestrial light detection and ranging (LiDAR) elevation data were collected from a vessel-mounted laser scanner to estimate locations of emergent debris and marine structures, and measure riverbank elevations;
- Side-scan sonar (SSS) imagery was collected from a vessel-towed unit to identify underwater debris and estimate its location;
- Magnetic field measurements were collected from a vessel-towed magnetometer to identify ferrous material both above and below the mudline and estimate their locations; and
- Sub-bottom profiling was conducted from a vessel bottom-mounted transducer to illustrate geological formations, identify the presence of buried debris/utilities, and estimate their locations.

These surveys will inform development of a debris removal plan that will be developed in the Basis of Design Report. In addition to the surveys mentioned above, this report summarizes desktop efforts to document existing utilities, and updates to the project stormwater outfall inventory based on recent findings, with the purpose of evaluating potential impacts to these utilities during RA.

1.2 PROJECT AREA

The SIB Project Area is between approximately River Mile (RM) 8.1 and RM 9.2 on the northeast side of the Willamette River. The debris and utilities survey area encompassed a portion of the main Willamette River Channel and the SIB. The survey area within the Willamette River Channel began at approximately RM 7.7, northwest of the SIB Project Area, and extended within the Willamette River Channel to RM 9 and within SIB to approximately RM 9.2 to collect the necessary data to support the survey objectives.

1.3 DOCUMENT ORGANIZATION

This report is organized into the following sections:

- Section 1 presents an introduction, including the objectives and scope of the debris and utility surveys;
- Section 2 describes survey activities completed;
- Section 3 summarizes the data collected;
- Section 4 provides an analysis of debris and utilities;
- Section 5 presents conclusions of the debris and utility surveys; and
- Section 6 presents the references cited in this report.

2.0 SURVEY ACTIVITIES

Surveys were conducted by eTrac between April 5 and 9, 2022, in accordance with the Survey and Quality Control Plan (MM, 2022). The surveys were conducted in a manner that satisfies the data quality objectives established in the Uniform Federal Policy-Quality Assurance Project Plan for SIB (HGL, 2022b). Table 2-1 presents a summary of survey equipment used for the activities described in this section. Detailed equipment specifications and methods are provided in the Survey and Quality Control Plan (MM, 2022).

In addition to the four surveys described below, the riverbed was imaged using a Multibeam EchoSounder (MBES) during a multibeam bathymetry survey that was conducted between April 4 and April 7, 2022. The multibeam bathymetry dataset is discussed in the Bathymetric Survey Summary Report (HGL, 2024c). However, the multibeam bathymetry dataset will have multiple uses, including identifying debris and providing elevation data for completing a sitewide unified elevation model. Where applicable, the multibeam bathymetry dataset is referenced and relevant observations regarding debris resulting from analysis of the MBES survey are discussed in this report.

2.1 MOBILE LiDAR SURVEY

A vessel-mounted mobile LiDAR survey was conducted on April 7, 2022, along the riverbank area and marine structures. The extents of the mobile LiDAR survey are shown on Figure 2-1. The survey collected location/elevation data using methods described in Sections 2.5 and 2.6 in Appendix A of the Survey and Quality Control Plan (MM, 2022). The data were stored as a point cloud.

2.2 SIDE-SCAN SONAR SURVEY

SSS imagery was collected from a vessel-towed unit on April 5 and 6, 2022, along 28 vessel tracks shown on Figure 2-2. The data collection methods are described in Sections 3 and 3.1 in Appendix A of the Survey and Quality Control Plan (MM, 2022). The tow fish's distance above the bottom of the riverbed was maintained between 8 and 20 percent of the range scale used, aligning with the NOAA Hydrographic Survey Specifications. A layback calibration was performed using an object from the multibeam dataset for quality control. The data were stored in both image and native eXtended Triton Format data files.

2.3 MAGNETOMETER SURVEY

A vessel-towed magnetometer survey was conducted on April 6 and 8, 2022, along track lines shown on Figure 2-3. The survey collected magnetic field data using methods described in Sections 4 and 4.1 in Appendix A of the Survey and Quality Control Plan (MM, 2022). The data were stored in ASCII X-Y-Gamma format.

2.4 SUB-BOTTOM PROFILER SURVEY

Geophysical data were collected from a vessel-mounted sub-bottom profiler on April 7 and 8, 2022, along 30 transects shown on Figure 2-4. The geophysical data collection methods are described in Sections 5 and 5.1 in Appendix A of the Survey and Quality Control Plan (MM, 2022). The data were stored in native Society of Exploration Geophysicists format files.

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3.0 SURVEY RESULTS SUMMARY

This section provides a summary of the findings from the four different types of debris and utility surveys.

3.1 MOBILE LiDAR SURVEY

The mobile LiDAR survey results (elevation data points) are shown on Figure 3-1. The mobile LiDAR survey data points have accuracy in the 0.07- to 0.1-foot (ft) range, with sub-centimeter vertical accuracy. One purpose of the mobile LiDAR data is to bridge the gap between the in-water bathymetry survey data and existing upland topography data, especially below structures. As expected, coverage was reduced in some areas by unavoidable obstructions. The mobile LiDAR data were combined with other elevation information (e.g., MBES survey, publicly available upland LiDAR data) into a unified elevation model.

Prior to acquisition, a boresight calibration was conducted to account for errors that could propagate into the data upon installation. A boresight calibration quantifies and adjusts for misalignment angles between the scanner and the Inertial Measurement Unit (IMU). Based on various vessel and scanner orientations, each of the three misalignment angles (roll, pitch, and yaw) can be isolated and corrected in post processing. Real-time kinematic (RTK) observations of a reference point on the scanner mounting plate were performed prior to acquisition to verify the offsets on each axis. The measured values from the RTK rover were compared to the values computed in real-time by the data collection software QINSy.

Overall, the mobile LiDAR elevation data points provided valuable topography data in large areas under wharves that is challenging and costly to obtain otherwise. The impact of the obstructions on the unified elevation coverage is minimal due to the availability of additional and recent public and third-party datasets. The result is a unified elevation dataset suitable for use in developing the Basis of Design Report. The unified elevation model is being constructed using the best available elevation data in each area. The areas in which each elevation data source will be used are being tracked for future reference, and to maintain an understanding of potential limitations. The unified elevation model will be the primary elevation data source for PDI engineering studies and modeling efforts; however, its suitability for use in design will be re-evaluated during preliminary remedial design and additional surveying performed as necessary. The development of the unified elevation model, including data sources used and spatial coverage, will be described in the Basis of Design Report. The mobile LiDAR data also provide locations and elevations of structures and debris to be used during RD.

3.2 SIDE-SCAN SONAR SURVEY

The SSS provides imaging of the river bottom through pile fields, beneath structures, and behind vessels. A mosaic of the SSS results is shown on Figure 3-2. The SSS sweeps an approximately 656-ft swath (328-ft range in either direction) and covers many areas inaccessible to the MBES and mobile LiDAR survey. Additionally, the image resolution depicts objects, such as debris, down to approximately 1.5 ft in size across the image range. Because the SSS data are not geometrically corrected for the bottom profile, object locations are qualitative and are best used in tandem with the MBES survey for debris and utility identification.

The SSS images show the pile field along the riverbank at Berths 306 to 308 from a historical berthing dock structure and pile-supported structures at the U.S. Navy (USN) pier, Marine Salvage Consortium (MSC) dock, and the U.S. Coast Guard (USCG) dock, all of which were not captured in the MBES survey. Figure 3-3 presents results from a mid-basin transect that shows a portion of the pile-supported MSC dock and debris field and the area around and under the Port of Portland Dredge Base. Figure 3-4 shows the side-scan results at Berth 312 (Pier D) on the Willamette River, which demonstrate limited debris in the berth and the pile field under the wharf.

3.3 MAGNETOMETER SURVEY

The magnetometer survey provides magnetic field strength data in units of nanotesla (nT, or Gamma). The magnetometer detects the magnetic field strength, which can be perturbed by ferrous (steel and iron) materials. The measured magnetic field strength is shown on the surveyed transects in Figure 3-5. The largest gamma values are nearly at the “regional field” value (approximately 34,000 nT), which is found far from ferrous objects and represents a background condition. Logically, significant anomalies (lower values between 46,000 and 53,000 nT) were measured near vessels, dry docks, and steel dock structures. The gamma values were evaluated relative to distances from fixed and mobile ships and structures (known ferrous objects) to identify potential unknown ferrous objects. Specifically, if significant anomalies were found at greater distances from known ferrous objects, an unknown/buried object could be present. The magnetometer's distance above the bottom of the riverbed was maintained between 15 and 25 feet. With the magnetometer in this range, typical object detection can fall between 0.5 to 2 nanoTeslas. A ferrous object found in the multibeam dataset was used for the layback calibration. Lines were run over the object in opposing directions and then post-processed to confirm quality control before data acquisition.

Figure 3-6 shows a cross-plot of the relationship between recorded gamma values and proximities to the closest known ferrous object. The data indicate a logical relationship, with lower values (anomalies) found near known ferrous objects. Low gamma values at relatively large distances from known ferrous objects would suggest the presence of unknown ferrous objects. However, gamma values indicative of large unknown ferrous objects were not observed in the survey data. The significant number and size of large ferrous objects (e.g., ships) in SIB limits the capability of the magnetometer technology to identify small adjacent ferrous objects. The challenges of remote detection of small ferrous objects were anticipated and represent an uncertainty that will be addressed during RD. There are no known magnetometer technologies that could be used to better identify small ferrous objects. Therefore, the uncertainty associated with small ferrous objects will be addressed by planning for potential additional debris removal and disposal during construction, similar to other buried debris.

3.4 SUB-BOTTOM PROFILER SURVEY

The sub-bottom profiler collects acoustic reflections from surface and subsurface materials. Sub-bottom surveys are used to identify buried debris and utilities, as well as obtain geological information. Transects surveyed are shown in a 3D view on Figure 3-7. Data were provided by eTrac as geolocated profiles aligned to the riverbed elevations from the MBES survey. MM reviewed the diffraction patterns for anomalies that are potentially indicative of buried objects (e.g., pipelines and cables) and exported the locations to GIS.

Anomalies were identified near the Dry Dock Basin that correspond to surface "drag marks" observed in the MBES survey, but these anomalies were not interpreted to be buried cables. Transect A-A', running down the centerline of the SIB interior, shows typical conditions of soft sediment over a denser return and a lack of apparent buried debris (Figure 3-8). Transect B-B', in the main channel of the Willamette River near Berth 312, shows typical uniform returns, with less apparent stratigraphy, and a lack of apparent buried debris (Figure 3-9). No buried debris or utilities (or other objects) were identified in any of the sub-bottom profile transect data.

4.0 DEBRIS AND UTILITY ANALYSIS

This section provides an analysis of debris and utility information garnered from the field data collection, as well as the accompanying desktop utility identification efforts.

4.1 PRELIMINARY DEBRIS INVENTORY

Using the SSS data and the MBES bathymetry data, approximately 1,600 objects 1 ft or larger were identified on the riverbed or in the water column, as shown in the surface debris inventory overview in Figure 4-1. Debris targets were identified using 0.25-ft and 0.5-ft gridded MBES bathymetry products in ArcGIS. Identified targets were manually inspected and classified. The identifications were made to the extent feasible with the remote sensing data.

The SIB Project Area is divided into Debris Zones A to J for the purpose of debris quantification and identification, as shown on Figures 4-2a through 4-2f. Debris zones are aligned with the 150-ft Project Area grid, shown in Figure 4.1.

Observed debris included submerged platforms, small skiffs, tires, submerged piles, and various other small unidentifiable objects. Much of the debris sitting on the riverbed consists of timber piles, logs/trees, or rock. A summary of the debris inventory counts by zone and type is included in Table 4-1. The following is a narrative description of debris by zone:

- Debris Zone A (Project Area grid reference: m-r, 0-8), which includes the Berth 312 and the Vigorous Dry Dock area, has 56 identified objects. Remnants of former marine shipways – “Shipways (1940s)” – are tentatively identified in exposures along the riverbank (Figure 4-2a).
- Debris Zone B (Project Area grid reference: i-m, 0-3), which includes the mouth of SIB, has 167 identified objects. Most of the objects are concentrated in a high-density debris field, on the north side of the debris zone (Figure 4-2b).
- Debris Zone C (Project Area grid reference: i-m, 4-8), in the Dry Dock Basin, has 38 identified objects (Figure 4-2b).
- Debris Zone D (Project Area grid reference: b-g, 1-7), which includes the area from Berth 301 to the USCG pier and dock, has 213 identified objects (Figure 4-2c). A small debris field near the USCG dock was identified. Historically, houseboats as well as log rafts were moored along the northern portion of this debris zone.
- Debris Zone E (Project Area grid reference: b-f, 8-12), which includes the area from Berth 302 across the SIB to portions of the USN pier and MSC dock, has 254 identified objects (Figure 4-2d). A debris field near the MSC dock includes a small boat. Scattered rocks associated with the riprap-covered bank were identified shoreward of the dock. Additionally, submerged piles were identified near the USN pier.
- Debris Zone F (Project Area grid reference: b-f, 13-17), which includes the area from Berth 303 across the SIB to portions of the MSC dock, has 287 identified objects. Historically, timber pile supports for a 1940s pedestrian bridge were located near the MSC dock (Figure 4-2d).

- Debris Zone G (Project Area grid reference: b-f, 18-22), which includes the area from Berths 304 and 305 to the Port of Portland Dredge Base, has 267 identified objects (Figure 4-2e), including a debris field near the Dredge Base staging area. The area under and shoreward of the Dredge Base was not inventoried; however, the SSS images suggest additional debris in these areas.
- Debris Zone H (Project Area grid reference: b-f, 23-27), which includes the area from Lay Berth 306 across the SIB, has 130 identified objects (Figure 4-2e), including a small boat. Historically, a timber pile supported berthing dock spanned from the end of the current Lagoon Wharf (Berth 302 to Berth 305) past Lay Berth 308; see “Berthing Dock (1940-1960s)” in Debris Zones H, I and J on Figures 4-2e and f.
- Debris Zone I (Project Area grid reference: b-f, 28-32), which includes the area from Lay Berths 307 and 308 across to Berth 311, has 68 identified objects, including two small boats and one platform (Figure 4-2f). This debris zone also includes the historical berthing dock described above for Debris Zone H.
- Debris Zone J (Project Area grid reference: b-f, 33-37), which includes the head of SIB, has 166 identified objects, including four small boats and six platforms (Figure 4-2f). This debris zone also includes the historical berthing dock described above for Debris Zone H.

Figure 4-3 shows example closeup 3D views of several objects identified in the SIB, including small skiffs and platforms.

Debris identification is not complete due to inaccessible and obstructed areas of the SIB Project Area. Incomplete coverage was anticipated due to technology limitations and obstructions. The areas that were not inventoried represent an uncertainty that will be addressed during RD.

4.2 UTILITIES ANALYSIS

Four data sources were consulted to evaluate the presence of utilities in the project area, for future use in determining potential impacts during RA:

- Surveys (Sub-Bottom and Magnetometer),
- Navigation Chart Data,
- Utility Locate, and
- Active Stormwater Outfall Inventory (January 2023).

4.2.1 Sub-Bottom and Magnetometer Surveys

Sub-bottom and magnetometer survey data did not identify buried objects of potential concern within the limitations and coverage of the surveys described in Sections 3.3 and 3.4, and in the Survey and Quality Control Plan (MM, 2022). Surface debris observed in the SIB is indicative of the amount of debris at depth within the sediment column. Buried debris represents an uncertainty that will be addressed during RD.

4.2.2 Navigation Chart Data

U.S. Army Corps of Engineers (USACE) hydrographic survey charts and National Oceanic and Atmospheric Administration (NOAA) navigation charts describe three "cable areas" in the SIB Project Area. The 2022 USACE survey did not identify cables as the survey did not extend inside the SIB; the notation is carried over from historical charts that call out previously designated cable areas.

The USACE cable areas do not correspond to any known submarine cable or potential objects identified from sub-bottom profiles or magnetometer transects at the head of SIB, or from a sub-bottom profile near Pier C. This information is included here out of an abundance of caution; there is no evidence from surveys (i.e., sub-bottom profiler and magnetometer) or utility locate responses that buried cables exist in the areas shown on USACE charts.

4.2.3 Utility Locate

The Oregon Utility Notification Center (OUNC) (https://digsafelyoregon.com/resources/locate-requests/) administers a statewide system through which individuals can notify operators of underground facilities of proposed excavations and can request that the underground facilities be marked. As part of the geotechnical sampling program, MM notified OUNC of the intent to drill in both upland and in-water areas of the SIB. Operators of underground facilities were then requested to mark their facilities within the SIB Project Area (both upland and in-water). The member operators that received the information requests, and the responses they provided, are shown in Table 4-2. Based on OUNC member operator responses and member-provided field marks, no potential utility conflicts were identified within the SIB.

4.2.4 Active Stormwater Outfall Inventory (January 2023)

A running inventory of active stormwater outfall information for the City of Portland and private outfalls in the SIB Project Area is included in Table 4-3. The inventory is still being compiled and validated. The inventory includes details regarding outfall location, configuration, and understanding of status and functionality. These outfalls are depicted in Figure 4-5.

Outfall status, location, and integrity have been verified in the field and in communication with owner/operators with exceptions noted in Table 4-3. Some details on smaller private outfalls were still not available as of December 2022, as the riverbank reconnaissance efforts could not locate some of the private outfalls due to dense vegetation. However, it is known that upland discharges occur to some of these outfalls because they are shown as drainage points in current site plans in facility stormwater pollution control plans. Additional details regarding the stormwater systems present in the SIB, as well as planned changes to the stormwater systems, are actively being obtained from property owners. Outfall details will be updated prior to publication of the PDI Evaluation Report.

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5.0 CONCLUSIONS

The debris and utility surveys, including mobile LiDAR, SSS, magnetometer, and sub-bottom profiling, were conducted to support development of the RD by providing data for use in PDI engineering studies, including a future Debris Removal Plan. The data were used to document the location and nature of the debris and utilities. Many small pieces of debris, and a limited amount of larger debris, were observed on the riverbed. No in-water buried utilities were identified by member operators in the SIB Project Area following the utility location service notification, or in the sub-bottom profile survey. Although the sub-bottom profile survey technology does not provide complete coverage, buried debris was not identified. Derelict pile debris in shoreline areas will be further considered during development of the Basis of Design Report, if warranted based on proposed RA in those areas. Potential unidentified debris represents an uncertainty that will be addressed during the RD.

The debris and utility identification and survey data will be used to develop a Debris Removal Plan as part of the Basis of Design Report. The Debris Removal Plan will consider many factors in assessing the impact of the debris on the RD and RA, and the best approach to mitigating those impacts during construction. Conclusions from evaluation of each debris and utility survey data type are listed below.

5.1 MOBILE LIDAR SURVEY

Mobile LiDAR data successfully documented the locations and extent of debris, and riverbank topography, filling the data gaps identified in the PDI Work Plan. Structure locations and elevations will be taken from the mobile LiDAR dataset as needed during the RA impact evaluations. Topography data on open riverbanks and riverbanks under wharf structures was processed for inclusion in a sitewide unified elevation model, filling the elevation data gaps identified in the PDI Work Plan. The unified elevation model will be used for several PDI engineering studies and modeling efforts (e.g., cap stability evaluation, recontamination evaluation, RA impact evaluations). The mobile LiDAR data were compiled into a point cloud database for further use during PDI engineering studies, as well as during future development of a Debris Removal Plan.

5.2 SIDE-SCAN SONAR SURVEY

SSS images show existing pile fields along the riverbank that could not be captured in the MBES survey due to the presence of obstructions. The SSS assisted in confirming presence of debris shown in MBES survey data, as well as the lack of debris under various moored floating docks and vessels. The SSS data were compiled into a database for further use in the RA impact evaluations and during future development of a Debris Removal Plan. As with other data sources, areas that were not inventoried represent an uncertainty that will be addressed during RD.

5.3 MAGNETOMETER SURVEY

Magnetometer data identified no significant buried unknown ferrous objects within the survey area, within the limitations of the remote sensing technology. The lack of large ferrous buried objects, at least within the survey areas, is a positive development for RA in areas where dredging may occur. Small, ferrous objects that could not be identified due to their proximity to moored vessels represent an uncertainty that will be addressed during RD.

5.4 SUB-BOTTOM PROFILER SURVEY

Sub-bottom geophysical data demonstrated logical patterns of stratigraphy and did not identify buried pipelines, cables, or other debris in the areas surveyed. The sub-bottom profiler data achieved the purpose of the survey by showing that no buried debris or utilities were present within the coverage and inherent limitations of the sub-bottom survey as described in the Survey and Quality Control Plan (MM, 2022).

5.5 DESKTOP UTILITY AND DEBRIS IDENTIFICATION

Approximately 1,600 objects (riverbed elevation disturbances) 1 ft or larger were identified using the SSS data and MBES bathymetry data, as shown in the surface debris inventory overview (Figure 4-1). A number of partially submerged shoreline piles and dolphins were identified, and typically correspond to areas of historically documented piles or structures.

No in-water utilities were identified by member operators in the SIB Project Area following the utility location service notification. The 2022 USACE hydrographic survey and historical NOAA navigation charts identify three "cable areas" in the SIB Project Area; however, no utilities or buried cables were identified from the surveys themselves.

Bridgewater Group reviewed an inventory of stormwater outfalls (public and private) and updated it as part of the utility identification effort. Ongoing changes to the stormwater systems around the SIB will be monitored, additional details will be obtained from private outfall owners, and the inventory will be updated with additional details (e.g., invert elevations) prior to publication of the PDI Evaluation Report. During RD, the outfall locations, invert elevations, and functionality will provide sufficient data for determining whether the outfalls could be affected by, or could affect, the proposed RA.

6.0 REFERENCES

HydroGeoLogic, Inc. (HGL), 2022a. *Pre-Design Investigation Work Plan*, Revision 3, CERCLA Docket No. 10-2021-001. Prepared for the Swan Island Remedial Design Group, Overland Park, Kansas. May.

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TABLES

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Table 2-1
Survey Equipment Summary
Debris and Utility Identification and Survey Report, Swan Island Basin Project Area, Portland, Oregon

Survey	Equipment	Description
Mobile LiDAR	Riegl VZ400 Laser Scanner	Data was acquired by eTrac in QPS QINSy and processed in RiScan Pro. A Riegl VZ400 Laser Scanner was mounted on S/V Spectrum and integrated with an Applanix POSMV inertially-aided position and orientation system with laser scanner sampling rate of 200 Hz and a maximum range of 300 ft. Multiple passes were performed to improve coverage around obstructions. eTrac decimated the data using and Octree function and exported the processed data as an XYZ point cloud file.
Side-Scan Sonar	A dual frequency, 4200 MP EdgeTech side scan	Data was acquired by eTrac using an Edgetech 4200 MP Side-Scan Sonar unit towed behind the S/V Spectrum. The vessel, as described above, was be positioned with a fully integrated POSMV receiving corrections from WSRN. The dual frequency scan at 300/600 kHz was conducted with a range of 100 meters and 20% overlap target.
Magnetometer	Geometrics G-882 cesium vapor marine magnetometer	Data was acquired by eTrac using a Geometrics G-882 cesium vapor marine magnetometer towed behind the S/V Spectrum. The background noise specified was to be less than +/- 3 gammas (nT) with a cycle rate of 1.2- to 1.3-second intervals. The Geometric G-882 magnetometer can detect 10 lbs of iron at an altitude of 23 ft in ideal conditions. The vessel was positioned as described above.
Sub-Bottom Profiler	Innomar SES Compact 2000 sub-bottom profiler system	Data was acquired by eTrac using an Innomar SES Compact 2000 sub-bottom profiler system unit beneath the S/V Spectrum and positioned as described above. The sub-bottom profiler used is a ping-type, dual frequency system capable of 100 kHz and 2-15 kHz at 238 dB. Data was collected in SEG-Y format and post-processed by eTrac using SonarWiz 7.

Notes:
eTrac= eTrac Inc.
ft = feet/foot
dB = decibels
Hz = hertz
lbs = pounds
LiDAR = light detection and ranging
kHz = kilohertz
nT = nanotesla
PDXA= WSRN station named "PDXA" located at Portland International Airport
POSMV = Position and Orientation System for Marine Vessels
QINSy = Quality Integrated Navigation System
QPS = Quality Positioning Services
SEG-Y = Society of Exploration Geophysicists
WSRN = Washington State Reference Network

Table 4-1
Preliminary Debris Inventory Summary
Debris and Utility Identification and Survey Report, Swan Island Basin Project Area, Portland, Oregon

Description	Zone										Total
	A	B	C	D	E	F	G	H	I	J	
Boat					1			1	2	4	**8**
Log				3	2	6	2	2	1	2	**18**
Pile	2	14	1	17	9	14	6	13	5	12	**93**
Platform									1	6	**7**
Tire		1		1	2	2			1	1	**8**
Unclassified	54	152	37	192	240	265	259	114	58	141	**1,512**
Total	**56**	**167**	**38**	**213**	**254**	**287**	**267**	**130**	**68**	**166**	**1,646**

Table 4-2
Responses to Intent to Drill (Utility Locate)
Debris and Utility Identification and Survey Report, Swan Island Basin Project Area, Portland, Oregon

Underground Facility Operator	Response to Intent to Drill	Response Communication Documentation
Comcast Cable	Clear/No conflict	iSite ticket check response added, May 6, 2022
Level 3 Now Centurylink	Level 3 Communications has marked facilities	Email, May 6, 2022, and May 24, 2022
Zayo Fna Abovenet	Clear/No conflict	iSite ticket check response added, May 5, 2022, and May 23, 2022
NW Natural Gas	No Locate Required	Email, May 4, 2022, and May 24, 2022
Portland General Electric	No Locate Required	Email, May 4, 2022, and May 24, 2022
Port of Portland	Clear/No conflict, Field marked	Field marked/no conflict recorded in status tracking spreadsheet
City of Portland Sewer-Storm	Clear for City of Portland Sewers	Email, May 4, 2022, and May 23, 2022
Portland Parks and Recreation	Clear/No conflict, Field marked	Field marked/no conflict recorded in status tracking spreadsheet
Portland Wtr - Int City Limits	No conflicts with Portland Water Bureau	Email, May 3, 2022, and May 23, 2022
Ctlql-Centurylink	Cleared for CenturyLink local network	Email, May 6, 2022, and May 24, 2022

Table 4-3
Active Stormwater Outfall Inventory (January 2023)
Debris and Utility Identification and Survey Report, Swan Island Basin Project Area,
Portland, Oregon

Identification (Alias)	Owner/Operator	Longitude	Latitude	Size	Material	Invert Elevation	Status	Field Verified (2022)	Integrity
OFM-1	City of Portland	-122.7160	45.5678	60"	CSP	TBD	ACTIVE	Yes	Good. STORM - stormwater only outfall
OFM-2	City of Portland	-122.7109	45.5652	60"	CSP	TBD	ACTIVE	Yes	Good. STORM - stormwater only outfall
OFM-3	City of Portland	-122.7065	45.5627	60"	CSP	TBD	ACTIVE	Yes	Good. STORM - stormwater only outfall
OFS-1	City of Portland	-122.7155	45.5653	36"	CMP	TBD	ACTIVE	Yes	Good. STORM - stormwater only outfall
OFS-2	City of Portland	-122.7077	45.5610	36"	CSP	TBD	ACTIVE	Yes	Good. STORM - stormwater only outfall
WR-198 (Outfall 1)	USCG MSU	-122.7214	45.5709	15"	HDPE	TBD	ACTIVE	Yes	Good. Outfall 1 on 2017 Site Map.
WR-199 (Outfall 2)	USCG MSU	-122.7218	45.5711	10"	HDPE	TBD	ACTIVE	Yes	Good. Outfall 2 on 2017 Site Map.
WR-200 (Outfall 3)	USCG MSU	-122.7225	45.5709	12"	HDPE	TBD	ACTIVE	Yes	Good. Outfall 3 on 2017 Site Map.
WR-201 (Outfall 4)	USCG MSU	-122.7231	45.5708	12"	HPDE	TBD	ACTIVE	Yes	Good. Outfall 4 on 2017 Site Map.
WR-70	BT-OH, LLC	-122.7128	45.5664	10"	STL	TBD	ACTIVE	Yes	Good. Discharges from CBs and RDs from truck activity / parking areas at United Parcel Service facility at 6125-6235 N. Basin Avenue.
WR-69 (DP004)	ATC Leasing	-122.7120	45.5661	UNKNOWN	UNKNOWN	TBD	ACTIVE	No	Coordinates consistent with discharge point DP004 shown on 2022 ATC Leasing Site Map.
WR-71 (DP006)	ATC Leasing	-122.7118	45.5662	UNKNOWN	UNKNOWN	TBD	ACTIVE	No	Coordinates consistent with discharge point DP006 shown on 2022 ATC Leasing Site Map.
WR-289 (DP005)	ATC Leasing	-122.7118	45.5661	UNKNOWN	UNKNOWN	TBD	ACTIVE	No	Coordinates consistent with discharge point DP005 shown on 2022 ATC Leasing Site Map.
WR-68 (Outfall #1)	Swan Island Dock Company / Barge Eagle	-122.7107	45.5655	15”	UNKNOWN	TBD	ACTIVE	Yes	Good. Flow from RDs and CBs in truck activity areas. Location Outfall #1 on 2021 Barge Eagle Drainage Characteristics Map.
WR-185 (Outfall #2)	Swan Island Dock Company / Barge Eagle	-122.7101	45.5651	12"	PVC	TBD	ACTIVE	Yes	Good. Flow from RDs and CBs in truck activity areas. Location Outfall #2 on 2021 Barge Eagle Drainage Characteristics Map.
WR-185 (Outfall #3)	Swan Island Dock Company / Barge Eagle	-122.7093	45.5647	12"	PVC	TBD	ACTIVE	Yes	Good. Flow from RDs and CBs in truck activity areas. Location Outfall #3 on 2021 Barge Eagle Drainage Characteristics Map.
WR-15	Swan Island Dock Company / Barge Eagle	-122.7085	45.5640	10”	Concrete and PVC	TBD	ACTIVE	Yes	Good. CBs and RDs in truck / vehicle activity areas at 5617-5885 N. Basin Avenue.
WR-16	Swan Island Dock Company / Barge Eagle	-122.7064	45.5629	10”	STL	TBD	ACTIVE	Yes	Good. CBs and RDs in truck / vehicle activity areas at 5617-5885 N. Basin Avenue.
WR-253	Daimler Trucks North America	-122.7090	45.5618	12"	CMP	TBD	ACTIVE	No	Not observed due to dense vegetation. Site plans indicate that CBs and RDs flow to storm filter for treatment prior to discharge. New 12” outfall to replace existing 8” outfall proposed on 2003 Grading and Utility Plan.
WR-30	Port of Portland	-122.7094	45.5621	8"	CMP	TBD	ACTIVE	Yes	Poor. CMP sections extend to river. Sections of pipe are missing or broken. Possible flow to CB from paved parking area.
WR-31	Port of Portland	-122.7097	45.5622	8"	CMP	TBD	ACTIVE	Yes	Poor. CMP sections extend to river. Sections of pipe are missing or broken. Possible flow to CB from paved parking area.
WR-32	Port of Portland	-122.7101	45.5624	8"	CMP	TBD	ACTIVE	Yes	Poor. CMP sections extend to river. Sections of pipe are missing or broken. Possible flow to CB from surrounding area.
WR-33	Port of Portland	-122.7104	45.5626	8"	CMP	TBD	ACTIVE	Yes	Poor. CMP sections extend to river. Sections of pipe are missing or broken. Possible flow to CB from surrounding area.
WR-34	Port of Portland	-122.7108	45.5628	8"	CMP	TBD	ACTIVE	Yes	Poor. CMP sections extend to river. Sections of pipe are missing or broken. Possible flow from paved storage area.
WR-35	Port of Portland	-122.7110	45.5629	8"	CMP	TBD	ACTIVE	Yes	Poor. CMP sections extend to river. Sections of pipe are missing or broken. Possible flow from paved storage area.
WR-40 (N2)	Vigor Industrial, LLC	-122.7126	45.5638	8"	CMP	TBD	ACTIVE	Yes	Good. Location N2 on 2022 Vigor Drainage Area Map.
WR-41 (N1)	Vigor Industrial, LLC	-122.7128	45.5639	8"	CMP	TBD	ACTIVE	Yes	Good. Location N1 on 2022 Vigor Drainage Area Map.
WR-44 (N)	Vigor Industrial, LLC	-122.7143	45.5648	12"	CMP	TBD	OVERFLOW ONLY	Yes	Good. Location N on 2022 Vigor Drainage Area Map.
WR-47 (M1)	Vigor Industrial, LLC	-122.7153	45.5653	10"	CMP	TBD	OVERFLOW ONLY	Yes	Good. Location M1 on 2022 Vigor Drainage Area Map.

Table 4-3 (continued)
Active Stormwater Outfall Inventory (January 2023)
Debris and Utility Identification and Survey Report, Swan Island Basin Project Area,
Portland, Oregon

Identification (Alias)	Owner/Operator	Longitude	Latitude	Size	Material	Invert Elevation	Status	Field Verified (2022)	Integrity
WR-49 (L)	Vigor Industrial, LLC	-122.7167	45.5659	10"	STL	TBD	OVERFLOW ONLY	Yes	Good. Location L on 2022 Vigor Drainage Area Map.
WR-54 (J2)	Vigor Industrial, LLC	-122.7183	45.5668	10"	STL	TBD	OVERFLOW ONLY	Yes	Good. Location J2 on 2022 Vigor Drainage Area Map.
WR-55 (J)	Vigor Industrial, LLC	-122.7190	45.5672	10"	STL	TBD	OVERFLOW ONLY	Yes	Good. Location J on 2022 Vigor Drainage Area Map.
WR-63 (A)	Vigor Industrial, LLC	-122.7235	45.5687	10"	STL	TBD	OVERFLOW ONLY	Yes	Good. Location A on 2022 Vigor Drainage Area Map. Dock drains from Berth 301, discharging 3 CBs along dock
WR-64 (B)	Vigor Industrial, LLC	-122.7225	45.5685	10"	STL	TBD	OVERFLOW ONLY	Yes	Good. Location B on 2022 Vigor Drainage Area Map. Dock drains from Berth 301, discharging 4 CBs along dock
WR-65 (C)	Vigor Industrial, LLC	-122.7215	45.5684	10"	STL	TBD	OVERFLOW ONLY	Yes	Good. Location C on 2022 Vigor Drainage Area Map. Dock drains from Berth 301, discharging 1 CB along dock
WR-155 (D)	Vigor Industrial, LLC	-122.7209	45.5682	10"	STL	TBD	OVERFLOW ONLY	Yes	Good. Location D on 2022 Vigor Drainage Area Map. Dock drains from Berth 301, discharging 2 CBs along dock and 7 upland CBs.
WR-161 (S)	Vigor Industrial, LLC	-122.7220	45.5668	10"	STL	TBD	OVERFLOW ONLY	Yes	Good. Location S on 2022 Vigor Drainage Area Map.
WR-162 (R, 004)	Vigor Industrial, LLC	-122.7243	45.5657	14"	CMP	TBD	ACTIVE	Yes	Good. Location R and Monitoring Location 004 (Building #72 RDs with treatment) on 2022 Vigor Drainage Area Map
WR-359 (T)	Vigor Industrial, LLC	-122.7219	45.5676	10"	STL	TBD	ACTIVE	Yes	Good. Location T on 2022 Vigor Drainage Area Map.
WR-441 (N4)	Vigor Industrial, LLC	-122.7120	45.5634	8"	CMP	TBD	ACTIVE	Yes	Good. Location N4 on 2022 Vigor Drainage Area Map.
WR-480 (J1-B)	Vigor Industrial, LLC	-122.7185	45.5669	16"	CMP	TBD	OVERFLOW ONLY	Yes	Good. Location J1-B on 2022 Vigor Drainage Area Map.
WR-482 (J3)	Vigor Industrial, LLC	-122.7177	45.5664	16"	CMP	TBD	OVERFLOW ONLY	Yes	Good. Location J3 on 2022 Vigor Drainage Area Map.
WR-484 (L1)	Vigor Industrial, LLC	-122.7162	45.5656	10"	CMP	TBD	OVERFLOW ONLY	Yes	Good. Location L1 on 2022 Vigor Drainage Area Map.
R1 (012)	Vigor Industrial, LLC	-122.7241	45.5663	TBD	TBD	TBD	ACTIVE	Yes	Good. Location R1 and Monitoring Location 012 on 2022 Vigor Drainage Area Map.
Pier C Scupper (009)	Vigor Industrial, LLC	-122.7234	45.5677	10”	STL	TBD	ACTIVE	Yes	Good. Monitoring Location 009 (Pier C Scupper) on 2022 Vigor Drainage Area Map

Notes:
CB = catch basin
CMP = corrugated metal pipe
CSP = corrugated steel pipe
HDPE = high density polyethylene
MSU = Marine Safety Unit
RD = roof drain
STL = steel
TBD = to be determined
USCG = U.S. Coast Guard

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FIGURES

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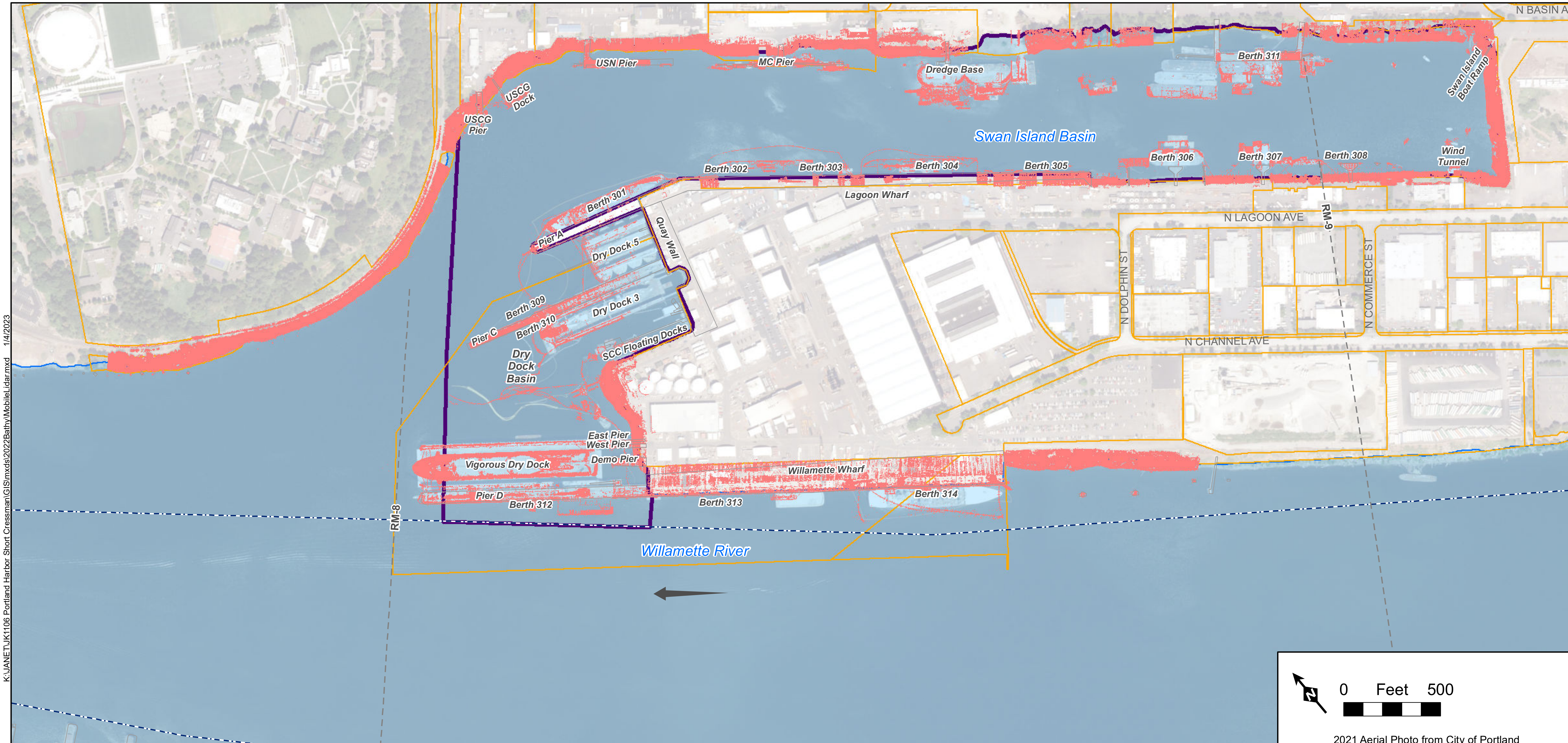


Mobile LiDAR Coverage

River Mile (RM)

Swan Island Sediment Decision Unit (SDU)

Federal Navigation Channel (USACE, 2020)

Docks and Structures

Tax Lot Boundary

Ordinary High Water (City of Portland, 2013)

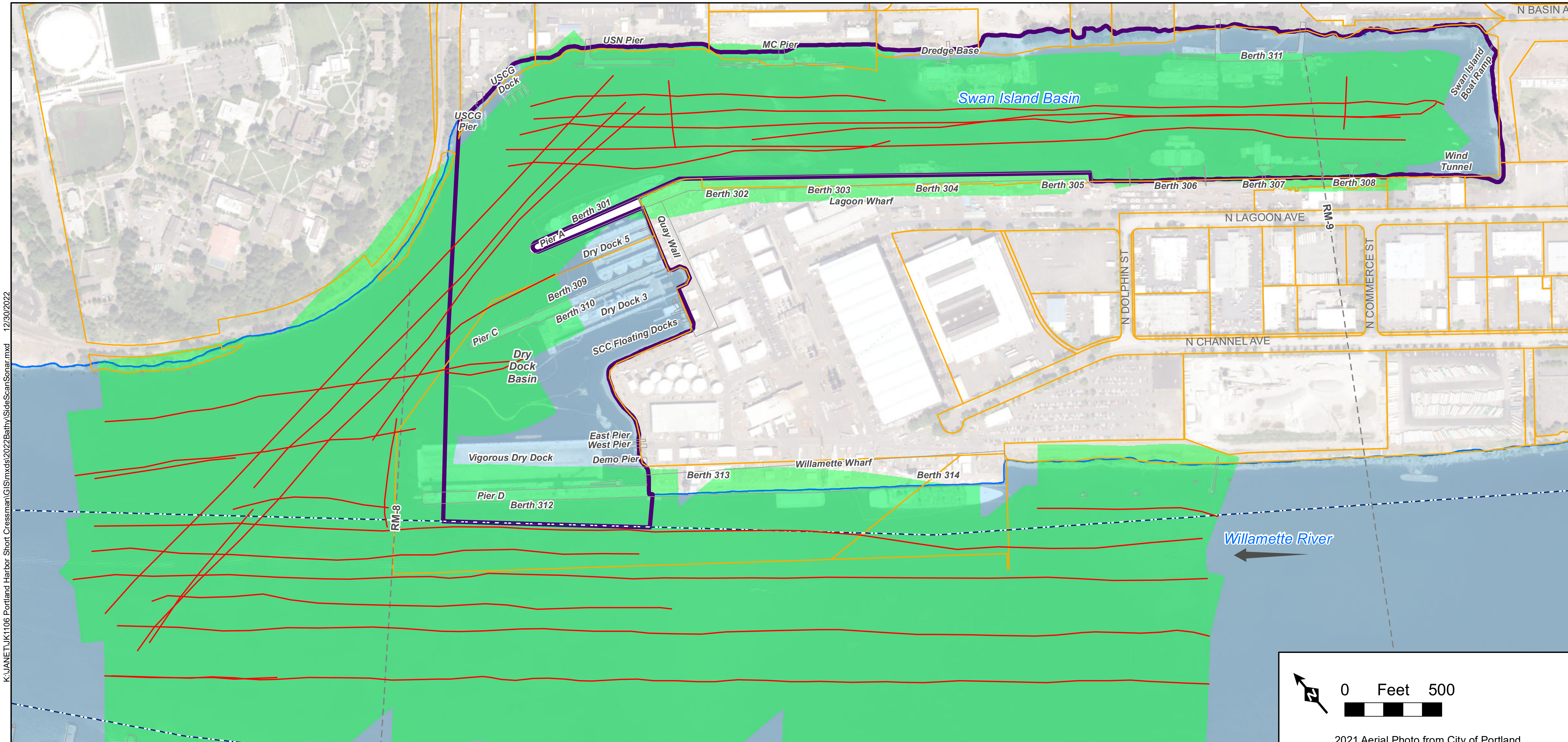
River Flow Direction

Notes:
LiDAR - light detection and ranging
MC – Marine Consortium
SCC – Shipyard Commerce Center
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USN – U.S. Navy

Figure 2-1
Extent Surveyed by Mobile LiDAR

Prepared on:1/4/2023
Debris and Utility Identification and Survey Report
Swan Island Basin

PACIFIC groundwater GROUP
HGL
MOTT MACDONALD
BRIDGEWATER GROUP



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Vessel Track
Side-Scan Sonar Coverage

River Mile (RM)
Swan Island Sediment Decision Unit (SDU)
Federal Navigation Channel (USACE, 2020)
Docks and Structures
Tax Lot Boundary
Ordinary High Water (City of Portland, 2013)

Notes:
MC – Marine Consortium
SCC – Shipyard Commerce Center
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USN – U.S. Navy

River Flow Direction

Figure 2-2
Extent Surveyed by Side-Scan Sonar

Prepared on:1/4/2023
Debris and Utility Identification and Survey Report
Swan Island Basin

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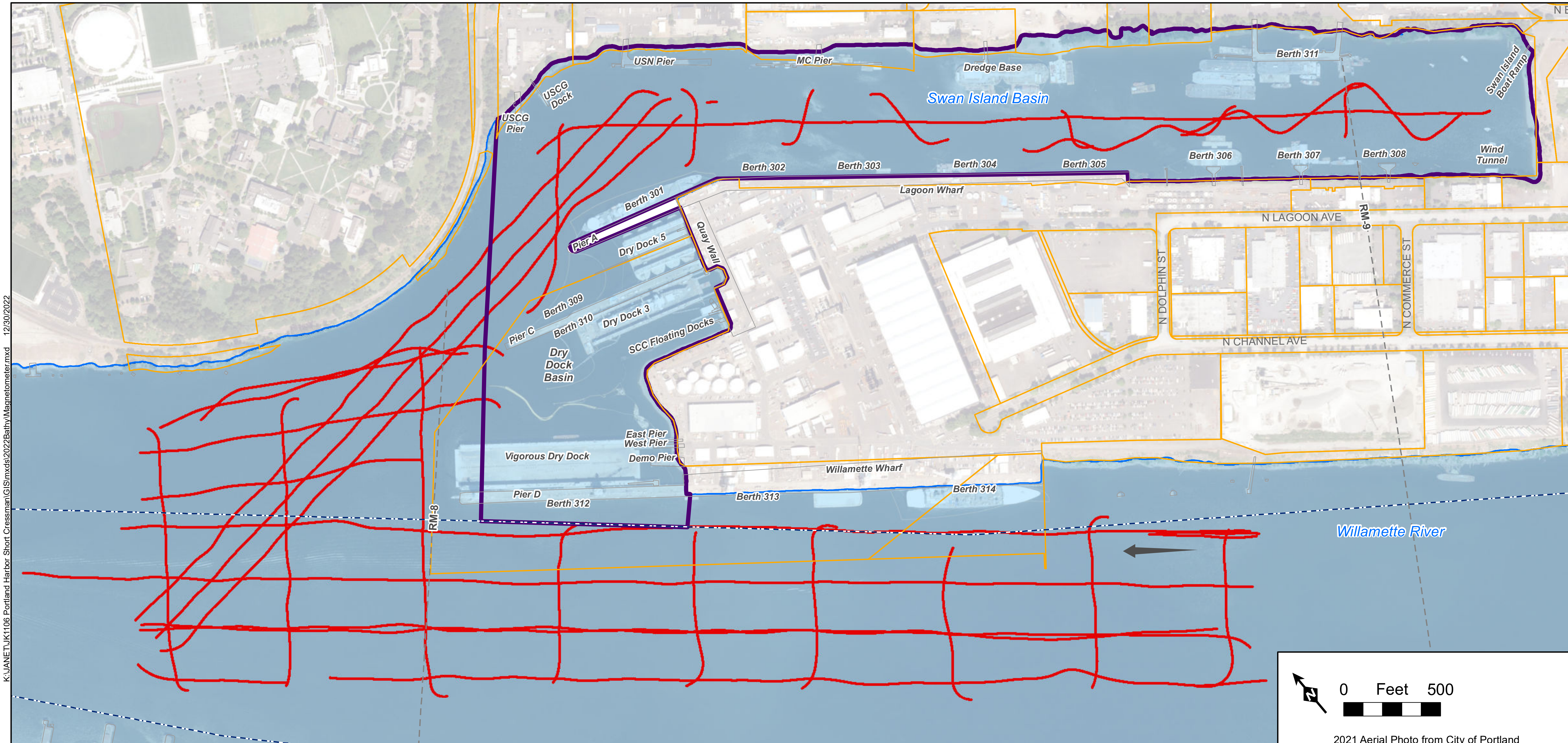

Magnetometer Transects

River Mile (RM)
Swan Island Sediment Decision Unit (SDU)
Federal Navigation Channel (USACE, 2020)
Docks and Structures
Tax Lot Boundary
Ordinary High Water (City of Portland, 2013)

River Flow Direction

Notes:
MC – Marine Consortium
SCC – Shipyard Commerce Center
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
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Figure 2-3

Transects Surveyed by Magnetometer

Prepared on:1/4/2023
Debris and Utility Identification and Survey Report
Swan Island Basin

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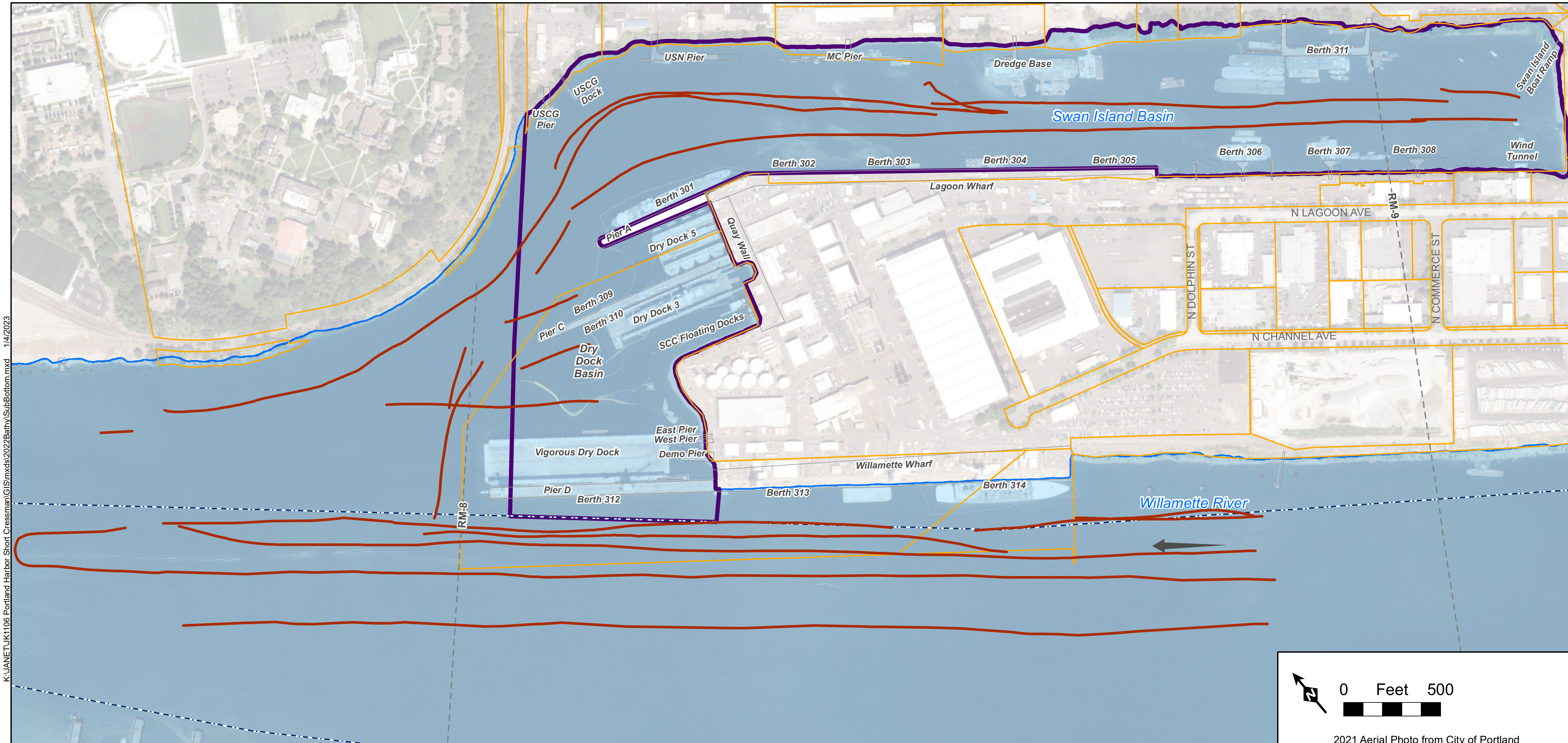

Sub-Bottom Transects

River Mile (RM)
Swan Island Sediment Decision Unit (SDU)
Federal Navigation Channel (USACE, 2020)
Docks and Structures
Tax Lot Boundary
Ordinary High Water (City of Portland, 2013)

River Flow Direction

Notes:
MC – Marine Consortium
SCC – Shipyard Commerce Center
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
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Figure 2-4
Transects Surveyed by Sub-Bottom Profiler

Prepared on:1/4/2023
Debris and Utility Identification and Survey Report
Swan Island Basin

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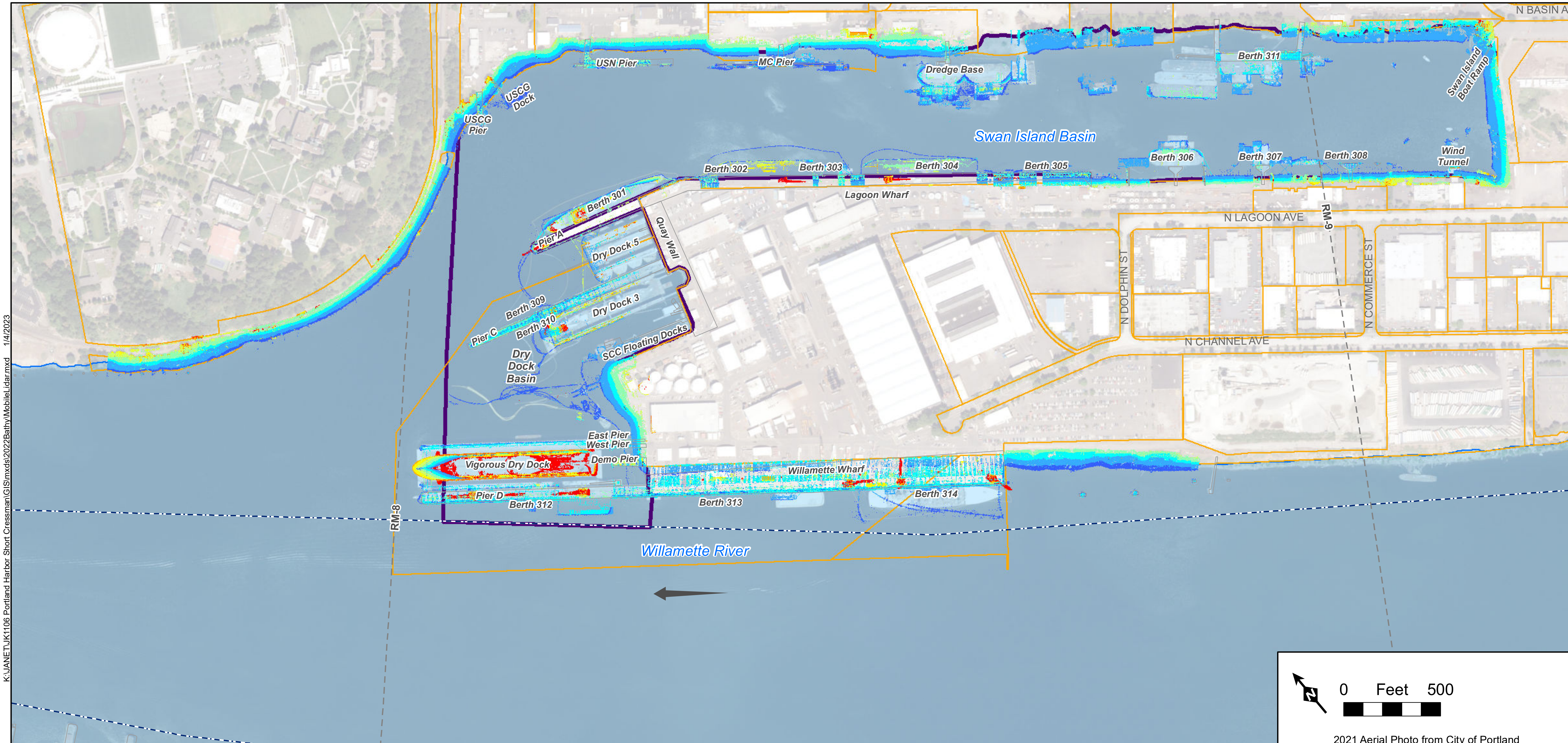

Minimum Elevation Return
Feet NAVD88

- > 80
- 70.1 - 80
- 60.1 - 70
- 50.1 - 60
- 40.1 - 50
- 30.1 - 40
- 20.1 - 30
- 10.1 - 20
- <= 10

- River Mile (RM)
- Swan Island Sediment Decision Unit (SDU)
- Federal Navigation Channel (USACE, 2020)
- Docks and Structures
- Tax Lot Boundary
- Ordinary High Water (City of Portland, 2013)

Notes:
LiDAR - light detection and ranging
MC – Marine Consortium
NAVD88 - North American Vertical Datum of 1988
(5.28' NAVD88 = 0' Columbia River Datum (CRD))
SCC – Shipyard Commerce Center
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USN – U.S. Navy

River Flow Direction

Figure 3-1
Results of the Mobile LiDAR Survey

Prepared on:1/4/2023
Debris and Utility Identification and Survey Report
Swan Island Basin

PACIFIC groundwater GROUP
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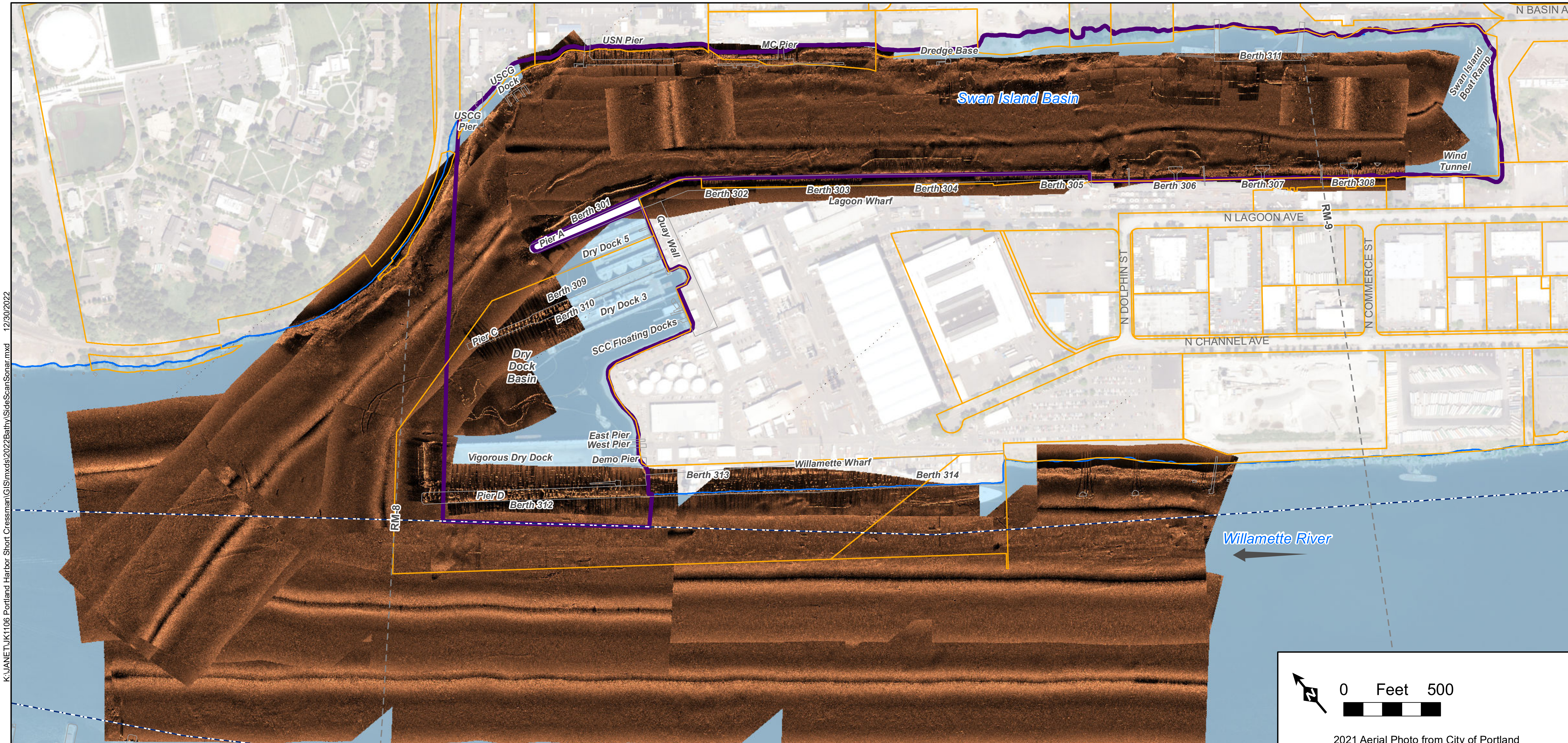
BRIDGEWATER GROUP



- River Mile (RM)
- Swan Island Sediment Decision Unit (SDU)
- Federal Navigation Channel (USACE, 2020)
- Docks and Structures
- Tax Lot Boundary
- Ordinary High Water (City of Portland, 2013)

River Flow Direction

Notes:
MC – Marine Consortium
SCC – Shipyard Commerce Center
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USN – U.S. Navy

Figure 3-2

Results of the Side-Scan Sonar Survey

Prepared on:1/4/2023
Debris and Utility Identification and Survey Report
Swan Island Basin

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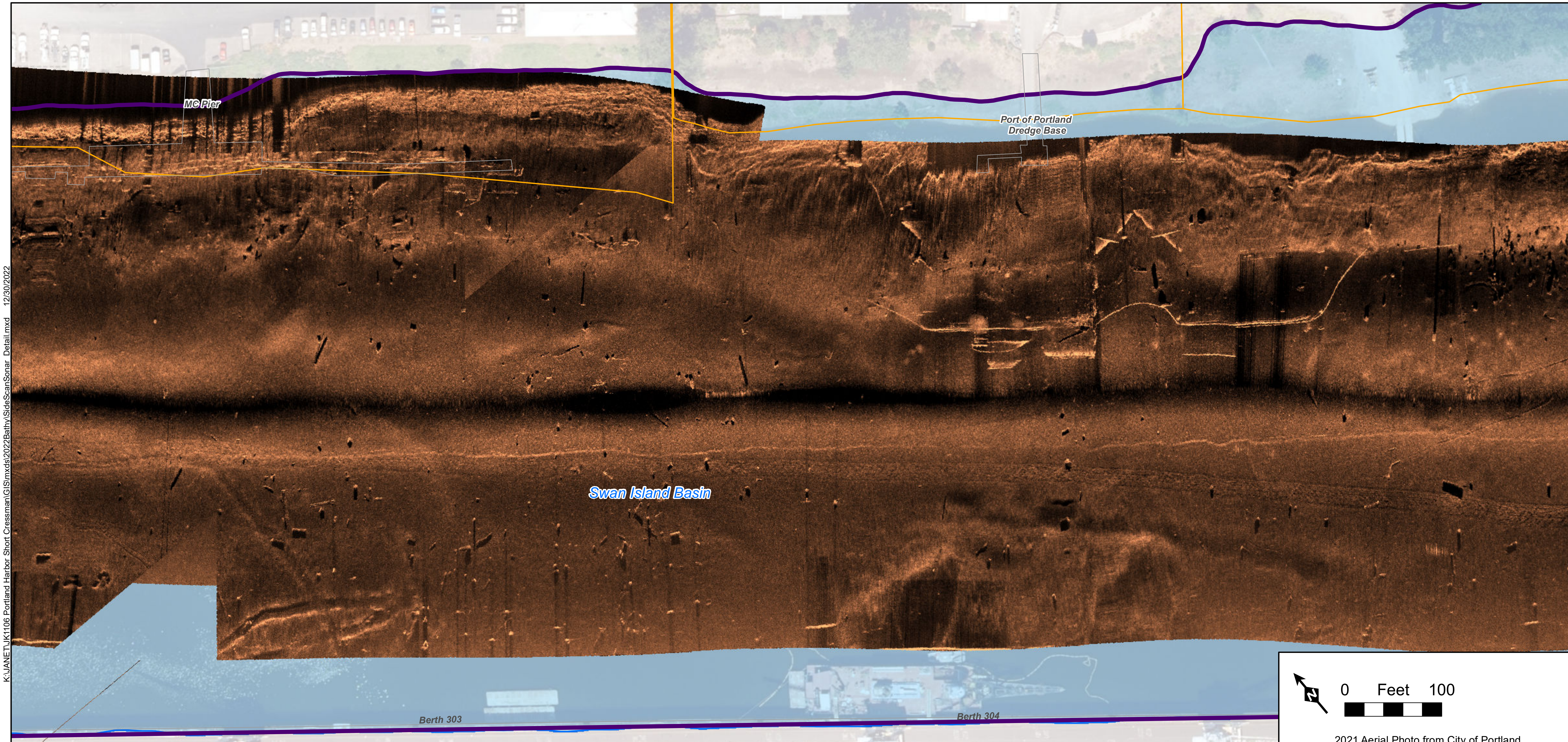

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- River Mile (RM)
- Swan Island Sediment Decision Unit (SDU)
- Federal Navigation Channel (USACE, 2020)
- Docks and Structures
- Tax Lot Boundary
- Ordinary High Water (City of Portland, 2013)

Notes:
Side Sonar Line 4 and Line 4100

MC – Marine Consortium

Figure 3-3

Results of the Side-Scan Sonar Survey, Center of Swan Island Basin

Prepared on:1/4/2023
Debris and Utility Identification and Survey Report
Swan Island Basin

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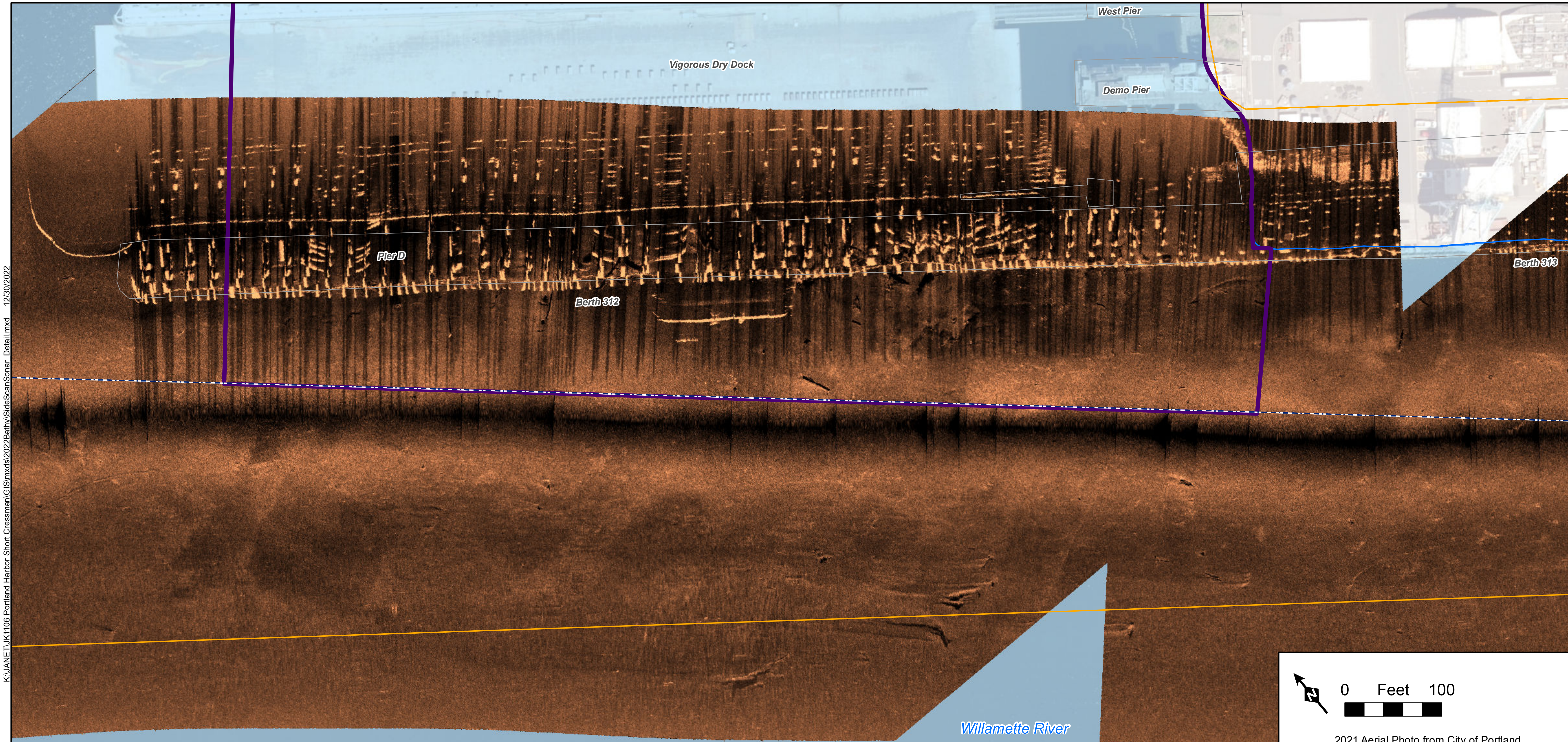
MOTT MACDONALD
BRIDGEWATER GROUP



- - - - River Mile (RM)
Swan Island Sediment Decision Unit (SDU)
Federal Navigation Channel (USACE, 2020)
Docks and Structures
Tax Lot Boundary
Ordinary High Water (City of Portland, 2013)

Notes:
Side Sonar Line 6

Figure 3-4

Results of the Side-Scan Sonar Survey at Berth 312

Prepared on:1/4/2023
Debris and Utility Identification and Survey Report
Swan Island Basin

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BRIDGEWATER GROUP

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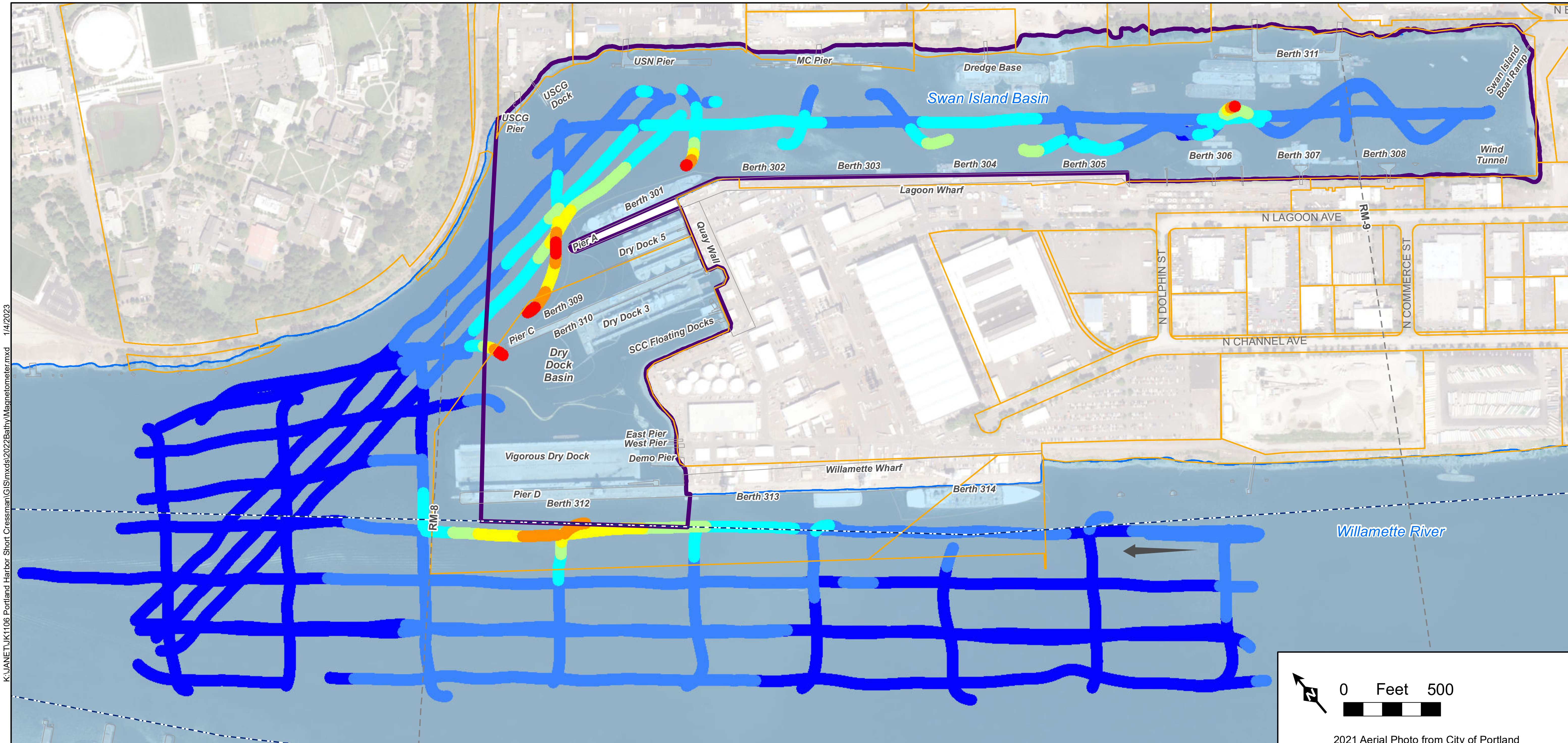


Magnetometer Survey
Gamma (nT)

- 52,001 - 52,717
- 51,001 - 52,000
- 50,001 - 51,000
- 49,001 - 50,000
- 48,001 - 49,000
- 47,001 - 48,000
- 46,694 - 47,000

River Mile (RM)
Swan Island Sediment Decision Unit (SDU)
Federal Navigation Channel (USACE, 2020)
Docks and Structures
Tax Lot Boundary
Ordinary High Water (City of Portland, 2013)

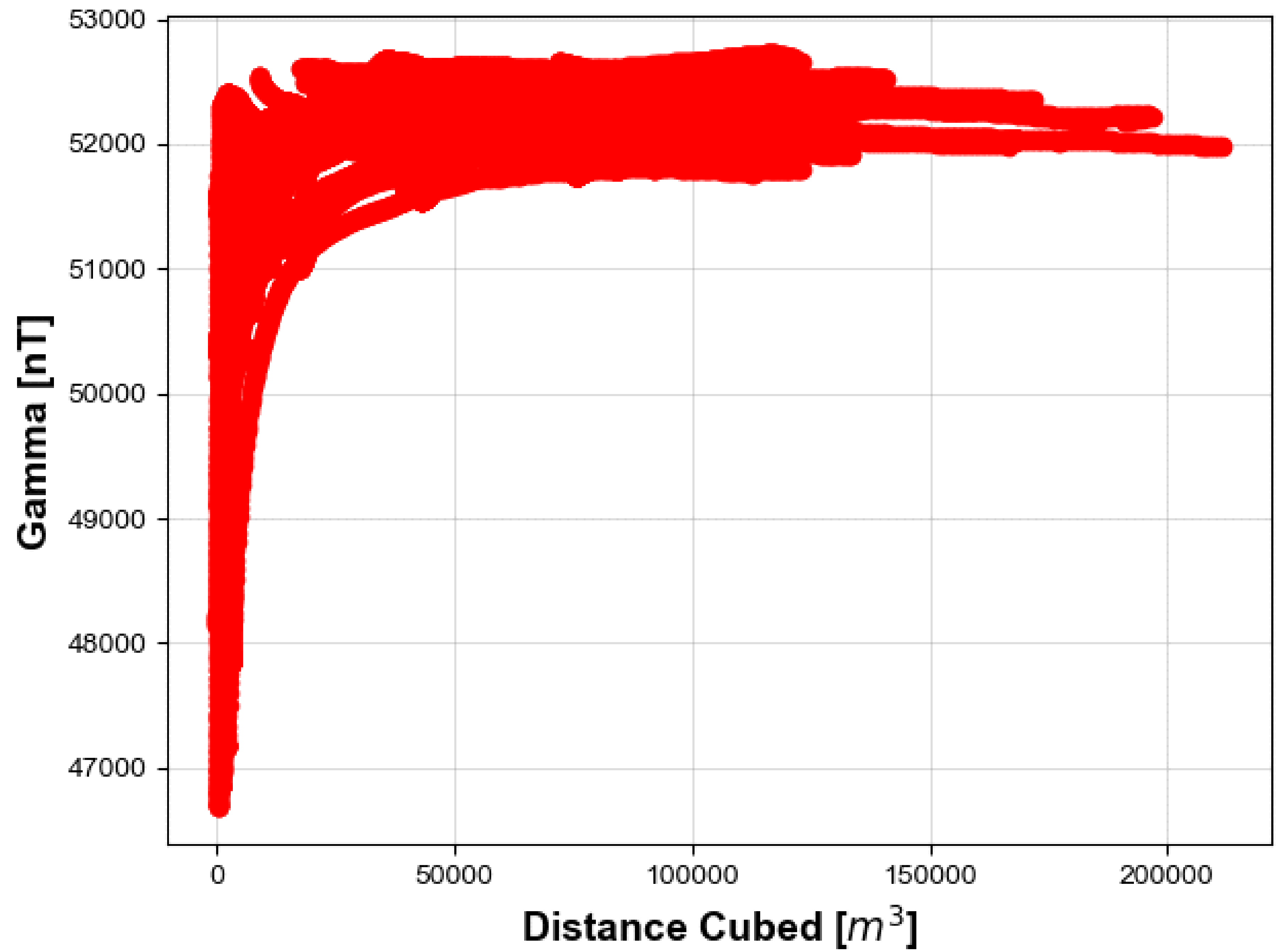
Notes:
nT = nanotesla
MC – Marine Consortium
SCC – Shipyard Commerce Center
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USN – U.S. Navy

River Flow Direction

Figure 3-5
Results of Magnetometer Survey

Prepared on:1/4/2023
Debris and Utility Identification and Survey Report
Swan Island Basin

PACIFIC groundwater GROUP · HGL · MOTT MACDONALD · BRIDGEWATER GROUP



Notes:
nT = nanotesla
m = meters

Distance Cubed [m^3] used as a representative distance from known ferrous objects.

Figure 3-6

Cross-Plot of Magnetic Field Strength and Proximity to Known Ferrous Objects

Prepared on:1/4/2023
Debris and Utility Identification and Survey Report
Swan Island Basin

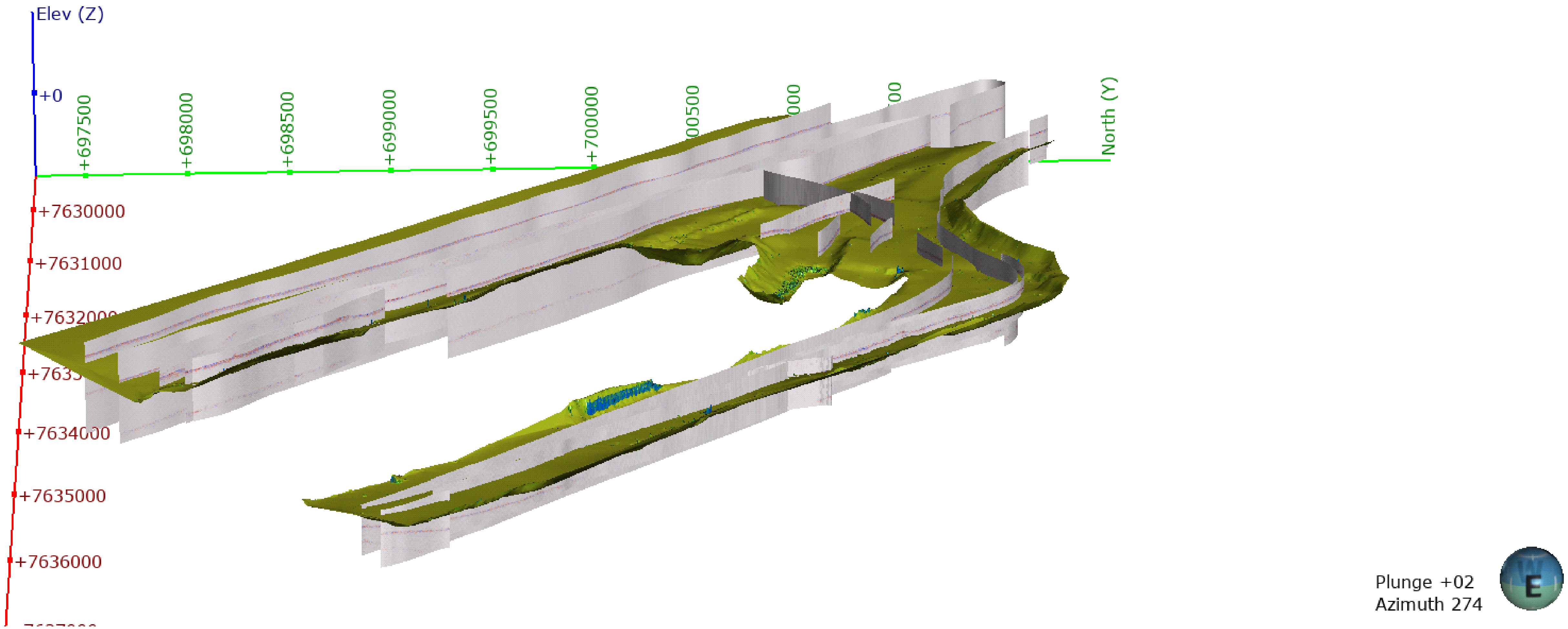


Figure 3-7

Sub-Bottom Profile Transects, 3D View

Prepared on:1/4/2023
Debris and Utility Identification and Survey Report
Swan Island Basin

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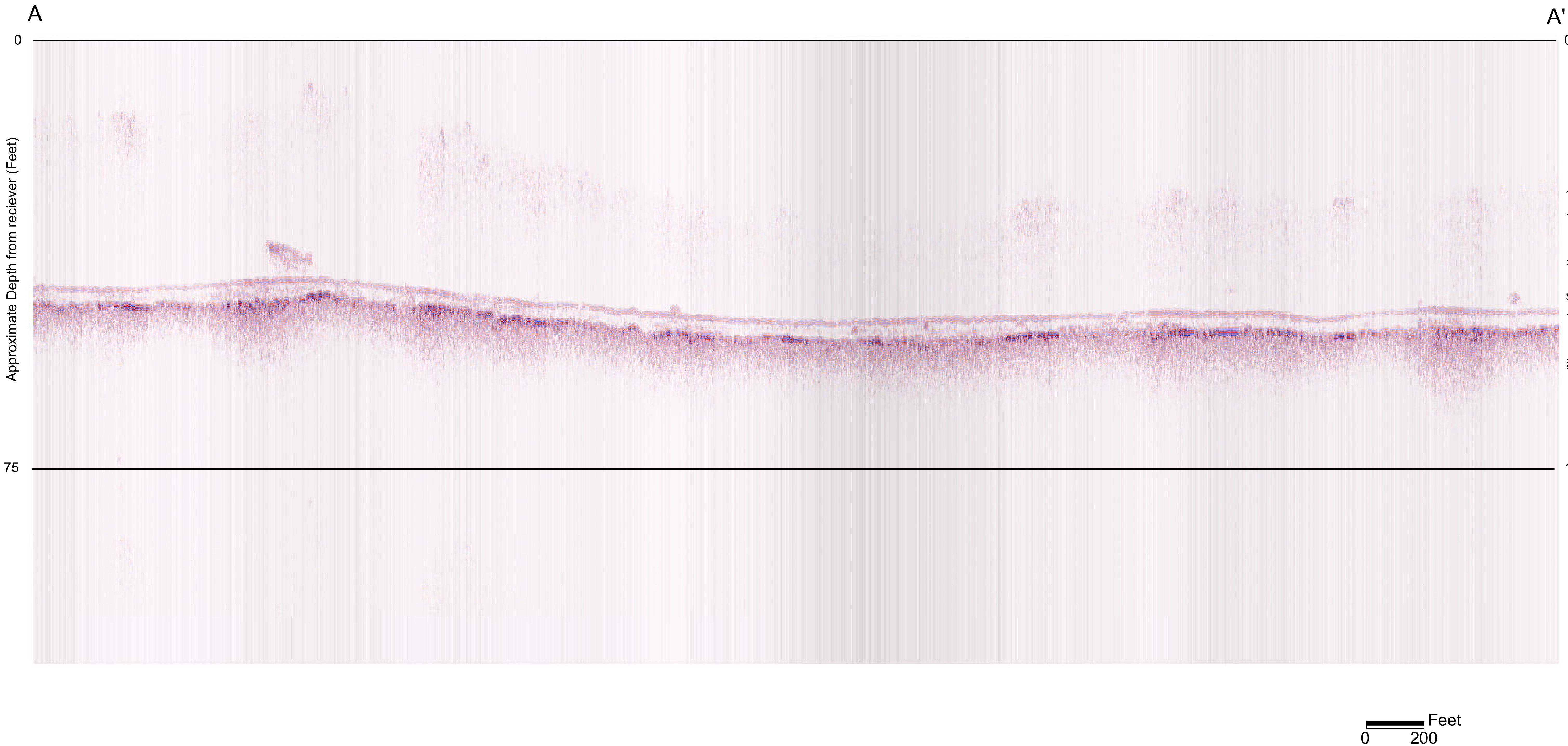

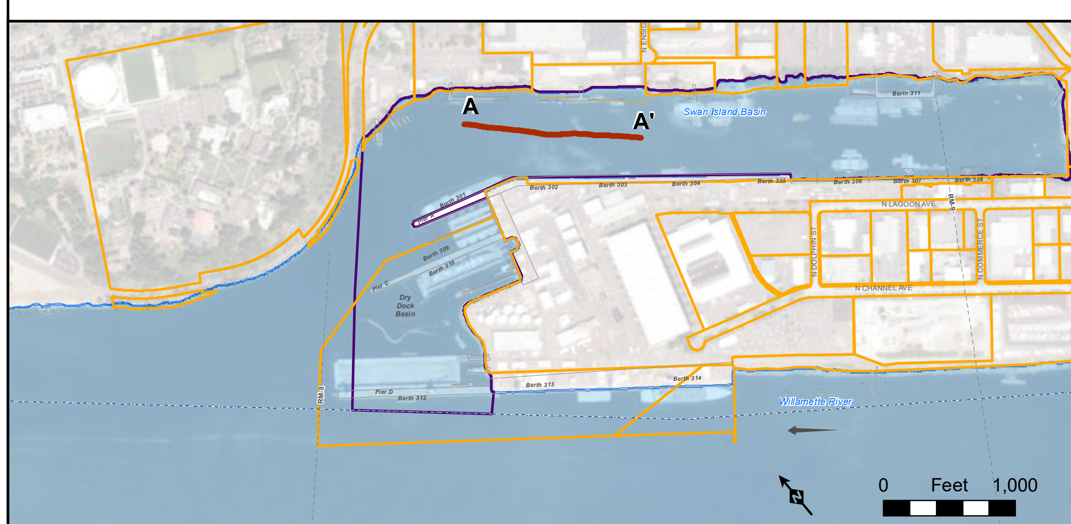

Notes:

Units in milliseconds (ms) from the receiver. Conversion to depth through water or soft sediment is 1.5m/ms or ~5ft/ms.

Polyline 009
HGLEtrac_07042022_200009_RAW_LF-CH1

Figure 3-8

Results of the Sub-Bottom Profile Survey, Transect A-A'

Prepared on:1/4/2023
Debris and Utility Identification and Survey Report
Swan Island Basin

PACIFIC groundwater GROUP
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BRIDGEWATER GROUP

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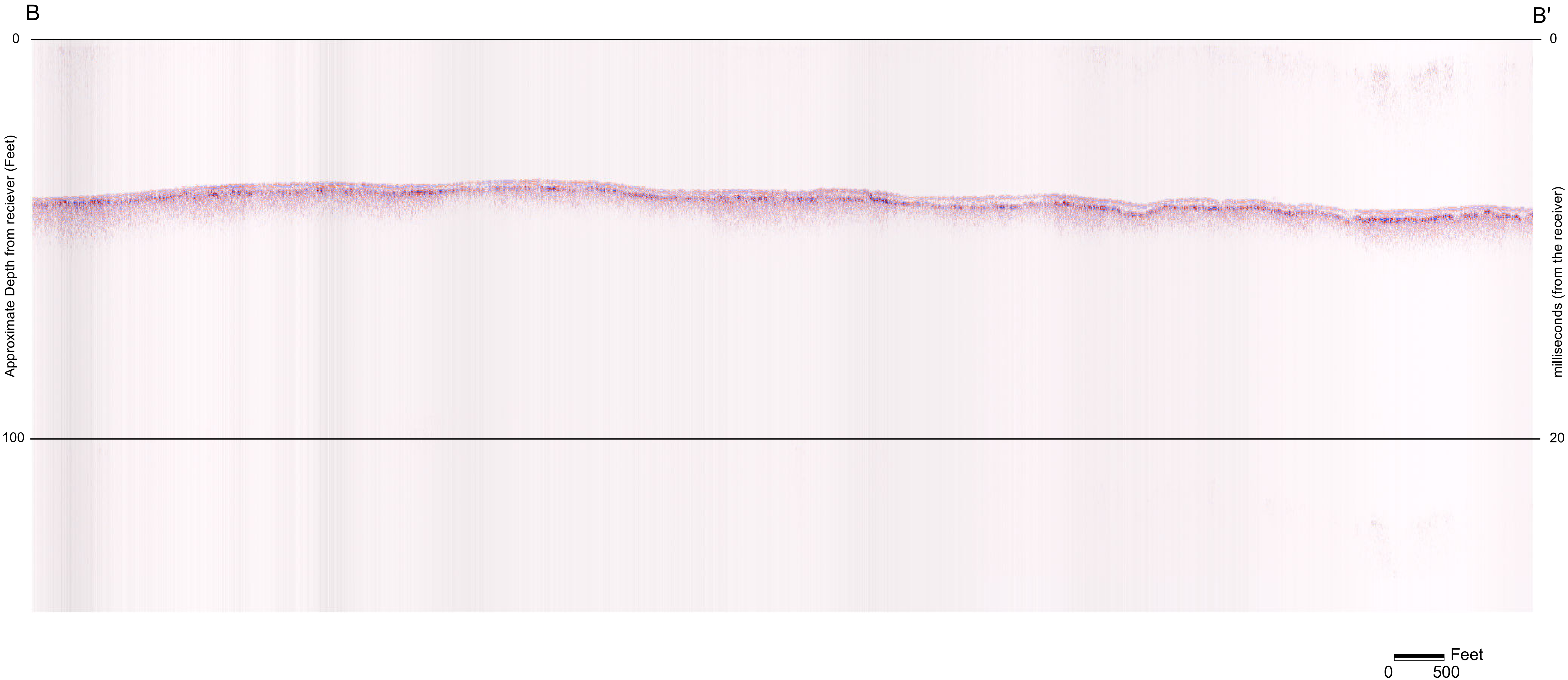

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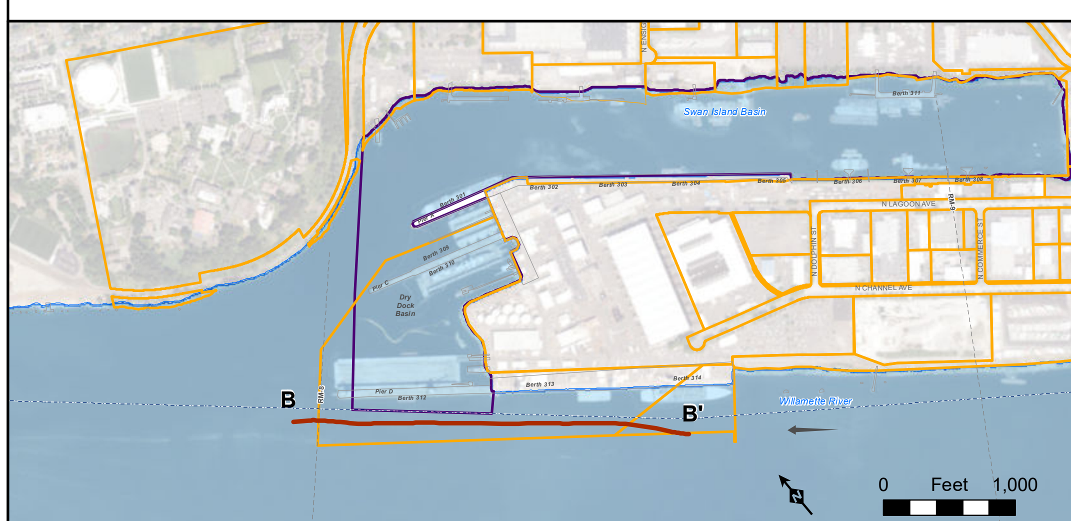

Notes:

Units in milliseconds (ms) from the receiver. Conversion to depth through water or soft sediment is 1.5m/ms or ~5ft/ms.

Polyline 918
HGLEtrac_07042022_215918_RAW_LF-CH1

Figure 3-9

Results of the Sub-Bottom Profile Survey, Transect B-B’

Prepared on:1/4/2023
Debris and Utility Identification and Survey Report
Swan Island Basin

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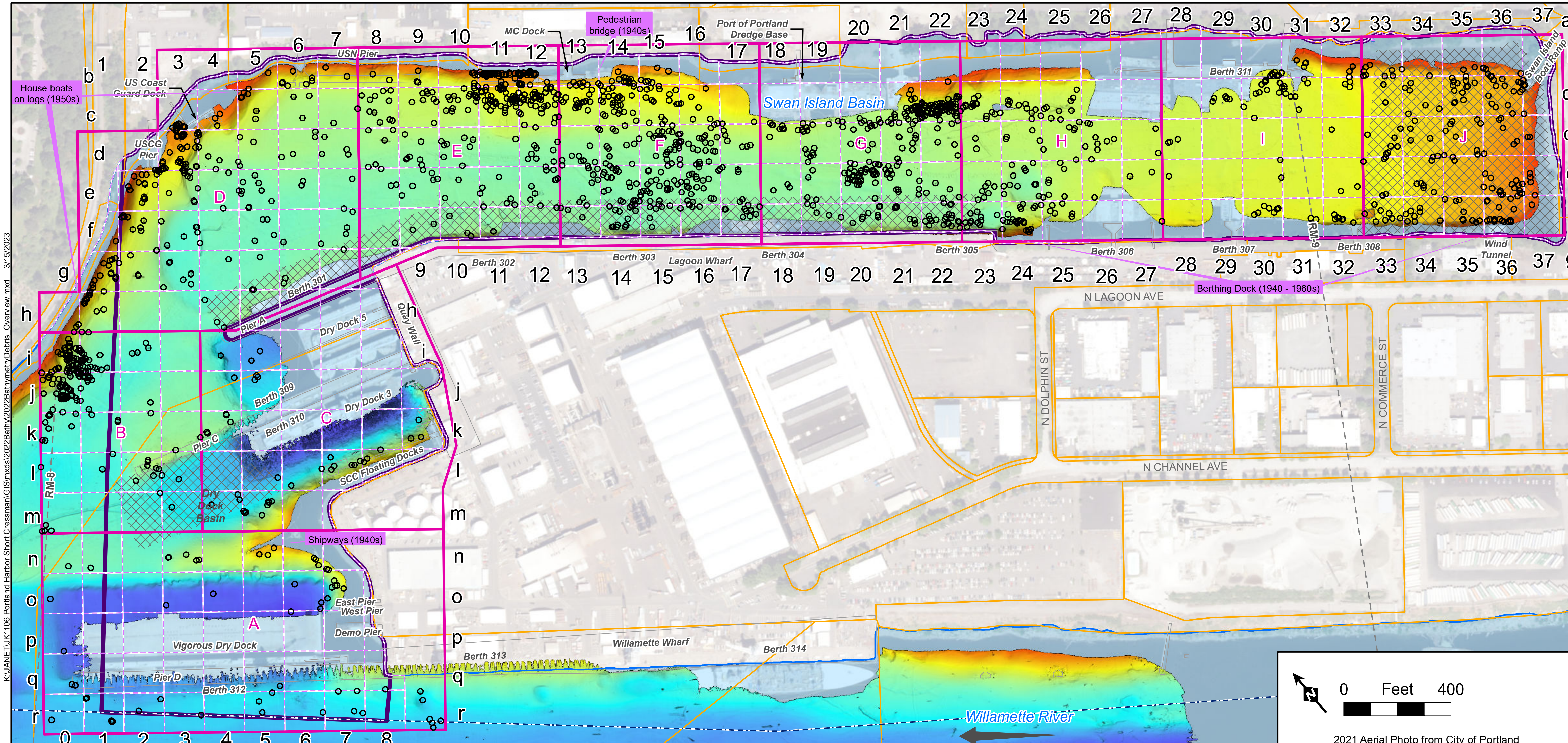
BRIDGEWATER GROUP



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Debris Zones
Project Area Grid
Cable Areas (USACE, 2022)
River Mile (RM)
Swan Island Sediment Decision Unit (SDU)
Federal Navigation Channel (USACE, 2020)
Docks and Structures
Tax Lot Boundary
Ordinary High Water (City of Portland, 2013)
River Flow Direction

o Debris Inventory Feature

Historical structure identification for informational purposes only, and is not intended as debris identification.

B Debris Zone Label

m Project Area Grid Label

Notes:
MC – Marine Consortium
SCC – Shipyard Commerce Center
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USN – U.S. Navy

Figure 4-1
Surface Debris Inventory Overview

Prepared on:3/15/2023
Debris and Utility Identification and Survey Report
Swan Island Basin

PACIFIC groundwater GROUP
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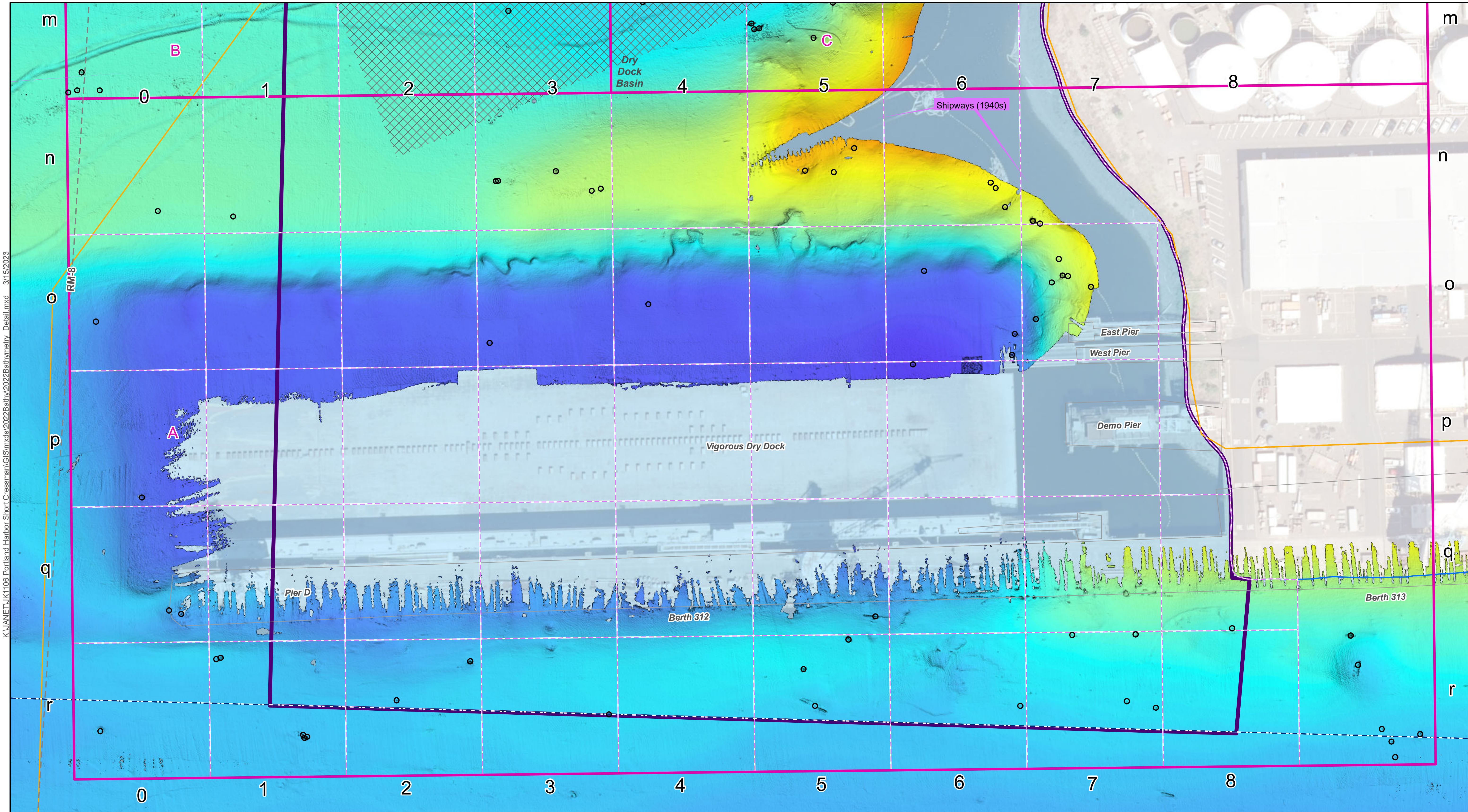
MOTT MACDONALD
BRIDGEWATER GROUP



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- Debris Inventory Feature
- River Mile (RM)
- Swan Island Sediment Decision Unit (SDU)
- Federal Navigation Channel (USACE, 2020)
- Cable Areas (USACE, 2022)
- Docks and Structures
- Tax Lot Boundary
- Ordinary High Water (City of Portland, 2013)
- Debris Zones
- Project Area Grid

Historical structure identification for informational purposes only, and is not intended as debris identification.

B Debris Zone Label

m Project Area Grid Label

Notes:
USACE – U.S. Army Corps of Engineers

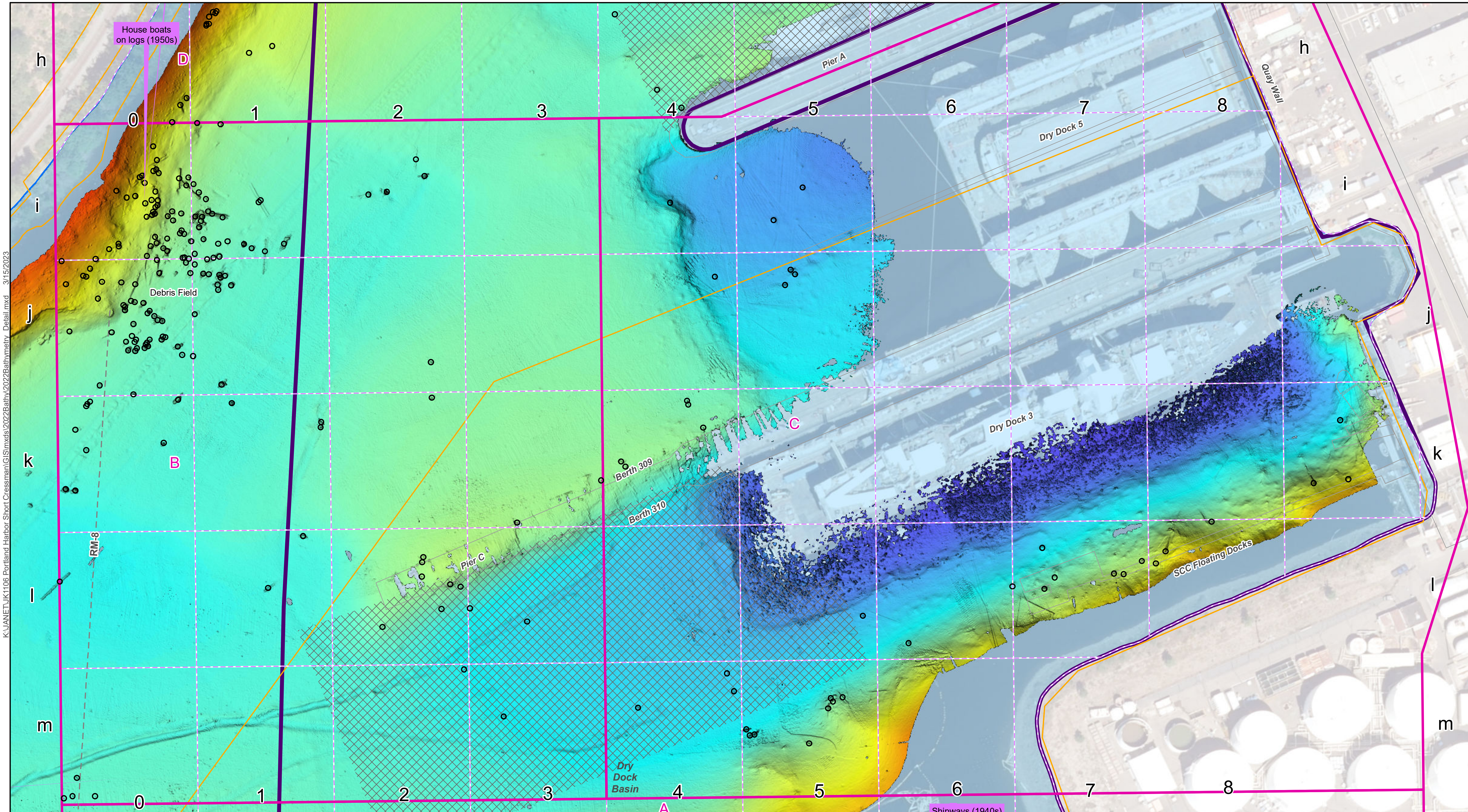
0 Feet 100

2021 Aerial Photo from City of Portland

Figure 4-2a

Surface Debris Inventory, Zone A

Prepared on:3/15/2023
Debris and Utility Identification and Survey Report
Swan Island Basin



Debris Inventory Feature
River Mile (RM)
Swan Island Sediment Decision Unit (SDU)
Cable Areas (USACE, 2022)
Docks and Structures
Tax Lot Boundary
Ordinary High Water (City of Portland, 2013)
Debris Zones
Project Area Grid

Historical structure identification for informational purposes only, and is not intended as debris identification.

B Debris Zone Label
m Project Area Grid Label

Notes:
SCC – Shipyard Commerce Center
USACE – U.S. Army Corps of Engineers

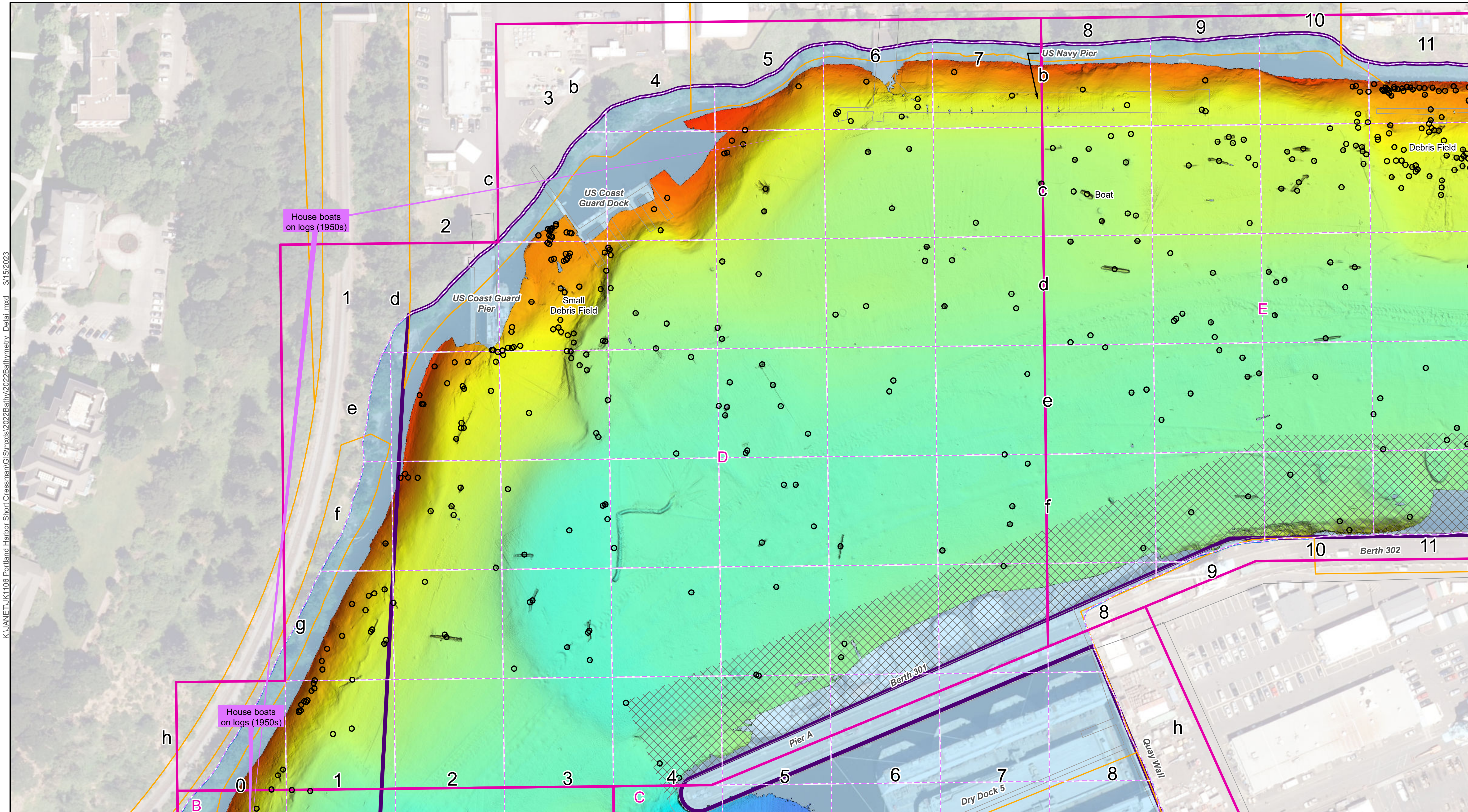
0 Feet 100

2021 Aerial Photo from City of Portland

Figure 4-2b
Surface Debris Inventory, Zones B and C

Prepared on:3/15/2023
Debris and Utility Identification and Survey Report
Swan Island Basin

PACIFIC groundwater GROUP
HGL
MOTT MACDONALD
BRIDGEWATER GROUP



Debris Inventory Feature
Swan Island Sediment Decision Unit (SDU)
Cable Areas (USACE, 2022)

Docks and Structures
Tax Lot Boundary
Ordinary High Water (City of Portland, 2013)
Debris Zones
Project Area Grid

Historical structure identification for informational purposes only, and is not intended as debris identification.

B Debris Zone Label

m Project Area Grid Label

Notes:
USACE – U.S. Army Corps of Engineers

0 Feet 100

2021 Aerial Photo from City of Portland

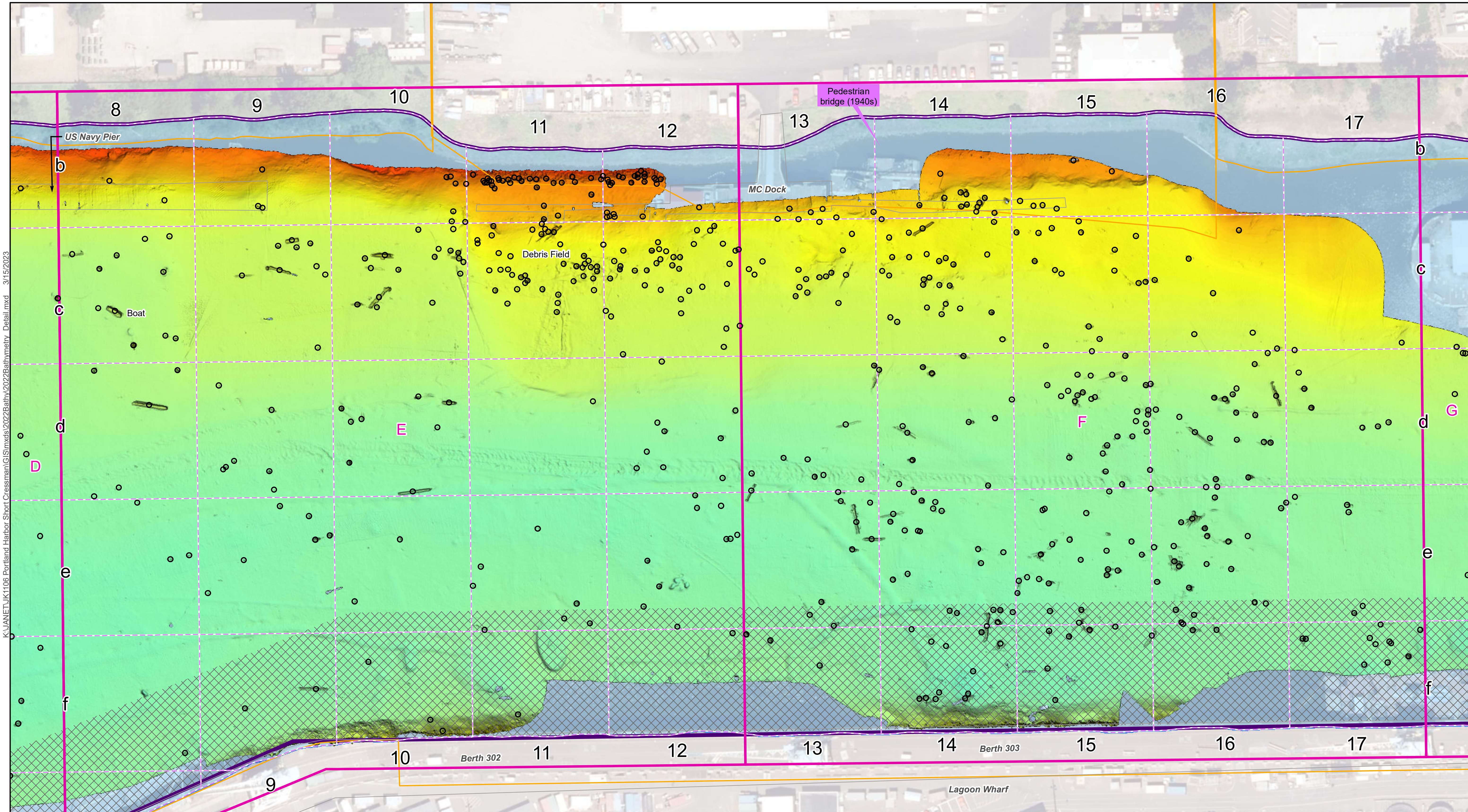
Figure 4-2c

Surface Debris Inventory, Zone D

Prepared on:3/15/2023
Debris and Utility Identification and Survey Report
Swan Island Basin

PACIFIC groundwater GROUP HGL MOTT MACDONALD BRIDGEWATER GROUP

K:\JANET\JK1106 Portland Harbor Short Cressman\GIS\mxds\2022Bathy\2022Bathymetry_Detail.mxd 3/15/2023



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- Debris Inventory Feature
- Swan Island Sediment Decision Unit (SDU)
- Cable Areas (USACE, 2022)
- Docks and Structures
- Tax Lot Boundary
- Ordinary High Water (City of Portland, 2013)
- Debris Zones
- Project Area Grid

Historical structure identification for informational purposes only, and is not intended as debris identification.

B Debris Zone Label

m Project Area Grid Label

Notes:
MC – Marine Consortium
USACE – U.S. Army Corps of Engineers

0 Feet 100

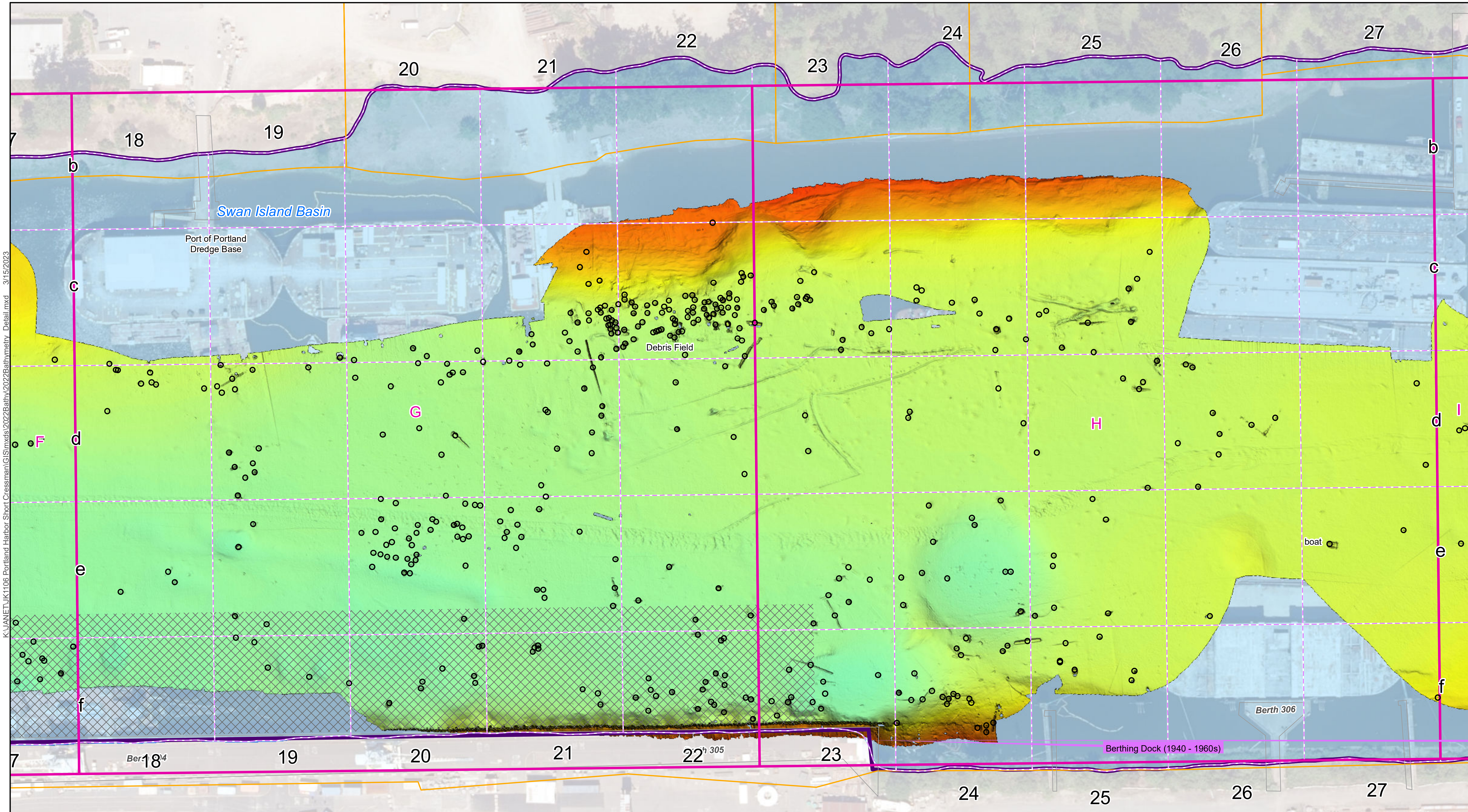
2021 Aerial Photo from City of Portland

Figure 4-2d

Surface Debris Inventory, Zones E and F

Prepared on:3/15/2023
Debris and Utility Identification and Survey Report
Swan Island Basin

PACIFIC groundwater GROUP
HGL
MOTT MACDONALD
BRIDGEWATER GROUP



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- Debris Inventory Feature
- Swan Island Sediment Decision Unit (SDU)
- Cable Areas (USACE, 2022)
- Docks and Structures
- Tax Lot Boundary
- Ordinary High Water (City of Portland, 2013)
- Debris Zones
- Project Area Grid

Historical structure identification for informational purposes only, and is not intended as debris identification.

B Debris Zone Label

m Project Area Grid Label

Notes:
USACE – U.S. Army Corps of Engineers

0 Feet 100

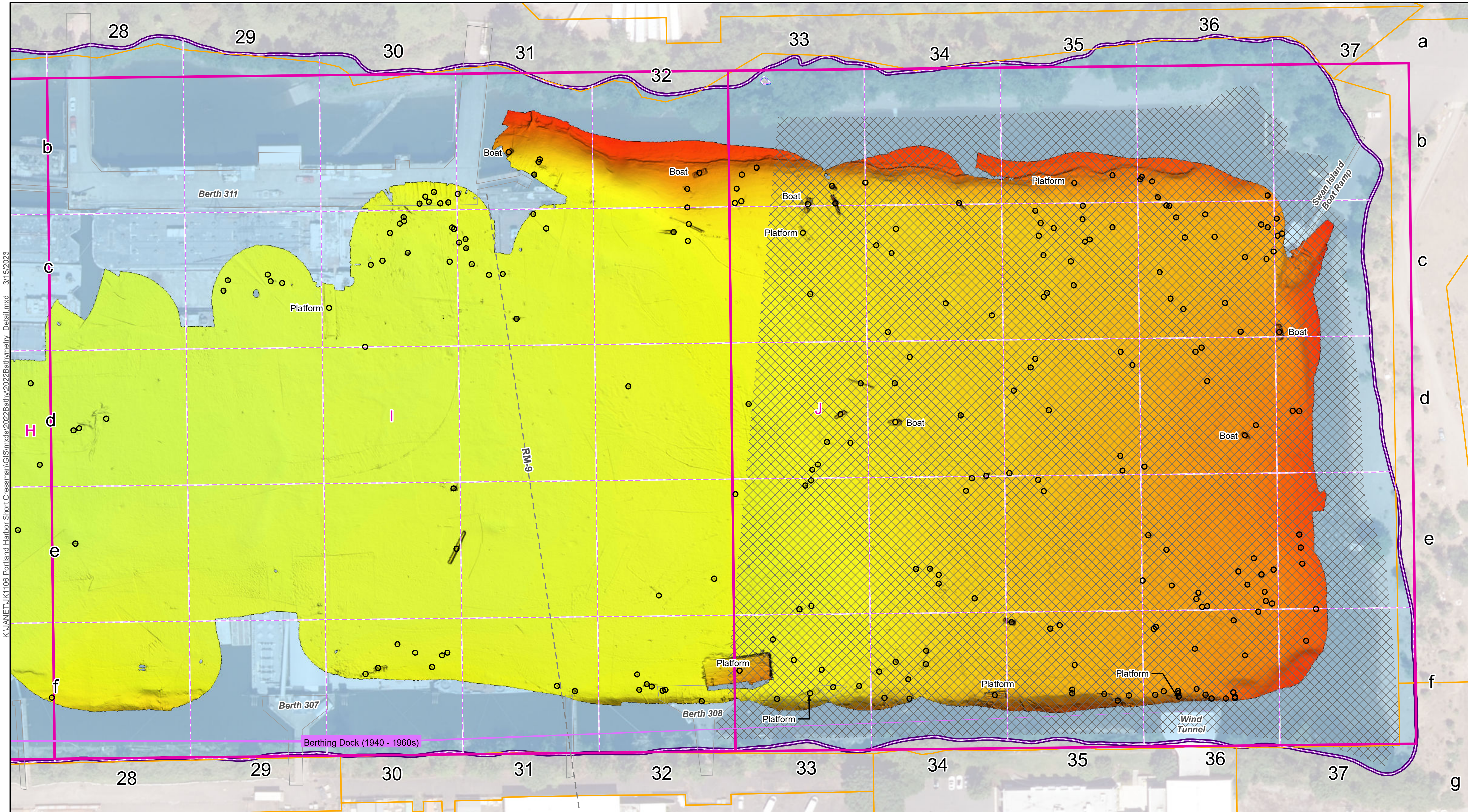
2021 Aerial Photo from City of Portland

Figure 4-2e

Surface Debris Inventory, Zones G and H

Prepared on:3/15/2023
Debris and Utility Identification and Survey Report
Swan Island Basin

PACIFIC groundwater GROUP
HGL
MOTT MACDONALD
BRIDGEWATER GROUP



Debris Inventory Feature
River Mile (RM)
Swan Island Sediment Decision Unit (SDU)
Cable Areas (USACE, 2022)

Docks and Structures
Tax Lot Boundary
Ordinary High Water (City of Portland, 2013)
Debris Zones
Project Area Grid

Historical structure identification for informational purposes only, and is not intended as debris identification.

B Debris Zone Label

m Project Area Grid Label

Notes:
USACE – U.S. Army Corps of Engineers

0 Feet 100

2021 Aerial Photo from City of Portland

Figure 4-2f

Surface Debris Inventory, Zones I and J

Prepared on:3/15/2023
Debris and Utility Identification and Survey Report
Swan Island Basin

PACIFIC groundwater GROUP
HGL
MOTT MACDONALD
BRIDGEWATER GROUP

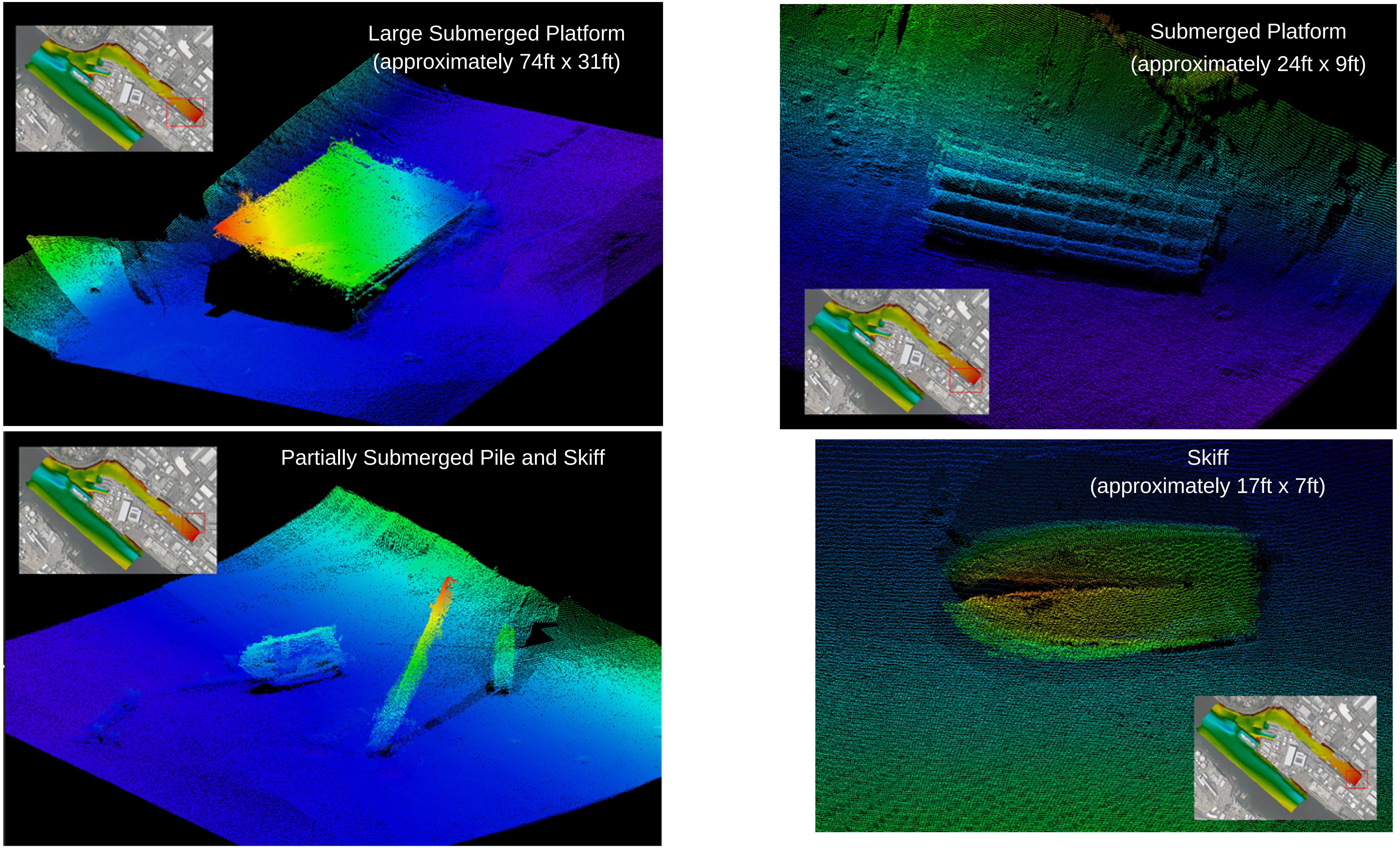
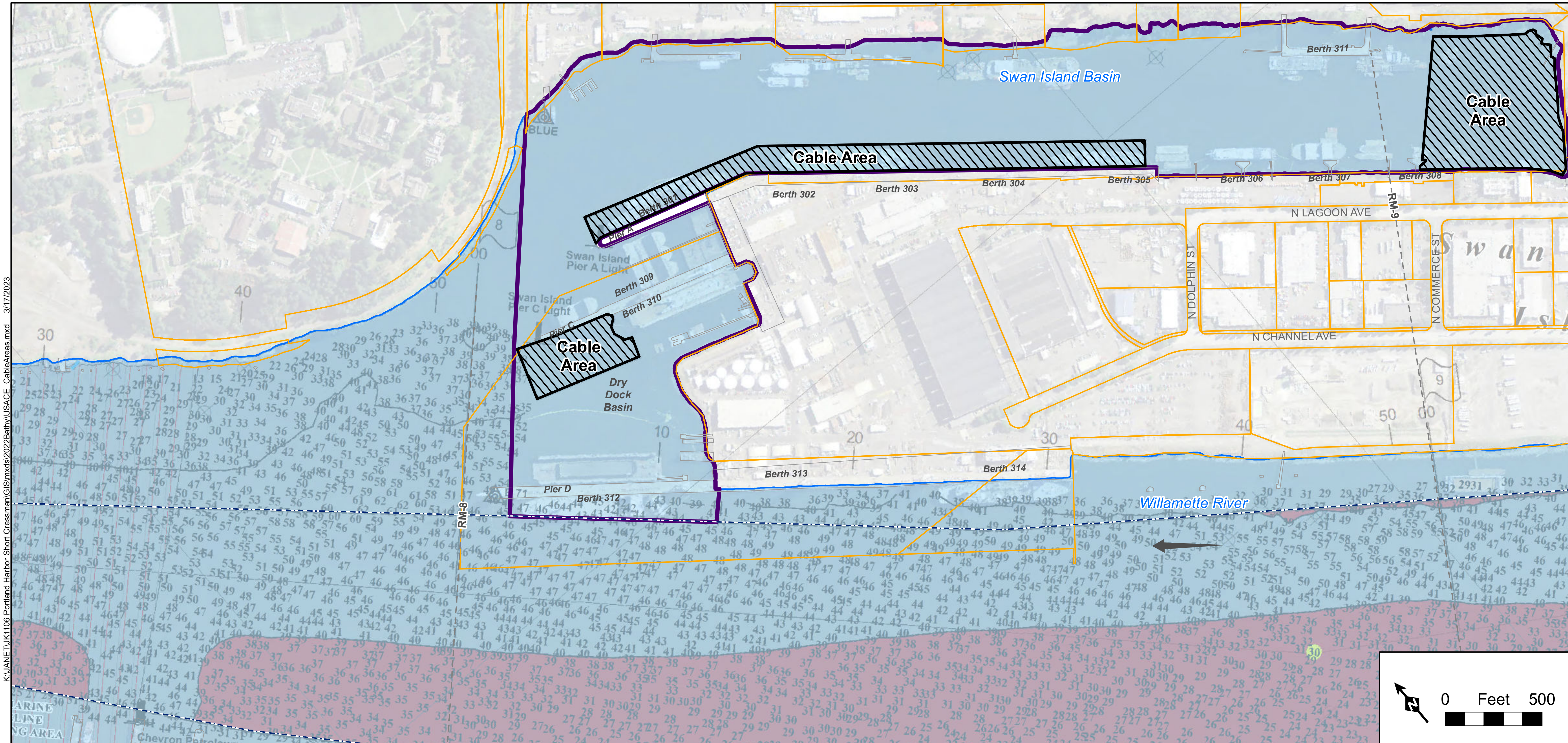


Figure 4-3
Example Debris Identified in Multibeam EchoSounder (MBES) Data

Prepared on:1/4/2023
Debris and Utility Identification and Survey Report
Swan Island Basin

PACIFIC groundwater GROUP
HGL
MOTT MACDONALD
BRIDGEWATER GROUP



K:\JANET\JK1106 Portland Harbor Short Cressman\GIS\mxds\2022Bathy\USACE_CableAreas.mxd 3/17/2023

Cable Area (emphasized)

River Mile (RM)

Swan Island Sediment Decision Unit (SDU)

Federal Navigation Channel (USACE, 2020)

Docks and Structures

Tax Lot Boundary

Ordinary High Water (City of Portland, 2013)

River Flow Direction

Legend from USACE Survey Map

- Federal Navigation Channel
- Federal Navigation Channel Centerline
- Pipeline, Submarine On Land Line
- Cable, Overhead
- Cable Area
- Pipeline Area
- Shoaling Area
- Benchmark
- Obstruction Point
- Shoalest Sounding**
- Beacon, General
- Contour Lines

Notes:
USACE – U.S. Army Corps of Engineers
Source: U.S. Army Corps of Engineers, 2022. *Condition Survey of Willamette River, Mile 7.5 to Broadway Bridge*. September.
Source modified to emphasize cable areas and reduce emphasis on other features.

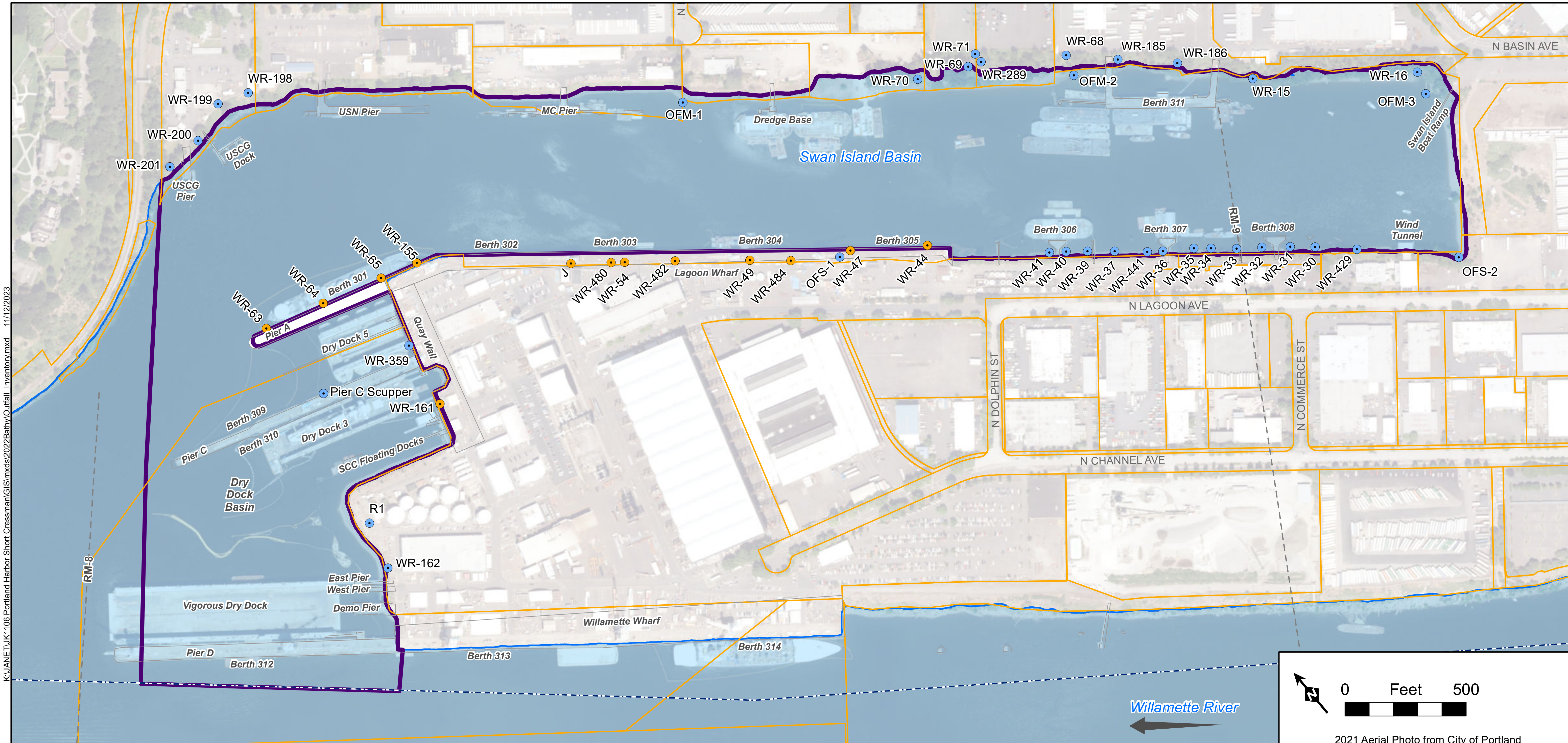
Notes from USACE Survey Map:
2009 Aerial Photography data source: U.S.D.A., Service Center Agencies
Reference is Navigation Chart No. 18526
Vertical Datum: Soundings are shown in feet and indicate depths below Columbia River Datum (CRD). CRD is 5.28 feet above the North American Vertical Datum of 1988 (NAVD 88 Geoid 09) at Willamette River Mile 9.7.
River mileage conforms to the River Mile Index of the Hydrology and Hydraulics Committee, Pacific Northwest River Basins Commission, July 1972.
The information depicted on this map represents the results of a survey conducted on the date indicated and can only be considered to represent the general channel conditions existing at that time and is in support of channel maintenance only.
** Shoalest Sounding per Quarter per Reach

Figure 4-4

Excerpt from USACE Survey Map Showing "Cable Areas" (Not Identified During Survey)

Prepared on:3/17/2023
Debris and Utility Identification and Survey Report
Swan Island Basin

PACIFIC groundwater GROUP · HGL · MOTT MACDONALD · BRIDGEWATER GROUP



Active Stormwater Outfalls

- Active
- Overflow Only

- River Mile (RM)
- Swan Island Sediment Decision Unit (SDU)
- Federal Navigation Channel (USACE, 2020)
- Docks and Structures
- Tax Lot Boundary
- Ordinary High Water (City of Portland, 2013)

River Flow Direction

Notes:
Outfalls were field verified except outfalls WR-69, WR-71, WR-289, and WR-253.

MC – Marine Consortium
SCC – Shipyard Commerce Center
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USN – U.S. Navy

Figure 4-5
Active Stormwater Outfall Inventory (January 2023)

Prepared on:11/12/2023
Debris and Utility Identification and Survey Report
Swan Island Basin

PACIFIC groundwater GROUP
HGL
MOTT MACDONALD
BRIDGEWATER GROUP