BATHYMETRIC SURVEY SUMMARY REPORT
REVISION 2

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:

ETRAC, INC.
617 S. Knik-Goose Bay Rd.,
Ste. C, Wasilla, AK 99654

On behalf of:

11107 Sunset Hills Road, Suite 400
Reston, Virginia 20190

April 2024

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LIST OF ACRONYMS AND ABBREVIATIONS

2-D	two dimensional
3-D	three dimensional
CRM	Colombia River Datum
EDD	Electronic Data Deliverable
EM	Engineer Manual
EPA	U.S. Environmental Protection Agency
ft	foot/feet
GAMS	GNSS Azimuth Measurement System
GeoTIFF	Geo-referenced Tiff
CRD	Columbia River Datum
HGL	HydroGeoLogic, Inc.
IMU	inertial measurement system
LiDAR	light detection and ranging
MBES	Multibeam EchoSounder
PDI	Pre-Design Investigation
RD	Remedial Design
RM	River Mile
RTK	real-time kinematic
SBET	Smoothed Best Estimate of Trajectory
SIB	Swan Island Basin
USGS	U.S. Geological Survey

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BATHYMETRIC SURVEY SUMMARY REPORT
SWAN ISLAND BASIN PROJECT AREA
PORTLAND HARBOR SUPERFUND SITE
PORTLAND, MULTNOMAH COUNTY, OREGON

1.0 INTRODUCTION

This report presents an overview of the multibeam bathymetric survey conducted in the Swan Island Basin (SIB) Project Area of the Portland Harbor Superfund Site in Portland, Multnomah County, Oregon. The work was performed by eTrac Inc., in response to a request from HydroGeoLogic, Inc. (HGL) and on behalf of the SIB Remedial Design (RD) Group based on the requirements of the Portland Harbor Superfund Site Record of Decision (EPA, 2017) and the Administrative Settlement Agreement and Order on Consent (EPA, 2021). The scope of work was proposed in the March 2022 Pre-Design Investigation (PDI) Work Plan (HGL, 2022a), and was conditionally approved by U.S. Environmental Protection Agency on April 5, 2022. The scope of the survey remained consistent with that detailed in the final PDI Work Plan that was fully approved in May 2022. The goal of the survey was to address the data gap identified in Section 3.5 of the PDI Work Plan.

1.1 OBJECTIVES AND SCOPE

Bathymetric data was collected to provide survey data for studies in support of development of the RD. This bathymetric data will fundamentally support multiple aspects of the RD. The multibeam bathymetry dataset will have multiple uses, including (1) estimating sedimentation and erosion trends based on comparisons with previous elevation data, (2) identifying debris, and (3) providing elevation data for completing a site-wide unified elevation model. The unified elevation model will be a regular grid of best-available elevations for use in performing analysis and supporting development of an updated Remedial Action concept. From this unified elevation model, transects or subsets can be extracted as needed for analysis work. Additional elevation data will be collected in the future on an as-needed basis for the purposes of supporting preliminary and final engineering design.

This data acquisition effort is intended to result in additional elevation data in the SIB using multibeam survey techniques. The extent of the multibeam bathymetry survey includes a portion of the main Willamette River channel outside of the SIB Project Area. Bathymetry in the river channel is needed to inform the development of the hydrodynamics and sediment transport model that will evaluate the exchange of sediment and water between SIB and the main river channel. Bathymetric data collection was conducted in accordance with the Survey and Quality Control Plan (Mott MacDonald, 2022) that was developed in response to U.S. Environmental Protection Agency comments on the PDI Work Plan and the Field Sampling Plan (HGL, 2022b).

1.2 PROJECT AREA BACKGROUND

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 multibeam bathymetry 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 (Figure 1-1).

1.3 DOCUMENT ORGANIZATION

This summary documents the multibeam bathymetric survey field activities conducted at SIB and the adjacent Willamette River Channel. The report is organized into the following sections:

- Section 1 presents an overall introduction including the objectives and scope of the multibeam bathymetric survey;
- Section 2 provides a description of survey activities completed, calibration/validation procedures, and data processing;
- Section 3 provides an overview of the data collected; and
- Section 4 presents the references used in this report.

2.0 SURVEY ACTIVITIES

The multibeam bathymetry survey was conducted between April 4 and April 7, 2022, in accordance with the Survey and Quality Control Plan (Mott MacDonald, 2022). The survey was conducted in a manner that satisfies the data quality objectives established in the Uniform Federal Policy-Quality Assurance Project Plan for SIB (HGL, 2022c). Figure 2-1 presents the survey lines collected on this project.

2.1 MULTIBEAM BATHYMETRIC SURVEY

The extents of the multibeam bathymetry survey are shown in Figure 1-1.

The data quality objectives for the multibeam bathymetric survey include obtaining current and accurate depth information in the river and SIB, obtaining estimated submerged riverbed elevations, covering best available upper riverbank area, and ensuring coverage within the project area everywhere except locations rendered inaccessible by unavoidable obstructions.

The riverbed surface was imaged using an R2 Sonic 2024 Multibeam EchoSounder (MBES), which deviated from the proposed R2 Sonic 2020 MBES to provide better imaging resolution. The prescribed survey accuracy goal is best feasible based on field conditions, at sampling frequency 400 kilohertz within a 656-foot (ft)[1] operational range (HGL, 2022c). Bathymetry data were acquired in accordance with the U.S. Army Corps of Engineers (USACE) 2013 Engineer Manual (EM) 1110-2-1003 Hydrographic Surveying (USACE, 2013) per the Survey Plan, which states acceptable accuracy is +/- 0.5 foot vertically and 3 feet horizontally for 95 percent of all data points. Real-time kinematic (RTK) checks described in this report indicated that better accuracies were achieved. Table 2-1 presents a summary of the survey equipment.

2.2 HORIZONTAL AND VERTICAL CONTROL CHECKS

All data was referenced to North American Datum of 1983 (NOAA, 2011), Oregon North in international ft. The vertical datum will be referenced to North American Vertical Datum of 1988[2] using Geoid 12B in ft.

The horizontal and vertical positions of three existing benchmarks (*V14, UPSTREAM 2 1978, WALL 1961*) were verified using the Washington State Reference Network station PDXA. Each benchmark was staked out then verified through a series of three, 180-epoch RTK observations. Daily RTK checks were performed at the National Oceanic and Atmospheric Administration Tidal Station 9439221 Portland, Morrison Street Bridge, Oregon, before and after data acquisition using

[1] Units have been converted from metric system to imperial system throughout the document for consistency.

[2] 0 ft Colombia River Datum (CRD) = 5.28 ft North American Vertical Datum of 1988. CRD is used as the nautical chart datum for the Lower Willamette River. CRD is a reference plane that U.S. Army Corps of Engineers established in 1912 by observing low water elevations at various points along the Columbia and Willamette rivers (USACE, 1966). Consequently, CRD is not a fixed/level datum but slopes upward as one moves upstream. River users can obtain the depth on a chart and apply tide or river-level gauge readings, relative to CRD, to compute actual water depth. Low water values are used for navigation charting to provide conservative depth values in the event accurate tide data is not available to the river user.

corrections from station PDXA. Tolerances did not exceed 0.07 ft vertically. Figure 2-2 presents the benchmark locations relative to the survey area and the benchmark elevations compared to RTK observations.

2.3 CALIBRATION, VALIDATION, AND DATA PROCESSING

The vessel was positioned with an integrated Position and Orientation System for Marine Vessels Wavemaster with inertial measurement unit (IMU) to account for the vessel's angular movement. Prior to MBES collection, a patch-test calibration was completed to quantify and adjust for misalignment angles between the multibeam sonar and the IMU. During the survey, specific planned lines were run to account for roll, pitch, and yaw misalignment values.

Vertical offsets were measured while on the trailer, prior to initiating survey activities, to ensure measurements to and from positioning equipment were accurate with a precision of less than 1.2 inches[3]. RTK observations were performed and compared real-time to the collection software on the vessel to verify offsets within 0.1ft to the IMU, sonar and waterline on the vessel. The waterline measurement verification showed less than 0.1ft difference between the vessel measurement and RTK measurement. The bar check occurred within SIB at the Marine Consortium, Inc. pier. The bar check verification also showed less than 0.1ft difference between the sonar and bar check measurements. Sound velocity was measured at the multibeam sonar head and sound velocity profiles of the water column were taken throughout the survey area as additional validation. Vessel load did not change substantially during survey operations. Draft was verified once at the beginning of the survey. The EM 1110-2-1003 Hydrographic Surveying (USACE, 2013) states that when precise RTK water surface elevation is determined in real time, there is no requirement to track tide changes and dynamic draft variations separately.

Latency was checked once at the beginning of the survey during the patch test and found to be zero. In accordance with the EM 1110-2-1003 Hydrographic Surveying (USACE, 2013), latency biases are zero when Coordinated Universal Time time-tagged Global Positioning Systems are used. Additionally, latency is generally negligible when surveys are conducted with very accurate Global Navigation Satellite System time synchronization and pulse-per-second triggering.

Approximately 175 percent coverage with multibeam data was achieved. A statistical test completed with the SIB Project Area data illustrates that 100 percent of the multibeam survey data comprises the International Hydrographic Organization Special Order category. Position data was post-processed in Applanix Position and Orientation Post Processing Package™ inertial processing software using Washington State Reference Network station PDXA. This allowed the creation of a more accurate and robust Smoothed Best Estimate of Trajectory (SBET) solution which was applied to the data for positioning corrections and horizontal and vertical control throughout the duration of the survey. Prior to applying corrections, the SBET was analyzed for quality. The full motion and position solution of the SBET was applied to the multibeam data to maximize overall accuracy.

[3] Units have been converted from metric system to imperial system throughout the document for consistency.

Establishment of survey control was not required due to availability of existing nearby benchmarks, and control was verified in place. Prior to collection, a GNSS Azimuth Measurement System (GAMS) calibration of the POSMV was performed. Post-processing was aided by real-time standard deviation plots for overlapping survey data that were created and monitored throughout the survey. Collecting multibeam data with an active standard deviation layer ensures all erroneous data and objects of interest stand out due to a high standard deviation value. Quality control was achieved through RTK check shots to verify vessel offsets, GAMS calibrations to assure accurate positioning, and a bar check to assure accurate depths before beginning the survey.

All MBES bathymetry data was processed in the Qimera software. Multibeam data was analyzed in both a 3-D point cloud, which visualizes the full dataset, as well as in 2-D which is down-sampled as a gridded dataset. Data was gridded at the highest resolution that the data coverage allowed. The horizontal resolution resulted in a grid cell size of 1ft by 1ft. Analysis that eTrac performed prior to the survey indicated that slopes were relatively flat in the multibeam survey area and that 1x1-foot gridded data would meet the data quality objectives laid out in the Survey Plan.

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3.0 SURVEY RESULTS SUMMARY

This section provides a summary overview of the findings of the bathymetric survey and identification of features on the riverbed surface. The multibeam bathymetry survey dataset, following the Federal Geographic Data Committee Content Standard for Digital Geospatial Metadata, is provided as an electronic data deliverable (EDD, Attachment A). The EDD includes the following digital files:

1. Vessel positioning data files, including raw and processed vessel location data for use in POSPAC and base data for use in the Trimble Business Center;
2. Digital elevation model, in *.dem format for use in ArcGIS, ArcPro, Autodesk Civil3D, or Global Mapper;
3. Raw survey data files, including raw multibeam database files for use in Qimera;
4. Daily Field Reports;
5. Geo-referenced Tiff (GeoTIFF) files; and
6. Google Earth kmz format merged DEM data."

3.1 MULTIBEAM BATHYMETRY

The main channel of the Willamette River has depths up to 57 ft located downstream of the dry dock basin, and approximately 53 ft within the dry dock berth. At the mouth of SIB near the northeast end of Pier A, moving into the SIB towards the southeast end of the SIB, depths decrease from approximately 30 ft to less than 10 ft. Figure 3-1 presents an overview of the bathymetry in the survey area. Figures 3-2 to 3-11 present close-ups of the observed elevations in different zones within the survey area corresponding to zones as labeled in Figure 3-1.

3.2 SURFACE FEATURES

The bathymetry survey identified marks on the surface of the riverbed within the dataset. The marks are illustrated on Figure 3-12.

3.3 DATA GAPS IN BATHYMETRY SURVEY DATASET

Data gaps still exist in areas where large vessels and structures obstructed the bathymetric survey and along the shoreline due to the river stage at the time of the survey (Figure 3-1). There were vessels present in zones C, G, H, and I. The river stage precluded obtaining shoreline data from all zones but zone B. A unified elevation model is in progress that incorporates other data types/sources including City of Portland 2019 light detection and ranging (LiDAR), SIB 2022 mobile LiDAR, 2018 Bathymetric Survey for the Vigor Shipyard Facility (eTrac, Inc.), and Willamette River, Oregon – River Mile 1.9 to 11.8 Hydrographic Survey (2018 Portland Harbor Bathymetry Data – David Evans and Associates, Inc.). A comparative evaluation of historical (2018) bathymetry data and 2022 bathymetry data will be completed during subsequent stages of the PDI Evaluation Report and Basis of Design Report development to determine whether the 2018 bathymetry datasets can be utilized to address data gaps. If there are gaps in the bathymetric data needed to support the remedial design that cannot be addressed with existing LiDAR and bathymetry data sources, an additional bathymetric survey may be considered to fill these data gaps.

As noted in the introduction, the bathymetry survey was intended to provide additional information for analysis purposes during the PDI. Coverage was maximized at SIB by observing vessel movements to attempt to survey while vessels were not at berth, revisiting areas when feasible based on the vessel movements and tides, targeting shallower areas at highest possible water levels during the survey period, and maneuvering the vessel into the tightest possible areas while maintaining safe operations. Shallower areas could not be surveyed due to river stage at the time of the survey, which was conducted in tandem with the utility and debris survey efforts at SIB. Based on gage data from the U.S. Geologic Survey (USGS) station 14211720, the river stage during the survey ranged from 6.83 to 10.71 feet North American Vertical Datum of 1988 (USGS, 2023). Reasonable bottom elevation approximations will be made in areas where data collection was not feasible (e.g., under permanently moored vessels or large pile-restrained floats), using interpolation based on observed slopes, or filling with previously collected bathymetric data if analysis based on comparative evaluation of historic (2002-2018) bathymetry data sets and 2022 bathymetry data shows that recent changes are minimal.

During RD, areas not surveyed in the 2022 Multibeam survey will be evaluated to determine sensitivity of the preliminary design concept to slight changes in riverbed elevations. In areas where any structural modifications (aside from removal) are to be performed, a new hydrographic survey will be performed prior to final design. In areas where dredging and/or capping is proposed, new hydrographic survey requirements will be determined based on the historical elevation change rate in that area developed from prior multibeam surveys. In areas of measurable change (more than a few inches per year), a new hydrographic survey will be performed prior to final design.

4.0 REFERENCES

U.S. Environmental Protection Agency (EPA), 2017. *Record of Decision, Portland Harbor Superfund Site*, Portland, Oregon.

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TABLES

Table 2-1
Multibeam Bathymetry Survey Equipment and Calibration Check Information

Equipment	Description
R2 Sonic 2024 MBES	Utilizes 256 discrete beams with a maximum swath width of 160° run at 450 kHz with a maximum 100° swath width and 700 kHz with a maximum swath width of 60°. The MBES and vessel were positioned with a fully integrated position and motion system receiving corrections from WSRN station PDXA and were processed using an SBET.
AML BaseX2 Sound Velocity Probe	Capability down to 1,640 ft and a sound velocity range of 4,511 to 6,234 ft/s.
Universal Sonar Mount	Sound velocity was measured and monitored at the multibeam sonar head and sound velocity profiles of the water column were taken throughout the survey area.
R2Sonic I2NS Marine Inertial Positioning System	Tightly coupled GNSS and inertial MRU to account for the movement of the vessel along each axis.
Applanix POSPac™	Inertial processing software using WSRN station PDXA, allowing creation of a robust SBET solution, which was applied to the data for positioning corrections and horizontal and vertical control throughout the duration of the survey.
QINSy positioning software	Utilized to acquire multibeam and vessel positioning data

Notes:

°	degrees
ft	feet/foot
ft/s	feet per second
GNSS	Global Navigation Satellite System
IMU	inertial measurement system
kHz	kilohertz
MBES	Multibeam EchoSounder
MRU	motion reference unit
PDXA	WSRN station named “PDXA” located at Portland International Airport
POSMV	Position and Orientation System for Marine Vessels
POSPac™	Applanix Position and Orientation Post Processing Package
QINSy	Quality Integrated Navigation System
RTK	real-time kinematic
SBET	Smoothed Best Estimate of Trajectory
WSRN	Washington State Reference Network

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FIGURES

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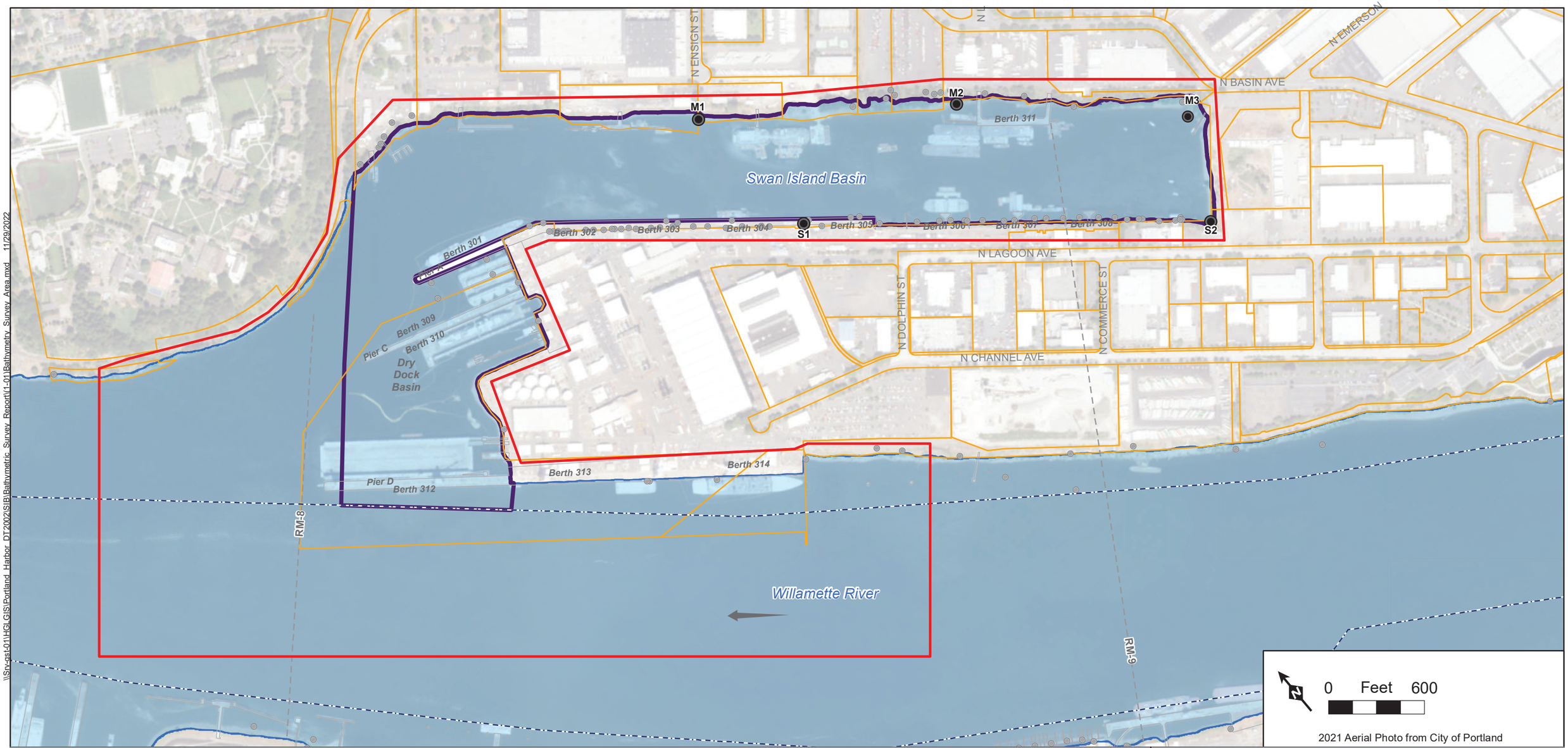

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- City of Portland Stormwater Outfall
- Non-City Outfall
- River Flow Direction
- River Mile (RM)
- Swan Island Sediment Decision Unit (SDU)
- Federal Navigation Channel (USACE, 2020)*
- Docks and Structures
- Tax Lot Boundary
- Ordinary High Water (City of Portland, 2013)
- Bathymetry Data Collection Area

Notes:
*The Swan Island SDU is located outside the Federal Navigation Channel.
USACE: U.S. Army Corps of Engineers

Figure 1-1

Bathymetry Survey Area

Swan Island Basin

PACIFIC groundwater GROUP
HGL
MOTT MACDONALD
BRIDGEWATER GROUP

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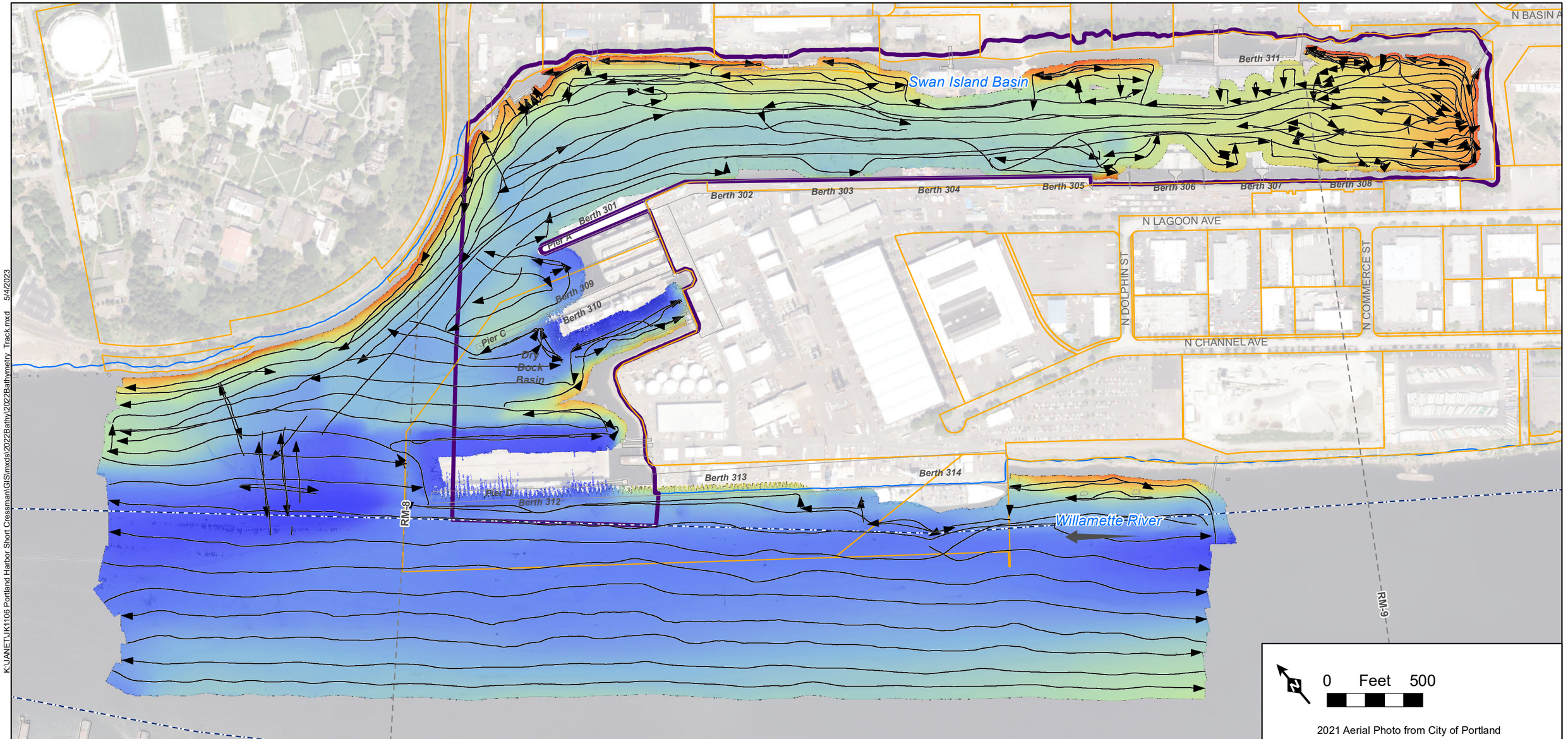


River Mile (RM)
Swan Island Sediment Decision Unit (SDU)
Federal Navigation Channel (USACE, 2020)
Docks and Structures
Tax Lot Boundary
Ordinary High Water (City of Portland, 2013)

Multibeam Survey Line

2022 Bathymetry (Feet NAVD88)
High : 8
0
-10
-20
-30
-40
-50
Low : -60

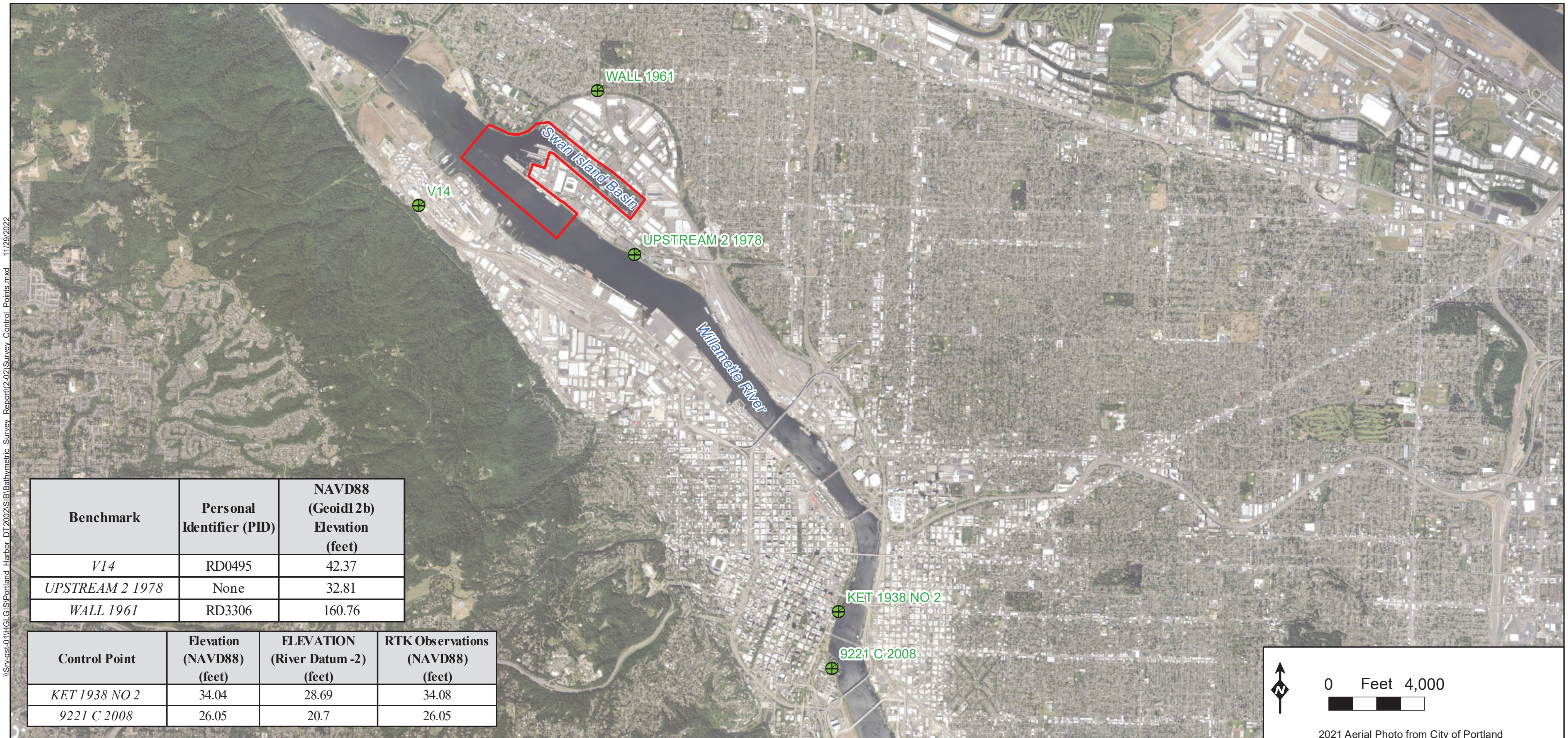
River Flow Direction

Notes:
NAVD88 – North American Vertical Datum of 1988
USACE – U.S. Army Corps of Engineers

Figure 2-1
Multibeam Survey Lines

Swan Island Basin

PACIFIC groundwater GROUP
HGL
MOTT MACDONALD
BRIDGEWATER GROUP



Benchmark	Personal Identifier (PID)	NAVD88 (Geoid12b) Elevation (feet)
V14	RD0495	42.37
UPSTREAM 2 1978	None	32.81
WALL 1961	RD3306	160.76

Control Point	Elevation (NAVD88) (feet)	ELEVATION (River Datum -2) (feet)	RTK Observations (NAVD88) (feet)
KET 1938 NO 2	34.04	28.69	34.08
9221 C 2008	26.05	20.7	26.05

Survey Control Point

Bathymetry Data Collection Area

Notes:
NAVD88 - North American Vertical Datum of 1988
RTK - Real-time kinematic positioning

Figure 2-2
Overview of Survey Control Points

Swan Island Basin

PACIFIC groundwater GROUP
HGL
MOTT MACDONALD
BRIDGEWATER GROUP

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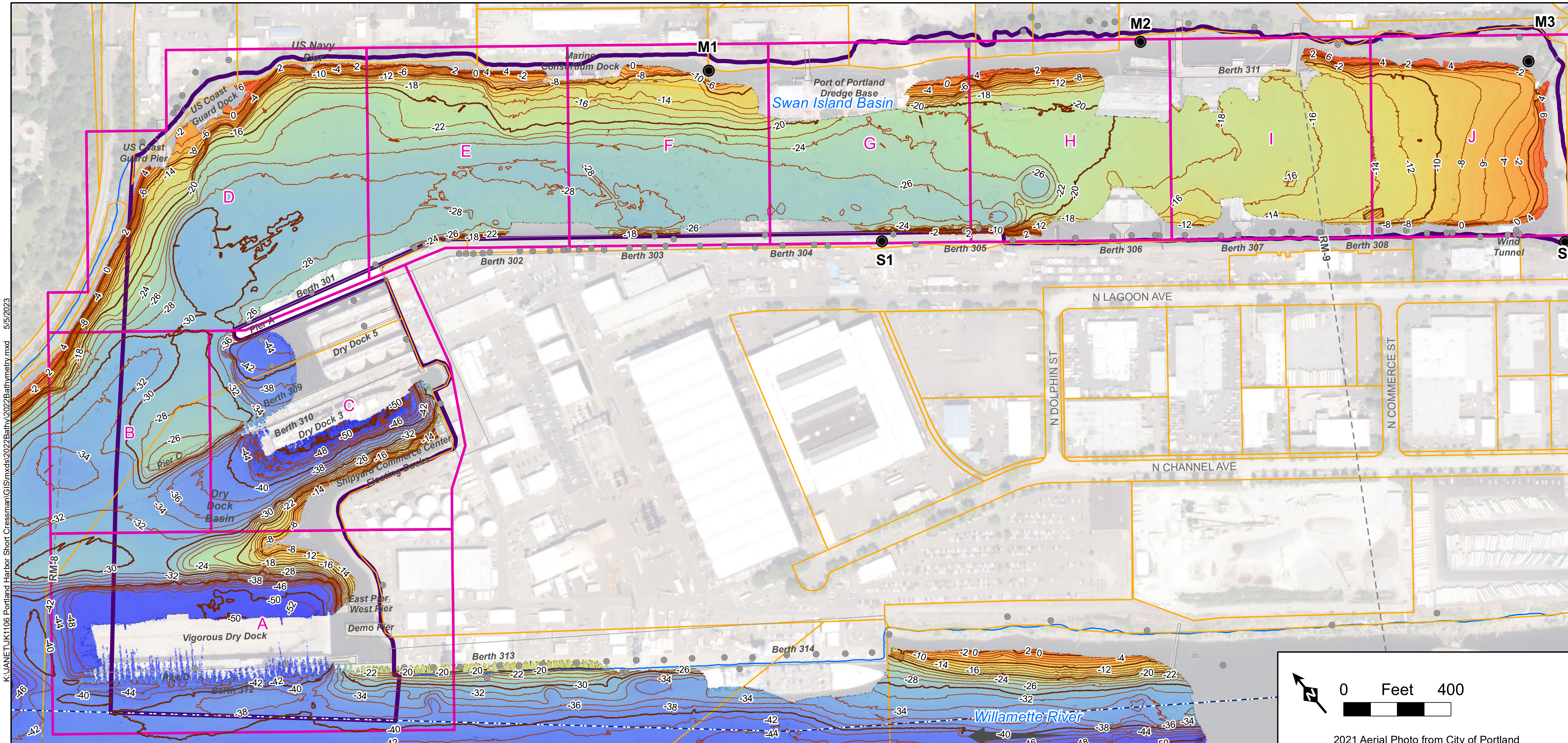

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- City Stormwater Outfall
- Non-City Outfall
- Bathymetry Zones
- River Mile (RM)
- Swan Island Sediment Decision Unit (SDU)
- Federal Navigation Channel (USACE, 2020)
- Docks and Structures
- Tax Lot Boundary
- Ordinary High Water (City of Portland,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

2022 Bathymetry (Feet NAVD88)

High : 8
0
-10
-20
-30
-40
-50
Low : -60

- 10-foot Contours 2022 Bathymetry (Feet NAVD88)
- 2-foot Contours 2022 Bathymetry (Feet NAVD88)

Notes:
NAVD88 – North American Vertical Datum of 1988
USACE – U.S. Army Corps of Engineers

Figure 3-1
Bathymetry Overview

Swan Island Basin

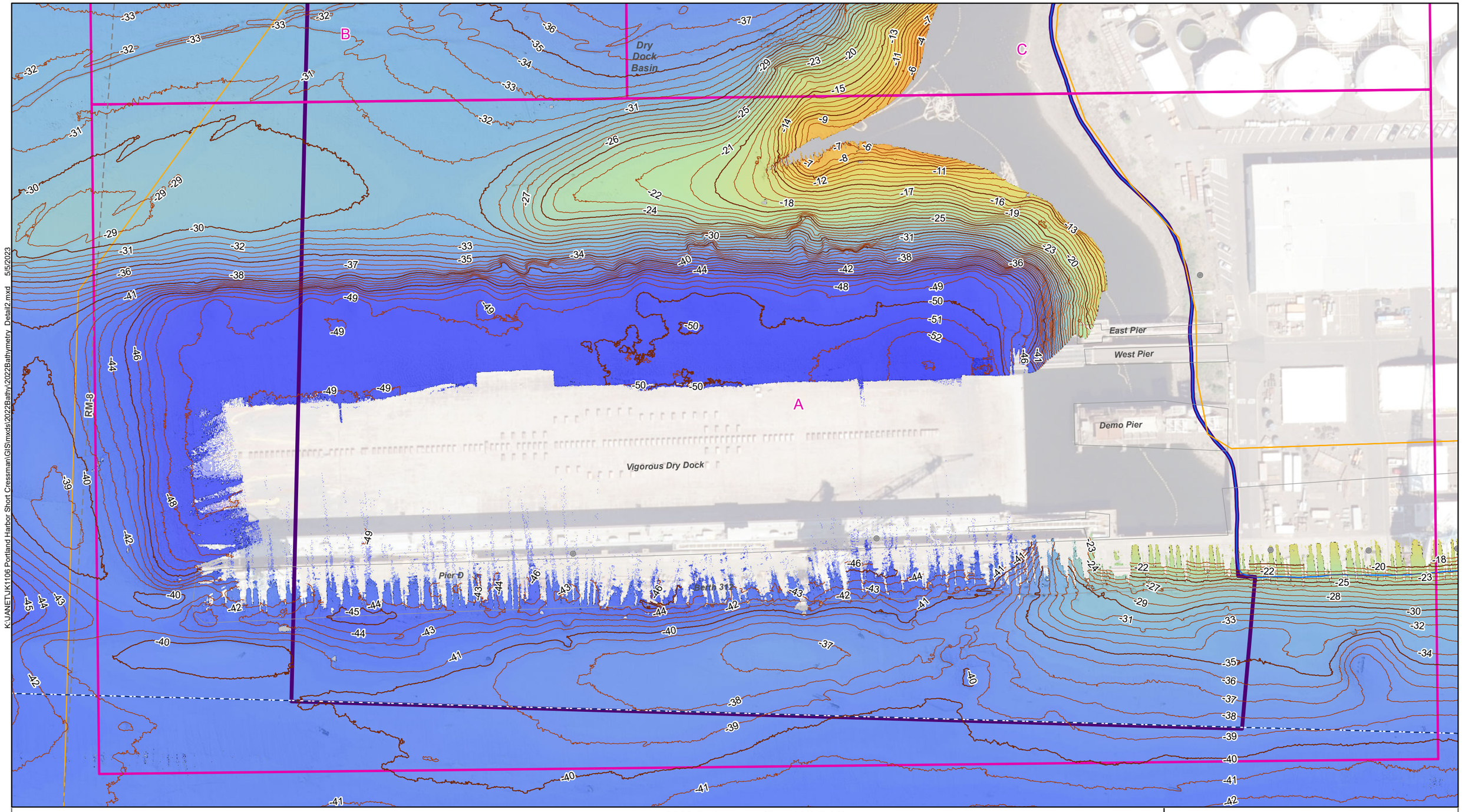

Figure 3-2

Bathymetry in Zone A

Swan Island Basin

PACIFIC groundwater GROUP
HGL
MOTT MACDONALD
BRIDGEWATER GROUP

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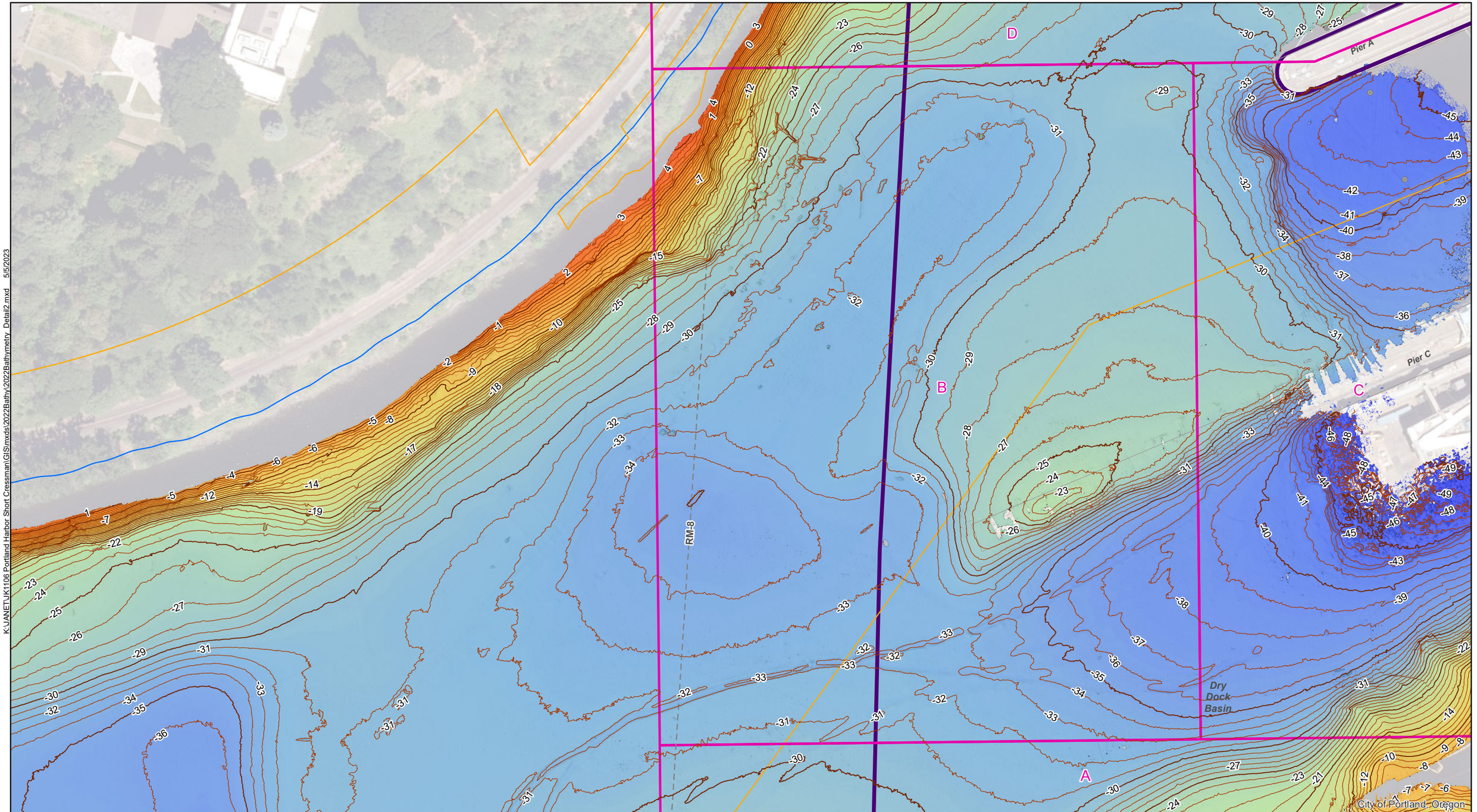

- Non-City Outfall
- River Mile (RM)
- Swan Island Sediment Decision Unit (SDU)
- Docks and Structures
- Tax Lot Boundary
- Ordinary High Water (City of Portland, 2013)
- Bathymetry Zones
- 5-foot Contours 2022 Bathymetry (Feet NAVD88)
- 1-foot Contours 2022 Bathymetry (Feet NAVD88)

2022 Bathymetry (Feet NAVD88)

High : 8 0 -10 -20 -30 -40 -50 Low : -60

Notes:
NAVD88 – North American Vertical Datum of 1988

0 Feet 100

2021 Aerial Photo from City of Portland

Figure 3-3

Bathymetry in Zone B

Swan Island Basin

PACIFIC groundwater GROUP
HGL MOTT MACDONALD
BRIDGEWATER GROUP

K:\JANET\JK1106 Portland Harbor Short Cressman\GIS\mxds\2022Bathy\2022Bathymetry_Detail2.mxd 5/5/2023

A
B
C
D
RM-8
Pier A
Dry Dock 5
Berth 309
Pier C
Berth 310
Dry Dock 3
Shipyard Commerce Center Floating Docks
Dry Dock Basin

- Non-City Outfall
- River Mile (RM)
- Swan Island Sediment Decision Unit (SDU)
- Docks and Structures
- Tax Lot Boundary
- Ordinary High Water (City of Portland, 2013)
- Bathymetry Zones
- 5-foot Contours 2022 Bathymetry (Feet NAVD88)
- 1-foot Contours 2022 Bathymetry (Feet NAVD88)

2022 Bathymetry (Feet NAVD88)

High : 8 | 0 | -10 | -20 | -30 | -40 | -50 | Low : -60

Notes:
NAVD88 – North American Vertical Datum of 1988

0 Feet 100

2021 Aerial Photo from City of Portland

Figure 3-4

Bathymetry in Zone C

Swan Island Basin

PACIFIC groundwater GROUP
HGL
MOTT MACDONALD
BRIDGEWATER GROUP

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US Navy Pier

US Coast Guard Dock

US Coast Guard Pier

Marine Consc

Berth 302

Berth 301

Pier A

A

B

C

D

E

F

City of Portland, Oregon

Non-City Outfall

Swan Island Sediment Decision Unit (SDU)

Docks and Structures

Tax Lot Boundary

Ordinary High Water (City of Portland, 2013)

Bathymetry Zones

5-foot Contours 2022 Bathymetry (Feet NAVD88)

1-foot Contours 2022 Bathymetry (Feet NAVD88)

2022 Bathymetry (Feet NAVD88)

High : 8 0 -10 -20 -30 -40 -50 Low : -60

Notes:
NAVD88 – North American Vertical Datum of 1988

0 Feet 100

2021 Aerial Photo from City of Portland

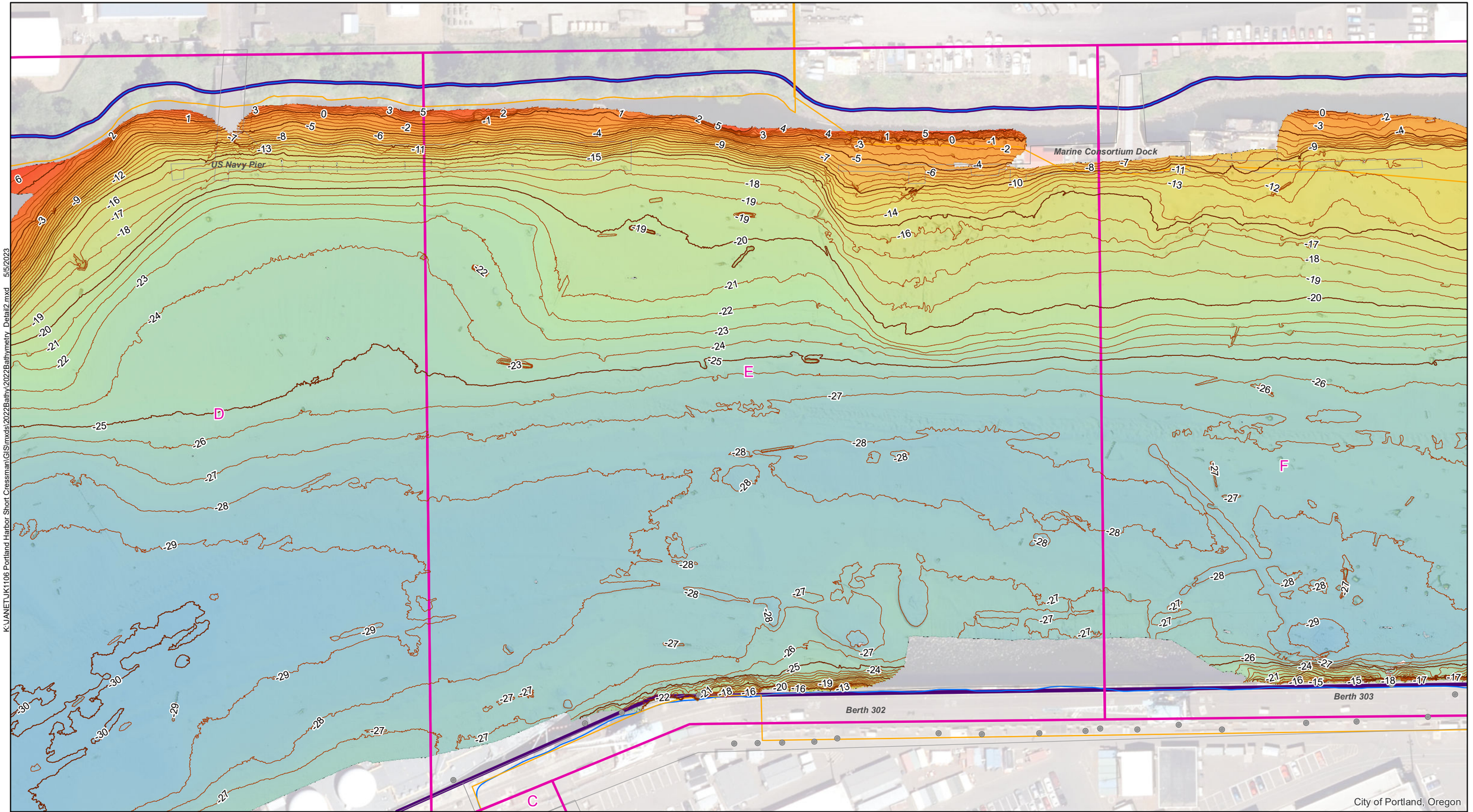
Figure 3-5

Bathymetry in Zone D

Swan Island Basin

PACIFIC groundwater GROUP
HGL MOTT MACDONALD
BRIDGEWATER GROUP

K:\ANET\UK1106 Portland Harbor Short Cressman\GIS\mxds\2022Bathy\2022Bathymetry_Detail2.mxd 5/5/2023



- Non-City Outfall
- Swan Island Sediment Decision Unit (SDU)
- Docks and Structures
- Tax Lot Boundary
- Ordinary High Water (City of Portland, 2013)
- Bathymetry Zones
- 5-foot Contours 2022 Bathymetry (Feet NAVD88)
- 1-foot Contours 2022 Bathymetry (Feet NAVD88)

2022 Bathymetry (Feet NAVD88)

High : 8 0 -10 -20 -30 -40 -50 Low : -60

Notes:
NAVD88 – North American Vertical Datum of 1988

0 Feet 100

2021 Aerial Photo from City of Portland

Figure 3-6

Bathymetry in Zone E

Swan Island Basin

PACIFIC groundwater GROUP
HGL
MOTT MACDONALD
BRIDGEWATER GROUP

K:\JANET\JK1106 Portland Harbor Short Cressman\GIS\mxds\2022Bathy\2022Bathymetry_Detail2.mxd 5/5/2023

Marine Consortium Dock

M1

Swan Island Basin

Port of Portland Dredge Base

E

F

G

Berth 302

Berth 303

Berth 304

City of Portland, Oregon

City Stormwater Outfall

Non-City Outfall

Swan Island Sediment Decision Unit (SDU)

Docks and Structures

Tax Lot Boundary

Ordinary High Water (City of Portland, 2013)

Bathymetry Zones

5-foot Contours 2022 Bathymetry (Feet NAVD88)

1-foot Contours 2022 Bathymetry (Feet NAVD88)

2022 Bathymetry (Feet NAVD88)

High : 8 0 -10 -20 -30 -40 -50 Low : -60

Notes:
NAVD88 – North American Vertical Datum of 1988

N

0 Feet 100

2021 Aerial Photo from City of Portland

Figure 3-7

Bathymetry in Zone F

Swan Island Basin

PACIFIC groundwater GROUP

HGL

MOTT MACDONALD

BRIDGEWATER GROUP

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Swan Island Basin

Port of Portland Dredge Base

M1

S1

Berth 304

Berth 305

F

G

H

City of Portland, Oregon

- City Stormwater Outfall
- Non-City Outfall
- Swan Island Sediment Decision Unit (SDU)
- Docks and Structures
- Tax Lot Boundary
- Ordinary High Water (City of Portland, 2013)
- Bathymetry Zones
- 5-foot Contours 2022 Bathymetry (Feet NAVD88)
- 1-foot Contours 2022 Bathymetry (Feet NAVD88)

2022 Bathymetry (Feet NAVD88)

High : 8 | 0 | -10 | -20 | -30 | -40 | -50 | Low : -60

Notes:
NAVD88 – North American Vertical Datum of 1988

0 Feet 100

2021 Aerial Photo from City of Portland

Figure 3-8

Bathymetry in Zone G

Swan Island Basin

PACIFIC groundwater GROUP
HGL
MOTT MACDONALD
BRIDGEWATER GROUP

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Port of Portland Dredge Base

M2

Berth 311

Berth 306

Berth 307

Berth 305

S1

G

H

I

City of Portland, Oregon

City Stormwater Outfall
Non-City Outfall
Swan Island Sediment Decision Unit (SDU)

Docks and Structures
Tax Lot Boundary
Ordinary High Water (City of Portland, 2013)
Bathymetry Zones
5-foot Contours 2022 Bathymetry (Feet NAVD88)
1-foot Contours 2022 Bathymetry (Feet NAVD88)

2022 Bathymetry (Feet NAVD88)
High : 8 0 -10 -20 -30 -40 -50 Low : -60

Notes:
NAVD88 – North American Vertical Datum of 1988

0 Feet 100
2021 Aerial Photo from City of Portland

Figure 3-9

Bathymetry in Zone H

Swan Island Basin

PACIFIC groundwater GROUP
HGL
MOTT MACDONALD
BRIDGEWATER GROUP

K:\ANET\UK1106 Portland Harbor Short Cressman\GIS\mxds\2022Bathy\2022Bathymetry_Detail2.mxd 5/5/2023

M2

Berth 311

Berth 306

Berth 307

Berth 308

RM-9

I

J

City of Portland, Oregon

- City Stormwater Outfall
- Non-City Outfall
- River Mile (RM)
- Swan Island Sediment Decision Unit (SDU)
- Docks and Structures
- Tax Lot Boundary
- Ordinary High Water (City of Portland, 2013)
- Bathymetry Zones
- 5-foot Contours 2022 Bathymetry (Feet NAVD88)
- 1-foot Contours 2022 Bathymetry (Feet NAVD88)

2022 Bathymetry (Feet NAVD88)

High : 8 0 -10 -20 -30 -40 -50 Low : -60

Notes:
NAVD88 – North American Vertical Datum of 1988

0 Feet 100

2021 Aerial Photo from City of Portland

Figure 3-10

Bathymetry in Zone I

Swan Island Basin

PACIFIC groundwater GROUP
HGL
MOTT MACDONALD
BRIDGEWATER GROUP

K:\JANET\JK1106 Portland Harbor Short Cressman\GIS\mxds\2022Bathy\2022Bathymetry_Detail2.mxd 5/5/2023

Berth 311
Berth 307
Berth 308
Wind Tunnel
M3
S2
RM-9
H
I
J

City of Portland, Oregon

City Stormwater Outfall
Non-City Outfall
River Mile (RM)
Swan Island Sediment Decision Unit (SDU)

Docks and Structures
Tax Lot Boundary
Ordinary High Water (City of Portland, 2013)
Bathymetry Zones
5-foot Contours 2022 Bathymetry (Feet NAVD88)
1-foot Contours 2022 Bathymetry (Feet NAVD88)

2022 Bathymetry (Feet NAVD88)
High : 8 0 -10 -20 -30 -40 -50 Low : -60

Notes:
NAVD88 – North American Vertical Datum of 1988

0 Feet 100
2021 Aerial Photo from City of Portland

Figure 3-11
Bathymetry in Zone J
Swan Island Basin

PACIFIC groundwater GROUP
HGL
MOTT MACDONALD
BRIDGEWATER GROUP

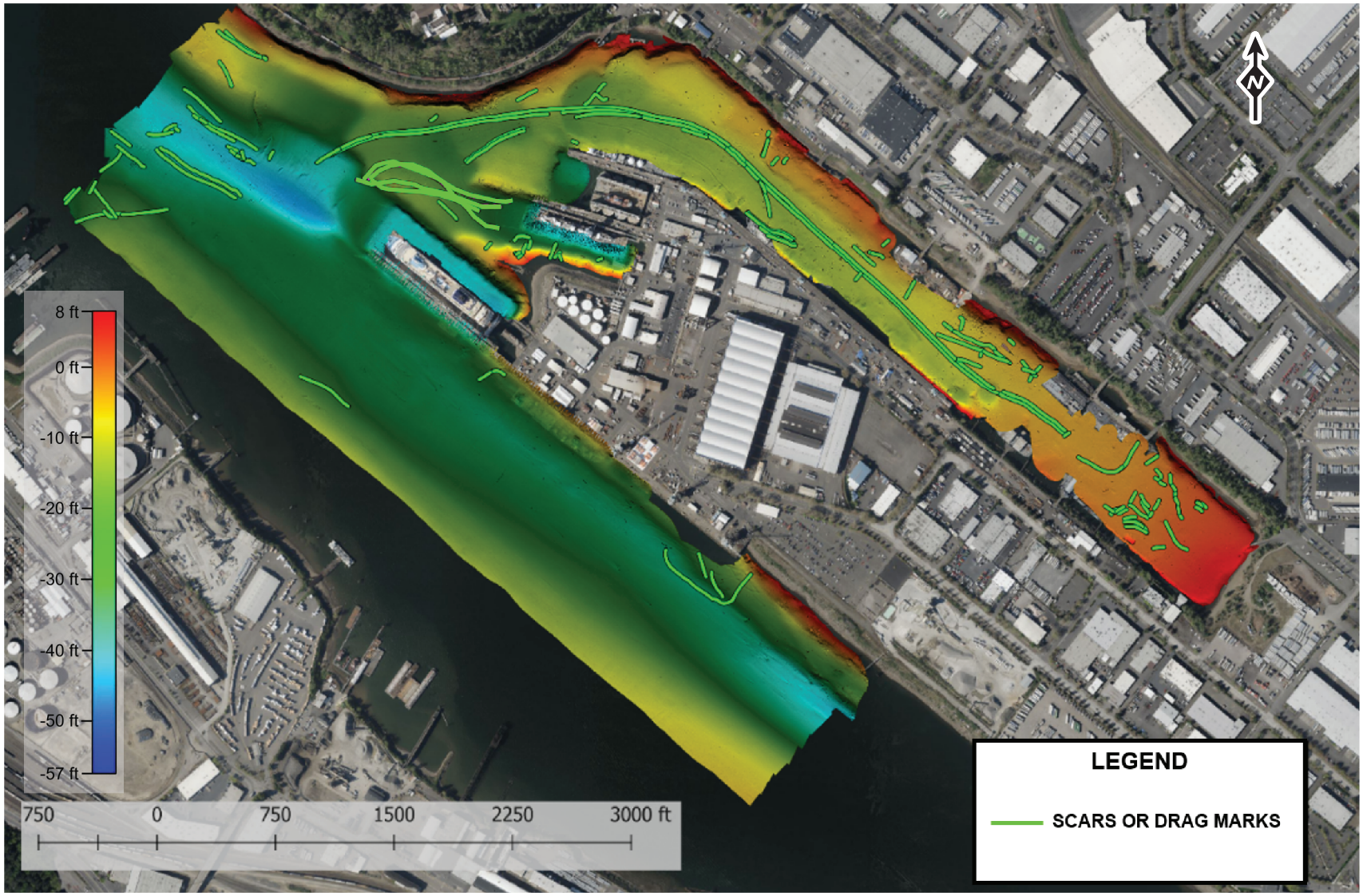

Figure 3-12
Scarring and Drag Marks

Swan Island Basin

PACIFIC groundwater GROUP
HGL
M MOTT MACDONALD
BRIDGEWATER GROUP

ATTACHMENTS

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ATTACHMENT A

ELECTRONIC DATA DELIVERABLE

The complete multibeam bathymetry survey dataset is available at this link:
Attachment A Electronic Data Deliverable

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