Portland General Electric Harborton Restoration: Year 3 Monitoring Report

Portland General Electric

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List of Acronyms and Abbreviations

ACM	Active Channel Margin
CPD	City of Portland Datum
DO	Dissolved Oxygen
EM	Effectiveness Monitoring
EMR	Effectiveness Monitoring Report
FWS	U.S. Fish and Wildlife Service
Harborton	PGE's Harborton Property
IMR	Implementation Monitoring Report
LWM	Large Woody Material
MAMP	Monitoring and Adaptive Management Plan
NMFS	National Marine Fisheries Service
NRD	Natural Resource Damage
ODA	Oregon Department of Agriculture
ODFW	Oregon Department of Fish and Wildlife
OHW	Ordinary High-Water Elevation
OLW	Ordinary Low-Water Elevation
PGE	Portland General Electric
Project	PGE's Harborton Restoration Project
Property	PGE's Harborton Property
RCG	Reed canarygrass
Site	PGE's Harborton Restoration Project
Trustees	Portland Harbor Natural Resources Trustee Council

Executive Summary

In 2020, Portland General Electric (PGE) began construction of the Harborton Restoration Project (Project or Site) and finished all work including the plantings in 2021. As part of the restoration work, PGE is performing monitoring and maintenance of the Site for ten years. Components of the Project include:

Habitat Area (acres):	53.4
Off-channel Habitat (acres):	28
Riparian Buffer (acres):	13.5
Lowest Elevation/Highest Elevation (ft):	8/44
Large Wood Pieces:	438
Vertical Snags:	73
Mink Rock Piles:	12

The monitoring program covers the following elements:

- Geomorphology
- Hydrology and Hydraulics
- Sedimentation
- Vegetation
- Water Quality
- Fish and Wildlife

Monitoring results indicate the Site is meeting or exceeding six of eight performance standards as summarized in the following table. Standards not met include surface water extent in Sub Area 4 during certain dry periods, and one of the thirteen vegetation performance standards.

Table 1. 2023 Performance Standard Summary

Performance Standards	Met/Not Met	Adaptive Management Needed	Notes
Retention of Habitat Features/Elements	Met	No	
Extent of ACM Habitat	Met	No	
Extent and Stability of Channel, Streambank, and Floodplain Habitat	Met	No	
Preservation of Fish Passage/Fish Accessibility	Met	No	Fish passage at outlet seasonally affected by Willamette River, Constructed channel is barrier free.
Retention of Wetland Hydrology/Habitat for Use by Northern Red-legged Frog	Not Met	No	Low water in Feb, May, and week 4 in June. Water levels are weather dependent and not managed by PGE.
Extent of High Flow Inundation	Met		
Vegetation Density/Diversity/Cover	Not Met	Yes	11 of 16 Standards Met
Reed Canarygrass (RCG) Across Relevant Habitats	Met	Yes	RCG management planned for 2024

1. Introduction

This document is the Year 3 Effectiveness Monitoring Report (EMR) prepared for the Portland General Electric Harborton Restoration Project (Project). This report documents habitat conditions for the PGE Harborton Habitat Restoration Project (Harborton). The Portland Harbor Natural Resources Trustee Council (Trustee Council) developed the Portland Harbor Natural Resources Damages (NRD) Monitoring and Stewardship Framework (M&S Framework; Trustee Council 2014) to aid Project Implementers (PIs) in designing site-specific monitoring and stewardship plans for NRD restoration projects. As part of the guidance, the Trustee Council presented an EMR model detailing required monitoring over an initial performance period of 10 years following construction/implementation or as needed until performance standards are met. This EMR presents performance goals, monitoring methods and monitoring results, management efforts, and adaptive management strategies to promote and improve ecological functions.

Background

Construction to restore habitat functions at the 53.4-acre Site occurred from June 2020 to February 2021 (Figure 1). Restoration activities included earthwork to create Willamette River floodplain and a new stream channel, upland forest habitat preservation, native plant installation, weed management, and wildlife habitat structure installation. Supplemental restoration work not in the approved Harborton Habitat Development Plan but performed at the request of the Trustee Council included placing additional large woody material in July 2021 and adding two mink rock piles in October 2021. Year 3 site effectiveness monitoring commenced in January 2023 and was complete in November 2023, with the exception of supplemental data requested by the Trustee Council collected in 2024.

The Project's restoration goals are:

- Provide seasonal fish passage opportunities between Sub Areas 3, 4, and the Willamette River through construction of the new North Channel
- Provide 28 acres of seasonally available off-channel habitat associated with the North Channel, and an additional 13.5 acres of riparian buffer within the floodplain for out-migrating juvenile Chinook salmon (*Oncorhynchus tshawytsch)* through excavation and re-grading of portions of the Site.
- Enhance aquatic, riparian, and upland habitat in and proximate to the new North Channel through installation of habitat enhancement features/elements, invasive species management, and re-vegetation with native emergent, herbaceous, shrub, and tree species.
- Preserve existing wetlands in areas utilized by northern red-legged frogs (*Rana aurora aurora*) and other wildlife.

- Create new wetlands in upland areas adjacent to known red-legged frog habitat through excavation and removal of historically imported fill in Sub Area 3, installation of aquatic and riparian habitat enhancement features/elements, management of invasive plant species, and re-vegetation with native emergent, herbaceous, shrub, and tree species.

This report is organized into sections that generally follow the order of monitoring elements described in the Monitoring and Adaptive Management Plan (MAMP) (PGE 2021).

2. Monitoring Requirements

2.1 EFFECTIVENESS MONITORING

The objective of effectiveness monitoring (EM), as described in the MAMP, is to document the change in habitat conditions occurring as habitat enhancement measures mature and evolve. PGE designed the EM in accordance with the "Monitoring Plan Study Design" guidance provided by the Trustee Council (Trustee Council 2014) with modifications approved by the Trustee Council and additional minor adjustment described in the sections below. The MAMP describes specific methods and performance standards used to measure and evaluate habitat elements. The EM study examined the following monitoring elements:

- Geomorphology
- Hydrology and Hydraulics
- Sediment
- Vegetation
- Water Quality
- Fish and Wildlife

The following section includes descriptions of each monitoring element, methods, results, performance standards, and a discussion of findings. Fixed monitoring points in key locations, and aerial orthomosaic images were the basic tools used to collect site data.

2.2 GEOMORPHOLOGY

Geomorphological features are those physical features that add complexity and dimension to Harborton. They include landscape patterns and irregularities, structures from natural materials, masses and voids that influence wind, water, temperature, and any number of other physical elements. Monitoring and assessment involve topographic surveys, photography, hydrology, hydraulics, and visual inspections to verify that the total quantity of habitats proposed occur on site, that there are no barriers to fish access, and that structural habitat features installed during Site construction remain functional. The following sections include descriptions of specific monitoring protocol.

2.2.1 Retention of Installed Habitat Features/Elements

Retention of installed habitat features/elements is studied in years 1, 3, 5, 7, and 10. PGE compared aerial images from November 2020 and July 2023 to identify retention of structures, especially large woody material. Harborton retained all 12 mink rock piles and all 73 vertical snags. Slash piles (small twigs, branches, and bark) tucked in and around horizontal rootwads have depleted over time, likely due to site flooding. Most horizontal logs and rootwads are still intact. Some wood, mostly around the North Channel inlet, has shifted and relocated to other areas, while some large wood pieces appear to have been captured at the Site, likely drifting in during flood events. In all, 13 large woody pieces from near the North Channel outlet shifted or moved from their original location, and a total of 19 large wood pieces relocated or were captured at Harborton since 2020.

2.2.2 Extent of Active Channel Margin (ACM) Habitat

Extent of ACM habitat is examined in years 0, 1, 3, 5, 7, and 10. ACM habitat is defined as those natural habitat areas occurring below the ordinary high-water elevation (OHW), which is 18.0 feet CPD as determined by the Corps of Engineers. Natural habitat, (native plant assemblage and habitat structures) at and below this elevation is persistent and maturing. The native vegetation community created by this project is thriving as detailed in Section 2.5, and habitat structures (snags and large woody material) placed in ACM are stable and used by wildlife based on field observations.

The performance criterion for this monitoring element is that changes should be less than 10 percent ACM habitat or stream length. Greater changes trigger adaptive management or corrective action measures. Harborton has retained all the ACM habitat created by this project. Low elevations that make up the ACM area and the length of stream channel are all intact. Figure 2 shows as-built conditions/elevations; Figures 2A through 2J show survey elevations from October 2023. Figure 2k provides channel cross-section profiles. Note: 2021 cross-sectional data recorded channel width, channel bottom width, and water depths during field measurements. The assumption in 2021 was that channel depth was 1 foot as recorded on the as-built survey.

PGE conducted a ground-based, 2023 survey after a June 2023 LiDAR study of Harborton proved error-prone and not a reliable source on which to base elevation comparisons. LIDAR error is attributed to dense vegetation. The ground-based survey is accurate to within 1.5 cm. Based on these surveys, there are negligible elevation differences between 2020 constructed conditions and 2023 surveyed conditions. PGE has observed no evidence of slides, slumps, notable erosion or deposition, or other surface anomalies.

Peak seasonal flooding of the ACM in 2023 was 17.05 feet in elevation on May 19 (Figure 3). This event provided 24.3 acres of accessible open water habitat for fish, including outmigrating juvenile salmonids, to feed, rest, and cover.

Regarding open water measured at Harborton, in years when the Willamette River does not flood to OHW, or when it exceeds OHW there will be a shortfall or an exceedance, respectively, of the

flooded ACM acreage year to year. The 2023 estimate of 24.3 acres of flooded ACM is 86.8 percent of the anticipated 28 acres of flooded ACM in a normal year. PGE does not recommend adaptive management measures for Extent of ACM Habitat because the Site performance reflects the variability inherent in a natural, dynamic, large-river system.

2.2.3 Extent and Stability of Channel, Streambank, and Floodplain Habitat

Extent and stability of channel streambank, and floodplain habitat are examined in years 0, 1, 3, 5, 7, and 10. PGE compared current conditions to as-built conditions using the same topological study described in Section 2.2.2 above (Figure 2 set). Results indicate a stable environment except for a couple of anomalies. The area near the outlet of the North Channel shows elevation changes of 1-2 feet that fluctuate seasonally. This finding is consistent with observations of Willamette River sediments seasonally accreting then eroding along the shoreline in this location.

In contrast, Figure 4 is a heat map showing a comparison of 2020 elevation data to LIDAR-based data collected in October 2023. LIDAR was captured using a drone-mounted device. Findings were not dependable. Discrepancies as great as five feet were observed between the ground-based surveyed and LIDAR surveyed elevations. The most dramatic differences occur where vegetation is dense and varied and where terrain is relatively flat and even.

PGE conducted a field survey in October 2023 to measure site elevations, including channel dimensions at the ten permanent monitoring transects arrayed perpendicular to the channel (Appendix D). Field observations included examination for lateral migration or downcutting. Table 2 below includes results from 2023 and the 2021 survey for comparison.

Table 2. Extent and Stability of Channel, Streambank, and Floodplain Habitat

		Downstream End									Upstream End	
	Transect	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	Ave.
Bank-to-bank width (ft)	2021	6.5	7.1	7.1	6.8	7.3	7.1	7.2	6.9	7.2	6.8	7.0
	2023	6.8	6.8	7.2	7.0	7.2	7.4	7.2	7.2	7.3	7.0	7.1
Channel bottom width (ft)	2021	2.2	3.0	3.0	2.9	3.0	3.0	2.9	3.3	3.0	3.0	2.9
	2023	3.1	3.1	3.2	3.0	3.0	3.2	3.0	3.1	3.2	3.0	3.1
Channel bottom depth (ft)	2021	not measured										
	2023	0.6	1.1	1.2	1.0	0.8	1.1	0.9	0.9	1.0	1.1	1.0
Width Depth Ratio	2023	11.3:1	6.2:1	6:01	7:01	9:01	7.6:1	8:01	8:01	7.3:1	6.4:1	7.6:1

As-built (c. 2020) longitudinal channel slope was 0.409 percent as calculated by surveyed elevation difference from inlet to outlet, divided by channel length. Longitudinal channel slope in October 2023 was 0.406 percent. The channel bottom is essentially flat, with no elevational features that could present "jumps" for fish.

PGE has observed no evidence of lateral migration, bank erosion, or downcutting, and no discernible change in longitudinal slope since channel construction in 2020. Differences from 2021 to

2023 in bank-to-bank width and channel bottom width are minimal and likely due to differences in variations in field survey (e.g. staff rod placement/point capture). Visual observations and survey data from October 2023 indicate that there are no hydraulic jumps, barriers or other physical features that would inhibit fish movement in the channel. The only notable change in channel dimension appears near the outlet (Transect 1), which has a flatter width/depth ratio and shallower channel depth. This finding is consistent with observations of sediment deposition and erosion influenced by Willamette River flooding and longshore currents.

2.2.4 Preservation of Fish Passage /Fish Accessibility

PGE documented EM for fish passage by monitoring water levels and North Channel access to the upstream wetlands, and downstream to the Willamette River. PGE determined fish passage/accessibility based on observations of surface waters presence/absence at the upstream and downstream ends, and by looking for barriers such as accumulated debris, over-steep gradients, or head cuts. The Trustee Council requested that PGE measure water temperature in the channel to determine suitability for fish during periods when the North Channel is disconnected from the Willamette River. The probe measuring depths and temperatures at the mouth of North Channel was lost in 2023; equipment theft/vandalism is suspected. Consequently, temperature measurements from soon after July 12 to July 25, the period for which surface water was observed in the channel but connectivity to the Willamette River was blocked, are not available. PGE will harden or better conceal the probe deployed in this area for 2024 monitoring.

Methods

PGE referenced NOAA Fisheries' Anadromous Salmonid Passage Facility Design criteria (NOAA Fisheries 2008) to determine whether year 3 channel conditions allowed fish passage in the North Channel. PGE performed photomonitoring at the channel outlet monthly from February 24 and November 22. PGE observed sediment accretion/erosion at simple staff gauges (rebar rods marked in 6-inch increments) between June 22 when the gauges were installed, and November 22 to identify sediment accretion and erosion at the channel outlet. PGE recorded wetted channel length and connectivity to Sub Area 4 (upstream end) 10 times between January 4 and August 6 through direct observation.

PGE recorded channel surface water depths manually in the field between January 1 and August 6 at three locations along the channel length. Methods included visual observation of channel water depths at the deepest point of the channel cross section. Peak surface water areal extent, which is important in providing fish access to the Harborton interior habitat areas, is discussed in Section 2.3.

Surface water temperatures in the North Channel were measured by two remote, water data logging devices that measure depth and temperature. The devices were deployed at the upper and lower ends of the channel. As mentioned above, the downstream device was not located and presumed lost or stolen. Subsequently, all temperature measurements are from the upstream monitoring device. A new downstream probe will be placed in 2024.

Results

High water in 2023 at Harborton occurred on May 19. Backwater flooding from the Willamette River covered significant portions of the site during the third week of May, rising to its peak on the 19th, then receding through June 6 when backwatering from the Willamette River was no longer evident. Open water in Sub Areas 3 and 4, and channel connectivity between the two areas and the Willamette River provided the intended seasonal off-channel habitat that gave fish opportunity for access and movement to feed, shelter, and rest.

Table 3 below summarizes channel surface water connectivity to Sub Area 3, wetted channel length, periods when juvenile salmonids are likely present, and connectivity to the Willamette River observed in 2023 with additional 2024 observations requested by the Trustee Council. Observations were recorded in the field by PGE scientists. Appendix A provides a photographic record of channel conditions at various times in 2023.

Table 3. North Channel Connectivity Log

	Expected Migration Timing Past Harborton										
Month	Fry	Fingerlings	Yearlings	2023	Upstream Connected	Wetted Channel length	Downstream Connected	2024	Upstream Connected	Wetted Channel length	Downstream Connected
January				1/4/2023	Yes	1,850	Yes	1/4/2024	Yes	1,850	Yes
								1/23/2024	Yes	1,850	Yes
								1/26/2024	Yes	1,850	Yes
								1/30/2024	Yes	1,850	Yes
February								2/6/2024	Yes	1,850	Yes
								2/16/2024	Yes	1,850	Yes
								2/20/2024	Yes	1,850	Yes
							Yes	2/29/2024	Yes	1,850	Yes
March				3/21/2023	Yes	1,850	Yes	3/6/2024	Yes	1,850	Yes
							Yes	3/15/2024	Yes	1,850	Yes
							yes	3/19/2024	Yes	1,850	Yes
April				4/26/2023	Yes	1,850	Yes	4/2/2024	Yes	1,850	Yes
								4/8/2024	Yes	1,850	Yes
								4/10/2024	No	1,800	Yes
								4/12/2024	No	1,770	Yes
								4/19/2024	No	1,700	Yes
May				5/11/2023	No	1,780	Yes	5/6/2024	Yes	1,850	Yes
				5/19/2023	Yes	1,850	Yes	5/10/2024	Yes	1,850	Yes
				5/23/2023	No	1,800	No	5/24/2024	No	1,500	Yes
June				6/12/2023	No	1,530	No	6/7/2024	No	1,550	Yes
								6/19/2024	No	1,550	Yes
July				7/12/2023	No	650	No	7/5/2024	No	880	No
				7/25/2023	Dry Channel			7/9/2024	No	300	No
								7/13/2024	Dry Channel		
August				no data							
September				9/5/2023							
				9/20/2023							
				9/29/2023	No	1,100	Yes				
October				10/2/2023	No	1,550	Yes				
				10/13/2023	No	1,620	Yes				
				10/20/2023	No	1,650	Yes				
November				11/22/2023	No	1,750	Yes				
				11/29/2023	Yes	1,850	Yes				
December				12/9/2023	Yes	1,850	Yes				

KEY:
- Juvenile Salmonid Potentially Present
- Fish Accessible
- Not Fish Accessible
- Potential Stranding Condition

As-built conditions were constructed so that fish passage into North Channel from the Willamette and from Sub Area 4 is not impeded due to excessive gradient, depth, and channel velocity. Field observations indicate no significant changes to as-built channel conditions; observed slope and velocity conditions are within acceptable fish passage ranges. Table 4 below shows observations of sediment accretion/erosion and channel connectivity of the North Channel confluence with the Willamette River. Accretion/erosion depths were determined using a rebar gauge installed at the channel outfall.

Table 4: Accretion/Erosion at North Channel Outlet

Date	Sediment Depth Accretion/(Erosion)	Material	Channel connected?
4/26/2023	n/a		yes
5/17/2023	n/a		yes
6/12/2023	n/a		yes
6/23/2023*	0"	fines	yes
7/13/2023	2"	fines	yes
9/5/2023	7"	fines	no (dry)
9/28/2023	7"	fines	yes
10/8/2023	7"	fines	yes
10/13/2023	7"	fines	yes
11/26/2023	-1"	fines	yes

*date of rebar gauge installation (baseline)

Sediment depths displayed in Table 4 are compared to baseline conditions established by installation of the rebar gauge on June 23, 2023. Data was not available for August 2023. Dates where 7" of fines are recorded and when the channel is connected are indicative of North Channel migrating away from the rebar gauge to a newly established channel.

The North Channel outfall to the Willamette River is the primary dynamic fluctuating channel feature. Interaction with Willamette lateral shoreline flow, tidal fluctuations, backwater flooding, and sediment loading create variations in outfall conditions throughout the year.

In 2022, the Willamette River deposited coarse gravels at the channel outlet. That year, the North Channel retained active flow through the summer, allowing the channel to migrate laterally around the gravel deposition to form a new, braided shoreline connection. This feature was reformed into a single-thread channel by a rain event on September 27-28, 2022, that increased North Channel volume and velocity, causing the new channel outlet configuration.

By comparison, the North Channel went dry in late July 2023 which allowed fine sandy sediments deposited by the Willamette River to accrete at the North Channel outlet. This sand bar remained relatively static as the Willamette River levels receded over the summer, until the first substantial rain event in September which rewetted the channel and allowed flow to erode the sand bar and

reconnect to the Willamette River. These types of variations within the lower channel and its outlet are expected and will continue to be influenced by weather and other related factors. Station 1 is near the North Channel-Willamette River confluence, Station 3 is near the upstream end of North Channel, and Station 2 is at the approximate channel midpoint.

Table 5. North Channel Maximum Water Depths (inches)

Station	5-May	16-Jun	5-Jul	28-Aug	29-Sep	20-Oct	27-Oct
1	*	13.5	6.5	dry	4.0	4.0	3.25
2	11.0	6.0	dry	dry	1.0	1.0	0.75
3	6.5	dry	dry	dry	dry	dry	dry

*Water measurement inaccessible- flood conditions, depth estimated to be >48".

Performance Standard

The performance standard is for the North Channel to not have fish passage barriers, as defined in NOAA Fisheries' Anadromous Salmonid Passage Facility Design (NOAA Fisheries 2008).

Discussion

The performance standard for fish passage was met in the constructed channel. No barriers, jumps, steep gradients, or other impediments to fish passage are present in the North Channel. Fine-sandy material deposited by the Willamette River formed on the beach below the North Channel outlet after the channel went dry but was scoured out when North Channel was re-wetted following a rain event in September.

PGE expressed concern to the Trustee Council in 2022 that the Willamette River could create a coarse-grained (gravel-sized or greater) sediment bar forming a seasonal fish blockage at the mouth of North Channel. This blockage would only be a concern if discharge from the North Channel was not sufficient to erode the sediment deposition to reconnect surface waters to the Willamette. Observations to date have shown two consistent characteristics:

1) Sediment accretion caused by the Willamette River tends to be sandy or finer materials and not coarse-grained (gravelly or cobbly) sediments; and
2) When the North Channel has active flow and can provide fish access and habitat, it has eroded sediments deposited by the Willamette River at the North Channel outfall, maintaining connectivity.

Sediment deposited by the Willamette River at the mouth of North Channel observed in mid- to late summer is important when considering channel function. This bar creates a fish barrier, but occurs during periods when juvenile salmonids are not likely to be present, nor are conditions in the channel likely to attract outmigrating juvenile salmonids.

Formation of this bar was anticipated in the project design given that there is no perennial upstream water source for North Channel. Seasonal connectivity during juvenile salmonid outmigration followed by loss of connectivity in summer mirrors natural Willamette Tributary habitat. Based on field observations captured in Table 3 above, North Channel is active and accessible to juvenile salmonids during nearly the entire period salmonids are expected to migrate past Harborton. The site is functioning naturally and as designed. Given the variability of weather patterns year-to-year and fluctuating Willamette River discharge, fish accessibility observed during salmonid outmigration is a positive outcome.

2.3 HYDROLOGY AND HYDRAULICS

Water levels in the North Channel, off-channel areas, and shallow water habitat are important to the overall habitat function of the Site. Many valuable habitat functions depend on the ways water functions and interacts at the Site. This section describes monitoring results for water depth and surface water duration and extent in Sub Area 4 and a portion of Sub Area 3 wetlands from January to July, the key period for amphibian breeding and rearing. At the request of the Trustee Council following the review of the 2021 Year 1 Monitoring Report, PGE tracked North Channel connectivity to Sub Area 4, length of the dry channel, and made measurements of water depth in the channel at Water Monitoring Stations (see Figure 5).

2.3.1 Retention of Wetland Hydrology/Habitat for Use by Northern Red-Legged Frog

Effectiveness Monitoring (EM) was conducted to ensure there was no substantial loss of wetland area, hydroperiod, and function which are important for the existing population of northern red-legged frogs. EM of wetland hydrology included measurements to document the depth and areal extent of open water wetlands in Sub-Area 4 and the adjacent wetland in Sub Area 3 that is an extension of frog habitat, from January through July to determine if wetlands persist at sufficient depths to support frog egg-laying and metamorphosis from the tadpole to froglet phase. EM of northern red-legged frog habitat is achieved through monitoring hydroperiod, wetland/open water area and depth, and duration from Year 1 through Year 10 of the Performance Period. Suitable amphibian habitat within the property boundaries was quantified based on assessment of standing water (areal extent, duration, and depth) necessary for frog egg-laying and larva metamorphosis (transformation from tadpoles to frogs).

Methods

Water level data was collected using HOBO remote barometric pressure readers georeferenced to site-specific topographic data and to specific river discharge levels (i.e., OHW, OLW, flood stage, and low tide at MLW). An atmospheric HOBO was deployed to process and correct water elevations.

Two HOBO water level measuring devices were deployed to document water depth in Sub Area 4. The HOBO devices in Sub Area 4 wetland are in established, screened well casings used over the past several years. Depth readings were compared to Site elevations to determine average monthly surface water depths from January through July, and average weekly surface water elevations in June. Depth measurements were used to calculate areal extent of flooding and duration of surface water based on correlating depth to Site topography. Areal surface water extent was then compared to monthly/weekly averages established during baseline studies (see Table 6 below).

Results

Table 6 shows areal extent and water depths for Sub Area 4 for the monitoring period of January through July, with the critical development period in June shown week to week. Appendix B includes maps of average surface water during that period.

Table 6. Water Areal Extent and Depth

Month		Areal Extent (ac) Sub Area 4			Depth (ft)		
		Standard	Measured	% of Std.	Standard	Measured	% of Std.
Jan		9.4	8.46	90%	3.4	3.55	104%
Feb		10.03	5.71	57%	3.52	3.01	86%
Mar		10.55	8.84	84%	3.66	3.66	100%
Apr		9.55	8.74	92%	3.21	3.63	113%
May		8.01	1.44	18%	2.63	2.18	83%
Week in June	1	2.84	1.15	40%	1.4	2.01	144%
	2	1.76	1.89	107%	1.1	2.24	204%
	3	1.29	1.64	127%	0.88	1.32	150%
	4	1.02	0.25	25%	0.75	0.1	13%
July		0.11	0	0%	0.48	0	0%

Performance Standard

From January through May, areal extent and depth of the wetland should be no less than 80 percent of the baseline (standard) measurements (<20 percent change from baseline, defined by pre-project monthly averages). In June, the areal extent and depth of the wetland should be no less than 90 percent of the baseline measurements, as defined by pre-project weekly median (weeks 23-26 as described in PGE's November 19, 2019 memo).

Discussion

The performance standards for areal surface water extent were met during 5 of the 10 time periods monitored; the water depth performance standard was met during 8 of the 10 time periods monitored. Drier than normal conditions in 2023 led to smaller and less persistent open water compared to baseline estimates, apart from the second and third weeks of June. Peak water in 2023 occurred in mid-May, followed by a rapid drying period through late June. The high-water event at

Harborton occurred on May 19 when water levels in the Willamette River (Morrison St. Bridge gauge) and Columbia River (Vancouver, WA gauge) peaked at 13.7 and 13.54 feet, respectively. During this period, the water elevation at Harborton reached 17.05 feet. By May 29, water elevations at these two gauging stations dropped to 6.94 and 7.41 feet, respectively. Observations during fieldwork verified a correlating surface water drawdown. For comparison, in 2022 the Willamette River was above 13.7 feet from June 11 through June 21, eventually peaking on June 14 at 16.36 feet and staying above 7.0 feet until July 4th.

A consequence of the rapid drying period is that site hydrology in May resembled that of baseline conditions in June. The relocation of City of Portland hydrant water flushing away from Sub Area 4 may have contributed to low water in May and part of June but would have no bearing on low water in February because the City operates the hydrant autoflush system from March/April up to the first hard-freeze period of fall/winter. In 2022, the autoflush system contributed approximately one acre-foot of water per month to the storm system, most of which discharged to Sub Area 4. None of the autoflush discharge entered this storm system in 2023.

Amphibian egg-mass viability from reduced surface water area and depth could be impacted under certain conditions. Egg-mass stranding during a rapid drawdown could cause larval mortality and a reduction of the froglet population for that year. Drier than normal weather and low Willamette River flow in February led to a surface water area that was 57 percent of baseline. Water levels through February, however, were consistent week-to-week, which is important when considering egg mass viability. PGE performed the 2023 egg mass survey on February 17 which coincided with the low water elevation for the month (3.00 feet). No stranded (non-submerged) egg masses were noted during the survey, so egg-mass stranding does not appear to be a concern. The smaller than baseline open water area in May resembles conditions found in June. As discussed in Section 2.7.6 below, northern red-legged frog tadpoles captured on April 14 had formed leg buds, indicating development from tadpole to froglet was advancing prior to loss of open water in late June and July.

2.3.2 Extent of High Flow Inundation

Extent of high flow inundation is used to assess the extent of Active Channel Margin (ACM). ACM is that portion of the river's edge that is located at the interface of unwetted shoreline and shallow water and occurs from the OHW mark to OLW. Young-of-the-year Chinook move in association with the shoreline edge, thus areal extent of inundation is important.

Methods

High flow inundation was assessed by taking the highest water depth reading from HOBOs deployed to the site and creating an orthophoto image showing open water extent correlated to that site elevation.

Results

The highest measured water elevation was 17.05 feet CPD on May 19, 2023, which is 95 percent of the 2-year flood elevation of 18.0 feet.

Performance Standard:

The Performance Standard for this monitoring element is <20% reduction from baseline.

Discussion

The performance standard was met. High water inundation in 2023 was 95 percent of the baseline high flow of 18.0 feet defined in the HDP, which meets the standard of no less than 20 percent divergence from baseline. The observed high flow elevation correlated to an estimated surface water area of 24.3 acres, 87 percent of the estimated 28 acres of ACM at 18.0 feet CPD.

2.4 SEDIMENT

Sediment monitoring in the North Channel involved two methods: 1) lab analysis of grab samples collected from the channel bed, and 2) modified Wollman Pebble Count method at ten locations along the channel.

Grab samples of channel sediments were collected from two locations by USFWS on 6/30/2023 as part of annual lamprey monitoring. Samples received by ALS Environmental (Kelso, WA) lab on 8/9/23 were analyzed for grain size using Puget Sound Estuary Program Protocol (Washington Dept. of Ecology, 2015). Table 7 below provides results of the lab analyses on the two samples.

Table 7 - North Channel Sediment Grain Size Analysis

Description	% Composition by Weight	
	Sample 1	Sample 2
Gravel	6.31	100.56
Very Coarse Sand	3.28	0.02
Coarse Sand	5.95	0.09
Medium Sand	35.19	0.14
Fine Sand	43.6	0.14
Very Fine Sand	1.47	0.32
62.5 µm	1.57	0.12
31.3 µm	0.6	0.49
15.6 µm	0.53	0.94
7.8 µm	0.15	0.02
3.9 µm	0.34	0.02
1.95 µm	0.07	0
<0.98 µm	0.22	0.07

Wollman Pebble Count method is for wadable streams and involves walking transects perpendicular to the channel. At each step along the transect, the researcher will reach down and touch the sediment in front of the toe of their foot, then record the diameter of the sediment at that location. The Wollman method was modified for Harborton given the narrowness of the channel. The modified method involves a sample at center channel of the sample point, followed by three samples taken in a zigzag pattern on the upstream and downstream sides of the central point. The zigzag pattern is to try to eliminate bias from sediments unevenly distributed along inside or outside channel bends. Results of the modified pebble count are included in Table 8 below. Transects start from the outlet (Transect 1) and continue upstream. Channel sample locations coincide to where vegetation transects shown on Figure 6 cross the stream channel.

Table 8. 2023 Channel Transect Grain Size Analysis

	Grain Size Count				
Transect	*Cobble*	*Coarse Gravel*	*Fine Gravel*	*Sand*	*Fines*
1			*2*	*5*	
2			*3*		*4*
3			*2*		*5*
4			*2*		*5*
5	*1*				*6*
6					*7*
7					*7*
8		*1*		*1*	*5*
9		*1*			*6*
10			*2*		*5*

Fine sediments comprise the greatest proportion of grain sizes encountered in the channel. This finding is consistent with what one might expect in a low-gradient, low energy channel that experiences a mix of backwatering and seasonal discharge.

2.5 VEGETATION

EM of vegetation consisted of sampling across the entire Site to evaluate establishment, enhancement, and conservation of native vegetation. Vegetation assemblage/starting conditions that were monitored and evaluated include the following:

- Upland Forest Establishment
- Upland Scrub-Shrub Establishment
- Riparian Forest Establishment
- Riparian Forest Enhancement/Conservation
- Wetland (ACM) Establishment
- Wetland (ACM) Enhancement/Conservation

2.5.1 Vegetation Assessment Methods

EM of vegetative community development employed 2 line-intercept transect approaches. The first approach collected data on all habitats across the Site equally using the general habitat assessment configuration of the line-intercept methodology (Figure 7). The second approach gathered vegetative data specifically within the ACM of the North Channel on Site using the stream habitat assessment configuration of the line-intercept method (Figure 6). Methods and results for each of the two line-intercept transects approaches are described in the following sections.

The Trustee Council's Monitoring & Stewardship Framework guidance document suggests using belt transects to estimate shrub cover. In the MAMP, PGE instead proposed using 100-meter line-intercept sample transects (Bonham 1989) as described in the Methods section below.

Each habitat class has a minimum of 10 permanent monitoring plots located along linear transects, except for Upland Forest and Upland Scrub-Shrub which has a combined 10 monitoring plots due to limited acreage. A base transect was located along the southwestern border of the Site, parallel to NW Marina Way. Survey transects were established perpendicular to the base transects, at fixed 100-meter intervals. The location of the first survey transect was randomly established between 0-50 meters from the southeastern end of the base transect (Elzinga et al. 1998; Figure 7).

One-meter square plots are used to measure herbaceous vegetation; 5-meter circular plots are used to record woody plants. Establishment of specific plot locations were along parallel, equally spaced transects. The first plot in the transect was randomly located and subsequent plots were spaced at equal intervals along the transect. Interval spacing distances were adjusted for each habitat class to provide a minimum of 10 plots per class. Circular plots are centered around the permanent plot markers; square-meter plots are measured by orienting one side of the frame parallel to the Willamette River then, while facing the river, placing the lower right corner of the frame on the plot marker. The Willamette River is used for frame orientation because it provides a clear, efficient, repeatable reference when performing fieldwork.

Areas not covered by vegetation were recorded as bare substrate. Notation was made as to whether the bare substrate was open water, bare soil, or rock. Total cover in a plot was recorded as absolute values and therefore may exceed 100 percent due to layering.

For shrub and tree cover, the crowns are projected vertically. Distinct holes in the canopy were subtracted from the estimate. Plants overhanging into the sample plot, but that are rooted in an area that does not represent plot conditions or habitat classification, were subtracted from cover estimates. Plants that overhang into the sample plot that have the same habitat classification and plot condition were included in cover estimates. For example, a plot in emergent wetland that has overhanging canopy from a nearby upland area would not record canopy cover from those trees rooted in the upland area.

In shrub-dominated and forested systems, the number of live plants emerging from the ground for shrubs and the number of live plants for trees were counted. For multi-stemmed shrubs that form thickets, such as rose and Douglas spirea, a plant is counted as an individual if the stem originates from a single point in the ground and appears to support a root structure capable of sustaining that plant. A plant is counted if any part of the stem lies within the plot. Shrub and forested habitat classes are distinguished for stratification based on potential height, not actual height. Seedlings and woody sprouts will be counted as shrubs or trees. Areas with a predominance of tree species, regardless of current size, will be considered forested habitat.

Data for each plot was entered into an excel spreadsheet that included the following elements:

- Plot ID
- Plant species
- Plant strata (herb, shrub, tree)
- Plant classification
    - Native
    - Non-native, not listed
    - Invasive
- Percent absolute cover
- Number of plants (woody species only)

The current Oregon Department of Agriculture (ODA) Noxious Weed list and the Portland Plant List (Rank A, B, and C lists) were referenced to identify "invasive" non-native plants. These plants were categorized separately from other non-native plants, which were designated "non-native, not listed" to distinguish them from invasive species. The distinction between these two categories ("invasive" and "non-native, not listed" was incorporated into plant tables in Appendices D and E. PGE is not required to report non-native, not listed plant species but does so because it provides a fuller, more complete illustration of the vegetation community assemblage and overall habitat.

The sample mean and confidence interval were calculated and compared to each performance standard to determine if action is necessary or if the objective has been reached. The objective is to be 80 percent confident that the estimate reported is within ±10 units of the true population. Values for vegetation performance standards (excluding diversity) will be reported as Mean (CIx = Y1-Y2), where:

CI = confidence interval
x = 80% confidence level
Y1 = low estimate
Y2 = high estimate

Y1 and Y2 are calculated as Mean ± (standard error * t-factor 80%). Standard error is calculated as the standard deviation divided by the square root of the number of samples taken in the habitat unit (stdev/sqrt(n)). The t-factor for an 80 percent confidence level is 1.282.

Sample plots for each habitat type were compared to performance standards separately. Table 9 below describes which habitat type each sample plot represents. Appendix C shows sample plot locations.

Table 9. Sample Plots in Each Habitat Type

Upland Forest Establishment	Upland Scrub-Shrub Establishment	Riparian Forest Establishment	Riparian Forest Enhancement/ Conservation	Wetland (ACM) Establishment	Wetland (ACM) Enhancement/ Conservation
T06-2, 3, 4	T06-1	T04-1, 2, 7, 8, 9, 10	T01-2	T04-3, 4, 5, 6	T01-1
T07-2, 3, 4	T07-1	T05-1, 6, 9, 10	T02-4, 6, 7	T05-2, 3, 4, 5, 7, 8	T02- 5
T08-2	T08-1		T03-5, 6, 8, 9, 10		T03-7
			T04-11		
			T05-11		
			T06-5		
			T07-5		
			T08-3		
			T09-1		

Fieldwork was performed on July 11-13, 4 and August 1, 3, 9, 29-31.

2.5.2 Performance Standards and Results

Vegetation monitoring results are included below. Each of the following habitat-type subsections includes performance standards and results. Vegetation monitoring results for each transect and sample plot can be found on data sheets in Appendix C.

2.5.2.1 Upland Forest Establishment

Performance standards and monitoring results for Upland Forest Establishment are shown below:

Performance Standard	Result	Met/Not Met
Density: ≥1,200 native woody plants/acre	1,105	Not Met
Diversity: ≥3 native tree species	6	Met
Diversity: ≥5 native shrub species	8	Met
Cover: ≥10% native herbaceous plants	72	Met
Cover: ≤10% invasive herbaceous plants (excl. RCG)	0	Met
Cover: ≤10% invasive shrub cover	0	Met

-

The density of native tree and shrub species in the seven sample plots was 1,105 per acre, an increase of 15 percent from 2022 (965/ac) and close to 2021 monitoring results (1,134/ac). Six native tree and eight native shrub species were recorded in the sample area. Cover of native herbaceous plants averaged 72 percent in the sample area, with yarrow (*Achillea millefolium*) representing the most prevalent species counted. Invasive herbaceous cover was negligible, with Queen-Anne's lace (*Daucus carota*) and hairy-cat's ears (*Hypochaeris radicata*) found at 1 percent in one plot each.

2.5.2.2 Upland Scrub-Shrub Establishment

Performance standards and results for Upland Scrub-Shrub Establishment include the following:

Performance Standard	Result	Met/Not Met
Density: ≥1,200 native woody plants/acre	1,186	Not Met
Diversity: ≥5 native shrub species	6	Met
Cover: ≥10% native herbaceous plants	66	Met
Cover: ≤10% invasive herbaceous plants (excl. RCG)	0	Met
Cover: ≤10% invasive shrub cover	0	Met

Stem density was 1,186 stems per acre from six different shrub taxa in the three scrub-shrub sample plots. Native herbaceous groundcover was 66 percent and comprised primarily of yarrow and riverbank lupine (*Lupinus rivularis*). One percent cover of Hairy-cat's ears and Canada thistle (*Cirsium arvense*) were noted in sample plot T06-1. Scot's broom (*Cytisus scoparius*) was noted in the same plot. Himalayan blackberry (*Rubus armeniacus*), found in one of the sample plots in 2022, was absent in 2023 likely due to weed management efforts.

2.5.2.3 Riparian Forest Establishment

Performance standards for Riparian Forest Establishment include the following:

Performance Standard	Result	Met/Not Met
Density: ≥1,200 native woody plants/acre	1,119	Not Met
Diversity: ≥3 native tree species	7	Met
Diversity: ≥5 native shrub species	10	Met
Cover: ≥10% native herbaceous plants	55	Met
Cover: ≤10% invasive herbaceous plants (excl. RCG)	3	Met
Cover: ≤10% invasive shrub cover	8	Met

Woody plant density was 1,119 per acre, slightly below the performance criterion. Tree and shrub taxa are diverse and broadly distributed, which may be indicative of both a young site still establishing its identity and supplemental planting efforts aimed at increasing woody plant diversity.

Cover of native herbaceous species was 55 percent, up from 51 percent in 2022. Invasive herbaceous plant cover averaged 3 percent, and invasive shrubs, mostly Himalayan blackberry averaged 8 percent, similar to 2022 findings. Predominant native herbaceous cover is tall bentgrass (*Agrostis exarata*), riverbank lupine and large leaved lupine (*Lupinus polyphyllus*). The principal invasive herbaceous species is white clover (*Trifolium repens)* which occurred in 4 of 10 sample plots, down one plot from 2022. Himalayan blackberry was found in 7 of the 10 sample plots, which is identical to 2022, and Scot's broom was recorded in 3 of 10 plots, down from 5 in 2022.

2.5.2.4 Riparian Forest Enhancement/Conservation

Performance standards for Riparian Forest Enhancement/Conservation include the following:

Performance Standard	Result	Met/Not Met
Density: ≥1,200 native woody plants/acre	1,107	Not Met
Diversity: ≥3 native tree species	5	Met
Diversity: ≥5 native shrub species	10	Met
Cover: ≥10% native herbaceous plants	22	Met
Cover: ≤10% invasive herbaceous plants (excl. RCG)	1	Met
Cover: ≤10% invasive shrub/tree cover	3	Met

Woody plant density was 1,107 woody plants per acre, which is down slightly from 2022 numbers (1,158). Five native tree and 10 native shrub taxa were recorded in the study area, which is nearly identical to 2022. Native herbaceous cover averages 22 percent in this habitat zone, which is identical to 2022. Invasive herbaceous cover is 1 percent, and invasive tree/shrub species cover is 3 percent. The similarity of 2022 and 2023 numbers makes sense when considering that this area is part of the

established habitat. The plants and habitat conditions in this study area were in place prior to habitat restoration activities in 2020 and have been left relatively intact except for limited weed management and supplemental plantings.

2.5.2.5 Wetland (ACM) Establishment

Performance standards for Wetland Establishment include the following:

Performance Standard	Result	Met/Not Met
Diversity: ≥5 native herbaceous species	16	Met
Cover: ≥30% native herbaceous plants	69	Met
Cover: ≤10% invasive herbaceous plants (excl. RCG)	2	Met

There were 16 native herbaceous plants occupying more than 5 percent cover in at least 10 percent of sample plots, which exceeds the more than 5 species minimum. Native herbaceous cover was 69 percent in 2023, down approximately 14 percent from 2022 but well above performance standards.

The drop in herbaceous cover may be attributable to an increase in overhead tree and shrub canopy density as young woody plants mature, and to an increase in woody stems. Tree and shrub stem density increased from 1,060/acre in 2022 to 1,464/acre in 2023, which represents an increase of 38 percent. There is no performance standard for stem density in this habitat type. Observations noted that the increase in woody stem density appears to be from volunteer willow (*Salix* sp.), cottonwood (*Populus balsamifera* var. *trichocarpa*), and Oregon ash (*Fraxinus latifolia*).

Invasive herbaceous cover was 2 percent, down from 4 percent observed in 2022. Invasive cover is comprised primarily of bird's-foot trefoil (*Lotus corniculatus*).

2.5.2.6 Wetland (ACM) Enhancement/Conservation

Performance standards for Wetland Enhancement/Conservation include the following:

Performance Standard	Result	Met/Not Met
Diversity: ≥5 native herbaceous species	5	Met
Cover: ≥30% native herbaceous plants	23	Not Met
Cover: ≤10% invasive herbaceous plants (excl. RCG)	0	Met

Native herbaceous diversity increases in 2023 appear due, in part, to 2023 supplemental plantings and to natural recruitment by bedstraw (*Gallium aparine*) and trailing blackberry (*Rubus ursinus*). Challenges to native herbaceous diversity and cover in the 3 plots within this habitat type include dense shade from the overhead canopy formed by mature trees, and the established RCG. Shade, leaf-drop, and competition for sunlight and water with RCG appear to slow the growth and spread of native groundcover. The cover performance standard for this habitat type is likely attainable, however it will management to clear areas of RCG to provide opportunities and the time needed for native plants to become established.

Native seed applied to this area in 2023 did not contribute to diversity and cover but is anticipated to contribute to native cover and diversity in the coming years based on observation of seed application in other areas of Harborton. Those other areas where native seed was applied often took 2-3 years before plants sprouted and gained a foothold. The same is expected in this habitat type.

Invasive Himalayan blackberry was recorded at 2 percent cover in one sample plot. No non-native (not listed) herbaceous species were observed in the sample plots. RCG continues to be the primary herbaceous ground cover in this habitat zone, comprising 32 percent cover on average over the three sample plots. This represents a decrease of 41 percent from 2022 (RCG 45% cover). The decrease appears attributable to management via herbicide applied in fall 2021 and to hand-clearing performed in 2023. Anecdotally, herbicide appears to have affected the vigor and viability of RCG, creating opportunity for other plants to spread and persist, and/or bare ground to form where there is evidence of seasonally persistent surface water and where the tree canopy is dense. In areas with more sunlight and less overhead canopy, such as the edge between Sub Areas 3 and 4, RCG seems less affected.

2.5.2.7 Northern Red-legged Frog Wetlands

There are no performance standards for habitat in the Northern Red-legged Frog breeding area, which is the portion of Sub Area 4 with a surface elevation below 15 feet CPD. Sample plots in this area include the following:

	Transect	
	T02	T03
Plot	1,2,3	1,2,3,4

RCG is the dominant plant cover with an average of 77 percent cover. Four of seven sample locations have 95 percent or greater RCG cover. Plot T02-2 is just outside of the area managed for RCG via solarization in 2023 (See Figure 7). Should solarization as a management tool be successful in this area, PGE may propose to the Trustee Council extension of this management tool to a limited area within the northern red-legged frog management area to see if the successes could be replicated. The long-term goal would be to replace RCG with native plants better suited to egg-mass anchoring compared to RCG, and plants that provide greater overall habitat functions.

2.5.3 Discussion

Performance standards for plant diversity and cover in all established habitat areas were met, except for the cover criterion in the Wetland Enhancement/Conservation area. Improvements in site performance in 2023 are attributable to maturation of seeded and installed plants, weed management, and supplemental seeding and planting performed in late 2022 and in 2023. The Wetland Enhancement/Conservation area is contending with established RCG and deep shade from a mature overhead tree canopy. Plantings in this area increased diversity, and widespread seeding

along with RCG management and the maturation of planted species is expected to improve herbaceous plant density to meet performance standards in the coming years.

Table 10 below summarizes site performance for Site Vegetation Monitoring.

Table 10. Site Vegetation Perf. Summary

	Habitat Type					
Perf. Standard	Upland Forest Estab.	Upland Scrub-Shrub Estab.	Riparian Forest Estab.	Riparian Forest Enhancem./Cons.	Wetland (ACM) Estab.	Wetland (ACM) Enhancem./Cons.
Density	NOT MET	NOT MET	NOT MET	NOT MET	n/a	n/a
Diversity	MET	MET	MET	MET	MET	MET
Cover	MET	MET	MET	MET	MET	NOT MET

2.5.4 North Channel ACM Habitat Vegetation Assessment Method

Methods were slightly modified in 2021 following field trials, which found overlap with the general plant community sample plots and gaps that missed significant plant assemblages. The current methods have been employed for all monitoring periods to date.

Vegetation species composition and approximate groundcover were recorded within the riparian zone of the North Channel. The riparian zone is defined as the vegetation within 15 meters of the North Channel's thalweg. The line-intercept method was employed for this study, with 10 channel transects oriented perpendicular to the North Channel thalweg (Figure 6). Channel transects extend from top to top of the Sub Area 3 channel excavation. These transects are unevenly spaced so that various orientations of the channel transects do not cross. Channel transects vary in length depending on the extent of the floodplain area they span.

Channel transect endpoints are marked with 4-foot fiberglass rods. The rod tips are painted either orange or blue, and alternate colors to avoid error while following the channel transect line. Percent cover of herbaceous species was visually estimated, and number of woody plants was recorded in a contiguous plot measuring 1 meter wide and extending 15 meters perpendicular from on each side of the thalweg along the 10 transect lines. Fieldwork was performed July 5, 13, and 15, 2023.

2.5.4.1 Results

Vegetation within 15 meters of the channel is diverse and includes several naturally recruited taxa. Fourteen native herbaceous taxa were documented with cover exceeding 5 percent in at least 10 percent of sample plots. A list of those species is included below.

Native herbaceous plants found in sample plots include the following:

- Tall bentgrass (*Agrostis exarata)*
- Water plantain (*Alisma plantago-aquatica)*
- Water foxtail (*Alopecurus geniculatus)*
- American sloughgrass (*Beckmannia syzigachne)*
- Beggar's-tick (*Bidens frondosa)*
- Slough sedge (*Carex obnupta)*
- Downingia (*Downingia elegans*)
- Western mannagrass (*Glyceria occidentalis)*
- Spreading rush (*Juncus patens)*
- Riverbank lupine (*Lupinus rivularis)*
- Popcorn flower (*Plagiobothyrus figuratus*)
- Wapato (*Sagittaria latifolia*)
- Small-fruited bulrush (*Scirpus microcarpus)*

Native herbaceous cover averaged 51 percent, which is a 19 percent increase from the 43 percent cover documented in 2022.

Eight invasive plant species (including RCG), and seven non-native, not listed herbaceous plants were recorded along the transects. Non-native, not listed herbaceous cover averaged 4 percent over the ten transects. Invasive herbaceous cover averaged 4 percent in the study area.

Performance Standard

The performance standards for ACM vegetation are:

Performance Standard	Result	Met/Not Met
Diversity: ≥5 native herbaceous species	14	Met
Cover: ≥30% native herbaceous plants	51	Met
Cover: ≤10% invasive herbaceous plants (excl. RCG)	4	Met

2.5.4.2 Discussion

Riparian area conditions meet the Diversity and Cover performance criteria (Appendix D). Twenty-four distinct native taxa were documented in 2023, 14 of which met the Diversity criterion. Native areal cover increased to 51 percent in 2023 from 43 percent in 2022. The 2022 monitoring report noted that most species found along the channel transects were planted or seeded during construction. That finding is still true but in addition, seeded/planted species have spread from their original locations to other areas of the site. For example, wapato bulbs were installed around Transects 2 and 3; wapato is now found around those transects and also along Transects 4, 7, and 8. Other species show similar colonization tendencies.

2.5.5 Reed Canarygrass (RCG) Across Relevant Habitats (Wetlands)

Detailed data on RCG cover was assessed for wetland areas at Harborton, except for 5.16 acres of Sub Area 4 wetlands that are excluded/prohibited from RCG management activities due to its preference for breeding by frogs. Wetlands in RCG-managed areas include 6.62 acres in Sub Area 3 and 8.31 acres in Sub Area 4. Table 11 below presents sample plots located in wetlands that are managed for RCG. See Appendix C for plot locations:

Table 11 – Monitoring Plots in RCG-managed Areas

Transect	Plots
T01	1, 2
T02	5
T03	7
T04	3, 4, 5, 6, 8, 11
T05	2, 3, 4, 5, 7, 8, 11

Methods

Assessment methods included mapping RCG in the field by walking wetland areas while performing visual cover estimates, then mapping findings. Orthomosaic images were used to support interpretation of findings. Portions of Sub Area 4 below the 15-foot elevation are prohibited from RCG management and were not included in areal calculations.

Results

RCG cover in wetlands is estimated to be 28.6 percent across managed areas of the Site. Management through solarization and manual removal helped reduce RCG cover in Sub Area 4 wetlands, and herbicide application and hand pulling helped to minimize RCG cover in Sub Area 3. RCG appearing near the inlet of the North Channel and along the Sub Area 3/Sub Area 4 wetland border were managed via spraying and hand pulling individual clumps. Application of approximately 0.5 acres of black plastic for the purpose of solarizing RCG in Sub Area 4 created a notable reduction in percent cover in that management area from 90 percent in 2022 to 73 percent in 2023.

RCG in Sub Area 4 wetlands includes a range of conditions from emergent areas with an estimated 90 percent RCG cover to shrub and forested areas with an estimated 39 percent RCG cover. Table 12 below describes cover in each habitat area and provides an overall estimate based on weighing the percent RCG cover by wetland type. As described in Section 2.5.2.6 above, herbicide applied to approximately 0.5 acres of RCG in the Sub Area 4 forested habitat in fall 2021 appears to have stressed and thinned RCG cover. An estimated 0.3 acres of RCG appear to have been removed/controlled by spraying and hand clearing in this area.

Table 12. RCG Coverage in Managed Wetlands

Sub Area	Wetland	Acreage	Est. % RCG	Acres RCG
3	Emergent/Shrub/Forest	6.62	trace%	<0.01
4	Forested	4.37	39%	1.71
4	Scrub-shrub	1.1	46%	0.51
4	Emergent	2.84	77%	2.06
	Total Acres	14.93		4.41
			Percent RCG in Managed Wetlands:	28.6%

Performance Criteria

Performance criterion for RCG cover:

Performance Standard	Result	Met/Not Met
Years 1-5: ≤30% RCG	28.6%	Met

Discussion

Herbicide and solarization appear effective in managing RCG in the short-term. Hand clearing and spot herbicide application have also been effective management tools in controlling RCG establishment in created wetland areas. Estimated RCG cover in managed wetlands for 2023 was 28.6 percent, which meets the performance standard of less than 30 percent cover in years 1-5. Future management will be needed to maintain gains realized, and to meet the 25 percent and 20 percent cover standards in Year 7 and Year 10, respectively. The use of black plastic in 2023 to solarize RCG cover appears effective, but further observations and adaptation of methods are needed as PGE learns from this preliminary effort and discovers the best methods for successfully repopulating treated areas with native plants.

2.6 WATER QUALITY

EM of water quality criteria included measurements of temperature and dissolved oxygen (DO) in the North Channel. The purpose is to better understand conditions under which juvenile salmonids and other fish are expected to be on site.

Methods

Two long-term temperature monitoring sensors were installed in fixed locations in the North Channel. As discussed with the Trustee Council, the sensor at the channel outlet was lost over the summer likely to vandalism or theft. The remaining temperature sensor gathered temperature data in one-hour intervals at the channel inlet.

DO was measured using a hand-held meter (Milwaukee MW600). Prior to use, the device was calibrated per manufacturer specifications. Readings were collected at three locations within North Channel (Figure 5) except during periods of flooding when readings were done along the shoreline as close to the monitoring station as possible.

Results

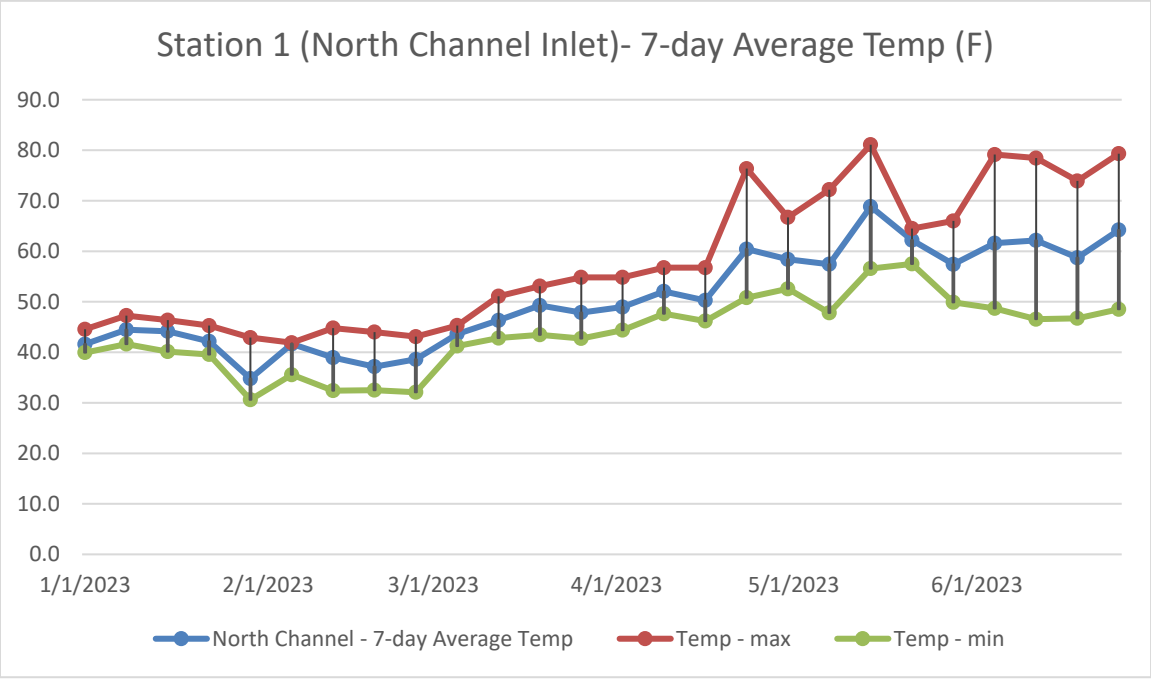
Table 13 below shows dissolved oxygen levels for the months surveyed to date. Table 13 shows temperature readings for Station 1.

Table 13. North Channel Dissolved Oxygen (mg/L)

Station	Nov '22	Dec '22	Jan '23	Feb '23	Mar '23
1	12.4	13.0	13.4	12.6	12.0
2	12.1	12.1	13.3	11.9	11.7
3	dry	dry	12.7	12.2	11.5

Table 14 below describes 7-day averages for high water temperature (red), low temperature (green) and average daily temperature (blue).

Table 14. Water Temperature at Water Monitoring Station 1



Performance Standard

There is no performance standard for this monitoring element.

Discussion

Dissolved oxygen levels in the North Channel waters are adequate to support aquatic life, including salmonids (USGS 2022). DO levels below 6.5-8.0 mg/L are considered low but non-lethal. Levels below 2 mg/L are considered anoxic and potentially lethal to aquatic organisms.

Temperature readings are from the probe at the North Channel inlet and reported through the first week of July 2023. The data indicate weekly water temperatures fluctuate tens of degrees over the 7-day period while the channel is wetted, as shown from January 1 to the week of April 16, and again around the week of May 21 during the recorded high-water event at the site. Between the weeks of April 16 and May 21 surface water was documented at the channel inlet, but this period coincided with shallow surface water and the first heat wave of the season, possibly explaining the broader range of temperatures during that 4-week period. Observations of surface water in the channel were made through July 25th approximately when the entire length of North Channel dried.

2.7 FISH AND WILDLIFE

Year 3 fish and wildlife monitoring include fish, lamprey, breeding birds, bald eagle, mink, northern red-legged frog, and benthic macroinvertebrates. Results of monitoring efforts are below.

2.7.1 Fish

A fyke net fish trap was deployed to the site on the afternoon of May 16 and checked the morning of May 17. A total of 11 fish species, including one wild, juvenile Chinook salmon were documented. A total of 452 fish were collected and identified to species. Table 15 below summarizes the catch. Twenty of the 419 stickleback fish perished in the net trap, likely due to their spined fins getting caught in the net, preventing movement which led to asphyxiation. There is no performance criterion for fish.

Table 15. Harborton Fish Sampling

Species	Life Stage	Count	Morts	Length (mm)
Wild Chinook	Juvenile	1	0	56
Peamouth	N/A	1	0	N/A
Bluegill	N/A	4	0	N/A
Yellow Perch	N/A	10	0	N/A
Stickleback	N/A	419	20	N/A
Pumpkin Seed	N/A	8	0	N/A
White Crappie	N/A	2	0	N/A
Sculpin	N/A	3	0	N/A
Large Scale Sucker	N/A	1	0	N/A
Pikeminnow	N/A	2	0	N/A
Yellow Bullhead Catfish	N/A	1	0	N/A
TOTAL		**452**	**20**	

2.7.2 Lamprey

Pacific lamprey (*Lampetra tridentata*) presence and use of the Site is monitored by USFWS through a separate agreement. Monitoring efforts include post-implementation sampling of the tributary habitat, which did not exist prior to habitat restoration activities. Pre-sampling began in 2017 in offshore (Willamette River channel) locations; post sampling of the North Channel began in 2021 and sampling of North Channel and the Willamette shoreline began in 2022.

Fieldwork in 2023 was performed on June 29. Study methods are found on page 14 of the *Evaluation of Larval Pacific Lamprey Occupancy of Habitat Restoration Sites in the Portland Harbor Superfund Area* (USFWS, 2022). No lamprey were found during the 2023 study. There is no performance criterion for lamprey.

2.7.3 Breeding Birds

EM for breeding-bird use employed a modified version of the general habitat assessment configuration of the line-intercept method, as described in the MAMP. Modifications were made so that sampling effort is consistent with Metro's breeding bird assessment methods (Huff et al. 2000). The modified method is designed to assess and track habitat quality and restoration effectiveness by using breeding birds as bio-indicators. There is no performance criterion for the breeding bird survey.

Method

Metro's survey protocol calls for surveys of breeding birds to be conducted from fixed point-count stations within specific habitats. The protocol requires at least 3 surveys between May 15 and June 30.

Thirteen point-count stations were established approximately 150 meters apart (Figure 8). Surveys were conducted during peak bird activity, approximately sunrise until completed. Table 16 below denotes survey date, starting point, start and end time, and general weather conditions.

Table 16. Breeding Bird Survey Conditions

Date	Start Station	Start Time	End Time	Weather Conditions
23-May	13	05:26	08:05	clear, no wind
6-Jun	13	05:15	08:03	clear, no wind
13-Jun	13	05:12	07:52	clear, no wind

Fifty-three bird species were recorded during the 2023 survey, including 18 species not previously observed. The most abundant species were red-winged blackbird (117 counted), starling (86) and song sparrow (53). Species observed in 10 or more of the 13 monitoring stations (80th percentile) include red-winged blackbird, song sparrow, American robin, western wood pewee, and yellow-rumped warbler. Full monitoring results are included in Appendix E.

2.7.4 Bald Eagle

Bald eagle monitoring is performed in years 3, 5, 7, and 10. Monitoring consists of weekly observations for one hour as close as possible to dawn or dusk from December through August from a fixed monitoring station atop the soil berm in Sub Area 2. Ideally monitoring occurred for one hour near dawn or dusk, though some monitoring events did not adhere to this schedule. No bald eagles were observed during surveys.

Table 17 - Bald Eagle Survey Observations

Month	Date	Start Time	Obs	Month	Date	Start Time	Obs
Jan	1/4/2023	16:00	none	May	5/5/2023	nr	none
	1/10/2023	16:00	none		5/17/2023	6:45	none
	1/18/2023	11:00	none		5/23/2023	15:15	none
	1/27/2023	7:50	none		5/28/2023	17:00	none
	1/31/2023	9:25	none	Jun	6/2/2023	5:35	none
Feb	2/24/2023	15:30	none		6/6/2023	5:30	none
	2/28/2023	8:28	none		6/16/2023	20:10	none
Mar	3/10/2023	10:10	none		6/22/2023	19:30	none
	3/15/2023	7:45	none	Jul	7/14/2023	19:30	none
	3/22/2023	nr	none		7/15/2023	6:10	none
Apr	4/7/2023	10:15	none	Aug	8/2/2023	8:10	none
	4/14/2023	6:30	none		8/11/2023	7:15	none
	4/26/2023	nr	none		8/31/2023	18:00	none

nr = not recorded

2.7.5 Mink

Mink presence/absence was monitored in 2023 by direct observation twice monthly from April through July, and through trail cameras and scent lure stations established in three areas likely to be visited. Figure 5 shows trail camera and scent stations. Caven's Mink Master Mink Gland Lure was applied to vegetation and the ground surface at each monitoring station. Table 18 below includes dates of field monitoring as well as observations.

Table 18 - Mink Monitoring

Month	Date	Obs	Month	Date	Obs
Apr	4/14/2023	none	Jun	6/6/2023	none
	4/26/2023	none		6/12/2023	none
May	5/5/2023	none	Jul	7/5/2023	none
	5/19/2023	none		7/13/2023	none

None of the images captured by the trail cameras appeared to show mink, and no observations of mink activity such as tracks, fur, or prey scraps were observed.

2.7.6 Northern Red-legged Frogs

Monitoring for northern red-legged frog (*Rana aurora aurora;* RAAU) egg masses occurred on February 17, 2023. Table 19 summarizes egg mass findings over the past 6 years.

Table 19. Sub Area 4 Amphibian Egg Mass Counts

	Rana aurora aurora			
Date	Developing	Hatched	Bleached	Total
2/28/2018	137	0	21	158
3/14/2019	144	46	4	194
2/20/2020	1387	0	5	1392
2/27/2021	411	23	1	435
2/11/2022	168	4	0	172
2/17/2023	404	4	0	408

Observations of tadpole development were made on March 22nd and again on April 14th. No tadpoles were captured/observed on March 22nd and RAAU tadpoles with nearly formed legs and tail remnants were observed in April;. Table 20 below compares Harborton egg mass numbers to those found in Northern Multnomah Channel during Metro's annual survey.

Table 20. Northern Red-legged Frog Regional Comparison

Year	Harborton (PGE)	N. Mult. Channel (Metro)
2018	158	35
2019	194	56
2020	1392	64
2021	435	29
2022	172	n/a*
2023	408	n/a*

*Note: Metro did not perform egg mass counts in 2022 or 2023

Harborton and N. Multnomah Channel annual surveys show similar trends in numbers in the years both were surveyed. Metro did not perform egg mass surveys in 2022 or 2023. PGE understands that Metro is in favor of conducting egg mass counts on the same day(s) as the PGE survey for 2024 so that closer comparisons may be made. PGE will explore this option with Metro.

2.7.7 Aquatic Macroinvertebrates

Monitoring for aquatic invertebrates is to identify established aquatic macroinvertebrate species to gauge species presence, abundance, and diversity/richness as a proxy for evaluating stream health and habitat function. Monitoring was performed in the North Channel at permanent, fixed monitoring locations.

Methods

Monitoring was performed on July 5, 2023. Seven of the ten stream transects (4 through 10) were dry during fieldwork and therefore not sampled (Figure 6). Field methods followed protocol described in *Environmental Monitoring and Assessment Program - Surface Waters: Western Pilot Study Field Operations Manual for Wadable Streams* (Peck et al 2001). Sample locations coincided with transect crossings established under the Stream Habitat Method. Observations of shoreline groundcover, aquatic plant cover, canopy cover, channel dimensions, and water depths were made at each of the sampling locations.

Kick samples were collected using a D-shaped 500 micron seining net measuring 18 inches wide by 9 inches tall. The net was held static while sediments and bed material upstream were agitated. Materials collected were placed in trays for sorting, cleaning, and identification. Invertebrate samples were identified to the lowest taxonomic level feasible using Fresh-water Invertebrates of the United States as the primary reference (Pennak 1978).

Results

Five species from two distinct phyla were collected and recorded. The most abundant taxon was *Hemiptera*, commonly known as a water walker. There are no performance requirements for aquatic invertebrates. Table 21 contains monitoring results.

Table 21. Benthic Invertebrate Survey Results

					Sample									
Phylum	Class	Order	Family	Final ID	1	2	3	4	5	6	7	8	9	10
Annelida	*Clitellata*	*Hirudinea*	*Hirudidae*	*Hirudidae*		1		-	-	-	-	-	-	-
Arthropoda	*Crustacea*	*Amphipoda*		*Amphipoda1*		1		-	-	-	-	-	-	-
		Amphipoda		*Amphipoda2*	1			-	-	-	-	-	-	-
	Insecta	*Diptera*		*Diptera*	2	1		-	-	-	-	-	-	-
		Hemiptera		*Hemiptera*	11	5	1	-	-	-	-	-	-	-
		Hemiptera	*Cordixidae*	*Cordixidae*				-	-	-	-	-	-	-
Mollusca	*Gastropoda*			*Gastropoda*			3	-	-	-	-	-	-	-

"-" indicates dry conditions during fieldwork

2.7.8 General Wildlife Observations

Wildlife observed at Harborton, in addition to fish, frogs, and insects discussed above, include salamander, tree frogs, garter snakes, deer, coyote, raccoon, striped skunk, opossum, mice/voles, nutria, and beaver. There are several pollinating and non-pollinating insects that would be interesting to catalog, including praying mantis, swallowtail butterfly, ladybugs, honeybees, bumblebees, mason bees, and several beetle species. Established game trails are becoming apparent as noted by disturbed ground and vegetation growth patterns. Burrows and tunnels of small mammals, likely field mice and voles, are becoming more common. These features help inform placement of trail cameras and were instrumental in capturing images of beaver accessing the North Channel on at least two occasions. The overall impression is that restored habitat is hosting a broad variety and number of insects, reptiles, and animals.

3. Results and Discussion

3.1 SUMMARY OF RESULTS

Monitoring results indicate the Site is meeting or exceeding performance standards for nearly all required measures. Vegetation standards not met were off by <10% in those categories, some less than 5%. The fish accessibility standard is largely a function of river and weather dynamics. Table 22 below summarizes monitoring elements with performance standards, and a determination of whether standards are met or not met for the 2023 monitoring period.

Table 22. 2023 Performance Summary

Performance Standards	*Met/Not Met*	*Adaptive Management Needed*	*Notes*
Retention of Habitat Features/Elements	Met	No	
Extent of ACM Habitat	Met	No	
Extent and Stability of Channel, Streambank, and Floodplain Habitat	Met	No	
Preservation of Fish Passage/Fish Accessibility	Met	No	Fish passage at outlet seasonally affected by Willamette River, Constructed channel is barrier free.
Retention of Wetland Hydrology/Habitat for Use by Northern Red-legged Frog	Not Met	No	Low water in Feb., May, and 4th week of June
Extent of High Flow Inundation	Met	No	
Vegetation Density/Diversity/Cover	Not Met	Yes	11 of 16 Standards met
RCG Across Relevant Habitats	Met	Yes	Expand management areas in 2024

3.2 ADAPTIVE MANAGEMENT

When monitoring results demonstrate that the site does not meet performance standards and restoration goals, PGE will adjust monitoring or management activities in consultation with the Trustee Council as necessary to meet the goals and objectives of the HDP. The following description include a discussion of past adaptive management actions and proposed management actions planned for 2023.

3.2.1 Management Recommendations for 2024

Management recommendations for 2024 resemble those recommended for 2023. Principle management efforts will involve reducing RCG cover, maintaining and enhancing woody plant densities through weed management and irrigation , improving native herbaceous cover with a focus on Sub Area 4, and additional woody plantings in Sub Areas 2, 3, and 4.

RCG management measures will include continuation of herbicide application followed by targeted plantings, and expansion of areas treated via solarization. Management of other invasive species, such as Himalayan blackberry, Scots' broom and teasel (*Dipsacus fullonum*) will be undertaken in 2024 to maintain and expand on progress made in promoting native woody plants. PGE used contract labor in 2023 to hand pull and spray Scot's broom and blackberry and applied herbicide to teasel rosettes in Sub Area 3. PGE plans to repeat these efforts in 2024 with an early spring focus on teasel. Teasel flowers biennially so those rosettes that became established in 2023 will flower and seed in 2024 if not managed early. The Scot's broom seedbank is presumably extensive in areas of Harborton that were not subject to excavation due to extensive Scot's broom growth prior to restoration work and on the proliferation of seedling plants each year since restoration work. Routine management involving pulling, cutting and spraying is planned for the duration of PGE's Site management.

Herbicide application should not be prohibited by DSL in 2024 due to positive frog egg-mass numbers. Herbicide applied to shaded areas of Sub Area 4 in early 2021 appeared effective in stressing RCG which improved native groundcover performance. PGE plans to extend herbicide application to herbaceous areas lacking native groundcover primarily due to RCG.

3.2.2 Review of Adaptive Management Performed in 2023

Riparian Forest, Scrub-Shrub, and Upland Woody Density

The 2022 Monitoring Report recommended supplemental plantings to improve woody stem density. Approximately 6,770 native shrubs and trees were added to the Sub Areas 1, 2, and 3 in 2023. Woody plantings included twelve different taxa, eleven of which were planted in 2020/2021. Twinberry (*Lonicera involucrata*) was introduced to the site near the North Channel inlet to add competition to RCG in that area and because twinberry is suited for existing site conditions (full sunlight, seasonally persistent wetness, channel shoreline).

Scot's Broom

The Trustee Council noted that Scot's broom is found around the site but that no description of its management was included in the 2022 report. PGE routinely manages this invasive plant by hand pulling young plants and through cutting/herbicide application. In 2023, PGE targeted Scot's broom in Sub Area 3 uplands, mostly along the former railroad bed where a persistent seedbank seems to occur. PGE anticipates that management of this plant will be an annual, on-going task.

RCG Across Relevant Habitat

Adaptive management recommendations in the 2022 monitoring report for RCG included applying lessons learned in 2021 and 2022 from herbicide application, sod removal (Sub Area 3), and mechanical clearing. Hand pulling and herbicide treatment appears effective in managing newly formed bunches of RCG. Hand pulling during the early part of the season and after spring flooding drawdown is effective because soils are loose and stems and roots can be removed manually. Herbicide application is best other times when roots are hard to remove by hand.

Herbicide used at Harborton in 2023 included the following:

Table 23 - 2023 Harborton Herbicide Treatments

Date	Product	EPA #	Total Applied	Concentration %
6/21/2023	Element 3A	62719-37	64 oz	2%
	Roundup Pro	524-529	64 oz	2%
	Rainier EA (surfactant)			
	Hi-Light Blue (tracer)			
8/2/2023	Element 3A	62719-37	24 oz	2%
	Roundup Pro	524-529	24 oz	2%
	Rainier EA (surfactant)			
	Hi-Light Blue (tracer)			
9/25/2023	Element 3A	62719-37	45 oz	2%
	Roundup Pro	524-529	45 oz	2%
	Rainier EA (surfactant)			
	Hi-Light Blue (tracer)			
10/6/2023	Element 3A	62719-37	45 oz	2%
	Roundup Pro	524-529	45 oz	2%
	Rainier EA (surfactant)			
	Hi-Light Blue (tracer)			

PGE added solarization to RCG management in 2023. Preliminary results indicate that solarization is effective in stunting and stressing RCG. PGE plans to install native plugs and seed in 2024 to treated areas, and to expand solarization use where appropriate.

City of Portland Water System Autoflushing

PGE requested in October 2022 that the City of Portland relocate their water system autoflushing equipment away from Harborton to help eliminate year-long surface water observed in Harborton wetlands in 2022. The City started operating an autoflush system in spring 2021 to help maintain water quality in the municipal water system. That practice discharged water to a storm drain system that outfalls to Harborton from March/April until first freeze in November/December. Relocation of the City of Portland autoflushing system away from Harborton in 2023 likely reduced approximately 1 acre-foot/month of water previously available to the site during that period. Possibly as a consequence, Sub Area 4 surface water was absent by the end of July and the North Channel returned to seasonally wet conditions as site design intended.

3.3 SITE MANAGEMENT AND ACTIVITIES

Various Site management actions were performed following construction. Below is a list with brief descriptions of activities performed in 2023 to date:

- Weed management via hand pulling, herbicide application, and solarization over an estimated 13 acres in Sub Areas 1, 2, 3, and 4. Targeted plants included RCG, Scot's broom, Himalayan blackberry, teasel and water primrose (*Ludwigia peploides*).
- Installation of 6.770 woody-stem plants in spring and summer
- Irrigation of woody plants in Sub Area 3 uplands from July to first September rain.
- Hydrant flushing relocation
- Additional "Do Not Enter – Sensitive Habitat Area" signs posted
- Additional barriers placed to prevent unauthorized entry
- PGE Security mobilized to remove campers
- PGE Landscape mobilized to remove dumping
- Site tours provided to multiple interested parties (City of Portland, neighborhood frog volunteer group, ODFW, USFWS, PGE staff)

Maps of areas planted in 2023 are included in Appendix F. Herbicide spray record is included in Appendix G. Actions anticipated for 2024 include the following:

- Supplemental herbaceous and woody plant installation. Areas TBD (January-February)
- Weed management (spring/summer/fall)
- Irrigation as needed (upland planted areas)
- Fourth annual community volunteer event (summer)
- Routine Site security and trash removal measures (on-going)
- Replace lost/stolen "No Trespassing" signs
- Replace lost/stolen trail cameras and water level loggers
- Site tours (as requested and appropriate)

3.4 PHOTO MONITORING POINTS

Eight permanent photo monitoring points were established as shown in Appendix H. The locations were selected based on importance and interest of Site features, such as the North Channel, anticipated wildlife movement corridors, large wood components, and northern red-legged frog habitat.

Three game cameras were used in various locations around the Site. Camera locations were shifted and reset occasionally throughout 2023 as cameras were discovered by members of the public (as documented in images) or as site discoveries, such as tracks or evidence of wildlife activity, were noted. A collage of trail camera images is included in Appendix I.

Orthomosaic images collected by drone at various times during the year show habitat development and maturation through the year. Drone-captured Orthomosaic images from January 2023 through October 2023 are included in Appendix J.

3.5 DISCUSSION

Ecological functions at Harborton continue to improve year-to-year, consistently exceeding baseline conditions. Over 215 identified plant, bird, fish, mammal, amphibian, reptile, and insect species (including 57 bird species) are frequent visitors or have become established at Harborton.

The high-water event in 2023 occurred on May 19 when a high-water elevation of 17.05 feet CPD was reached. Surface water duration and extent in 2023 was low in some months and exceeded baseline conditions in other months. Most notable was low water in May which more closely resembled conditions typical of early June, likely reflecting the early arrival of summer like conditions in 2023. All of Sub Area 4 went dry during the summer and early fall, which is the desired condition for preventing bullfrog becoming established.

The North Channel ran completely dry for the first time recorded since construction. The channel remained dry from mid-July through the first rain event in September. This characteristic was the expected condition when the project was designed. The perennially wetted channel observed in past years should be considered anomalous and may be due in part to the City of Portland's past practice of hydrant flushing at the Site. That activity was relocated away from Harborton in October 2022.

No management actions are recommended for surface water extent and duration, and for Willamette River sediment deposition along the shoreline. Both conditions depend upon factors not within PGE's control such as climate, weather events, Willamette River discharge and sediment load. As discussed, low surface water conditions in May 2023 appear extreme under a percent-of-baseline analysis, but areal extent and depths resemble June conditions. The 2023 site conditions in the North Channel remain consistent with the Restoration Project goals including seasonal off-channel habitat.

Site trespass was an issue in 2023, including the loss of groundwater monitoring equipment in a high foot-traffic area along the Willamette shoreline. Boulders were placed to close a new vehicle entry point created in 2023, and additional "Do Not Enter" signage was added. PGE will continue to monitor for trespass and will work to better conceal replacement monitoring devices.

PGE is committed to providing community outreach and collaboration given the strong interest in Harborton by the neighbors and local population. PGE maintains frequent contact with frog shuttle organizers and continues to look for opportunities to use Harborton as a learning tool for interested parties. PGE would welcome Trustee Council suggestions and guidance in this endeavor.

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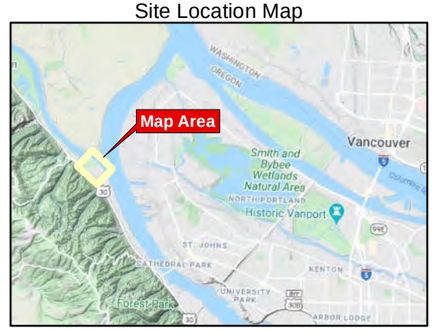
Site Location Map



Map Features

- Habitat Area
- Non-Habitat Area
- Survey Transect
- Property Line
- Olympic Pipeline
- Sub-Area Boundary

FIGURE 1

0 115 230

Feet

Portland General Electric

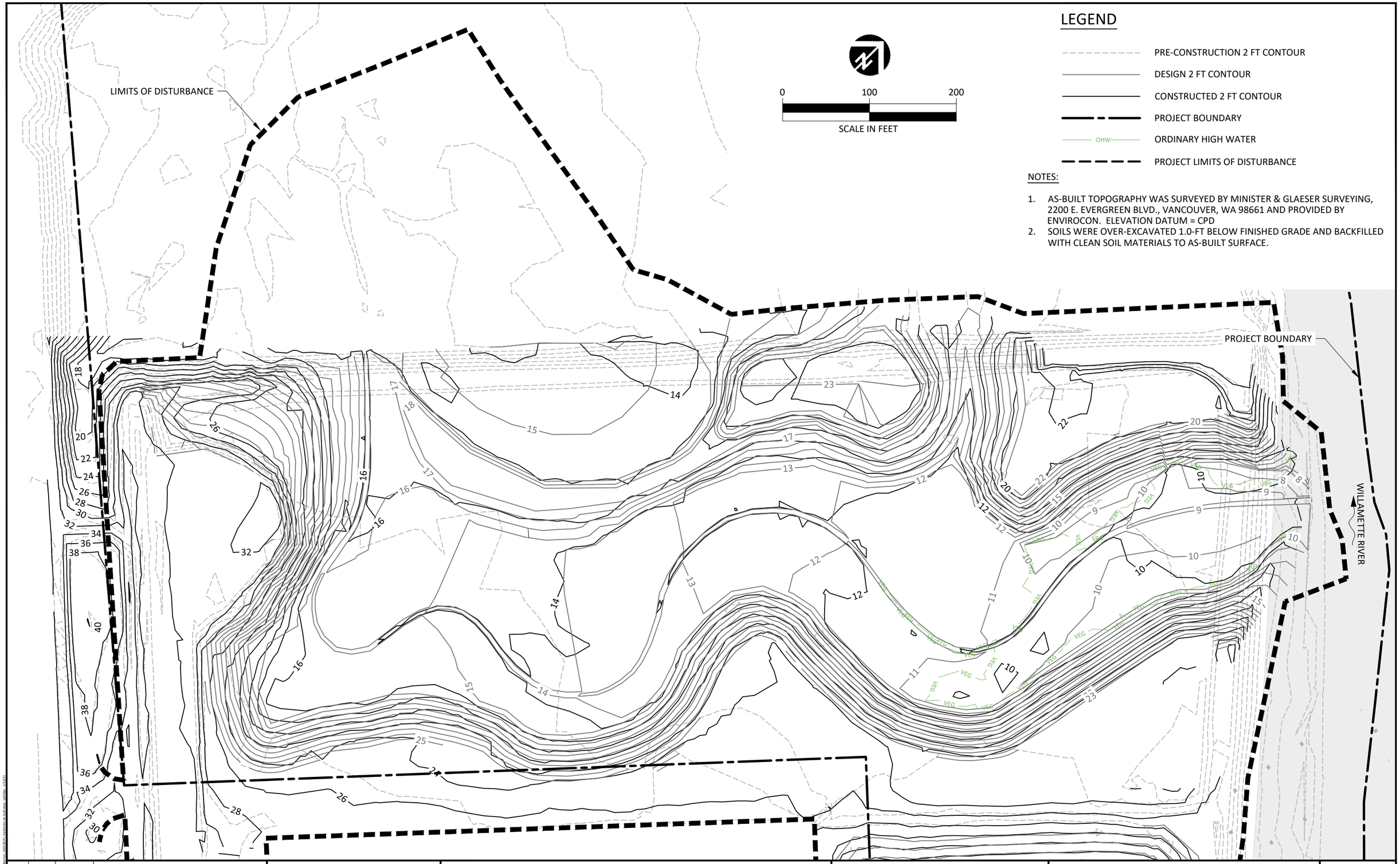
Portland, Oregon

Harborton Habitat Site

Harborton Restoration Project

Date:	Drawn By:	Rev.:
7/4/2020	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Hab_Fig3.mxd



LEGEND

- PRE-CONSTRUCTION 2 FT CONTOUR
- DESIGN 2 FT CONTOUR
- CONSTRUCTED 2 FT CONTOUR
- PROJECT BOUNDARY
- OHW — ORDINARY HIGH WATER
- PROJECT LIMITS OF DISTURBANCE

NOTES:

1. AS-BUILT TOPOGRAPHY WAS SURVEYED BY MINISTER & GLAESER SURVEYING, 2200 E. EVERGREEN BLVD., VANCOUVER, WA 98661 AND PROVIDED BY ENVIROCON. ELEVATION DATUM = CPD
2. SOILS WERE OVER-EXCAVATED 1.0-FT BELOW FINISHED GRADE AND BACKFILLED WITH CLEAN SOIL MATERIALS TO AS-BUILT SURFACE.

NO.	BY	DATE	REVISION DESCRIPTION

CP, RP	DM,JG,CM	DM
DRAWN	DESIGNED	CHECKED
	2/22/21	16-02-18
APPROVED	DATE	PROJECT

Portland General Electric
Harborton Restoration Project As-Built Record Drawings
Portland, Oregon

inter·fluve
501 Portway Avenue, Suite 101
Hood River, OR 97031
541.386.9003
www.interfluve.com

NORTH CHANNEL AS-BUILT GRADING PLAN

FIGURE 2

Site Location Map

Map Features

× 2023 GPS Field-Collected Data

FIGURE 2A

Note:
Field topography was collected by PGE Survey crew using RTK GPS on 9/21/2023 and 10/04/2023.
Elevations shown in City of Portland vertical datum (NAVD88 - 2.1 feet)
Vertical accuracy approximately 1.5 centimeters.

0 7.5 15
Feet

PGE

Portland General Electric
Portland, Oregon

Surface Elevation Data
2023 GPS Field Survey

PGE Environmental Services

Date:	Drawn By:	Rev.:
10/21/2024	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Field_COP_2023_100924.mxd

Site Location Map

Map Features

× 2023 GPS Field-Collected Data

FIGURE 2B

Note:
Field topography was collected by PGE Survey crew using RTK GPS on 9/21/2023 and 10/04/2023.
Elevations shown in City of Portland vertical datum (NAVD88 - 2.1 feet)
Vertical accuracy approximately 1.5 centimeters.

0 7.5 15
Feet

Portland General Electric
Portland, Oregon

Surface Elevation Data 2023 GPS Field Survey

PGE Environmental Services

Date:	Drawn By:	Rev.:
10/21/2024	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Field_COP_2023_100924.mxd

Site Location Map

Map Features

× 2023 GPS Field-Collected Data

FIGURE 2C

Note:
Field topography was collected by PGE Survey crew using RTK GPS on 9/21/2023 and 10/04/2023.
Elevations shown in City of Portland vertical datum (NAVD88 - 2.1 feet)
Vertical accuracy approximately 1.5 centimeters.

0 7.5 15
Feet

Portland General Electric
Portland, Oregon

Surface Elevation Data 2023 GPS Field Survey

PGE Environmental Services

Date:	Drawn By:	Rev.:
10/21/2024	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Field_COP_2023_100924.mxd

Site Location Map

Map Features

× 2023 GPS Field-Collected Data

FIGURE 2D

Note:
Field topography was collected by PGE Survey crew using RTK GPS on 9/21/2023 and 10/04/2023.
Elevations shown in City of Portland vertical datum (NAVD88 - 2.1 feet)
Vertical accuracy approximately 1.5 centimeters.

0 7.5 15
Feet

Portland General Electric
Portland, Oregon

Surface Elevation Data 2023 GPS Field Survey

PGE Environmental Services

Date:	Drawn By:	Rev.:
10/21/2024	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Field_COP_2023_100924.mxd

Site Location Map

Map Features

× 2023 GPS Field-Collected Data

FIGURE 2E

Note:
Field topography was collected by PGE Survey crew using RTK GPS on 9/21/2023 and 10/04/2023.
Elevations shown in City of Portland vertical datum (NAVD88 - 2.1 feet)
Vertical accuracy approximately 1.5 centimeters.

0 7.5 15
Feet

PGE

Portland General Electric
Portland, Oregon

Surface Elevation Data 2023 GPS Field Survey

PGE Environmental Services

Date:	Drawn By:	Rev.:
10/21/2024	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Field_COP_2023_100924.mxd

Site Location Map

Map Features

× 2023 GPS Field-Collected Data

FIGURE 2F

Note:
Field topography was collected by PGE Survey crew using RTK GPS on 9/21/2023 and 10/04/2023.
Elevations shown in City of Portland vertical datum (NAVD88 - 2.1 feet)
Vertical accuracy approximately 1.5 centimeters.

0 7.5 15
Feet

PGE

Portland General Electric
Portland, Oregon

Surface Elevation Data
2023 GPS Field Survey

PGE Environmental Services

Date:	Drawn By:	Rev.:
10/21/2024	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Field_COP_2023_100924.mxd

Site Location Map

Map Features

× 2023 GPS Field-Collected Data

FIGURE 2G

Note:
Field topography was collected by PGE Survey crew using RTK GPS on 9/21/2023 and 10/04/2023.
Elevations shown in City of Portland vertical datum (NAVD88 - 2.1 feet)
Vertical accuracy approximately 1.5 centimeters.

0 7.5 15
Feet

Portland General Electric
Portland, Oregon

Surface Elevation Data
2023 GPS Field Survey

PGE Environmental Services

Date:	Drawn By:	Rev.:
10/21/2024	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Field_COP_2023_100924.mxd

Site Location Map

Map Features

× 2023 GPS Field-Collected Data

FIGURE 2H

Note:
Field topography was collected by PGE Survey crew using RTK GPS on 9/21/2023 and 10/04/2023.
Elevations shown in City of Portland vertical datum (NAVD88 - 2.1 feet)
Vertical accuracy approximately 1.5 centimeters.

0 7.5 15
Feet

Portland General Electric
Portland, Oregon

Surface Elevation Data 2023 GPS Field Survey

PGE Environmental Services

Date:	Drawn By:	Rev.:
10/21/2024	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Field_COP_2023_100924.mxd

Site Location Map

Map Features

× 2023 GPS Field-Collected Data

FIGURE 2I

Note:
Field topography was collected by PGE Survey crew using RTK GPS on 9/21/2023 and 10/04/2023.
Elevations shown in City of Portland vertical datum (NAVD88 - 2.1 feet)
Vertical accuracy approximately 1.5 centimeters.

0 7.5 15
Feet

PGE

Portland General Electric
Portland, Oregon

Surface Elevation Data
2023 GPS Field Survey

PGE Environmental Services

Date:	Drawn By:	Rev.:
10/21/2024	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Field_COP_2023_100924.mxd

Site Location Map

Map Features

× 2023 GPS Field-Collected Data

FIGURE 2J

Note:
Field topography was collected by PGE Survey crew using RTK GPS on 9/21/2023 and 10/04/2023.
Elevations shown in City of Portland vertical datum (NAVD88 - 2.1 feet)
Vertical accuracy approximately 1.5 centimeters.

0 7.5 15
Feet

PGE

Portland General Electric
Portland, Oregon

Surface Elevation Data
2023 GPS Field Survey

PGE Environmental Services

Date:	Drawn By:	Rev.:
10/21/2024	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Field_COP_2023_100924.mxd

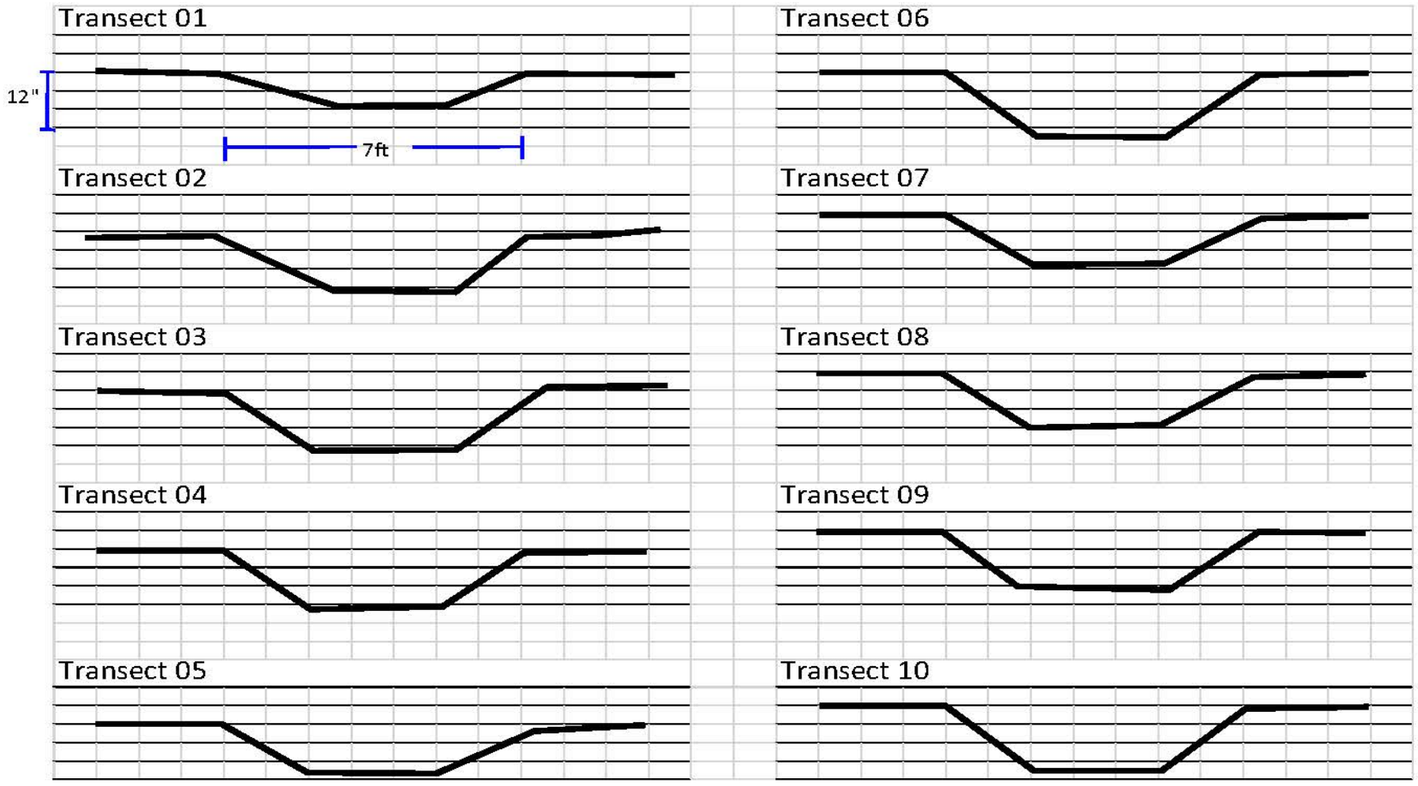


FIGURE 2K

Note:
Field topography was collected by PGE Survey crew using RTK GPS on 9/21/2023 and 10/04/2023.
Elevations shown in City of Portland vertical datum (NAVD88 - 2.1 feet)
Vertical accuracy approximately 1.5 centimeters.

Portland General Electric
Portland, Oregon

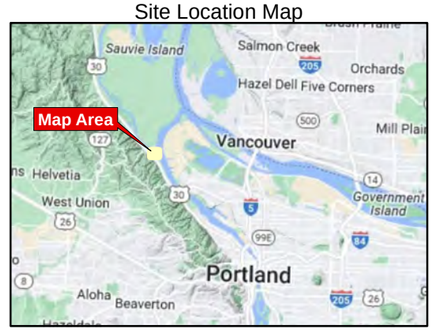
Channel Cross-sections
2023 GPS Field Survey

PGE Environmental Services

Date:	Drawn By:	Rev.:
10/21/2024	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Field_COP_2023_100924.mxd

Site Location Map



Map Features

5/19/2023 Max Depth
17.05 Ft. - 24.3 Acres

Habitat Area

FIGURE 3

Note:
Site aerial photo date - 06/02/23

0 100 200
Feet

Portland General Electric
Portland, Oregon

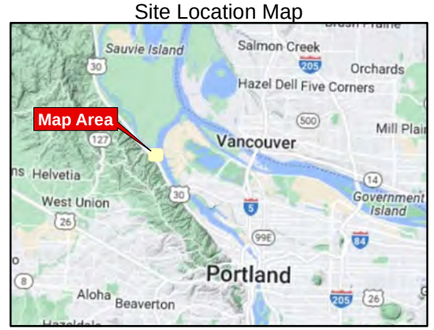
Harborton 2023 Peak Surface Water

PGE Environmental Services

Date:	Drawn By:	Rev.:
11/14/2023	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Max_Depth_2023.mxd

Site Location Map



Map Features

Habitat Area

Delta From As-Built

- 0-1 Feet
- 1-2 Feet
- 2-3 Feet
- 3-5 Feet
- >5 Feet

Note:
As-built topography was surveyed by Minister and Glaeser Surveying (provided by Envirocon).
Current surface was created by LiDAR flown on October 12, 2023.
Vertical datum used - City of Portland.

0 100 200
Feet

N
W E
S

FIGURE 4

Portland General Electric
Portland, Oregon

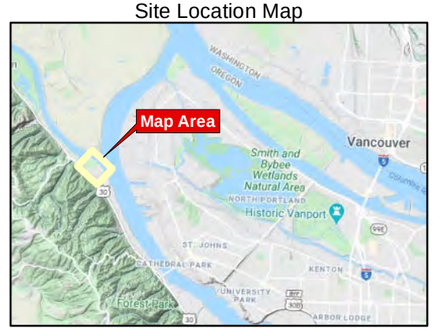
LIDAR-based Surface Elevation Comparison

PGE Environmental Services

Date:	Drawn By:	Rev.:
12/1/2023	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Topo_Delta_113023.mxd

Site Location Map



Map Features

- Habitat Area
- Non-Habitat Area
- Survey Transect
- Property Line
- Olympic Pipeline
- Water Level / Water Monitoring Station (WMS)
- Fish Passage Structure/Fish Accessibility
- Bald Eagle Monitoring Station
- Mink Scent Station/ Photmonitoring
- Mink Track and Scent Monitoring Routes
- Extent of High Flow Inundation
- S Water Level Staff Gauge
- TC Trail Camera

FIGURE 5

0 115 230
Feet

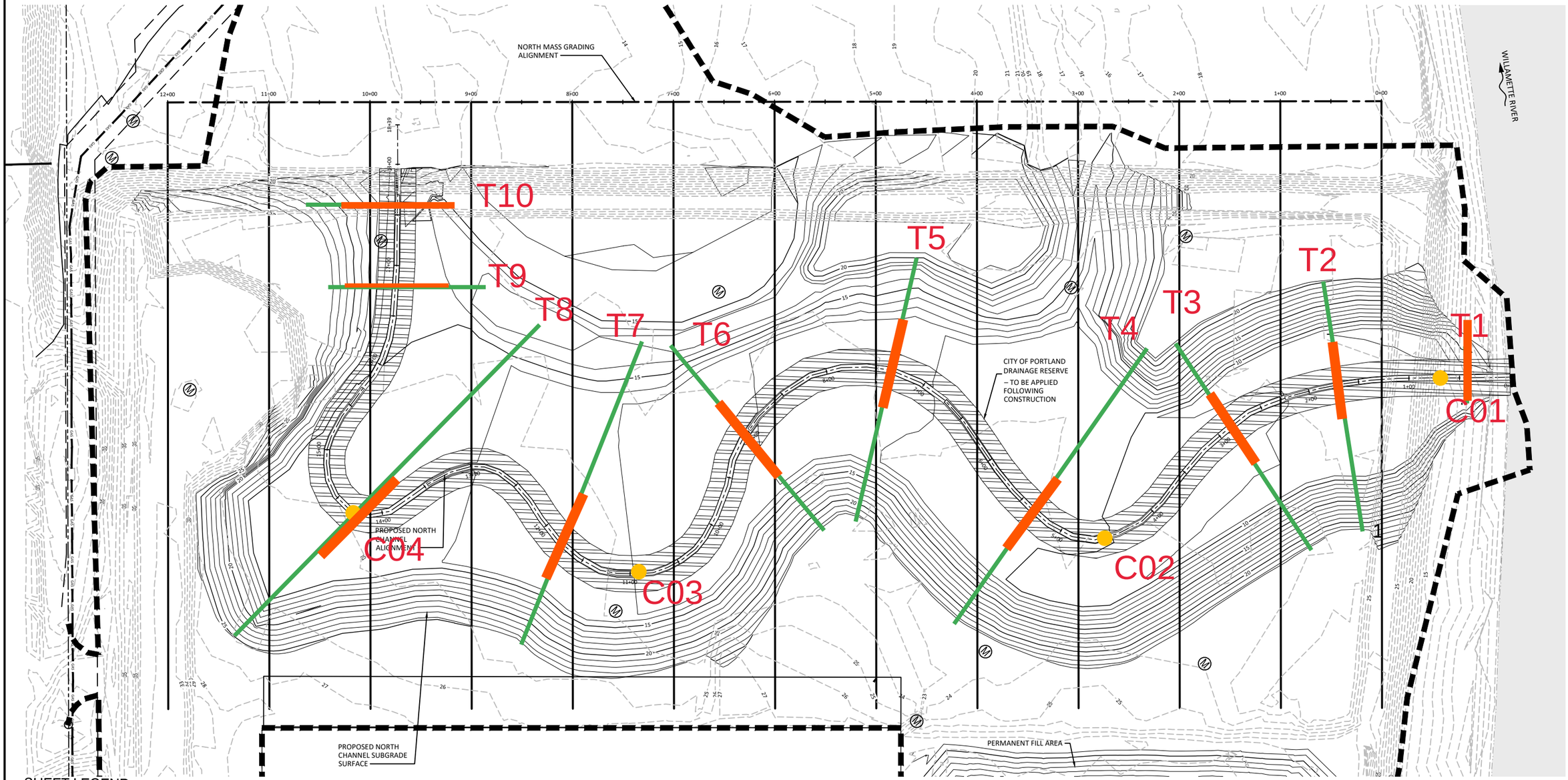
Portland General Electric
Portland, Oregon

Fixed Monitoring Stations

Harborton Restoration Project

Date:	Drawn By:	Rev.:
7/4/2020	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Hab_Fig5.mxd



SHEET LEGEND

- MONITORING PLOT
- MONITORING TRANSECT
- SEDIMENT GRAB SAMPLE
- BLACK = PROPOSED ELEVATION
- GRAY = EXISTING ELEVATION
- DRAINAGE RESERVE

SCALE IN FEET: 0, 50, 100

NOTES:

1. SEE SHEET 6 FOR SITE ACCESS.
2. SEE SHEET 7 FOR EROSION CONTROL BMP'S.

PI Station	Northing	Easting
0+00.00	719,549.02	7,614,601.26
0+51.97	719,510.48	7,614,566.39
0+78.95	719,490.80	7,614,547.93
1+11.48	719,466.61	7,614,526.19
1+37.42	719,446.52	7,614,509.78
1+63.59	719,425.20	7,614,494.60
1+90.67	719,402.24	7,614,480.24
2+16.72	719,379.28	7,614,467.94
2+42.73	719,355.38	7,614,457.67
2+62.96	719,336.29	7,614,450.97
2+93.81	719,305.56	7,614,448.35
3+20.75	719,278.63	7,614,447.37
3+53.83	719,245.76	7,614,451.00

PI Station	Northing	Easting
3+86.66	719,213.42	7,614,456.71
4+14.38	719,185.71	7,614,457.23
4+40.86	719,160.17	7,614,450.23
4+64.56	719,139.24	7,614,439.11
4+87.35	719,124.85	7,614,421.44
5+13.80	719,116.42	7,614,396.37
5+39.06	719,114.05	7,614,371.22
5+61.42	719,113.41	7,614,348.87
5+88.05	719,115.28	7,614,322.30
6+18.77	719,120.08	7,614,291.96
6+47.16	719,124.25	7,614,263.88
6+73.80	719,124.78	7,614,237.25
7+03.62	719,119.19	7,614,207.55

PI Station	Northing	Easting
7+36.46	719,105.63	7,614,178.05
7+59.83	719,090.59	7,614,160.16
7+84.88	719,071.89	7,614,143.48
8+16.35	719,044.26	7,614,128.44
8+49.01	719,012.09	7,614,122.74
8+81.98	718,979.12	7,614,123.14
9+09.85	718,951.84	7,614,128.83
9+32.38	718,930.86	7,614,137.04
9+57.81	718,910.30	7,614,152.01
9+90.96	718,880.58	7,614,166.70
10+13.92	718,858.83	7,614,174.04
10+29.04	718,843.91	7,614,176.45
10+46.74	718,826.28	7,614,174.84

PI Station	Northing	Easting
10+62.09	718,811.46	7,614,170.84
10+77.40	718,797.39	7,614,164.81
10+94.48	718,784.17	7,614,153.99
11+12.89	718,770.96	7,614,141.17
11+29.80	718,760.94	7,614,127.54
11+54.25	718,753.67	7,614,104.20
11+81.69	718,750.46	7,614,076.95
12+08.64	718,752.87	7,614,050.10
12+29.69	718,756.65	7,614,029.40
12+51.48	718,757.45	7,614,007.62
12+70.91	718,754.00	7,613,988.50
12+86.51	718,746.79	7,613,974.67
12+99.68	718,737.48	7,613,965.35

PI Station	Northing	Easting
13+20.98	718,718.60	7,613,955.49
13+43.84	718,696.57	7,613,949.38
13+62.02	718,678.52	7,613,947.26
13+92.31	718,648.53	7,613,943.01
14+12.99	718,631.38	7,613,931.45
14+31.67	718,620.56	7,613,916.23
14+52.77	718,619.87	7,613,895.14
14+70.15	718,625.41	7,613,878.67
14+86.36	718,635.03	7,613,865.62
15+00.77	718,645.30	7,613,855.50
15+13.54	718,656.55	7,613,849.47
15+36.73	718,678.44	7,613,841.80
15+54.58	718,696.06	7,613,838.97

PI Station	Northing	Easting
15+71.69	718,712.87	7,613,835.75
15+88.00	718,729.03	7,613,833.60
16+05.37	718,745.53	7,613,828.16
16+26.87	718,764.50	7,613,818.06
16+48.10	718,781.46	7,613,805.27
16+78.93	718,804.01	7,613,784.25
17+01.84	718,820.66	7,613,768.52
17+22.31	718,834.75	7,613,753.67
17+76.94	718,872.54	7,613,714.22
18+39.07	718,914.77	7,613,668.64

REGISTERED PROFESSIONAL ENGINEER
19089PE
OREGON
DANIEL S. MILLER
EXPIRES: 12/31/2020

NO.	BY	DATE	REVISION DESCPRIPTION

RP, CP	DM,JG,CM	DM,CM
DRAWN	DESIGNED	CHECKED
APPROVED	DATE	160218 PROJECT

PORTLAND GENERAL ELECTRIC HARBORTON RESTORATION PROJECT PORTLAND, OREGON

Interfluve
501 Portway Avenue, Suite 101
Hood River, OR 97031
541.386.9003
www.interfluve.com

MONITORING TRANSECTS - NORTH CHANNEL

FIGURE 6

Site Location Map

Map Features

- Survey Transect
- Habitat Area
- Non-Habitat Area
- Upland Forest Establishment
- Upland Scrub-Shrub Establishment
- Riparian Forest Establishment
- Riparian Forest Enhancement/Conservation
- Wetland (i.e., ACM) Establishment
- Wetland (i.e., ACM) Enhancement/Conservation
- Property Line
- Olympic Pipeline
- Sample Plot Location (approximate)

0 115 230
Feet

Portland General Electric
Portland, Oregon

Figure 7

Sample Line-intercept Vegetation Assessment Plots

PGE Environmental Services

Date:	Drawn By:	Rev.:
12/14/2020	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Hab_Fig6_Upd.mxd


BS01
BS02
BS03
BS04
BS05
BS06
BS07
BS08
BS09
BS10
BS11
BS12
BS13
Bird Survey Features
Bird Survey Point
50-Meter Range
150-Meter Range
Harborton Drone Photography
Mission Date: 04/25/2021
0
45
90
180
Scale in Feet
FIGURE 8
BIRD SURVEY LOCATIONS

Appendix A - North Channel Photomonitoring

CHANNEL INLET PHOTOS

CHANNEL INLET PHOTOS

Photo 01 – Channel Inlet, looking upstream 2/24/23

Photo 02 – Channel Inlet, looking downstream 4/21/23

Photo 03 – Channel Inlet, looking upstream 10/20/23

MID CHANNEL PHOTOS

MID CHANNEL PHOTOS

Photo 04 – Mid Channel, looking upstream 1/9/23

Photo 05 – Mid Channel, closeup looking upstream7/5/23

Photo 06 – Mid Channel, closeup looking upstream 9/20/23

CHANNEL OUTLET PHOTOS

OUTLET PHOTOS

Photo 07 – Outlet, 4/26/23

Photo 08 – Outlet, 5/17/23

Photo 09 – Outlet at low tide, 6/22/23

Photo 10 – Outlet at high tide, 6/22/23

Photo 11 – Outlet at low tide, 7/13/23

Photo 12 – Outlet, note approx. 6” sediment on 9/5/23

Photo 13 – Outlet following rain event, 9/28/23

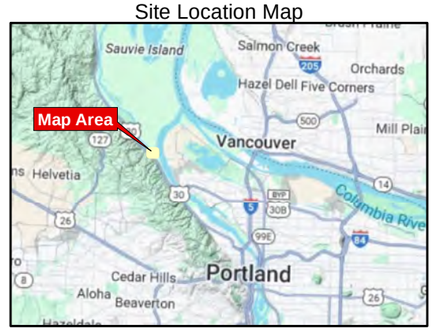
Photo 14 – Outlet, 10/13/23

Photo 15 – Outlet 10/27/23

Photo 16 – Outlet on 11/26/23, note shift from 10/27

Appendix B - Standing Water Areal Extent, January-July 2023

Site Location Map



Map Features

January Average Depth
4.35 Ft. - 8.5 Acres

Note:
Site aerial photo date - 06/02/23

0 70 140
Feet

N
W E
S

Portland General Electric
Portland, Oregon

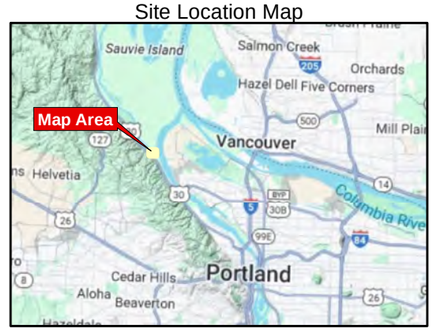
Harborton Inundation 2023 Study

PGE Environmental Services

Date:	Drawn By:	Rev.:
5/31/2024	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Depths_2023_053124.mxd

Site Location Map



Map Features

February Average Depth
3.81 Ft. - 5.7 Acres

Note:
Site aerial photo date - 06/02/23

0 70 140
Feet

PGE

N
W E
S

Portland General Electric
Portland, Oregon

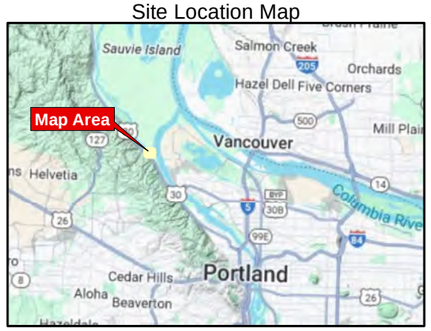
Harborton Inundation 2023 Study

PGE Environmental Services

Date:	Drawn By:	Rev.:
5/31/2024	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Depths_2023_053124.mxd

Site Location Map



Map Features

March Average Depth
4.46 Ft. - 8.8 Acres

Note:
Site aerial photo date - 06/02/23

0 70 140
Feet

N
W E
S

Portland General Electric
Portland, Oregon

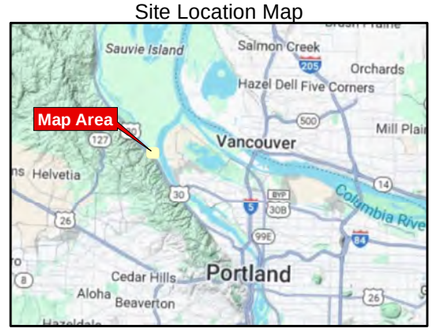
Harborton Inundation 2023 Study

PGE Environmental Services

Date:	Drawn By:	Rev.:
5/31/2024	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Depths_2023_053124.mxd

Site Location Map



Map Features

April Average Depth
4.43 Ft. - 8.7 Acres

Note:
Site aerial photo date - 06/02/23

0 70 140
Feet

N
W E
S

Portland General Electric
Portland, Oregon

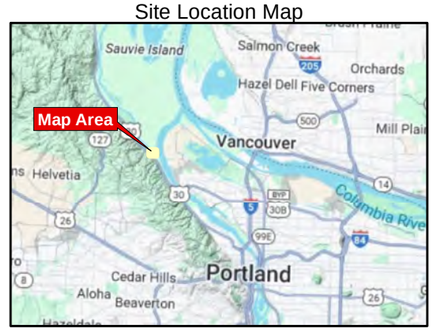
Harborton Inundation 2023 Study

PGE Environmental Services

Date:	Drawn By:	Rev.:
5/31/2024	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Depths_2023_053124.mxd

Site Location Map



Map Features

May Average Depth
2.98 Ft. - 1.4 Acres

Note:
Site aerial photo date - 06/02/23

0 70 140
Feet

Portland General Electric
Portland, Oregon

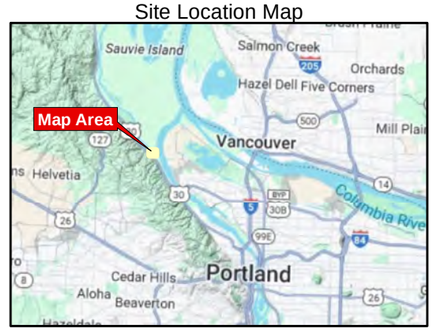
Harborton Inundation 2023 Study

PGE Environmental Services

Date:	Drawn By:	Rev.:
5/31/2024	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Depths_2023_053124.mxd

Site Location Map



Map Features

June Average Depth
2.25 Ft. - 0.2 Acres

Note:
Site aerial photo date - 06/02/23

0 70 140
Feet

Portland General Electric
Portland, Oregon

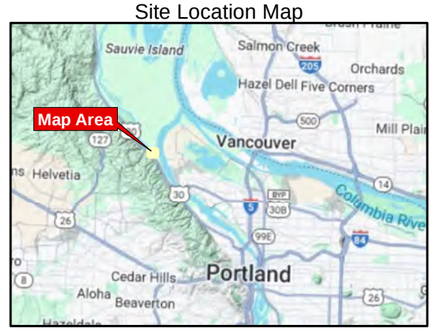
Harborton Inundation 2023 Study

PGE Environmental Services

Date:	Drawn By:	Rev.:
5/31/2024	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Depths_2023_053124.mxd

Site Location Map



Map Features

Week 1 June Ave. Depth
2.81 Ft. - 0.9 Acres

Note:
Site aerial photo date - 06/02/23

0 70 140
Feet

PGE

N
W E
S

Portland General Electric
Portland, Oregon

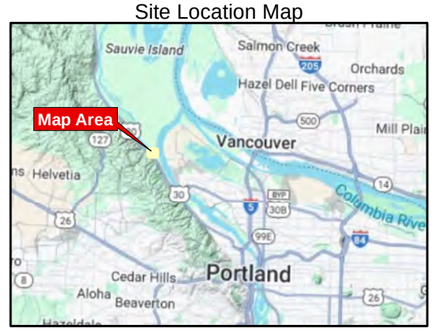
Harborton Inundation 2023 Study

PGE Environmental Services

Date:	Drawn By:	Rev.:
5/31/2024	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Depths_2023_053124.mxd

Site Location Map



Map Features

Week 2 June Ave. Depth
3.04 Ft. - 1.6 Acres

Note:
Site aerial photo date - 06/02/23

0 70 140
Feet

Portland General Electric
Portland, Oregon

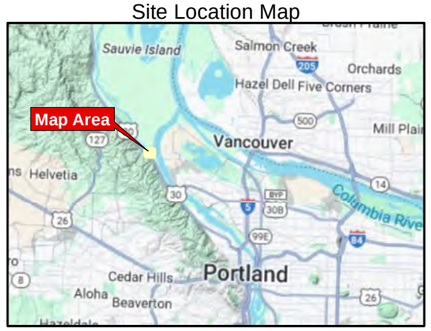
Harborton Inundation 2023 Study

PGE Environmental Services

Date:	Drawn By:	Rev.:
5/31/2024	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Depths_2023_053124.mxd

Site Location Map



Map Features

Week 3 June Ave. Depth
2.12 Ft. - 0.1 Acres

Note:
Site aerial photo date - 06/02/23

0 70 140
Feet

PGE

N
W E
S

Portland General Electric
Portland, Oregon

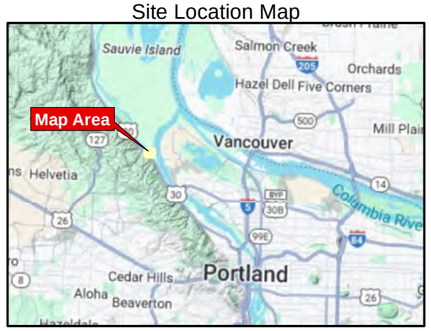
Harborton Inundation 2023 Study

PGE Environmental Services

Date:	Drawn By:	Rev.:
5/31/2024	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Depths_2023_053124.mxd

Site Location Map



Map Features

Week 4 June Ave. Depth
0.81 Ft. - 0 Acres

Note:
Site aerial photo date - 06/02/23

0 70 140
Feet

Portland General Electric
Portland, Oregon

Harborton Inundation 2023 Study

PGE Environmental Services

Date:	Drawn By:	Rev.:
5/31/2024	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Depths_2023_053124.mxd

Appendix C - Vegetation Data, Site Transects

Site: Harborton
Habitat: Upland Forest Establishment

Species	Origin (N, NN, I)	Wetland Status (1 - 5)	Transect T06 2	T06 3	T06 4	T07 2	T07 3	T07 4	T08 2	Row Average
Native Herbaceous Species										
Achillea millefolium	N	4	90	80	15	40	70	40	30	52
Agrostis exarata	N	3	0	5	40	0	0	10	0	8
Bromus carinatus	N	4	0	0	0	0	0	2	20	3
Clarkia amoena	N	4	0	0	0	0	0	0	0	0
Epilobium congesta	N	3	5	0	0	10	0	0	0	2
Epilobium watsonii	N	4	1	1	0	0	0	0	0	0
Festuca rubra	N	4	0	0	3	0	5	0	3	2
Lupinus polyphyllus	N	3	0	0	0	0	0	0	0	0
Lupinus rivularis	N	3	0	5	1	15	0	5	2	4
Madia gracilis	N	5	0	0	0	2	0	0	0	0
Polystichum munitum	N	5	0	0	0	0	0	0	0	0
Sidalcea campestris	N	4	0	0	0	3	0	0	0	0
Non-Native (Not Listed) Herbaceous Species										
Holcus lanatus	NN	2	0	0	0	0	0	0	0	0
Lolium multiflorum	NN	4	0	0	0	0	0	0	0	0
Poa annua	NN	3	0	0	0	0	0	0	2	0
Invasive Herbaceous Species										
Cirsium arvense	I	3	0	0	0	0	0	0	0	0
Daucus carota	I	5	0	0	0	0	0	1	0	0
Hypochaeris radicata	I	3	0	0	1	0	0	0	0	0
Reed Canarygrass										
Phalaris arundinacea	I	2	0	1	0	0	0	0	0	0
Native Shrub and Tree Species (Form)										
Acer macrophyllum (T)	N	4	0	8	0	0	6	0	0	2
Alnus rubra (T)	N	2	2	0	4	2	0	0	2	1
Amelanchier alnifolia (S)	N	4	0	0	0	0	2	0	0	0
Cornus alba (S)	N	2	0	0	3	0	0	4	2	1
Corylus cornuta (S)	N	2	0	0	2	0	0	0	0	0
Crataegus douglasii (T)	N	3	2	0	0	0	1	0	0	0
Frangula purshiana (T)	N	3	0	0	2	0	0	0	0	0
Mahonia nervosa (S)	N	4	0	4	0	0	4	7	0	2
Pinus contorta (T)	N	3	0	0	2	0	0	0	0	0
Prunus emarginata (T)	N	5	1	2	1	0	2	2	0	1
Pseudotsuga menziesii (T)	N	4	0	0	0	0	0	0	0	0
Quercus garryana (T)	N	5	0	1	4	9	4	2	0	3
Rosa nutkana (S)	N	3	4	3	3	0	2	1	1	2
Salix lasiandra (S)	N	3	0	0	0	0	0	0	0	0
Sambucus racemosa (S)	N	3	3	0	0	2	0	0	2	1
Symphoricarpos albus (S)	N	4	15	15	0	10	20	0	10	10
Non-Native Shrub and Tree Species										
Invasive Shrub and Tree Species										
Rubus armeniacus	I	4	0	0	0	0	0	0	0	0
Crataegus monogyna	I	3	0	0	0	0	0	0	0	0
Bare Substrate			0	0	0	0	0	0	0	0
Native Shrub and Tree Count										
Acer macrophyllum			0	5	0	0	3	1	0	1
Alnus rubra			1	0	2	1	0	0	1	1
Amelanchier alnifolia			0	0	0	0	2	0	0	0
Cornus alba			0	0	1	0	0	4	2	1
Corylus cornuta			0	0	1	0	0	0	0	0
Crataegus douglasii			1	0	0	0	1	0	0	0
Frangula purshiana			0	0	1	0	0	0	0	0
Mahonia nervosa			0	2	0	0	4	7	0	2
Pinus contorta			0	0	1	0	0	0	0	0
Prunus emarginata			1	2	1	0	2	2	0	1
Pseudotsuga menziesii			0	0	0	0	0	0	0	0
Quercus garryana			5	6	6	9	4	2	0	5
Rosa nutkana			4	3	3	0	2	1	1	2
Salix lasiandra			0	0	0	0	0	0	0	0
Sambucus racemosa			1	0	0	1	0	0	1	0
Symphoricarpos albus			10	10	1	5	9	9	8	7

Routine Performance Standards			**2**	**3**	**4**	**2**	**3**	**4**	**2**	**Habitat Average**	**Standard Error**
Cover of Native Herbaceous Species			96	91	59	70	75	57	55	72	6.2
Lower CI (80%)										64	
Upper CI (80%)										80	
Cover of Non Native Herbaceous Species			0	0	0	0	0	0	2	0	0.3
Lower CI (80%)										0	
Upper CI (80%)										1	
Cover of Invasive Herbaceous Species			0	0	1	0	0	1	0	0	0
Lower CI (80%)										0	
Upper CI (80%)										1	
Cover of Reed Canarygrass			0	1	0	0	0	0	0	0	0
Lower CI (80%)										0	
Upper CI (80%)										0	
Cover of Invasive Shrubs and Trees			0	0	0	0	0	0	0	0	0
Lower CI (80%)										0	
Upper CI (80%)										0	
Bare Substrate			0	0	0	0	0	0	0	0	0
Lower CI (80%)										0	
Upper CI (80%)										0	
Native Diversity (all layers)										5	N/A
Sum of plant cover			33	45	66	53	46	34	44		
		Average per acre									
Density of Woody Vegetation			1186	1443	876	825	1392	1340	670	1105	N/A
Plot Area (shrub/tree plot)	845										
Per acre multiplier: Input 4,047 if plot area entered in B84 is in sq.meters or 43,560 for sq.feet	43560										
Cover of Native Shrubs and Trees			27	25	21	23	35	16	17	23	2
Lower CI (80%)										20	
Upper CI (80%)										27	

Site: Harborton
Habitat: Scrub/Shrub Establishment

Species	Origin (N, NN, I)	Wetland Status (1 - 5)	Transect T06 1	T07 1	T08 1	Row Average
Native Herbaceous Species						
Achillea millefolium	N	4	60	30	40	43
Agrostis exarata	N	3	0	0	0	0
Bromus carinatus	N	4	5	15	10	10
Epilobium watsonii	N	4	0	5	1	2
Festuca rubra	N	4	0	2	0	1
Grindelia lanceolata	N	5	0	0	2	1
Lupinus polyphyllus	N	3	0	0	0	0
Lupinus rivularis	N	3	10	10	7	9
Non-Native (Not Listed) Herbaceous Species						
Holcus lanatus	NN	2	1	0	2	1
Lolium multiflorum	NN	4	1	0	0	0
Invasive Herbaceous Species						
Cirsium arvense	I	3	1	0	0	0
Daucus carota	I	5	0	0	0	0
Hypochaeris radicata	I	3	1	0	0	0
Reed Canarygrass Cover						
Phalaris arundinacea	I	2	0	5	0	2
Native Shrub and Tree Species (Form)						
Acer macrophyllum (T)	N	4	4	0	0	1
Alnus rubra (T)	N	2	0	0	0	0
Cornus alba (S)	N	2	5	5	10	7
Frangula purshiana (T)	N	3	0	0	0	0
Mahonia nervosa (S)	N	4	2	3	3	3
Pinus contorta (T)	N	3	0	0	0	0
Prunus emarginata (T)	N	5	0	1	2	1
Pseudotsuga menziesii (T)	N	4	0	0	0	0
Quercus garryana (T)	N	5	2	0	0	1
Rosa gymnocarpa (S)	N	3	0	3	0	1
Rosa nutkana (S)	N	3	3	0	3	2
Salix lasiandra (S)	N	3	0	0	0	0
Sambucus racemosa (S)	N	3	3	0	0	1
Symphoricarpos albus (S)	N	4	10	5	10	8
Non-Native (Not Listed) Shrub and Tree Species						
Invasive Shrub and Tree Species						
Cytisus scoparius	I	4	1	0	0	0
Rubus armeniacus	I	4	0	0	0	0
Bare Substrate			5	0	0	2

Plant Count (Shrubs) + Stem Count (Trees)

Native Shrub and Tree Count					
Acer macrophyllum	3	0	0	1	
Mahonia nervosa	2	3	3	3	
Alnus rubra	0	0	0	0	
Cornus alba	5	5	10	7	
Frangula purshiana	0	0	0	0	
Pinus contorta	0	0	0	0	
Prunus emarginata	0	1	2	1	
Pseudotsuga menziesii	0	0	0	0	
Quercus garryana	2	0	0	1	
Rosa gymnocarpa	0	3	0	1	
Rosa nutkana	3	0	3	2	
Salix lasiandra	0	0	0	0	
Sambucus racemosa	1	0	1	1	
Symphoricarpos albus	7	5	10	7	

Routine Performance Standards		**1**	**2**	**3**	**Habitat Average**	**Standard Error**
Cover of Native Herbaceous Species		75	62	60	66	4.7
Lower CI (80%)					60	
Upper CI (80%)					72	
Cover of Non Native Herbaceous Species		2	0	2	1	0.7
Lower CI (80%)					0	
Upper CI (80%)					2	
Cover of Invasive Herbaceous Species		2	0	0	1	1
Lower CI (80%)					0	
Upper CI (80%)					2	
Cover of Reed Canarygrass		0	5	0	2	2
Lower CI (80%)					0	
Upper CI (80%)					4	
Cover of Invasive Shrubs and Trees		0	0	0	0	0
Lower CI (80%)					0	
Upper CI (80%)					0	
Bare Substrate		5	0	0	2	2
Lower CI (80%)					0	
Upper CI (80%)					4	
Native Diversity (all layers)					5	N/A
Sum of plant cover		49	54	50		
	Average per acre					
Density of Woody Vegetation		1186	876	1495	1186	N/A
Plot Area (shrub/tree plot)	845					
Per acre multiplier: Input 4,047 if plot area entered in B84 is in sq.meters or 43,560 for sq.feet	43560					
Cover of Native Shrubs and Trees		25	17	28	23	3
Lower CI (80%)					19	
Upper CI (80%)					28	

Site: Harborton
Habitat: Riparian Forest Establishment

Species	Origin (N, NN, I)	Wetland Status (1 - 5)	Transect T04 1	T04 2	T04 7	T04 8	T04 9	T04 10	T05 1	T05 6	T05 9	T05 10	Row Average
Native Herbaceous Species													
Achillea millefolium	N	4	0	2	15	5	1	2	0	0	0	0	3
Agrostis exarata	N	3	2	20	25	10	10	20	60	20	0	25	19
Carex obnupta	N	2	0	0	0	0	0	0	0	0	0	0	0
Deschampsia cespitosa	N	2	0	0	0	0	0	0	0	30	20	0	5
Epilobium ciliatum	N	2	1	0	0	0	10	0	0	0	0	0	1
Equisetum arvense	N	3	0	0	0	0	0	0	0	0	0	0	0
Galium aparine	N	4	0	0	0	0	2	0	0	0	0	0	0
Hordeum brachyantherum	N	2	3	0	0	0	0	0	0	0	0	0	0
Lupinus polyphyllus	N	4	5	20	30	20	0	0	5	0	0	0	8
Lupinus rivularis	N	3	0	50	10	25	0	10	1	0	0	0	10
Madia gracilis	N	5	25	0	0	0	0	0	5	0	0	0	3
Plagiobothyrus figuratus	N	3	0	2	2	0	0	0	0	0	0	0	0
Potentilla gracilis	N	3	3	0	0	2	0	0	0	0	0	0	1
Rumex aquaticus var *fenestratus*	N	2	0	0	0	0	1	0	0	0	0	0	0
Trifolium wormskjoldii	N	3	2	0	0	1	0	0	0	0	0	0	0
Non-Native (Not Listed) Herbaceous Species													
Holcus lanatus	NN	3	0	0	0	0	0	0	0	0	30	0	3
Lolium multiflorum	NN	4	0	5	0	5	0	10	0	0	0	0	2
Poa annua	NN	3	0	10	0	2	0	0	0	0	0	0	1
Polypogon monspeliensis	NN	2	0	0	2	0	0	0	0	0	0	0	0
Rumex acetosa	NN	3	0	0	0	0	0	3	0	0	0	0	0
Vicia sativa	NN	5	0	3	0	0	0	0	0	5	0	0	1
Invasive Herbaceous Species													
Cirsium arvense	I	3	0	0	0	1	5	0	0	0	0	0	1
Daucus carota	I	5	0	0	0	1	1	0	0	0	0	0	0
Hypochaeris radicata	I	3	1	0	2	0	0	0	0	0	0	0	0
Lactuca serriola	I	4	0	0	0	0	0	0	0	2	0	5	1
Senecio jacobaea	I	4	0	0	0	0	2	0	0	0	0	0	0
Trifolium repens	I	3	0	1	2	5	0	2	0	0	0	0	1
Reed Canarygrass Cover													
Phalaris arundinacea	I	2	0	0	0	0	60	0	0	3	0	0	6
Native Shrub and Tree Species (Form)													
Acer macrophyllum (T)	N	4	0	0	0	4	6	0	0	0	0	0	1
Alnus rubra (T)	N	2	0	0	0	1	0	5	0	0	2	0	1
Amelanchier alnifolia (S)	N	4	5	2	10	7	0	0	3	0	0	0	3
Cornus alba (S)	N	2	0	6	10	0	15	0	0	0	5	4	4
Crataegus douglasii (T)	N	3	0	0	0	3	0	0	0	0	3	2	1
Fraxinus latifolia (T)	N	2	0	0	0	1	0	0	3	1	2	5	1
Mahonia aquifolium (S)	N	3	2	0	0	0	3	0	0	6	0	0	1
Physocarpus capitatus (S)	N	2	0	0	0	0	0	0	0	0	0	0	0
Pinus contorta (T)	N	3	0	0	0	2	0	3	3	5	0	0	1
Populus balsamif. var. *trichocarpa (T)*	N	2	0	0	10	2	6	12	0	2	5	0	4
Pseudotsuga menziesii (T)	N	4	5	0	0	4	0	2	0	1	0	0	1
Quercus garryana (T)	N	4	0	0	4	2	0	0	0	0	0	0	1
Rosa nutkana (S)	N	3	6	8	6	0	0	5	2	6	0	6	4
Salix fluviatilis (S)	N	2	0	0	0	0	0	0	0	0	0	0	0
Salix lasiandra (S)	N	2	0	0	0	0	0	0	0	6	50	10	7
Salix sitchensis (S)	N	2	5	5	10	0	0	0	3	0	5	20	5
Sambucus racemosa (S)	N	3	0	0	0	3	0	0	0	0	0	0	0
Spiraea douglasii (S)	N	2	0	10	0	0	0	1	3	6	3	0	2
Symphoricarpos albus (S)	N	4	0	5	5	1	0	0	0	1	0	5	2
Non-Native Shrub and Tree Species													
			0	0	0	0	0	0	0	0	0	0	0
Invasive Shrub and Tree Species													
Cytisus scoparius	I	5	3	1	0	0	0	1	0	0	0	0	1
Rubus armeniacus	I	3	3	0	5	5	25	15	0	8	0	10	7
Bare Substrate			30	0	10	15	5	15	0	0	0	0	8
Plant Count (Shrubs) + Stem Count (Trees)													
Native Shrub and Tree Count (Form)													
Acer macrophyllum (T)			0	0	0	4	6	0	0	0	0	0	1
Alnus rubra (T)			0	0	0	1	0	2	0	0	1	0	0
Amelanchier alnifolia (S)			5	1	3	7	0	0	3	0	0	0	2
Cornus alba (S)			0	6	4	0	3	0	0	0	5	4	2
Crataegus douglasii (S)			0	0	0	3	0	0	0	1	2	1	1
Fraxinus latifolia (T)			0	0	0	1	0	0	3	0	1	2	1
Mahonia aquifolium (S)			2	0	0	0	5	0	0	4	0	0	1
Pinus contorta (T)			0	1	0	2	0	1	1	3	0	0	1
Populus balsamif. v ar trichocarpa (T)			0	0	2	2	0	2	0	1	1	0	1
Pseudotsuga menziesii (T)			11	0	4	4	0	2	0	1	0	0	2
Physocarpus capitatus (S)			0	0	0	0	0	0	0	0	0	0	0
Quercus garryana (T)			0	0	4	2	0	0	0	0	0	0	1
Rosa nutkana (S)			6	4	3	0	0	5	2	3	0	4	3
Salix fluviatilis (S)			0	0	0	0	0	0	0	0	0	0	0
Salix lasiandra (S)			0	0	0	0	0	0	0	4	4	2	1
Salix sitchensis (S)			1	5	4	0	0	0	3	0	3	4	2
Sambucus racemosa (S)			0	0	0	3	0	0	0	0	0	0	0
Spiraea douglasii (S)			0	11	0	0	0	1	3	4	3	0	2
Symphoricarpos albus (S)			0	2	5	1	0	0	0	1	0	2	1

Routine Performance Standards			**1**	**2**	**7**	**8**	**9**	**10**	**1**	**6**	**9**	**10**	**Habitat Average**	**Standard Error**
Cover of Native Herbaceous Species			41	94	82	63	24	32	71	50	20	25	50	8.3
Lower CI (80%)													40	
Upper CI (80%)													61	
Cover of Non Native (Not Listed) Herbaceous Species			0	18	2	7	0	13	0	5	0	0	5	2.0
Lower CI (80%)													2	
Upper CI (80%)													7	
Cover of Invasive Herbaceous Species			1	1	4	7	8	2	0	2	0	5	3	0.9
Lower CI (80%)													2	
Upper CI (80%)													4	
Cover of Reed Canarygrass			0	0	0	0	60	0	0	3	0	0	6	6.0
Lower CI (80%)													-1	
Upper CI (80%)													14	
Cover of Invasive Shrubs and Trees			6	1	5	5	25	16	0	8	0	10	8	2
Lower CI (80%)													4	
Upper CI (80%)													11	
Bare Substrate			30	0	10	15	5	15	0	0	0	0	8	3
Lower CI (80%)													3	
Upper CI (80%)													12	
Native Diversity (all layers)													5	N/A
Sum of plant cover			71	148	133	107	146	89	88	102	125	92		
		Average per acre												
Density of Woody Vegetation			1289	1547	1495	1547	722	670	773	1134	1031	979	1119	N/A
Plot Area (shrub/tree plot)	845													
Per acre multiplier: Input 4,047 if plot area entered in B84 is in sq.meters or 43,560 for sq.feet	43560													
Cover of Native Shrubs and Trees			23	36	55	30	30	28	17	34	75	52	38	6
Lower CI (80%)													31	
Upper CI (80%)													45	

Site: Harborton
Habitat Type: Riparian Forest Enhancement/Conservation

			Transect																
			T01	T02			T03					T04	T05	T06	T07	T08	T09		
	Origin (N, NN, I)	Wetland Status (1 - 5)	2	4	6	7	5	6	8	9	10	11	11	5	5	3	1	Row Average	
Native Herbaceous Species																			
Achillea millefolium	N	5	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	1	
Agrostis exarata	N	2	20	30	0	0	0	0	40	0	0	0	0	0	0	0	0	6	
Carex obnupta	N	2	0	0	0	35	0	0	40	0	0	20	0	0	0	0	0	6	
Epilobium ciliatum	N	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	
Epilobium congesta	N	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	
Equisetum arvense	N	2	0	0	0	0	0	0	0	0	0	15	10	0	0	0	0	2	
Equisetum fluviatile	N	1	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	
Galium aparine	N	4	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	
Lupinus polyphylla	N	3	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	
Polystichum munitum	N	5	0	5	0	0	0	0	0	0	0	0	0	0	0	0	5	1	
Potentilla gracilis	N	3	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	2	
Rubus ursinus	N	4	0	5	5	0	0	15	15	0	0	0	0	0	0	3	0	3	
Urtica dioica	N	2	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	
Non-Native (Not Listed) Herbaceous Species																			
Holcus lanatus	NN	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	
Invasive Herbaceous Species																			
Cirsium arvense	I	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	
Daucus carota	I	5	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	
Geranium robertianum	I	4	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	
Invasive Herbaceous Species																			
Phalaris arundinacea	I	2	40	15	50	2	65	60	2	40	3	5	50	10	0	10	0	23	
Native Shrub and Tree Species (Form)																			
Acer macrophyllum (T)	N	4	0	0	0	0	0	0	0	0	0	0	0	0	0	80	0	5	
Alnus rubra (T)	N	3	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	1	
Cornus alba (S)	N	2	0	1	0	0	0	0	0	0	20	10	0	20	0	0	0	3	
Crataegus douglasii (T)	N	3	0	0	5	0	0	0	2	0	0	0	0	0	6	0	0	1	
Frangula purshiana (T)	N	4	0	0	0	0	0	0	0	0	0	0	0	5	0	2	10	1	
Fraxinus latifolia (T)	N	2	20	50	10	10	0	40	50	20	10	2	10	0	0	0	0	15	
Oemleria cerasiformis (S)	N	4	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Physocarpus capitatus (S)	N	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	
Populus balsamif. var. trichocarpa (T)	N	2	5	5	50	80	0	40	20	60	30	0	0	0	0	0	40	22	
Ribes divaricatum (S)	N	4	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	
Rosa nutkana (S)	N	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Salix fluviatilis (S)	N	1	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	1	
Salix hookeriana (S)	N	2	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	1	
Salix lasiandra (S)	N	2	0	0	0	0	0	0	0	0	0	0	30	70	40	0	0	9	
Salix sitchensis (S)	N	2	10	0	0	0	0	0	0	0	0	0	20	0	20	0	0	3	
Symphoricarpos albus (S)	N	4	0	40	10	50	0	4	15	20	25	0	0	0	0	4	0	11	
Non-Native Shrub and Tree Species																			
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Invasive Shrub and Tree Species																			
Cytisus scoparius	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	
Rubus armeniacus	I		2	2	0	0	0	0	0	0	0	0	0	10	10	0	10	2	
Bare Substrate			20	30	40	60	20	30	25	50	70	20	20	60	70	40	15	38	
			Plant Count (Shrubs) + Stem Count (Trees)																
Native Shrub and Tree Count																			
Acer macrophyllum			0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	
Alnus rubra			0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	
Amelanchier alnifolia			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cornus alba			1	1	0	0	0	0	0	0	12	2	0	9	6	0	0	2	
Crataegus douglasii			0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	
Frangula purshiana			0	0	0	0	0	0	0	0	0	0	0	1	0	2	1	0	
Fraxinus latifolia			7	8	1	3	12	10	17	7	3	1	3	0	0	0	0	5	
Oemleria cerasaiformis			0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Physocarpus capitatus			0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	
Populus balsamif. var trichocarpa			1	2	11	10	0	7	3	6	4	0	0	0	0	0	3	3	
Ribes divaricatum			0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	
Rosa nutkana			2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Salix fluviatilis			0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	1	
Salix hookeriana			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Salix lasiandra			0	0	0	0	0	0	0	0	0	2	3	5	3	0	0	1	
Salix sitchensis			2	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	
Sambucus racemosa			0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	
Symphoricarpos albus			0	30	6	40	0	2	11	14	20	0	0	0	0	2	0	8	

Routine Performance Standards		2	4	6	7	5	6	8	9	10	11	11	5	5	3	1	**Habitat Average**	**Standard Error**
Cover of Native Herbaceous Species		20	40	5	35	0	20	96	1	6	60	10	0	0	15	15	22	6.9
Lower CI (80%)																	13	
Upper CI (80%)																	30	
Cover of Non Native (Not Listed) Herbaceous Species		2	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0.4
Lower CI (80%)																	0	
Upper CI (80%)																	1	
Cover of Invasive Herbaceous Species		0	0	0	0	0	0	0	0	8	0	0	0	0	0	3	1	1
Lower CI (80%)																	0	
Upper CI (80%)																	1	
Cover of Reed Canarygrass		40	15	50	2	65	60	2	40	3	5	50	10	0	10	0	23	6
Lower CI (80%)																	15	
Upper CI (80%)																	31	
Cover of Invasive Shrubs and Trees		2	2	0	0	0	0	0	0	0	0	0	10	10	0	15	3	1
Lower CI (80%)																	1	
Upper CI (80%)																	4	
Bare Substrate		20	30	40	60	20	30	25	50	70	20	20	60	70	40	15	38	5
Lower CI (80%)																	32	
Upper CI (80%)																	44	
Native Diversity (all layers)																	5	N/A
Sum of plant cover		81	128	132	179	65	164	145	141	102	117	120	115	76	114	83		
	Average per acre																	
Density of Woody Vegetation		670	2371	1134	2835	619	979	1701	1443	2010	722	412	773	516	206	206	1107	N/A
Plot Area (shrub/tree plot) 845																		
Per acre multiplier: Input 4,047 if plot area entered in B84 is in sq.meters or 43,560 for sq.feet 43560																		
Cover of Native Shrubs and Trees		37	101	77	142	0	84	87	100	85	52	60	95	66	6	50	69	10
Lower CI (80%)																	57	
Upper CI (80%)																	82	

Site: Harborton
Habitat: Wetland Establishment (Emergent Wetlands)

Survey Date(s): July 11-13, 2023

Species	Origin (N, NN, I)	Wetland Status (1 - 5)	T04 Transect 3	T04 Transect 4	T04 Transect 5	T04 Transect 6	T05 Transect 2	T05 Transect 3	T05 Transect 4	T05 Transect 5	T05 Transect 7	T05 Transect 8	Row Average
Native Herbaceous Species													
Achillea millefolium	N	4	2	0	0	0	0	0	0	0	0	0	0
Agrostis exarata	N	3	10	0	0	0	0	0	0	5	0	0	2
Alisma plantago aquatica	N	1	5	35	25	2	0	0	5	0	5	5	8
Asclepias speciosa	N	5	0	0	0	0	0	0	0	0	0	0	0
Beckmannia syzigachne	N	2	5	5	0	15	10	0	0	20	0	10	7
Bidens frondosa	N	2	0	7	0	3	0	0	0	0	0	0	1
Bromus carinatus	N	4	0	0	0	0	0	0	0	0	0	0	0
Carex athrostachya	N	1	0	0	0	0	0	0	0	0	5	0	1
Carex obnupta	N	2	0	0	0	0	0	0	0	0	0	0	0
Carex stipata	N	2	0	0	0	0	2	10	0	0	0	0	1
Clarkia amoena	N	4	0	0	0	0	0	0	0	0	0	0	0
Deschampsia cespitosa	N	2	0	0	0	0	1	0	0	0	0	0	0
Downingia elegans	N	1	0	10	0	15	0	0	0	0	0	0	3
Eleocharis ovata	N	2	0	0	0	0	0	0	0	0	5	5	1
Eleocharis palustris	N	2	0	0	0	0	0	0	0	0	0	30	3
Epilobium ciliatum	N	2	0	0	0	0	0	0	0	0	0	0	0
Epilobium densiflorum	N	2	0	0	0	0	0	0	0	0	0	0	0
Equisetum arvense	N	3	0	0	0	0	0	0	0	0	0	0	0
Galium aparine	N	4	0	0	0	0	0	0	0	0	0	0	0
Glyceria occidentalis	N	2	0	0	0	15	0	0	0	0	0	10	3
Hordeum brachyantherum	N	2	0	4	2	5	5	0	0	30	0	0	5
Juncus bufonius	N	2	2	0	0	0	0	0	0	0	0	0	0
Juncus effusus	N	2	0	0	0	0	25	10	0	10	0	0	5
Juncus oxymeris	N	2	0	0	0	0	0	0	0	0	0	0	0
Juncus patens	N	2	0	0	0	0	10	20	5	0	0	0	4
Lupinus polyphyllus	N	4	0	0	0	0	0	0	0	0	0	0	0
Lupinus rivularis	N	3	0	0	0	0	0	0	0	0	0	0	0
Madia gracilis	N	5	0	0	0	0	0	0	0	0	0	0	0
Matricaria discoidea	N	4	0	0	0	0	0	0	0	0	0	0	0
Plagiobothyrus figuratus	N	3	2	5	0	7	0	0	0	0	0	0	1
Potentilla gracilis	N	3	0	0	0	0	0	0	0	0	0	0	0
Rumex aquaticus var fenestratus	N	2	0	0	0	0	0	0	0	0	0	0	0
Sagiittaria latifolia	N	1	0	0	0	0	0	0	0	0	5	10	2
Scirpus microcarpus	N	1	0	0	8	0	0	10	60	0	20	0	10
Trifolium wormskjoldii	N	3	0	0	0	0	0	0	0	0	0	0	0
Typha latifolia	N	1	0	0	0	0	20	30	2	0	0	0	5
Non-Native (Not Listed) Herbaceous Species													
Alopecurus geniculatus	NN	2	22	5	3	30	0	0	10	0	20	7	10
Alopecurus pratensis	NN	2	15	0	0	0	0	0	0	0	0	0	2
Echinochloa crus-galli	NN	3	3	0	0	2	0	0	0	0	0	0	1
Holcus lanatus	NN	2	0	0	0	0	0	0	0	0	0	0	0
Lolium multiflorum	NN	4	0	0	0	0	0	0	0	0	0	0	0
Poa annua	NN	3	0	0	0	0	0	0	0	0	0	0	0
Polypogon monspeliensis	NN	2	0	0	0	0	0	0	0	0	0	0	0
Rumex acetosa	NN	3	0	0	0	0	0	0	0	0	0	0	0
Vicia sativa	NN	5	0	0	0	0	0	0	0	0	0	0	0
Vicia tetrasperma	NN	5	0	0	0	0	0	0	0	0	0	0	0
Invasive Herbaceous Species													
Cirsium arvense	I	3	0	0	0	0	0	0	0	0	0	0	0
Daucus carota	I	5	0	0	0	0	0	0	0	0	0	0	0
Hypochaeris radicata	I	3	0	0	0	0	0	0	0	0	0	0	0
Lotus corniculata	I	3	0	0	0	0	0	0	0	0	0	0	0
Lythrum salicaria	I	2	0	0	0	0	0	0	0	0	1	0	0
Ranunculus repens	I	2	0	0	5	0	15	0	0	0	0	0	2
Senecio jacobaea	I	4	0	0	0	0	0	0	0	0	0	0	0
Trifolium repens	I	3	0	0	0	0	0	0	0	0	0	0	0
Reed Canarygrass													
Phalaris arundinacea	I	2	0	0	0	0	0	0	0	0	0	0	0
Native Shrub and Tree Species (Form)													
Acer macrophyllum (T)	N	4	0	0	0	0	0	0	0	0	0	0	0
Alnus rubra (T)	N	2	0	0	0	0	2		0	0	0	1	0
Amelanchier alnifolia (S)	N	4	0	0	0	0	0	0	0	0	0	0	0
Cornus alba (S)	N	2	15	25	15	5	0	0	0	3	0	8	7
Crataegus douglasii (T)	N	3	0	0	0	0	0	0	0	0	0	0	0
Frangula purshiana (T)	N	3	0	0	0	0	0	0	0	0	0	0	0
Fraxinus latifolia (T)	N	2	0	0	0	0	12	7	3	3	2	1	3
Mahonia nervosa (S)	N	4	0	0	0	0	0	0	0	0	0	0	0
Physocarapus capitatus (S)	N	2	0	0	0	0	0	0	0	0	0	0	0
Pinus contorta (T)	N	3	0	0	0	0	0	0	0	0	0	0	0
Populus balsamif. var. trichocarpa (T)	N	2	10	1	0	0	0	0	5	0	7	0	2
Pseudotsuga menziesii (T)	N	4	0	0	0	0	0	0	0	0	0	0	0
Quercus garryana (T)	N	5	0	0	0	0	0	0	0	0	0	0	0
Rosa nutkana (S)	N	3	0	0	0	0	2	0	0	7	0	0	1
Rosa pisocarpa (S)	N	4	0	0	0	0	0	0	0	0	0	0	0
Salix fluviatilis (S)	N	2	0	0	0	0	15	0	0	0	0	0	2
Salix hookeriana (S)	N	2	0	0	10	0	0	0	0	0	0	0	1
Salix lasiandra (S)	N	2	0	0	5	5		5	0	15	40	4	8
Salix sitchensis (S)	N	2	15	0	0	2	15	20	10	12	0	2	8
Sambucus racemosa (S)	N	3	0	0	0	0	0	0	0	0	0	0	0
Spiraea douglasii (S)	N	2	0	0	20	0	0	0	17	0	1	2	4
Symphoricarpos albus (S)	N	4	0	0	0	0	0	0	0	0	0	0	0
Non-Native Shrub and Tree Species													
Invasive Shrub and Tree Species													
Cytisus scoparius	I	5	0	0	0	0	0	0	0	0	0	0	0
Rubus armeniacus	I	3	0	0	0	0	0	0	0	0	0	0	0
Bare Substrate			10	30	40	20	0	5	10	10	0	0	13
Native Shrub and Tree Count													
Acer macrophyllum			0	0	0	0	0	0	0	0	0	0	0
Alnus rubra			0	0	0	0	1	0	0	0	0	1	0
Amelanchier alnifolia			2	0	0	0	0	0	0	0	0	0	0
Cornus alba			13	22	14	5	0	0	0	3	0	8	7
Crataegus douglasii			0	0	0	0	0	0	0	0	0	0	0
Frangula purshiana			0	0	0	0	0	0	0	0	0	0	0
Fraxinus latifolia			0	0	0	0	12	7	2	2	2	1	3
Mahonia nervosa			0	0	0	0	0	0	0	0	0	0	0
Physocarpus capitatus			0	0	0	0	0	0	0	0	0	0	0
Pinus contorta			0	0	0	0	0	0	0	0	0	0	0
Populus balsamif. v ar trichocarpa			3	1	0	0	0	0	5	0	7	0	2
Pseudotsuga menziesii			0	0	0	0	0	0	0	0	0	0	0
Quercus garryana			0	0	0	0	0	0	0	0	0	0	0
Rosa nutkana			0	0	0	0	1	0	0	5	0	0	1
Rosa pisocarpa			0	0	0	0	0	0	0	0	0	0	0
Salix fluviatilis			0	0	0	0	0	0	0	0	0	0	0
Salix hookeriana			0	0	0	0	0	0	0	0	0	0	0
Salix lasiandra			0	0	0	5	5	1	0	8	28	1	5
Salix sitchensis			7	0	0	2	8	8	5	6	0	1	4
Sambucus racemosa			0	0	0	0	0	0	0	0	0	0	0
Spiraea douglasii			0	0	20	0	0	0	11	0	1	2	3
Symphoricarpos albus			0	0	0	0	0	0	0	0	0	0	0

Routine Performance Standards	T04 Transect 3	T04 Transect 4	T04 Transect 5	T04 Transect 6	T05 Transect 2	T05 Transect 3	T05 Transect 4	T05 Transect 5	T05 Transect 7	T05 Transect 8	**Habitat Average**	**Standard Error**
Cover of Native Herbaceous Species	26	66	35	62	73	80	72	65	50	60	59	5.4
Lower CI (80%)											52	
Upper CI (80%)											66	
Cover of Non Native (Not Listed) Herbaceous Species	40	5	3	32	0	0	10	0	20	7	12	4.5
Lower CI (80%)											6	
Upper CI (80%)											17	
Cover of Invasive Herbaceous Species	0	0	0	0	15	0	0	0	1	0	2	1
Lower CI (80%)											0	
Upper CI (80%)											4	
Cover of Native Tree Species	40	26	50	12	46	32	35	40	50	18	35	4
Lower CI (80%)											30	
Upper CI (80%)											40	
Cover of Invasive Shrubs and Trees	0	0	0	0	0	0	0	0	0	0	0	0
Lower CI (80%)											0	
Upper CI (80%)											0	
Bare Substrate	10	30	40	20	0	5	10	10	0	0	13	4
Lower CI (80%)											7	
Upper CI (80%)											18	
Native Diversity (all layers)											5	N/A
Sum of plant cover	104	97	88	106	134	112	117	105	121	85		
	Average per acre											
Density of Woody Vegetation	1289	1186	1753	619	1392	825	1186	1237	1959	722	1217	N/A
Plot Area (shrub/tree plot) 845												
Per acre multiplier: Input 4,047 if plot area entered in B84 is in sq.meters or 43,560 for sq.feet 43560												
Cover of Native Shrubs and Trees	40	26	50	12	46	32	35	40	50	18	35	4
Lower CI (80%)											30	
Upper CI (80%)											40	

Site: Harborton
Habitat: Wetland Enhancement/Conservation

Species	Origin (N, NN, I)	Wetland Status (1 - 5)	Transect T01	T02	T03	Row Average
			1	5	7	
Native Herbaceous Species						
Achillea millefolium	N	4	0	0	0	0
Agrostis exarata	N	3	0	0	0	0
Alisma plantago aquatica	N	1	0	0	0	0
Asclepias speciosa	N	5	0	0	0	0
Beckmannia syzigachne	N	2	0	0	0	0
Bidens frondosa	N	2	0	0	0	0
Bromus carinatus	N	4	0	0	0	0
Carex obnupta	N	2	5	5	8	6
Clarkia amoena	N	4	0	0	0	0
Eleocharis ovata	N	2	0	0	0	0
Epilobium ciliatum	N	2	0	0	0	0
Epilobium densiflorum	N	2	0	0	0	0
Equisetum arvense	N	3	0	0	0	0
Galium aparine	N	4	8	5	2	5
Glyceria occidentalis	N	2	0	0	0	0
Hordeum brachyantherum	N	2	0	0	0	0
Juncus bufonius	N	2	0	0	0	0
Juncus oxymeris	N	2	0	0	0	0
Juncus patens	N	2	7	0	2	3
Lupinus polyphyllus	N	4	0	0	0	0
Lupinus rivularis	N	3	0	0	0	0
Madia gracilis	N	5	0	0	0	0
Matricaria discoidea	N	4	0	0	0	0
Plagiobothyrus figuratus	N	3	0	0	0	0
Potentilla gracilis	N	3	0	0	0	0
Rubus ursinus	N	4	0	7	5	4
Rumex aquaticus var *fenestratus*	N	2	0	0	0	0
Sagiittaria latifolia	N	1	0	0	0	0
Scirpus microcarpus	N	1	0	7	8	5
Trifolium wormskjoldii	N	3	0	0	0	0
Non-Native (Not Listed) Herbaceous Species						
Alopecurus geniculatus	NN	2	0	0	0	0
Alopecurus pratensis	NN	2	0	0	0	0
Echinochloa crus-galii	NN	3	0	0	0	0
Holcus lanatus	NN	2	0	0	0	0
Lolium multiflorum	NN	4	0	0	0	0
Poa annua	NN	3	0	0	0	0
Polypogon monspeliensis	NN	2	0	0	0	0
Rumex acetosa	NN	3	0	0	0	0
Vicia sativa	NN	5	0	0	0	0
Vicia tetrasperma	NN	5	0	0	0	0
Invasive Herbaceous Species						
Cirsium arvense	I	3	0	0	0	0
Daucus carota	I	5	0	0	0	0
Hypochaeris radicata	I	3	0	0	0	0
Lotus corniculata	I	3	0	0	0	0
Senecio jacobaea	I	4	0	0	0	0
Trifolium repens	I	3	0	0	0	0
Reed Canarygrass						
Phalaris arundinacea	I	2	15	50	30	32
Native Shrub and Tree Species (Form)						
Acer macrophyllum (T)	N	4	0	0	0	0
Alnus rubra (T)	N	2	0	0	0	0
Amelanchier alnifolia (S)	N	4	0	0	4	1
Cornus alba (S)	N	2	0	2	0	1
Crataegus douglasii (T)	N	3	0	0	0	0
Frangula purshiana (T)	N	3	0	0	0	0
Fraxinus latifolia (T)	N	2	100	40	50	63
Mahonia nervosa (S)	N	4	0	0	0	0
Physocarapus capitatus (S)	N	2	0	0	0	0
Pinus contorta (T)	N	3	0	0	0	0
Populus balsamif. var. trichocarpa (T)	N	2	0	20	20	13
Pseudotsuga menziesii (T)	N	4	0	0	0	0
Quercus garryana (T)	N	5	0	0	0	0
Rosa nutkana (S)	N	3	0	0	0	0
Rosa pisocarpa (S)	N	4	0	0	0	0
Salix fluviatilis (S)	N	2	0	0	0	0
Salix hookeriana (S)	N	2	0	0	0	0
Salix lasiandra (S)	N	2	0	0	0	0
Salix sitchensis (S)	N	2	0	0	0	0
Sambucus racemosa (S)	N	3	0	0	0	0
Spiraea douglasii (S)	N	2	0	0	0	0
Symphoricarpos albus (S)	N	4	0	0	15	5
Non-Native Shrub and Tree Species						
Invasive Shrub and Tree Species						
Cytisus scoparius	I	5	0	0	0	0
Rubus armeniacus	I	3	2	0	0	1
Bare Substrate			80	20	15	38
Native Shrub and Tree Count						
Acer macrophyllum			0	0	0	0
Alnus rubra			0	0	0	0
Amelanchier alnifolia			0	0	2	1
Cornus alba			0	1	0	0
Crataegus douglasii			0	0	0	0
Frangula purshiana			0	0	0	0
Fraxinus latifolia			8	5	7	7
Mahonia nervosa			0	0	0	0
Physocarpus capitatus			0	0	0	0
Pinus contorta			0	0	0	0
Populus balsamif. var trichocarpa			0	8	3	4
Pseudotsuga menziesii			0	0	0	0
Quercus garryana			0	0	0	0
Rosa nutkana			0	0	0	0
Rosa pisocarpa			0	0	0	0
Salix fluviatilis			0	0	0	0
Salix hookeriana			0	0	0	0
Salix lasiandra			0	0	0	0
Salix sitchensis			7	0	0	2
Sambucus racemosa			0	0	0	0
Spiraea douglasii			0	0	0	0
Symphoricarpos albus			0	0	5	2

Routine Performance Standards			1	5	7	Habitat Average	Standard Error
Cover of Native Herbaceous Species			20	24	25	23	1.5
Lower CI (80%)						21	
Upper CI (80%)						25	
Cover of Non Native (Not Listed) Herbaceous Species			0	0	0	0	0.0
Lower CI (80%)						0	
Upper CI (80%)						0	
Cover of Invasive Herbaceous Species			0	0	0	0	0
Lower CI (80%)						0	
Upper CI (80%)						0	
Cover of Reed Canarygrass			15	50	30	32	10
Lower CI (80%)						19	
Upper CI (80%)						45	
Cover of Invasive Shrubs and Trees			2	0	0	1	1
Lower CI (80%)						0	
Upper CI (80%)						2	
Bare Substrate			80	20	15	38	21
Lower CI (80%)						12	
Upper CI (80%)						65	
Native Diversity (all layers)						5	N/A
Sum of plant cover			137	136	144		
		Average per acre					
Density of Woody Vegetation			773	722	876	790	N/A
Plot Area (shrub/tree plot)	845						
Per acre multiplier: Input 4,047 if plot area entered in B84 is in sq.meters or 43,560 for sq.feet	43560						
Cover of Native Shrubs and Trees			100	62	89	84	11
Lower CI (80%)						69	
Upper CI (80%)						98	

Appendix D - Vegetation Data, Stream Transects

STREAM CHANNEL TRANSECTS

Site: Harborton **Sample Date(s):** July 5, 13, 15

Percent Cover

Species (form)	Origin (N, NN, I)	1	2	3	4	5	6	7	8	9	10	Row Average
Native Herbaceous Species												
Achillea millefolium	N	0	0	1	0	0	0	0	0	0	1	0
Agrostis exarata	N	0	5	0	8	7	8	3	2	4	5	4
Alisma plantago aquatica	N	0	8	0	2	0	1	1	6	1	0	2
Beckmannia syzigachne	N	2	20	10	7	5	2	5	10	5	5	7
Bidens frondosa	N	1	15	5	0	0	0	0	0	0	2	2
Bromus carinatus	N	0	0	0	0	0	1	1	0	0	0	0
Carex obnupta	N	0	15	0	0	0	3	8	25	0	0	5
Eleocharis ovata	N	3	0	0	0	0	0	2	1	0	0	1
Epilobium ciliatum	N	3	0	1	0	0	0	1	0	1	0	1
Epilobium densiflorum	N	0	0	0	0	0	0	0	0	0	0	0
Equisetum arvense	N	0	0	0	0	0	0	0	0	0	0	0
Downingia elegans	N	0	0	0	0	0	0	0	1	0	7	1
Glyceria occidentalis	N	4	0	5	0	2	1	2	7	0	0	2
Hordeum brachyantherum	N	0	0	1	0	3	0	0	4	0	0	1
Juncus bufonius	N	0	0	0	0	2	0	0	0	1	1	0
Juncus oxymeris	N	0	0	0	0	0	0	1	0	0	0	0
Juncus patens	N	0	5	5	15	4	5	1	0	0	0	4
Lemna minor	N	0	0	0	0	0	1	3	3	0	0	1
Lupinus polyphyllus	N	0	0	2	5	0	0	3	3	3	5	2
Lupinus rivularis	N	0	3	3	7	3	4	0	2	5	2	3
Matricaria discoidea	N	0	0	1	0	0	0	0	0	0	0	0
Plagiobothyrus figuratus	N	0	0	0	1	0	0	0	1	3	8	1
Sagiittaria latifolia	N	0	7	2	2	0	0	2	2	0	0	2
Scirpus microcarpus	N	0	0	6	0	2	1	6	8	0	0	2
Schoenoplectus acutus	N	0	3	2	0	0	1	2	5	1	0	1
Trifolium wormskjoldii	N	0	0	0	0	0	0	0	0	0	0	0
Typha latifolia	N	0	3	7	4	3	2	4	4	1	0	3
Non-Native (Not Listed) Herbaceous Species												
Alopecurus geniculatus	NN	0	3	3	12	10	2	6	0	0	0	4
Echinochloa crus-galli	NN	0	1	2	3	0	5	1	1	1	0	1
Holcus lanatus	NN	0	0	2	0	0	1	1	0	0	3	1
Mentha arvense	NN	3	0	0	0	0	0	0	0	0	0	0
Poa annua	NN	0	0	0	0	0	0	4	4	0	0	1
Polygonum persicaria	NN	10	4	0	2	1	0	1	1	0	2	2
Polypogon monspeliensis	NN	5	0	0	0	1	0	0	3	0	0	1
Vicia sativa	NN	0	0	0	1	0	0	1	0	0	0	0
Invasive Herbaceous Species												
Cirsium arvense	I	5	0	0	0	0	0	0	1	0	0	1
Daucus carota	I	0	1	1	0	1	0	0	0	0	0	0
Dipsacus fullonum	I	0	0	0	0	0	0	1	0	0	0	0
Hypericum perforatum	I	0	3	0	1	1	1	0	0	1	1	1
Hypochaeris radicata	I	0	0	5	0	0	0	0	0	0	0	1
Lotus corniculata	I	0	0	0	0	0	4	0	2	0	0	1
Ludwigia peploides	I	0	0	0	0	0	0	0	0	0	0	0
Trifolium repens	I	2	1	0	1	2	1	0	1	0	0	1
Reed Canarygrass Cover												
Phalaris arundinacea	I	2	0	0	0	0	0	0	0	4	6	1
Native Shrub and Tree Species												
Alnus rubra (T)	N	0	0	0	1	0	0	0	1	0	0	0
Amelanchier alnifolia (S)	N	0	0	0	0	2	5	0	1	0	0	1
Cornus alba (S)	N	0	1	0	2	0	0	1	3	0	0	1
Frangula purshiana (T)	N	0	0	0	0	0	0	0	0	0	0	0
Fraxinus latifolia (T)	N	0	0	0	0	7	1	0	5	0	0	1
Lonicera involucrata (S)	N	0	0	0	0	0	0	0	0	0	3	0
Physocarapus capitatus (S)	N	0	0	0	1	0	0	0	0	0	0	0
Populus balsamif. var. trichocarpa (T)	N	3	1	0	0	0	1	2	5	5	2	2
Rosa nutkana (S)	N	4	0	0	5	0	5	0	1	2	0	2
Salix lasiandra (S)	N	0	5	0	3	4	7	7	4	4	0	3
Salix sitchensis (S)	N	0	0	0	0	0	1	3	6	0	0	1
Sambucus racemosa (S)	N	0	0	0	2	0	0	1	0	0	0	0
Spiraea douglasii (S)	N	0	5	2	0	1	5	3	2	6	2	3
Non-Native Shrub and Tree Species												
		0	0	0	0	0	0	0	0	0	0	0
Invasive Shrub and Tree Species												
Cytisus scoparius (S)	I	0	0	0	0	0	0	0	0	0	0	0
Rubus armeniacus (S)	I	1	1	0	1	0	0	2	0	1	0	1
Bare Substrate		80	25	20	35	20	10	15	10	20	25	26

Routine Performance Standards	1	2	3	4	5	6	7	8	9	10	Habitat Average	Standard Error
Cover of Native Herbaceous Species	13	84	51	51	31	30	45	84	25	36	45	7.5
Lower CI (80%)											35	
Upper CI (80%)											55	
Cover of Non Native (Not Listed) Herbaceous Species	18	5	4	6	2	6	8	9	1	5	6	1.5
Lower CI (80%)											4	
Upper CI (80%)											8	
Cover of Invasive Herbaceous Species	7	5	6	2	4	6	1	4	1	1	4	1
Lower CI (80%)											3	
Upper CI (80%)											5	
Cover of Reed Canarygrass	2	0	0	0	0	0	0	0	4	6	1	1
Lower CI (80%)											0	
Upper CI (80%)											2	
Cover of Invasive Shrubs and Trees	1	1	0	1	0	0	2	0	1	0	1	0
Lower CI (80%)											0	
Upper CI (80%)											1	
Bare Substrate	80	25	20	35	20	10	15	10	20	25	26	6
Lower CI (80%)											18	
Upper CI (80%)											34	
Native Diversity (all layers)											5	N/A
Sum of plant cover	48	110	65	86	61	69	79	125	49	54		

Appendix E - Breeding Bird Survey

Appendix E. 2023 Harborton Breeding Bird Monitoring

new species observation		Station														
Name	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	total by day	total by species
American crow	23-May-23									1					1	
	6-Jun-23													1	1	2
	13-Jun-23														0	
American goldfinch	23-May-23									1					1	
	6-Jun-23							15					1		16	22
	13-Jun-23			1		1		2	1						5	
American kestrel	23-May-23														0	
	6-Jun-23											1	1		2	2
	13-Jun-23														0	
American robin	23-May-23	2		1		2				1		1	1	2	10	
	6-Jun-23	2	1	1		1						1	1	1	8	28
	13-Jun-23	1		1		1	1	1		1	1	1	1	1	10	
Anna's hummingbird	23-May-23														0	
	6-Jun-23														0	1
	13-Jun-23								1						1	
bald eagle	23-May-23														0	
	6-Jun-23														0	0
	13-Jun-23														0	
band-tailed pigeon	23-May-23														0	
	6-Jun-23														0	0
	13-Jun-23														0	
barn swallow	23-May-23					1	4								5	
	6-Jun-23		1												1	8
	13-Jun-23		2												2	
belted kingfisher	23-May-23							1		1	1	1			4	
	6-Jun-23						1				1				2	7
	13-Jun-23							1							1	
Bewick's wren	23-May-23														0	
	6-Jun-23										1				1	2
	13-Jun-23			1											1	
black-cap chickadee	23-May-23								1		1			2	4	
	6-Jun-23	1												1	2	6
	13-Jun-23														0	
black-headed grossbeak	23-May-23	1		2		2	1						1	1	8	
	6-Jun-23	1											1	1	3	12
	13-Jun-23													1	1	
black-throated gray warbler	23-May-23														0	
	6-Jun-23														0	0
	13-Jun-23														0	
Brewer's blackbird	23-May-23														0	
	6-Jun-23														0	0

	13-Jun-23														0	
brown creeper	23-May-23														0	
	6-Jun-23														0	2
	13-Jun-23				1		1								2	
brown-headed cowbird	23-May-23						1								1	
	6-Jun-23								1						1	9
	13-Jun-23			1		1	1			1	2	1			7	
Bullock's oriole	23-May-23													1	1	
	6-Jun-23														0	1
	13-Jun-23														0	
Canada goose	23-May-23						2	3	4	5		1	3	2	20	
	6-Jun-23										1				1	21
	13-Jun-23														0	
cedar waxwing	23-May-23						1							2	3	
	6-Jun-23											4			4	8
	13-Jun-23		1												1	
chipping sparrow	23-May-23									1		2			3	
	6-Jun-23														0	3
	13-Jun-23														0	
cliff swallow	23-May-23														0	
	6-Jun-23														0	1
	13-Jun-23							1							1	
common yellowthroat	23-May-23									1	2	1	2	1	7	
	6-Jun-23	1										2	2	1	6	22
	13-Jun-23	1		1	1	2			2			1	1		9	
downy woodpecker	23-May-23				1										1	
	6-Jun-23														0	1
	13-Jun-23														0	
European collared dove	23-May-23														0	
	6-Jun-23					1									1	3
	13-Jun-23	1	1												2	
great blue heron	23-May-23					2	2								4	
	6-Jun-23		2			2	1	1	1	1	5				13	20
	13-Jun-23						2		1						3	
great egret	23-May-23														0	
	6-Jun-23		2			6			4	4					16	18
	13-Jun-23		1			1									2	
gull, not identified	23-May-23	1													1	
	6-Jun-23														0	1
	13-Jun-23														0	
hairy woodpecker	23-May-23														0	
	6-Jun-23				1										1	1
	13-Jun-23														0	
house finch	23-May-23												1		1	
	6-Jun-23		1	1											2	4
	13-Jun-23											1			1	
	23-May-23														0	

house wren	6-Jun-23															0	1
	13-Jun-23				1											1	
	23-May-23										1					1	
killdeer	6-Jun-23															0	1
	13-Jun-23															0	
	23-May-23					1										1	
mallard	6-Jun-23		8			8										16	17
	13-Jun-23															0	
	23-May-23															0	
mourning dove	6-Jun-23														1	1	2
	13-Jun-23													1		1	
	23-May-23															0	
northern flicker	6-Jun-23															0	0
	13-Jun-23															0	
	23-May-23							2		1						3	
osprey	6-Jun-23											1				1	8
	13-Jun-23							1	1			1		1		4	
Pacific slope flycatcher	23-May-23	2		2												4	
	6-Jun-23				1											1	8
	13-Jun-23	1		1	1											3	
purple martin	23-May-23															0	
	6-Jun-23															0	1
	13-Jun-23							1								1	
	23-May-23															0	
raven	6-Jun-23															0	0
	13-Jun-23															0	
red-breasted sapsucker	23-May-23															0	
	6-Jun-23							1								1	1
	13-Jun-23															0	
	23-May-23					2										2	
red crossbill	6-Jun-23	1														1	3
	13-Jun-23															0	
	23-May-23															0	
red-tail hawk	6-Jun-23															0	0
	13-Jun-23															0	
	23-May-23			1		7	3	1	5	5	2	1				25	
red-winged blackbird	6-Jun-23	1	4	1		6	7	3	12	6	6	2	1			49	117
	13-Jun-23	1	7	1		8	1	4	9	7	2	2	1			43	
scrub jay	23-May-23			1				1			1					3	
	6-Jun-23						1						1	1		3	9
	13-Jun-23				1						1	1				3	
	23-May-23	1		2	2	1	1	1	1	2	1	1	1	2		16	
song sparrow	6-Jun-23	1	1	2	1		2	3		1	3	2	3	1		20	53
	13-Jun-23	1	2	1	1	1	1	1	1	2	2	2	1	1		17	
	23-May-23										3					3	
spotted sandpiper	6-Jun-23															0	3
	13-Jun-23															0	

spotted towhee	23-May-23													1	1	
	6-Jun-23			1									1	1	3	7
	13-Jun-23											1	1	1	3	
starling	23-May-23				3								1		4	
	6-Jun-23				12	20	10	30	1	1					74	86
	13-Jun-23							1	4	3					8	
Stellar's jay	23-May-23														0	
	6-Jun-23	1													1	2
	13-Jun-23			1											1	
Swainson's thrush	23-May-23					1									1	
	6-Jun-23	1							1					1	3	9
	13-Jun-23	1		1		1	1		1						5	
swallow, not identified	23-May-23													1	1	
	6-Jun-23				1										1	2
	13-Jun-23														0	
tree swallow	23-May-23				1	2									3	
	6-Jun-23										1	4			5	12
	13-Jun-23							2	1		1				4	
turkey vulture	23-May-23														0	
	6-Jun-23		1												1	7
	13-Jun-23					1	5								6	
vaux swift	23-May-23							1							1	
	6-Jun-23														0	2
	13-Jun-23								1						1	
violet-green swallow	23-May-23							4	1						5	
	6-Jun-23		3				8		2	1					14	36
	13-Jun-23		1			4	5	1	3	3					17	
warbling vireo	23-May-23	1													1	
	6-Jun-23	1		1	1										3	7
	13-Jun-23	1			1								1		3	
western wood peewee	23-May-23	1			1			1			1	1	1	2	8	
	6-Jun-23		1	1	1	1					1			1	6	21
	13-Jun-23			2	1		1			1	1			1	7	
white-crowned sparrow	23-May-23							2	2	1	2	1	2		10	
	6-Jun-23								1	1			2		4	23
	13-Jun-23								1	1		5	1	1	9	
white-throated gray warbler	23-May-23														0	
	6-Jun-23														0	0
	13-Jun-23														0	
willow flycatcher	23-May-23														0	
	6-Jun-23														0	0
	13-Jun-23														0	
Wilsons warbler	23-May-23			1	1		1	1				1			5	
	6-Jun-23						1	1		1					3	8
	13-Jun-23														0	
wood duck	23-May-23								2	1					3	
	6-Jun-23														0	3

	13-Jun-23													0	
yellow-rumped warbler	23-May-23				1		1	1			1			4	
	6-Jun-23	1	1	1	1	1	1				1			7	18
	13-Jun-23	1		2	1			1		1			1	7	

Appendix F - 2023 Plantings

2023 PLANTINGS - PHASES 1 AND 2

500 Sidalcea (checkermallow)

2,000 Oregon grape

290 Oregon white oak

1,000 Douglas spirea

1,550 Snowberry

200 Bigleaf maple

500 Blue elderberry

875 Native rose (Nootka and pearhip)

500 Herbaceous plugs

100

100

100

50

200

200

200

200

100

200

150

150

Harborton Drone Photography
Mission Date: 01/24/2023

0 50 100 200
Scale in Feet

NW Harborton Dr

NW Harborton Dr

NW Harborton Dr

NW Harborton Dr

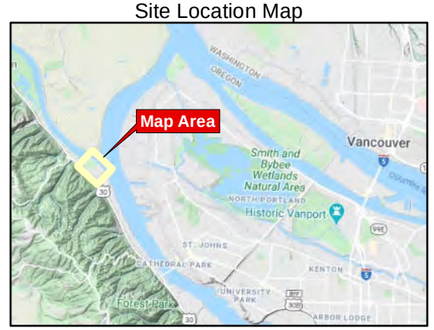
NW Marina Way

NW Marina Way

NW Marina Way

Kanfa River - Port

Site Location Map



Map Features

- Habitat Area
- Non-Habitat Area
- Survey Transect
- Property Line
- Olympic Pipeline
- Water Level / Water Monitoring Station
- Fish Passage Structure/Fish Accessibility (WMS)
- Bald Eagle Monitoring Station
- Mink Scent Station/ Photmonitoring
- Mink Track and Scent Monitoring Routes
- Extent of High Flow Inundation
- S Water Level Staff Gauge

0 115 230
Feet

PGE

Portland General Electric
Portland, Oregon

Figure 6
Fixed Monitoring Stations

Harborton Restoration Project

Date:	Drawn By:	Rev.:
7/4/2020	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Hab_Fig5.mxd

Appendix G - Herbicide Records

2023 Herbicide Treatment Areas

Harborton Drone Photography
Mission Date: 11/22/2021

0 35 70 140
Scale in Feet

Appendix H - Annual Photomonitoring

= DSL suggested approximate photo locations for 360 degree photos. Recommend using panoramic settings covering 120 degrees or less to avoid distorting the image. PGE may need to shift or add photos depending on if you're trying to show specific site conditions such as mink rocks, logs at the entrance, etc.

Multnomah Channel

Multnomah River

PP1
PP2
PP3
PP4
PP5
PP6
PP7
PP8
PP 1

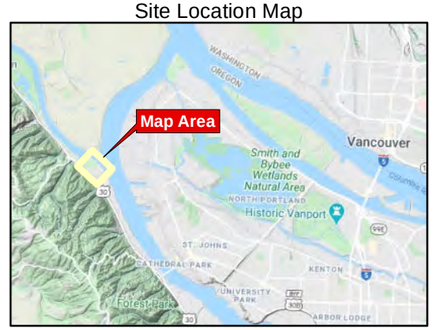
WMS01
WMS02
WMS03
WMS04
WMS05
WMS06
WMS07

Olympic Pipeline (Existing)

Harborton Substation (Existing)

Marina Way

Site Location Map



Map Features

- Habitat Area
- Non-Habitat Area
- Survey Transect
- Property Line
- Olympic Pipeline
- Water Level / Water Monitoring Station
- Photomonitoring Point
- Bald Eagle Monitoring Station
- Mink Scent Station/ Photmonitoring Mink
- Track and Scent Monitoring Routes
- S — Water Level Staff Gauge

0 115 230
Feet

Portland General Electric
Portland, Oregon

Fixed Monitoring Stations
Harborton Restoration Project

Date:	Drawn By:	Rev.:
7/4/2020	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Hab_Fig5.mxd

PHOTOMONITORING POINT 01 - FACING SOUTH (6/6/23)

PHOTOMONITORING POINT 02 - FACING SOUTHWEST (8/31/23)

PHOTOMONITORING POINT 03 - FACING NORTHWEST (2/23/23)

PHOTOMONITORING POINT 03 - FACING NORTHWEST (6/21/23)

PHOTOMONITORING POINT 04 - FACING NORTH (9/21/23)

PHOTOMONITORING POINT 05 - FACING WEST-SOUTHWEST (9/21/23)

PHOTOMONITORING POINT 06 - FACING NORTHEAST (9/21/23)

PHOTOMONITORING POINT 07 - FACING EAST (7/8/23)

PHOTOMONITORING POINT 08 - PHOTO FACING NORTHWEST (7/8/23)

Appendix I - Trail Camera Images

Sub Area 4 on February 23, 2023

Coyote near North Channel Outlet, February 24, 2023

Coyote Hunting Near Sub Area 2 Berm, March 31, 2023

Great Blue Heron at North Channel Outlet, March 23, 2023

Striped Skunk in Sub Area 3, March 31, 2023

Barn Owl in Sub Area 3, April 12, 2023

Sub Area 3 Wetland on July 5, 2023

Paper Wasp Nest on Sub Area 2 Berm, July 19, 2023

Sub Area 3 Wetlands on September 5, 2023

Appendix J - Orthomosaic Images

January 24, 2023

Harborton Drone Photography
Mission Date: 01/24/2023

0 50 100 200
Scale in Feet

NW Harborton Dr
NW Harborton Dr
NW Harborton Dr
NW Harborton Dr
NW Marina Way
NW Marina Way
NW Marina Way
Knife River - Port
Stevens Rd
30
30

March 14, 2023

Harborton Drone Photography
Mission Date: 03/14/2023

0 50 100 200
Scale in Feet

NW Marina
NW St Helens Rd
NW Harborton Dr
NW Marina Way
Knife River - Port

April 17, 2023

Harborton Drone Photography
Mission Date: 04/17/2023

0 50 100 200
Scale in Feet

NW Marina Way
NW Harborton Dr
NW Harborton Dr
NW Harborton Dr
NW Marina Way
NW Marina Way
NW Marina Way
30
30

May 10, 2023

Harborton Drone Photography
Mission Date: 05/10/2023

0 50 100 200
Scale in Feet

NW Harborton Dr
NW Harborton Dr
NW Harborton Dr
NW Harborton Dr
NW Marina Way
NW Marina Way
NW Marina Way

June 2, 2023

Harborton Drone Photography
Mission Date: 06/02/2023

0 50 100 200
Scale in Feet

NW Harborton Dr
NW Harborton Dr
NW Harborton Dr
NW Harborton D
St Helens Rd
NW Marina Way
NW Marina Way
NW Marina Way
30

July 17, 2023

Harborton Drone Photography
Mission Date: 06/02/2023

0 50 100 200
Scale in Feet

NW Harborton Dr
NW Harborton Dr
NW Harborton Dr
NW Harborton D
NW Marina Way
NW Marina Way
NW Marina Way
Knife River - Port
20

September 13, 2023

Harborton Drone Photography
Mission Date: 09/13/2023

0 35 70 140
Scale in Feet

November 1, 2023

Harborton Drone Photography
Mission Date: 11/01/2023

0 35 70 140
Scale in Feet