Portland General Electric
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July 26, 2022

To: Portland Harbor Trustee Council

From: Colin MacLaren

RE: Final Harborton Year 1 Habitat Monitoring Report

Dear Trustee Council members,

Thank you for your review and comments on PGE's Year 1 Habitat Monitoring report for Harborton (Report). Attached please find the final Year 1 Report. The report addresses the May 3, 2022 comments received from the Trustee Council (Council) on PGE's March 2022 submittal. Some comments are deferred and will be addressed in the 2022 annual monitoring report as requested by the Council comment.

PGE continues to monitor the site closely as it evolves over the course of 2022, watching for how habitat conditions will evolve given a full year for plants to mature, management efforts by PGE, and record spring precipitation. PGE looks forward to reviewing these findings with you in the future.

Please let me know if you have any questions or wish to discuss any facet of the attached report. PGE believes the site is meeting established restoration goals and is pleased by habitat conditions at Harborton thus far. We continue to be diligent in our oversight and look forward to monitoring and managing the site as it matures and forms the character and profile it is likely to maintain over the long term.

Regards,

Colin MacLaren, PWS
Wetland Ecologist

Portland General Electric Harborton Restoration: Year 1 Monitoring Report

Portland General Electric

December 2021, Revised July 2022

Portland General Electric Harborton Restoration: Year 1 Monitoring Report

Portland General Electric
121 SW Salmon Street
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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
HOBO	HOBO water level logger
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) and finished the plantings in 2021. As part of the restoration work, PGE will perform 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
- Sediment
- Vegetation
- Water Quality
- Fish and Wildlife

Monitoring results indicate the Site is meeting or exceeding performance standards for most subject areas and disciplines as summarized in the following table.

2021 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	
Retention of Wetland Hydrology/Habitat for Use by Northern Red-legged Frog	Not Met	No	Met for all periods except April/May.
Extent of High Flow Inundation	Met	No	
Vegetation Density, Diversity, Cover	Not Met	Yes	At least one standard not met in each habitat type. Weed management and supplemental woody planting planned for 2022
Reed Canarygrass (RCG) Across Relevant Habitats	Not Met	Yes	RCG management planned for 2022

1. Introduction

This document is the Year 1 Effectiveness Monitoring Report (EMR) prepared for the Portland General Electric (PGE) 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 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

Habitat restoration activities 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 creation, native plant installation, weed management, and wildlife structure creation. 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 1 site effectiveness monitoring commenced in February 2021 and was complete in November 2021, except for fish monitoring, which is delayed until suitable conditions are present, which was approved by the Trustee Council.

The Project's restoration goals are summarized as follows:

Provide fish passage opportunities between Sub Areas 3, 4, and the Willamette River through construction of a 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 wetland in areas utilized by northern red-legged frogs (*Rana aurora aurora*) and other wildlife.
- Create new wetland in upland areas adjacent to known red-legged frog habitat through excavation and removal of 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). Monitoring elements not included or required in 2021 but found in the MAMP are omitted.

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. The EM was designed in accordance with the "Monitoring Plan Study Design" guidance provided by the Trustee Council (Trustee Council 2014) with some 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. Descriptions of specific monitoring protocol are included in the following sections.

2.2.1 Retention of Installed Habitat Features/Elements

Habitat features monitored in 2021 included the following:

- Large woody material (LWM)/down wood: number, size, and locations (Active Channel Margin (ACM), Riparian, Channel, and Upland) of LWM/down wood pieces placed as habitat features/elements
- Brush Piles: number, size, and locations (Riparian, Upland) of brush piles placed as habitat features/elements

- Streambed gravel: distribution of gravel placed in the channel
- Mink rock piles: number, size of piles, and location of rock piles placed as habitat features/elements
- Snags: number, size, and locations (Riparian, Upland) of snags placed as habitat features/elements

Methods

LWM and in-stream gravel were monitored using the stream habitat assessment configuration of the line-intercept method. LWM and in-stream gravel were initially noted along ten transects oriented perpendicular to North Channel. Grain size at each channel crossing was recorded and is presented in detail in Section 2.4 Sediment. Because so few LWM structures and brush piles fell along transects, LWM and brush piles were monitored via direct count of all structures. Orthomosaic imagery collected in December 2020 and November 2021 was used to compare LWM and brush pile location and numbers. Installed snags and mink rock piles were monitored by direct count.

Results

Retention of downed LWM and vertical snags was 100 percent in 2021. Comparisons of orthomosaic images from December 2020, just after construction and prior to any flood events, to November 2021 show no change in number or general orientation (Appendix A). Direct observations of LWM found that at least four pieces had shifted 1-2 feet as evident from dimples in the ground surface where the wood was installed.

Seven of the 8 brush piles remained in place on Site. The one missing brush pile was installed in the Sub Area 3 wetland adjacent to Sub Area 4. Remnants of the brush are scattered near the installation location, but enough individual pieces had drifted or moved and were no longer interconnected to count that brush pile as lost.

All ten of the original mink rock piles and two supplemental mink rock piles installed at the Site remain in place. Table 1 summarizes habitat structures counted at the Site.

Table 1. Site Habitat Structure Summary

	Log with rootwads		Logs - no rootwads		Vertical Snags		Brush Plies		Mink Rock Piles	
Sub Area	Installed	Counted	Installed	Counted	Installed	Counted	Installed	Counted	Installed	Counted
1	0	0	0	0	0	0	0	0	1	1
2	13	13	13	13	3	3	2	2	3	3
3	192	192	43	49	70	70	6	5	8	8
4	32	32	0	0	0	0	0	0	0	0

Performance Standard

Greater than 80% retention of installed elements (including recruitment).

Discussion

Anchors used to secure LWM were extremely effective over the first year of the project. Full retention of installed LWM shows the efficacy of the threaded rod/boulder anchors used to secure the wood. Vertical snags, mink rock piles, and all but one of the eight brush piles were also retained over the 2021 monitoring period.

2.2.2 Extent of ACM Habitat

All created or enhanced habitat that occurs between ordinary low water elevation (OLW) and ordinary high-water elevation (OHW) and that is inundated by the Willamette River and Multnomah Channel during high flows, including "inland ACM" habitat in Sub Area 4, is counted as ACM habitat. ACM habitat quality was assessed through evaluation of vegetative community development, and visual assessment of erosion and deposition characteristics. Vegetative community development within the North Channel ACM is described in Section 2.5.4.

Methods

EM of ACM habitat was measured using two methods. The first method involves periodic collection of surface survey-derived elevation data to allow comparison with data collected during Implementation Monitoring and documented in the Project as-built design set. Surface survey data was collected in Year 0 and will be collected in Years 5 and 10.

The second approach involved a line-intercept method to observe physical surface conditions within the riparian zone of the North Channel (Figures 2 and 3). General descriptions were collected for sediment erosion/deposition, channel conditions, and other pertinent observations of physical ACM habitat conditions. Lateral transects along the North Channel extended from the top of the floodplain valley wall to the opposite top of the valley wall.

Results

High water for the 2021 monitoring period occurred on January 13 as measured by devices deployed to the Site. Water on that date reached an elevation of 17.49 feet City of Portland Datum (CPD). Areal cover of surface water at the 17.49-foot elevation is estimated to be 25.4 acres. Figure 4 shows the estimated maximum extent of inundation in 2021.

Observations of ACM did not note significant erosion/deposition or any significant changes to contours and ground surfaces that would affect the extent or function of ACM habitat.

Performance Standards

Changes of no more than 10% in ACM habitat acreage/linear feet from the as-built survey.

Discussion

The maximum water elevation of 17.49 feet CPD measured at Harborton in 2021 approaches the predicted OHW of 18.00 feet CPD. The 25.4 acres of open water in January is 91 percent of the ACM

habitat goal of 28 acres stated in the HDP, thus the performance standard for retention of ACM habitat at a water elevation of 18.0 feet meets the performance standard of no more than 10 percent deviation from as-built conditions.

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

EM of the retention and stability of channel habitat and streambank was assessed through multiple methods. Lineal feet of channel habitat and fish accessible channel habitat, and sediment accretion/erosion were recorded. Collectively, these factors help inform the assessment of channel stability, whether fish access is maintained, and whether material placed in over-excavated areas to address soil contamination remains intact.

Methods

Channel length was established through professional land survey conducted as part of implementation monitoring. Site observations for lateral channel migration were made to ascertain whether changes to channel length and width-depth ratio may have occurred in 2021. Sediment accretion/erosion was assessed using survey stakes placed at 100-foot intervals within the channel, and though field observations keyed into observing sediment accretion and/or erosion. Wetted channel width and water depth were collected at each of the ten line-intercept transects (Figure 3). Water depth was measured from the talweg, which is typically the deepest portion of the channel. Fieldwork to measure channel dimensions and water depth was conducted on August 2, 2021. Field examinations to look for lateral migration or downcutting were made during other, multiple field visits.

Results

No evidence of lateral channel erosion was observed along the entire stream length. Channel dimensions measured over the ten transects were relatively uniform and close to channel design except for Transect 1 near the downstream outlet of the channel. During fieldwork, channel bottom width at Transect 1 measured 2.2 feet across compared with an average 3.0 feet found at the other nine sites. Top to top bank width measured 6.5 feet compared with an average of 7.2 feet at the other 9 crossings. Water depth for Transect 1 was 4.75 inches compared with an average of 1.3 inches at the other 9 points. The North Channel maintained a surface water connection to the Willamette River throughout 2021.

Surface water remained in portions of the stream channel the entire year. The channel reach from the upstream end to approximately 1,550-foot mark went dry from early July to early October. The downstream 1,550 feet of channel retained surface water during that period.

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

1-Aug-21											
Transect	1	2	3	4	5	6	7	8	9	10	Ave.
Bank-to-bank width(ft)	6.5	7.1	7.1	6.8	7.3	7.1	7.2	6.9	7.2	6.8	7.0
Channel bottom width (ft)	2.2	3.0	3.0	2.9	3.0	3.0	2.9	3.3	3.0	3.0	2.9
Water Depth (in)	4.8	3.3	1.5	2.3	1.8	1.3	1.5	1.3	0	0	1.99

Data presented in Table 2 indicate a trend in water depths that supports a "gaining" channel supposition; water levels generally increase in the downstream direction (Transect 1 is furthest downstream) possibly indicating near-surface groundwater contributing to channel hydrology.

Observations of sediment stakes indicated that accretion/erosion is minimal to undetectable for 17 of 18 stakes. The stake closest to the Willamette River was lost or removed, so no direct observations could be measured. Anecdotal evidence suggests that sediments are accreting in this location based on sediment accumulation around LWM at that location, and on a larger percent of sand-sized grain sediments in this location.

Performance Standards

- Identification of any barriers preventing fish access to channel habitat on the Site (including sediment accretion, sub-surface flow, gradient, or other barriers)
- Loss of downstream flow of more than 20% of flow entering Site
- Changes of more than 10% in channel habitat acreages/linear feet from the as-built surveys
- Width to depth ratio change of greater than +/-50%
- Significant erosion in any areas along the North Channel

Discussion

All Performance Standards were met for extent and stability of channel and floodplain habitat. No evidence for stream channel migration, cap-fill material loss, or other notable variations from project design were identified. Surface water in the channel generally increased downstream, indicating that the channel is a "gaining" channel. That is, the channel appears to collect shallow groundwater rather than contribute surface water to the subsurface.

The most dynamic of the ten sample locations is Transect 1, which is nearest to the Willamette River and most susceptible to tidal fluctuation, which can range by 3 or more feet on some days. Field observations noted direct evidence of tidal influence on water levels as evident from drift lines and direct observations of channel elevation changes. The accretion of sandy sediments around Transect 1 can be attributed to Willamette River sediment transport and deposition rather than from the North Channel. Sediment composition is identical to beach sands noted up and down the Willamette shoreline along Harborton and there is little evidence of fine sediments originating from North Channel.

2.2.4 Preservation of Fish Passage /Fish Accessibility

EM of fish passage design features was documented by monitoring fish passable conditions in the North Channel. This assessment was based on observations at the confluence of the North Channel and Willamette River, and at the top end of North Channel looking for barriers such as accumulated debris, over-steep gradients, or head cuts.

Methods

NOAA Fisheries' Anadromous Salmonid Passage Facility Design criteria (NOAA Fisheries 2008) was referenced to determine conditions needed for fish passage as applicable to the North Channel. Surface survey-derived contour base as-built drawings were reference to determine whether as-built conditions meet fish passage conditions, and field observations were made to identify barriers, if any. Observations of channel conditions were made numerous times during fieldwork in 2021.

Results

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 conditions thus conditions are assumed to be within acceptable fish passage ranges.

Fish were observed in the channel from March 2021 through October 2021. Speckled dace (*Rhinichthys osculus*) were observed in small numbers along the entire length of wetted channel beginning in March and continuing through the October 31 monitoring period.

Performance Standard

North Channel grading and subsequent fluvial geomorphic changes do not create passage barrier, as defined in NOAA Fisheries' Anadromous Salmonid Passage Facility Design (NOAA Fisheries 2008).

Discussion

Conditions at the North Channel met performance standards for 2021. The channel confluence with the Willamette River did not experience head cutting though the channel geometry of the zone between the North Channel outlet and shallow waters of the Willamette shoreline changed and shifted, as expected, based on several factors including Willamette River stage, tides, and North Channel discharge.

During tidal fluctuations and over different periods through the year, the Willamette alternately deposits and erodes fine sediments along the shoreline and up North Channel during backwater periods. Deposited fine sediments are then transported riverward by North Channel discharge during high flow periods and/or during low Willamette River water elevations.

The underlying, cohesive mudstone bank appears sufficiently stable to prevent formation of a head cut that would pose a fish barrier, and discharge from North Channel was sufficient in 2021 to maintain an open water connection to the Willamette. North Channel discharge appears to have

sufficient competence to maintain channel connectivity in a manner consistent with natural tributaries to the Willamette River. Specifically, during most flow conditions North Channel appears able to convey fine sediments occasionally deposited by the Willamette River. If the North Channel outlet shows evidence of increasing coarse sediments (gravels or larger) to a degree that flow becomes hyporheic (sub-surficial) then contingency measures to maintain better surface connection should be considered.

2.3 HYDROLOGY AND HYDRAULICS

Water levels in the North Channel, off-channel areas, ACM, 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 wetlands from January to July, the key period for amphibian breeding and rearing.

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.

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

EM were 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 for the period of 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 will be 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

Three HOBO water level measuring devices were deployed to document water depth in Sub Area 4. Two HOBO devices in Sub Area 4 wetland are in established, screened well casings used over the past several years. The third was deployed near the original Sub Area 4 outlet in the north-northwest corner of the Sub Area. 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 3 below).

Results

Table 3 below shows areal extent and water depths for the monitoring period of January through July, with the critical development period in June shown week to week. Data shows that surface water persisted throughout the year in the section of wetland used by northern red-legged frog for breeding and larval development (Appendix B). The lowest surface water elevation measured in 2021 was 1.21 feet on August 10, indicating that Sub Area 4 remained wet throughout 2021. Water elevation data is included in Appendix C.

Table 3. Water Areal Extent and Depth

Month	Areal Extent (ac)			Depth (ft)		
	Standard	Measured	% of Std.	Standard	Measured	% of Std.
Jan	9.4	10.78	115%	3.4	4.32	127%
Feb	10.03	10.9	109%	3.52	4.36	124%
Mar	10.55	9.43	89%	3.66	3.96	108%
Apr	9.55	5.64	59%	3.21	3.18	99%
May	8.01	3.87	48%	2.63	2.81	107%
June 1	2.84	3.53	124%	1.4	2.74	196%
June 2	1.76	3.13	178%	1.1	2.65	241%
June 3	1.29	4.03	312%	0.88	2.84	323%
June 4	1.02	2.76	271%	0.75	2.56	341%
July	0.11	1.41	1282%	0.48	1.2	250%

Performance Standard

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

June Weeks	June Minimum Areal Extent 90% of median open water (acres)	June Minimum Depths- 90% of median depth (ft)
23	2.84	1.4
24	1.76	1.1
25	1.29	0.88
26	1.02	0.75

Discussion

Performance standards were met for all months/weeks except for April and May. Open water areas during April and May were 5.64 and 3.87 acres, respectively, which is approximately half of normal

but comparable to areas observed in June, which exceeded performance standards. Persistent surface water in Sub Area 4 was unexpected given the summer drought conditions in 2021. Fieldwork conducted over the summer months confirmed via direct observation that Sub Area 4 retained surface water through the summer. Factors that may have contributed to persistent surface water include the City of Portland's flushing their water system via a fire hydrant located along NW Marina Way. From approximately June through September the City operates an apparatus that opens a valve on the hydrant each night from 12 a.m. to 6 a.m. to allow the water system to flush. Water from the hydrant drains to a stormwater system that outfalls directly into Sub Area 4.

The City performed the same flushing program in prior years, using the same equipment and maintaining a similar discharge rate and duration as previous years (Suto 2021). PGE anticipates that the City will continue to flush the water system at this location every summer for the foreseeable future.

It may also be true that near surface groundwater was higher than in prior years. Evidence for such a scenario include persistent surface water in the North Channel at an elevation of approximately 14.5 feet CPD throughout the summer. It is suspected that a near surface aquifer may occur at that elevation.

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.

Duration of high flow sufficient to connect North Channel to Sub Area 4 wetlands is used to gauge the period during which salmonids and other fish species have access to that area.

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. Duration of channel connectivity to Sub Area 4 was assessed by noting the period during which Sub Area 4 water elevations exceeded 15.5 feet CPD. The 15.5 elevation is significant in that it is the invert elevation of the channel-wetland connection (15.4 feet CPD) plus 1/10 foot depth that would allow fish access.

Results

The highest measured water elevation was 17.49 feet CPD on January 13, 2021. The calculated area of open water based on that elevation is 25.5 acres. Figure 4 shows the areal extent of surface water on this date.

Water levels consistently exceeding 15.5 feet CPD near the Sub Area 4/Channel inlet were measured between November 17, 2020 and April 24, 2021, which is a duration of 158 consecutive days.

Performance Standard:

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

There is no performance standard for wetland/channel connectivity.

Discussion

The performance standard was met. High flow inundation in 2021 was 97 percent of the baseline high flow of 18.00 feet defined in the HDP. The observed high flow elevation correlated to an estimated surface water area of 25.5 acres, which is 91 percent of the estimated 28 acres of ACM at 18.0 feet CPD.

The 158 consecutive days in 2020-2021 during which North Channel maintained a surface water connection to Sub Area 4 wetland closely coincide with the period during which a significant number of juvenile Chinook salmon would be expected to migrate through the lower Willamette River past Harborton (Friesen, 2007). That same period coincides with the northern red-legged frog breeding period observed at Harborton.

2.4 SEDIMENT

Imported bed material consisting of a mix of cobble-sized to fine-grained sediments were used in construction of the channel to enhance fish habitat and maintain stable habitat characteristics. North Channel substrate is expected to change over time, with fine sediments working into the channel from the surrounding floodplain and from turbid floodwaters.

Methods

Sediment composition monitoring was performed for the North Channel on October 13, 2021 using two techniques. Grab samples were collected using a spade tip shovel to excavate the top 2″-3″ of substrate from four locations in the North Channel (Figure 3). Samples were placed in 1-liter plastic bags and shipped to ACS Testing, Inc. of Tigard, OR for sieve coarse/fine texture analyses.

Grain size was also analyzed using techniques adapted from Peck (Peck et al 2001) and Wolman (Wolman 1954) as follows:

- Assess substrate compositions for wetted North Channel width extending 5 meters upstream from survey transect using a modified version of the step-toe procedure in Wolman. The Wolman method specifies that sample transects run perpendicular to channel flow. This method was modified for Harborton to run diagonally from the edge of one wetted bank upstream to the opposite bank edge over a 5-meter distance.

- Classify percent representation of each substrate category:

Boulder	>250-4,000 mm	basketball to car size
Cobbles	>64-250 mm	tennis ball to basketball
Coarse Gravel	>16-64 mm	marble to tennis ball
Fine Gravel	>2-16 mm	ladybug to marble
Sand	>0.06-2 mm	Smaller than ladybug size, but visible as particles
Fines	<0.06 mm	silt, clay, muck

Results

Sieve analysis results are included in Appendix D. Table 4 below includes results of the Peck/Wolman analysis. The numbers in the table represent a count of each grain size sampled per transect. Between 6 and 7 samples were observed and recorded for each transect.

Table 4. Channel Transect Grain Size Analysis

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

Performance Standard

There is no performance standard specified for this monitoring element.

Discussion

The method differs slightly from that specified in the MAMP in that the modified Peck/Wolman was substituted for multiple grab samples because this method provides information on stream channel character that is not discernible using grab sample methods.

The channel thalweg and channel margins experience different forces from stream flow which affect sediment composition. The Wolman method helps identify thalweg location laterally within the channel and helps discern high velocity and low velocity reaches longitudinally by correlating sediment sizes to the channel's ability to move and sort those sediments. Identifying these channel characteristics may help anticipate erosion and deposition areas, zones of potential lateral migration, and flow characteristics that affect fish movement and aquatic invertebrate distribution. Such

characteristics should become discernible as the channel matures and responds to Site conditions in the coming years.

Additionally, analysis from the four grab samples show similar composition, which is expected given the regularity of the channel's slope and sinuosity along its entirety and given that construction utilized identical materials.

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 (i.e., ACM) Establishment
- Wetland (i.e., ACM) Enhancement/Conservation
- Northern Red-legged Frog Habitat (i.e., Sub Area 4 below 15 ft. elevation CPD) 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 2). 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 3). 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 2).

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.

Areas not covered by vegetation were recorded as bare substrate. Notation was made as to whether the bare substrate was open water, litter, duff, wood, bare soil or rock. Total cover in a plot was recorded as absolute values and therefore may exceed 100% 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 are 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 stems emerging from the ground for shrubs and the number of live stems for trees were counted. A plant 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)
- 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 separately from other non-native plants.

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% 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% confidence level is 1.282.

Sample plots for each habitat type were compared to performance standards separately. Table 5 below describes which habitat type each sample plot represents.

Table 5. Sample Plots in Each Habitat Type

Upland Forest Establishm.	Upland Scrub-Shrub Establishm.	Riparian Forest Establishment	Riparian Forest Enhancement / Conserv.	Wetland (ACM) Establishment	Wetland (ACM) Enhancement / Conserv.	Northern Red-legged Frog Habitat
T06-2, 3, 4	T06-1	T04-1, 2, 7, 8,	T01-2	T04-3, 4, 5, 6	T01-1	T02-1,2,3
T07-2, 3, 4	T07-1	9, 10	T02-4, 6, 7	T05-2, 3, 4, 5,	T02- 5	T03-1,2,3,4
T08-2	T08-1	T05-1, 6, 9, 10	T03-5, 6, 8, 9, 10	7, 8	T03-7	
			T04-11			
			T05-11			
			T06-5			
			T07-5			
			T08-3			
			T09-1			

Fieldwork was performed June 10, 11, 16, 17, 18, 23 and 24.

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 E.

2.5.2.1 Upland Forest Establishment

Performance standards for Upland Forest Establishment include the following:

- Density: ≥1,200 native woody plants per acre - MET
- Diversity: ≥3 native tree species and ≥5 native shrubs - MET
- Cover: ≥10% native herbaceous; ≤10% all non-native vegetation (excluding RCG) - MET

The density of native tree species in the seven sample plots was 1,355 per acre. Seven native tree and five native shrub species were recorded in the sample area. Cover of native plants averaged 49 percent in the sample area. Yarrow (*Achillea millefolium*) comprised the greatest percent of native groundcover at 40 percent. Non-native herbaceous cover averaged 7 percent, with Italian ryegrass (*Lolium multiflorum*) making up approximately 5 percent of that total. No invasive shrubs were noted in sample plots.

2.5.2.2 Upland Scrub-Shrub Establishment

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

- Density: ≥1,200 native woody plants per acre – NOT MET
- Diversity: ≥5 native shrubs - MET
- Cover: ≥10% native herbaceous; ≤10% all non-native vegetation (excluding RCG) - MET

Stem density was 739 stems per acre for the three scrub-shrub sample plots. Five native shrub taxa were represented in the three sample plots, meeting the diversity criterion. Native herbaceous groundcover was 55 percent and comprised primarily of yarrow. Non-native cover averaged 9 percent over the three sample plots. No invasive shrubs were noted in sample plots.

2.5.2.3 Riparian Forest Establishment

Performance standards for Riparian Forest Establishment include the following:

- Density: ≥1,200 native woody plants per acre – NOT MET
- Diversity: ≥3 native tree species and ≥5 native shrubs - MET
- Cover: ≥10% native herbaceous; ≤10% all non-native vegetation (excluding RCG) – PARTIALLY MET

Woody plant density was 1,195 per acre, which is just below the performance criterion. Eleven native tree and 11 native shrub taxa were recorded in the sample plots, meeting the diversity criterion. Cover of native herbaceous and all non-native vegetation was found to be 33.4 and 22.3 percent, respectively. Most of the non-native vegetation cover was in Transect 5, Plot 10 which supported 80 percent cover of Himalayan blackberry (*Rubus armeniacus*).

2.5.2.4 Riparian Forest Enhancement/Conservation

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

- Density: ≥1,200 native woody plants per acre - MET
- Diversity: ≥3 native tree species and ≥5 native shrubs - MET
- Cover: ≥10% native herbaceous; ≤10% all non-native vegetation (excluding RCG) – PARTIALLY MET

Woody plant density was 1,380 woody plants per acre. Four native tree and 7 native shrub taxa were recorded in the study area. Cover of native herbaceous and all non-native vegetation were 13.4 percent and 14.1 percent, respectively, excluding RCG. Himalayan blackberry in three of the 15 sample plots comprised most of the invasive cover observed.

2.5.2.5 Wetland (ACM) Establishment

Performance standards for Wetland Establishment include the following:

- Diversity: >5 herbaceous species (occupying >5% cover in at least 10% of sample plots) - MET
- Cover: ≥30% native herbaceous; ≤10% all non-native vegetation (excluding RCG) – PARTIALLY MET

There were 9 native herbaceous plants occupying >5% cover in at least 10% of sample plots, which exceeds the >5 minimum. Native herbaceous cover was 69.9 percent; cover of all non-native vegetation was 11.6 percent, excluding RCG.

2.5.2.6 Wetland (ACM) Enhancement/Conservation

Performance standards for Wetland Enhancement/Conservation include the following:

- Diversity: >5 herbaceous species (occupying >5% cover in at least 10% of sample plots) – NOT MET
- Cover: ≥30% native herbaceous; ≤10% all non-native vegetation (excluding RCG) – PARTIALLY MET

Native herbaceous diversity is minimal in the three monitoring sample plots in this habitat zone. Trailing blackberry (*Rubus ursinus*) occurs in two plots at 5 percent, which falls below the diversity criterion standard. There were no other native herbaceous species in the three sample plots; average native herbaceous plants occupy 3.33 percent. All non-native vegetation cover averages less than 1 percent (not counting RCG). RCG is the primary herbaceous ground cover in this habitat zone.

2.5.2.7 Northern Red-legged Frog Habitat

There are no Performance Standards for Northern red-legged frog habitat. Vegetation in this area is not subject to planted area performance standards per the HDP but are included as required by the HDP. The information collected may be used to compare vegetation in this sensitive area year-to-year to help inform management decisions for the benefit of northern red-legged frogs.

Native herbaceous plants were not observed in the seven plots in frog breeding habitat, except for Transect 3, sample plot 4 which supported 3 percent slough sedge (*Carex obnupta*) cover. RCG cover averages 80 percent over the seven plots. Sample plot T2, Plot 3 stands apart in that non-native annual bluegrass (*Poa annua*) and meadow foxtail (*Alopecurus pratensis*) each comprised 40 percent cover.

Woody overstory is found at Sample plots T2, Plots 1-2 only. Mature Oregon ash (*Fraxinus latifolia*) and Pacific willow (*Salix lucida*) growing near the wetland edge extend over these two sample plots.

2.5.3 Discussion

The current vegetation composition in established and enhancement/conservation areas come close to meeting density, diversity, and cover performance standards. Some areas where standards are not met they come very close, such as the Riparian Forest Establishment Density standard where the average woody stem density is 99.5 percent of the standard. Other areas, such as the Scrub-shrub density standard, may need to be reviewed to determine whether there is a need for supplemental plantings or whether three monitoring sample plots in that area is sufficient to accurately capture site conditions.

Shortfalls in cover standards can almost entirely be attributed to RCG or blackberry cover. One example is the Riparian Forest Enhancement/Conservation category where three of the 15 sample areas are covered with dense blackberry growth which caused the entire category to fall short of the non-native shrub cover standard.

Table 6 below summarizes site performance for Site Vegetation Monitoring.

Table 6. Site Vegetation Monitoring 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	MET	NOT MET	NOT MET	MET	n/a	n/a
Diversity	MET	MET	MET	MET	MET	NOT MET
Native Cover	MET	MET	MET	MET	MET	NOT MET
Non-Native Cover	MET	MET	NOT MET	NOT MET	NOT MET	MET

In northern red-legged breeding areas the mature trees provide poor opportunities as anchor points for amphibian egg masses due to their relatively large diameter. RCG cover shaded by these trees was found to be 70 and 90 percent. By contrast, RCG cover in unshaded sample plots averages 100 percent.

Sample plot T2, plot 3 is the anomaly in this area. Bluegrass and foxtail dominate an area located along the Olympic Pipeline easement near the 15-foot elevation boundary. The combination of a slightly higher elevation and annual mowing performed by the pipeline operator appear to reduce RCG cover.

2.5.4 North Channel ACM Habitat Vegetation Assessment Method

Vegetation within the North Channel ACM is included in Section 2.5.4 rather than 2.2.2 to better allow comparison to general site vegetation characteristics and a more complete picture of Harborton's vegetation community. Methods were slightly modified following field trials, which found overlap with the general plant community sample plots and gaps that missed significant plant assemblages.

2.5.4.1 Methods

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 transects oriented perpendicular to the North Channel thalweg (Figure 3). Transects extend from top to top of the Sub Area 3 excavation. Transects are unevenly spaced so that various orientations of the

transects do not cross and transects vary in length depending on the extent of the floodplain area they span.

Transect endpoints are marked with 4-foot fiberglass rods. The rod tips are painted either orange or blue, alternating each rod to avoid error while following a 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 August 26-27, 2021.

Performance Standard

- Diversity: >5 herbaceous species (occupying >5% cover in at least 10% of sample plots) – NOT MET
- Cover: ≥30% native herbaceous; ≤ 10% all non-native vegetation (excluding RCG) – NOT MET

2.5.4.2 Results

Five native plant species occupied >5% cover in at least 10% of sample plots, nearly meeting the diversity standard. All five, listed below, were seeded or planted.

- Water foxtail (*Alopecurus geniculatus*)
- American sloughgrass (*Beckmannia syzigachne*)
- Slough sedge (*Carex obnupta*)
- Western mannagrass (*Glyceria occidentalis*)
- Spreading rush (*Juncus patens*)

Native vegetation cover was 26 percent and all non-native cover was 11 percent. Neither result meets performance standards for North Channel ACM habitat.

2.5.4.3 Discussion

Vegetation within 15 meters of the channel is mostly comprised of planted or seeded species. Vegetation data for the channel transects are included in Appendix F. Notable non-native plants include St. John's wort (*Hypericum perforatum*) and floating primrose (*Ludwigia peploides*). St. John's wort is notable because it was recorded at nine of the sample locations and has been noted at several other locations, almost entirely concentrated in the gravel banks of the channel. Floating primrose was observed in only one of transect but was identified in five other areas within the channel after a search.

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

Detailed data on RCG cover was assessed for all wetland areas at Harborton, except for 5.16 acres of Sub Area 4 wetlands that are excluded/prohibited from RCG management activities. Wetlands in RCG-managed areas include 6.62 acres in Sub Area 3 and 8.31 acres in Sub Area 4. Table 7 below presents sample plots located in wetlands that are managed for RCG:

Table 7 – Monitoring Plots in RCG-managed Areas

Transect	Plots
T1	1, 2
T2	5
T3	7
T4	3, 4, 5, 6, 8, 11
T5	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 34 percent across managed areas of the Site. RCG is absent from the 6.62-acre wetland in Sub Area 3. 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 46 percent RCG cover. Table 8 below describes cover in each habitat area and provides an overall estimate based on weighing the percent RCG cover by wetland type.

Table 8. RCG Coverage in Managed Wetlands

Sub Area	Wetland	Acreage	Est. % RCG	Acres RCG
3	Emergent/Shrub/Forest	6.62	0%	0.00
4	Forested	4.37	46%	2.01
4	Scrub-shrub	1.1	46%	0.51
4	Emergent	2.84	90%	2.56
	Total Acres	**14.93**		**5.07**
			Percent RCG in Managed Wetlands:	**34%**

Performance Criteria

Performance criteria for RCG cover:

Years 1-5: ≤ 30% RCG
Year 7: ≤ 25% RCG
Year 10: ≤ 20% RCG

Discussion

The majority of RCG cover is in Sub Area 4 wetlands, much of which is utilized by northern red-legged frogs for breeding and, consequently, is not included in current management plans (Figure

5). Estimated RCG cover in managed wetlands for 2021 was 34% and does not meet the performance standard of less than 30% cover.

Following site monitoring, weed management targeting RCG was performed in late 2021 in both wetland and non-wetland areas. Because there is a 10-acre limit on herbicide application, areas of the site were prioritized and planned for multiple year spraying to ensure overall site coverage and management. Herbicide was applied to a 0.57-acre Sub Area 4 forested wetland area (PFO wetland), which accounts for approximately 0.26 acres of RCG cover (0.57ac x 46%), or 5.1 percent of RCG in managed wetland areas. It is not likely that this single event will eradicate RCG in this area and follow up observations in Spring 2022 are planned to evaluate herbicide efficacy to help inform management in this and other areas.

2.6 WATER QUALITY

EM of water quality criteria included installation of four long-term monitoring temperature sensors in fixed locations in the North Channel. Dissolved oxygen (DO) was measured in surface waters between June to November. DO measurements will continue during winter and spring months when out-migrating juvenile salmonids are likely utilizing off-channel habitat on-site. DO monitoring is co-located in surface waters proximate to the North Channel surface water monitoring stations so data can be correlated.

Methods

Temperature sensors gathered temperature data in one-hour intervals. DO was measured using a hand-held meter (Milwaukee MW600). Prior to use, the device was calibrated per manufacturer specifications. Readings were collected at four stations within North Channel (Figure 6). Temperature measurements were collected from two of the four monitoring stations using HOBO data loggers that were set on the channel bottom. The remaining two of the temperature loggers, the first and third starting from the channel outlet and counting upstream, could not be located and are presumed lost.

Results

Table 9 below shows dissolved oxygen levels for the months surveyed to date. Tables 10 and 11 show temperature readings for Stations 2 and 4, respectively.

Table 9. Dissolved Oxygen (mg/L)

Station	June	July	Aug	Sept	Oct	Nov
1	8.2	8.4	7.9	8.4	10.5	11.0
2	8.1	7.8	7.3	8.0	10.7	11.1
3	8.1	8.0	7.3	7.8	10.6	11.0
4	dry	dry	dry	dry	10.6	11.1

Table 10. Temperature at Water Monitoring Station 2

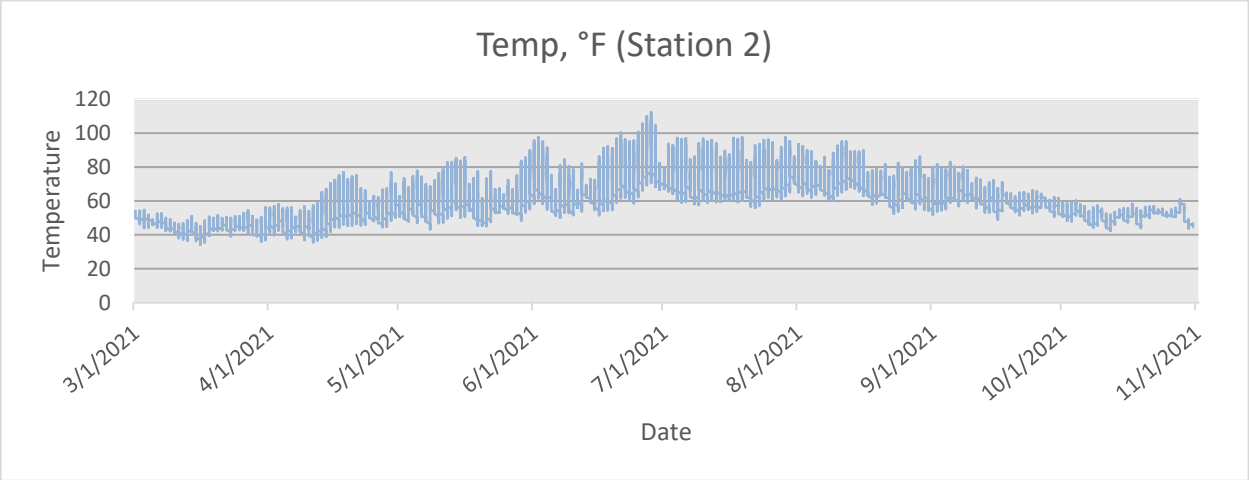
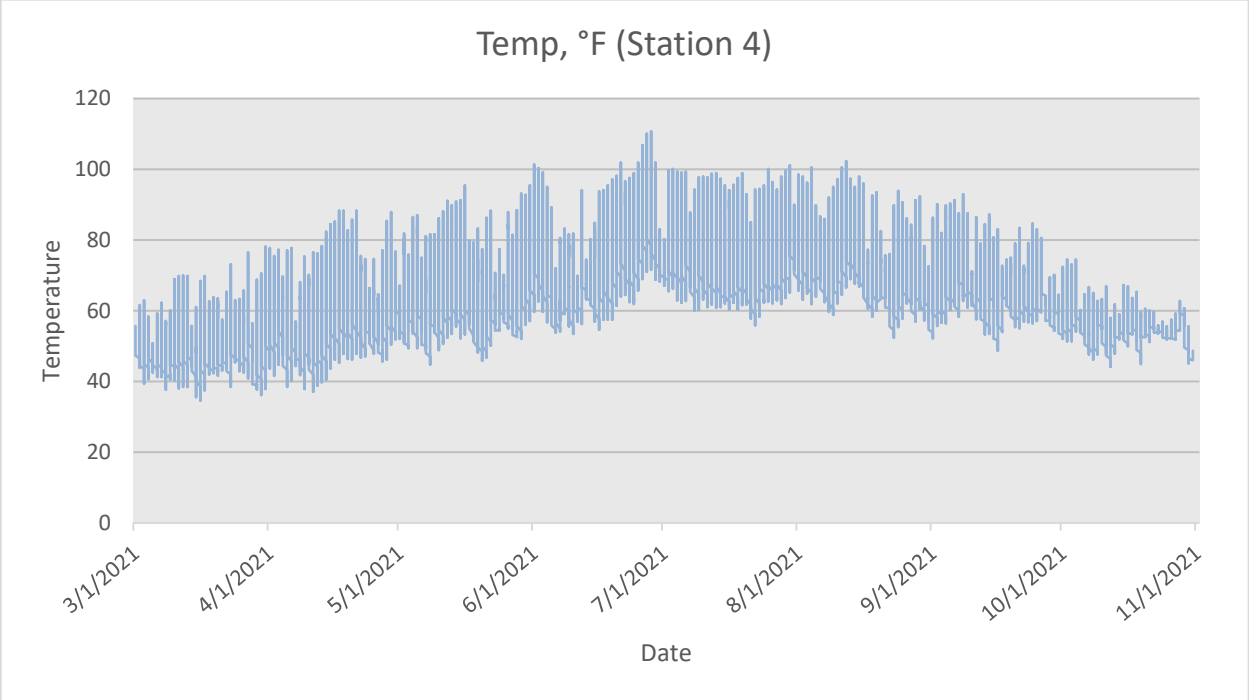


Table 11. Temperature at Water Monitoring Station 4



Performance Standard

There is no required performance standard for this monitoring element.

Discussion

Dissolved oxygen levels in the North Channel waters are adequate to support juvenile salmonids. Based on a review of published studies, JC Davis concluded there is "no impairment to rearing

salmonids if dissolved oxygen levels averaged 9 mg/L, while at oxygen levels of 6.5 mg/L the average member of the community will exhibit symptoms of oxygen stress" (Davis, 1975). Oxygen level data available during the period salmonids are most likely to be present at Harborton were in excess of 9 mg/L on average.

Maximum temperature readings appear to reflect that the probes were deployed on the channel surface in shallow water and were affected by ambient temperatures and direct sunlight on the probe casing. Redeployment of North Channel HOBOs using slotted casing installed just below the channel bottom, as is the configuration for the Sub Area 4 probes, is planned for 2022.

2.7 FISH AND WILDLIFE

EM was conducted to determine if the Site is being used by the Trustee Council's target species. For Year 1 monitoring those species include fish, lamprey, breeding birds, northern red-legged frog, and benthic macroinvertebrates.

2.7.1 Native Fish Use

EM of native fish use was conducted to verify if the Site is being used as off-channel habitat by juvenile salmonids during their outmigration periods and whether lamprey are utilizing the Site for rearing.

2.7.1.1 Juvenile Salmonids

EM of native fish use will be conducted to verify if the restoration Site is being used as off-channel habitat by juvenile salmonids during their outmigration periods and whether lamprey are utilizing Harborton for rearing.

Methods

A PGE fisheries scientist and PGE wetland ecologist deployed a 1.72-meter Fyke trap on January 6th, 2022 at 14:00. The trap mesh had a nominal dimension of 6.35 mm and 2 X 6 m long lead net. The trap was deployed in flooded riparian habitat approximately 30 meters from the Willamette River. Willamette River discharge measured at the Portland gage (USGS # 14211720) was approximately 140,000 cubic feet per second. The Fyke trap was checked/retrieved by PGE fisheries scientists on January 7 at 11:00.

Fish were crowded to cod end of the trap and transferred into an anesthetic bath of 50 mg/l of MS-222, 50 mg/l of buffering solution (CaCO3). Exposure times for non-salmonids were limited to reduce locomotion but not illicit full sedation. Non-salmonids were identified to the species level, recovered in ambient river water, and released back into the site. Salmonids were sedated, identified to the species level, measured to the fork of the caudal fin, photographed, and recovered in ambient river water for release back into the site. No mortality was observed during the collection, handling, and release.

Results

Eight unmarked juvenile Chinook (*Onchorhynchus tshawytscha*) and one unmarked juvenile coho (*O. kisutch*) were collected and released. The mean length of the juvenile Chinook was 103 mm (range 94-117 mm) while the coho was 83 mm. The 1,090 remaining fish were comprised of peamouth (*Mylocheilus caurinus*; n = 1,030), three-spine stickleback (*Gasterosteus aculeatus*; n = 20), yellow perch (*Perca flavescens*; n = 10); walleye (*Sander vitreus*; n = 8), black crappie (*Pomoxis nigromaculatus*; n = 8) sculpin (*Cottid* spp., n = 6); bluegill (*Lepomis macrochirus*; n = 5), goldfish (*Carassius auratus auratus*; n = 2), and a banded killifish (*Fundulus diaphanous*). One bullfrog (*Rana catesbeiana*) tadpole was also captured.

Performance Standards

There is no performance standard for this monitoring element.

Discussion

The capture of 8 wild salmonids at Harborton is encouraging and indicative of suitable habitat conditions. If floodplain and channel habitat persists or improves over time, an examination of future monitoring efforts should be considered. The discussion might consider effects of trapping and handling, monitoring goals (just presence/absence or more comprehensive habitat use assessment), and efficacy of different methods such as snorkeling, cameras or other monitoring approaches.

2.7.1.2 Pacific Lamprey

Pacific lamprey (*Lampetra tridentata*) presence and use of the Site will be monitored through a separate effort. Monitoring will be conducted by USFWS in Years 1-5, 6-8 (as needed to determine whether larval lampreys are stranded in ephemeral tributary), 10, 15, and 20. The monitoring effort will seek to evaluate how individual restoration projects affect Pacific lamprey, specifically their colonization and occupancy of restored habitat.

Method

USFWS has developed a detailed site-specific Lamprey Monitoring Plan that outlines sampling locations, monitoring techniques, and objectives. The site-specific lamprey monitoring plan, Evaluation of Portland Harbor Superfund Area Restoration: Larval Pacific Lamprey Harborton Restoration Site and supplemental Sediment Analysis Plan can be found in the MAMP. Lamprey monitoring results will be submitted by USFWS as a separate report.

Channel/slough and confluence (channel or slough mouths within the mainstem) habitats will be sampled in both restoration and reference sites. Concurrent to each sampling event a sediment sample will be taken (if possible) from each reach or quadrat. Analysis of sediment samples will be conducted by a third-party lab. Additional sampling, potentially including mark/recapture techniques, will be employed to evaluate the question of stranding in ephemeral tributary.

2.7.2 Breeding Bird Use

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.

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 7). Surveys were conducted during peak bird activity: approximately sunrise until completed. Each of the 3 survey events started at different locations to avoid site/time-of-day bias. Table 12 below denotes survey date, starting point, start and end time, and general weather conditions.

Table 12. Bird Survey Information

Date	Start Station	Start Time	End Time	Weather Conditions
21-May	13	05:37	08:19	overcast, no wind
4-Jun	9	06:08	08:38	clear, no wind
16-Jun	1	05:47	08:30	clear, slight breeze

Each station was monitored for 5 minutes. Birds were identified by call and by sight (where possible), with their position and distance from the monitoring station noted. Point-count data was recorded in a geospatial database to identify habitat association; approximate location of bird observations is shown on Figure 8.

Results

Forty-three bird species were observed during monitoring work. Song sparrow, counted 58 times at all 13 monitoring stations, was the most abundant and widespread. Red-winged blackbird, which was counted 54 times at 10 stations, was the second most abundant. Data showing counts by species and date are included in Appendix G.

Performance Standard

There is no required performance standard for this monitoring element.

Discussion

Bird activity primarily centered around forested habitat in Sub Area 1 and Sub Area 4; within those areas a preference seemed to be for edges between forest canopy and open clearings. Waterfowl

displayed a strong preference for open water areas in Sub Area 4 and there was a strong preference of wetland-adapted species, mostly red-winged blackbird, to the Oregon ash stands within those wetlands.

Killdeer and red crossbill were the only species seen in any numbers using the constructed habitat areas. Killdeer typically nest on open, mostly level gravelly surfaces. Killdeer were observed displaying their characteristic feigned injury/distraction behavior, possibly confirming use of the Site for nesting. Red crossbill were observed gathering in large numbers on snags in the Sub Area 3 floodplain just after dawn. Crossbill were not observed feeding or foraging but rather seemed to use the snags to gather before departing en masse soon after sunrise.

2.7.3 Northern Red-Legged Frog Use

EM of northern red-legged frog use will be achieved through comparison of annual amphibian egg mass trends at the Site year-to-year, and to other regional counts from Year 1 through Year 10 of the Performance Period.

Methods

The egg mass survey for 2021 was performed February 26th. Methods used were consistent with Metro Amphibian Survey Protocol (2010) for egg mass surveys. Six observers recorded egg mass numbers over all ponded portions of Sub Areas 3 and 4 by walking abreast in a single line. The observer at the line's end marked the transect with flagging so that the next transect would not overlap or stray from the area covered in the previous transect.

Documentation of amphibian species presence and stage of development was made during fieldwork in the months of June and July, and a frog-specific survey was performed July 7. Notes on location, number and life stage were recorded any time northern red-legged frogs were encountered during that period.

Egg mass survey results from the 2021 Multnomah Channel Marsh were not available at the writing of this report. Those results and a comparison with and discussion of Harborton results will be under a separate supplemental memorandum.

Results

Egg mass survey results from 2021 and from the previous three surveys are shown in Table 13 below. Visual survey of amphibians in June and July noted three verifiable northern red-legged froglets in Sub Area 4 wetlands and two adults in the stream channel in Sub Area 3. On several occasions frogs were noted jumping and/or swimming for cover. On those occasions, efforts were made to locate and identify the individuals which was often unsuccessful due to dense RCG and ample organic debris at the bottom of the ponded areas.

Table 13 – Sub Areas 3 and 4 *Rana aurora aurora* Egg Mass Counts

Year	Developing	Hatched	Bleached	Total
2018	137	0	21	158
2019	144	46	4	194
2020	1387	0	5	1392
2021	411	23	1	435

Performance Standard

There is no required performance standard for northern red-legged frog.

Discussion

The 2021 survey was conducted approximately four months following completion of earthwork and one week after plantings were completed. Except for placement of a few downed LWM, the survey area was untouched and not impacted by construction or habitat management. The 2022 survey will be the first following a full year of site maturation and under conditions expected to persist over the next decade and beyond.

Egg mass numbers for 2021 fell short of the extraordinarily high 2020 numbers but exceeded those of 2019 and 2018. The main conclusion to draw from survey results is that egg mass numbers fluctuate. Survey efforts in the next year will expand to include persistently ponded areas observed near the outlet of the North Chanel in Sub Area 3 as well as a persistently ponded area on the terrace at the base of the Sub Area 2 berm.

2.7.4 Benthic Macroinvertebrate Community

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 28, 2021. During fieldwork, the uppermost sample location was dry so Stream Transects 9 and 10 were not sampled (Figure 3). 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

Seven species from three different phyla were collected and recorded. Invertebrates were collected from eight of the ten sample locations; the uppermost (9 and 10) were dry during fieldwork and were not sampled. The most widely distributed species, commonly known as a water walker (*Hemiptera*), was collected from all 8 sample sites. Taxa with the greatest abundance was an Amphipoda that resembles very small shrimp. Table 14 contains the summary results.

Table 14. Benthic Invertebrates

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

"-" indicates dry conditions during fieldwork

Performance Standard

There is no required performance standard for this monitoring element.

Discussion

Species composition is similar to that found during the baseline study performed in South Channel in 2016. Taxa found in North Channel were present in the 2016 South Channel study.

Channel characteristics directly influence benthic macroinvertebrate recruitment, abundance, and distribution. The South Channel is a slow moving, seasonally wetted stream with a dense forest overstory and little exposed sediment due to the proliferation of RCG.

In contrast, the North Channel is a narrow channel that connects Sub Area 4 to the Willamette River. The channel was constructed using imported sediments ranging from cobble to fine-grained sands; fine-silt sized sediments and organic debris have since entered the channel and become part of the habitat character. Aquatic vegetation (excluding algae) was established over an estimated 5-15 percent of the channel. Algae cover comprised an additional 10-20 percent of channel cover during fieldwork. Channel flow is relatively uniform, with few riffles or pools. The lower channel reach (approximately 300-400 feet upstream of the confluence) was affected by Willamette River tidal fluctuations during fieldwork as noted by direct observation. During 2021, the first year following

construction, the lower 1,500 feet of the channel supported surface water through summer drought conditions.

3. Results and Discussion

3.1 SUMMARY OF RESULTS

Monitoring results indicate the Site is meeting or exceeding performance standards for most subject areas and disciplines. Table 15 below summarizes basic monitoring elements with performance standards, and a determination of whether standards are met or not met for the 2021 monitoring period. Appendix J provides a more detailed table summarizing monitoring results.

Table 15. 2021 Performance Standard Summary

Section	Performance Standards	Met/ Not Met	Adaptive Management Needed	Notes
2.2.1	Retention of Habitat Features/Elements	Met	No	100% retention observed
2.2.2	Changes of no more than 10% in ACM habitat acreage/linear feet from the as-built survey	Met	No	No changes from as-built conditions observed
2.2.3	Extent and Stability of Channel, Streambank, and Floodplain Habitat	Met	No	
2.2.4	Preservation of Fish Passage/Fish Accessibility	Met	No	
2.3.1	Retention of Wetland Hydrology/Habitat for Use by Northern Red-legged Frog	Not Met	No	Not met for April/May. Met for all other periods
2.3.2	Extent of High Flow Inundation	Met	No	
2.5.2	Upland and Riparian Vegetation Density/Diversity/Cover	Not Met	Yes	Density and non-native cover standards not met. Supplemental planting and weed management planned for 2022
2.5.2, 2.5.4	Wetland and North Channel (ACM) Vegetation Diversity/Cover	Not Met	Yes	Shortfalls due to non-native and RCG cover. Weed management planned for 2022
2.5.5	RCG Across Relevant Habitats	Not Met	Yes	RCG management planned for 2022

Several monitoring elements included in this report, such as sediment, breeding bird use, fish, benthic macroinvertebrates and others do not have performance standards.

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. Monitoring data in 2021 indicated that performance standards were not met for the following elements

3.2.1 Retention of Wetland Hydrology/Habitat for Use by Northern Red-legged Frog

Performance standards for this monitoring element were met for all months and periods except for April and May. As noted in Section 2.3.1, Harborton retained ponded conditions in April and May but at levels below baseline standards. It is likely that all egg masses had hatched well before April low-water, so egg-mass stranding should not be a concern. The extent of ponding in April/May resembles the critical June tadpole-to-froglet period, so available ponding does not appear to be a critical concern. The results, however, show that fluctuations over baseline conditions may be broad and do not necessarily follow precipitation patterns thus there is concern for such fluctuations during the critical June period. PGE recommends discussion of potential measures to be undertaken in 2022 should hydrologic fluctuations indicate the potential for a drastic decline in areal ponding in June.

3.2.2 Riparian Forest, Scrub-shrub, and Upland Density

Monitoring found a woody plant density of 1,105 trees and shrubs per acre, which is 92 percent of the performance standard. Much of the woody stem mortality appeared to be due to extreme heat and drought conditions experienced in 2021. Less than 100 woody stems were lost to what appeared to be browsing or physical damage from wildlife. Recommendations for addressing density shortcomings include additional bare root plantings in early season 2022.

Replanting plans include installation of 3,300 shrub and tree species in early 2022 followed by additional plantings in winter 2022 after evaluating woody plant survival and development over the growing season. A list of species and planting locations for early 2022 is included in Appendix I. Species composition and numbers for fall /winter 2022-2023 plantings will be developed following monitoring in 2022.

3.2.3 General Native Vegetation Cover

Himalayan blackberry is the principal non-native plant that pushed several of the habitat types to fall short of non-native vegetation cover. An aggressive treatment and removal plan is in place for 2022. Specifically, blackberry was sprayed in key areas (mostly along the Willamette River shoreline) in 2021 prior to plant dormancy but after site monitoring. In early Spring 2022 dead canes were removed and live blackberry plants mowed. In late summer 2022 areas with any remaining resprout will be treated with herbicide.

Management of other significant non-native species such as RCG and water pimpernel are planned in 2022. RCG is widespread and a well-recognized issue; water pimpernel is not widespread but spreads aggressively and rapidly. Both will be managed principally with herbicide in 2022.

3.2.4 RCG Across Relevant Habitat

RCG cover is an on-going issue that will require persistent management. RCG performance standards were not met in 2021; cover exceeded the Year 1-5 standard of less than 30 percent by 4 percentage points. Adaptive management measures for RCG include assessment of measures taken in 2021, including herbicide application, sod removal (Sub Area 3) and mechanical clearing, to inform and refine RCG management for 2022. Successes over the past year will be replicated in areas not managed in 2021, and other potential measures, such as solarization, may be considered.

3.3 SITE MANAGEMENT AND ACTIVITIES

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

- 48 supplemental LWM and slash habitat structures added to Sub Areas 2 and 3
- 2 supplemental mink rock piles added to Sub Area 3
- Weed management via mechanical clearing and herbicide application over a total of approximately 9 acres in portions of all four Sub Areas
- Irrigation performed on Sub Area 2 berm
- Community volunteer event to clear weeds and remove 300 pounds of garbage
- Security gate added to access point being used by public for Site access
- Boulders placed along MW Marina Way to close area used by public for Site access
- Signage reading "Do Not Enter – Sensitive Habitat Area" posted
- Interpretive sign installed at viewpoint near NW Marina Way to provide project information
- Site tours provided to multiple interested parties (City of Portland, Metro, neighborhood frog volunteer group, USFWS, ODFW, Wetlands Conservancy, West Multnomah County Drainage District, Columbia Land Trust)

Actions anticipated for 2022 include the following:

- Supplemental woody plant installation (February)
- Weed management (spring/summer/fall)
- Second annual community volunteer event (summer)
- Additional Site security measures (on-going)
- Site tours (as requested)

3.4 PHOTO MONITORING POINTS

Eight permanent photo monitoring points were established as shown on Figure 9. 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. Appendix H includes photographs from the monitoring point locations as well as photos from around the site. Permanent monitoring points were marked with etched aluminum tags affixed

to the ground with a long nail. Monitoring locations were recorded using a hand-held GPS unit accurate to within 5 feet.

Four game cameras were located at the site (Figure 9). The four camera locations were selected based on observations of wildlife tracks, proximity to habitat features and/or water features, and paths and passages likely to be used by wildlife. Three of the four cameras were stolen from the site and will be replaced in January 2022.

Orthomosaic images collected by drone following Site work show the progression from newly seeded and planted through a full growing season. Drone-captured Orthomosaic images from December 2020 to November 2021 are included in Appendix A.

3.5 DISCUSSION

Ecological functions at Harborton have improved dramatically over baseline conditions. Weed covered wetlands and uplands in Sub Area 3 have been replaced by active channel margin habitat, native plants, habitat structures, and a fish accessible channel and floodplain. Developed area (reducing the size of the electrical substation in Sub Area 2) has been reduced and replaced by upland habitat supporting native vegetation, and Sub Areas 1 and 4 have benefitted from early and on-going efforts to control weedy plants. Forty-three bird species, 114 plant species, fish, mammals, amphibians, reptiles, and insects are frequent visitors or have become established at Harborton.

The presence of water over the lower 1,550 feet of North Channel through the entire year was a beneficial condition. Channel wetness was expected to be seasonal, with surface water driven by precipitation, water levels in Sub Area 4, and by Willamette River backwatering. The upper 300 feet of channel lost surface water connection to Sub Area 4 in early April and remained so through mid-October but from the Willamette River to 1,550 feet upstream the channel was fully and contiguously wetted.

Fish monitoring provided evidence of a sizable number of fish using site habitat under flooded conditions. The 1,000+ fish trapped in less than 24 hours, including 8 native wild juvenile salmonids seems to indicate suitable habitat conditions. The next fish survey will be in 2023. Loss or theft of monitoring equipment at the Site was an issue in 2021. Three of four trail cameras were stolen, and three water monitoring probes were not found after thorough searching. Members of the public have been observed entering the Site by foot, bicycle, and vehicle. Measures undertaken to prevent vehicle access include installation of a security gate and placement of boulders to block access points. Measures were undertaken in 2021 to limit access points into the Site, including adding locks to an existing gate, installing a second security gate, placing boulders along vehicle access routes, and posting “Do Not Enter – Sensitive Habitat Area” signs at key locations. PGE also increased security awareness to issues at the Site and reported all incidents to have a record of events.

Irrigation was performed on the upland berm in Sub Area 2 to help woody plants survive summer drought conditions. Less than 4 inches of precipitation was measured by the on-site rain gauge from

April 1 through September 16. Irrigation was performed by water truck; two loads totaling 6,000 gallons was applied to the upland berm weekly from May 14 to September 8. Photos in Appendix H show Site conditions during the summer.

RCG cover in wetlands was anticipated to be a major issue; findings confirm this prediction. Constraints on RCG management due to amphibian habitat create a large segment of RCG habitat that will remain static and will continue to pose an infestation risk to other wetland areas. PGE would like to discuss study findings and potential management approaches that would move Harborton closer to meeting performance standards without posing risk to amphibian habitat.

Community outreach and collaboration continues to be an important component of Harborton. PGE is in frequent contact with frog shuttle organizers about activities and observations at the Site. PGE erected an interpretive sign visible from NW Marina Way describing Site history, restoration efforts, and ecological highlights for whomever may stop and pause to enjoy the view. In August, PGE held a volunteer event that included community activists and neighbors and, based on the positive feedback from the community PGE plans to hold annual volunteer events. PGE continues to maintain a webpage summarizing the work and site conditions.

4. References

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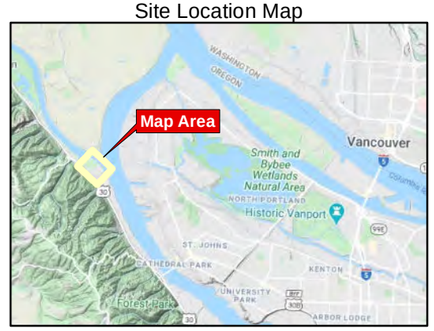
Figures

Site Location Map



Map Features

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

0 115 230

Feet

Portland General Electric

Portland, Oregon

Figure 1

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

T01 T02 T03 T04 T05 T06 T07 T08 T09

Olympic Pipeline (Existing)

Harborton Substation (Existing)

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

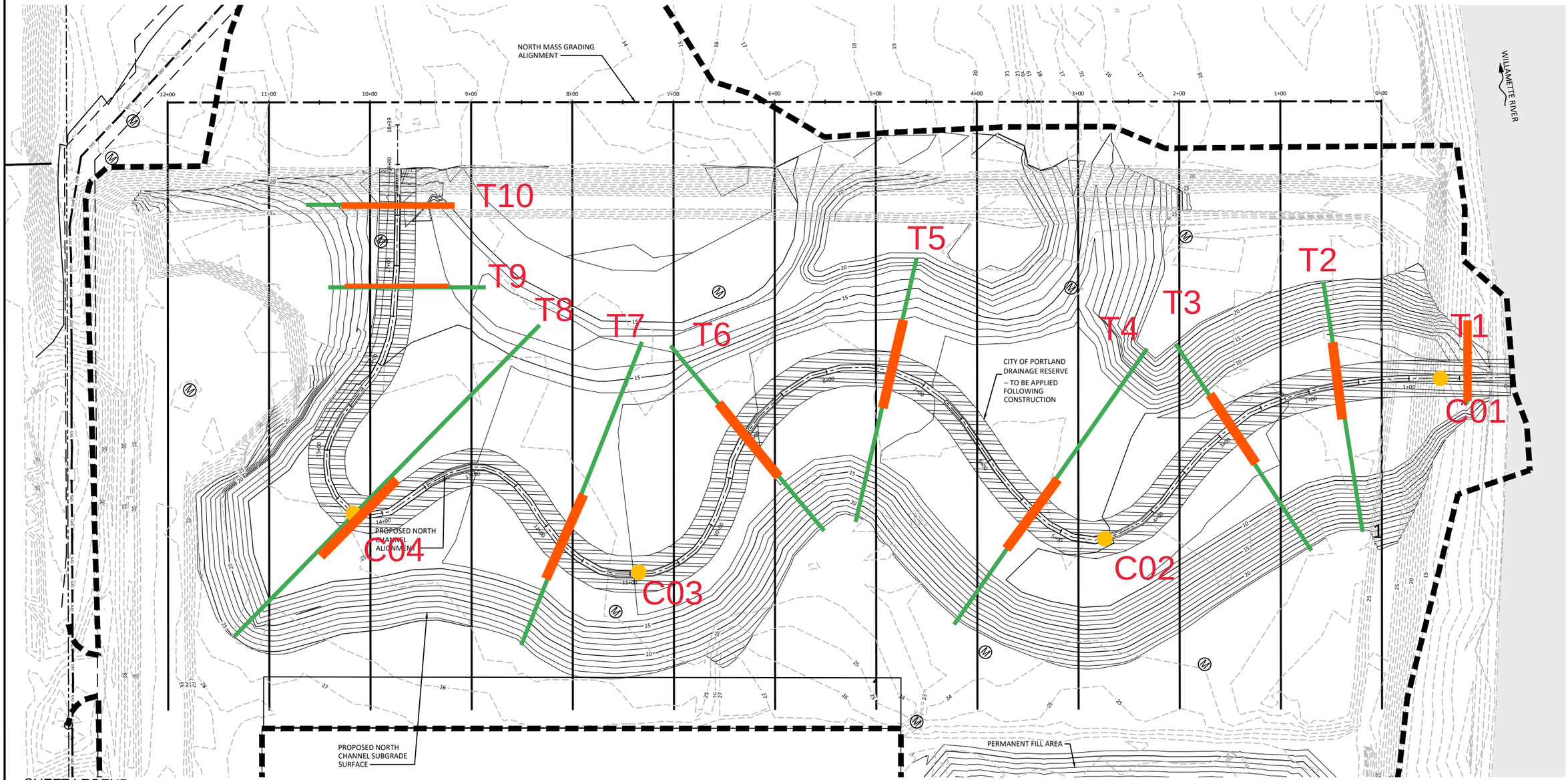
Figure 2

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



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
MAY 15, 1981
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 3

Site Location Map

Map Features

- 17.49 Feet Water El. (COP) 25.5 Acres
- Property Line
- Habitat Area

FIGURE 4

Note:
Site aerial photo date - 01/13/21

0 100 200
Feet

N
W E
S

Portland General Electric
Portland, Oregon

Harborton Inundation Study

PGE Environmental Services

Date:	Drawn By:	Rev.:
12/29/2021	J.B. Hoy	

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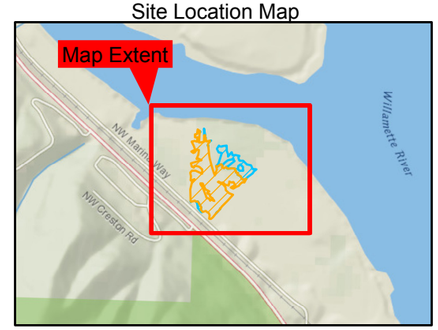
Site Location Map



Map Features

- 15 ft Elevation
- Upland RCG Area - Managed
- Wetland RCG Area - Managed
- Wetland RCG Area - Not Managed
- Red-legged Frog Breeding Habitat
- PGE Property

FIGURE 5

Treatment	Acres
Upland RCG Area - Managed	1.97
Wetland RCG Area - Managed	2.84
Wetland RCG Area - Not Managed	5.18

0 100 200
Feet

N
W E
S

Portland General Electric
Portland, Oregon

Harborton Reed Canarygrass Treatment and Nontreatment Area

Harborton

Date:	Drawn By:	Rev.:
4/18/2018	Brad Wymore	

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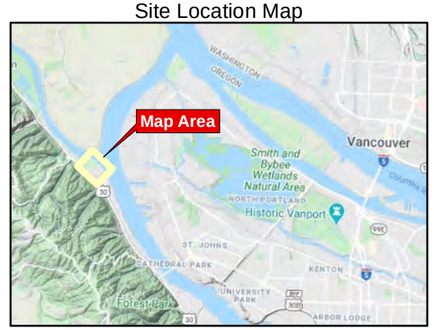
Site Location Map



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

Portland General Electric
Portland, Oregon

Figure 6
Fixed Monitoring Stations

Harborton Restoration Project

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

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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

Site Location Map

Map Features

- Bird Survey Point
- 50-Meter Range
- 150-Meter Range
- Habitat Area
- Non-Habitat Area
- Property Line
- Bird Observation (approximate location)

0 115 230

Feet

Portland General Electric

Portland, Oregon

Figure 8

Bird Survey Locations and Range

PGE Environmental Services

Date:	Drawn By:	Rev.:
26-May-21	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harb_Bird_Survey_B_052521.mxd


Match Line
PP-03
TC-02
TC-01
PP-04
PP-01
TC-03
PP-02
Match Line
PP-08
TC-04
PP-06
PP-05
PP-07
KEY
TC - trail camera
PP - photomonitoring point
Harborton Drone Photography
Mission Date: 02/08/2021
0 35 70 140
Scale in Feet

FIGURE 9

Appendix A – Orthomosaic Images

Appendix A – Orthomosaic Images

December 14, 2020

January 13, 2021

February 8, 2021

March 12, 2021

April 25, 2021


Harbor Line
Water Line
Harbor Line
Mission Date: 05/26/2021
Scale in Feet

May 25, 2021


Site Location Map
Salmon Creek
Vancouver Lake
Orchards
Map Area
Vancouver
PEARSON FLD
205
PORTLAND INTL AIRPORT
PORTLAND INTL AIRPORT
PORTLAND
Ilsboro
Portland
Beaverton
Gres
Map Features
0 70 140
Feet
PGE
Portland General Electric
Portland, Oregon
Harborton Inundation Study
PGE Environmental Services
Date: 12/13/2021
Drawn By: J.B. Hoy
Rev:
Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Indundation_121021.mxd

June, 2021


Harbor Drone Photography
Mission Date: 07/09/2021
Scale in Feet
NW Marina Way

July 9, 2021

August 5, 2021

September 26, 2021

October 22, 2021

November 22, 2021

Appendix B – Standing Water Areal Extent

Site Location Map

Map Features

Wetland Boundary

January Average Depth
4.32 Feet - 10.78 Acres

0 70 140
Feet

N
W E
S

Portland General Electric
Portland, Oregon

Harborton Inundation Study

PGE Environmental Services

Date:	Drawn By:	Rev.:
12/12/2021	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Indundation_121021.mxd

Site Location Map

Map Features

Wetland Boundary

February Average Depth
4.36 Feet - 10.90 Acres

0 70 140
Feet

N
W E
S

Portland General Electric
Portland, Oregon

Harborton Inundation Study

PGE Environmental Services

Date:	Drawn By:	Rev.:
12/12/2021	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Indundation_121021.mxd

Site Location Map

Map Features

- Wetland Boundary
- March Average Depth
  3.96 Feet Depth 9.43 Acres

0 70 140
Feet

N
W E
S

Portland General Electric
Portland, Oregon

Harborton Inundation Study

PGE Environmental Services

Date:	Drawn By:	Rev.:
12/12/2021	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Indundation_121021.mxd

Site Location Map

Map Features

- Wetland Boundary
- April Average Depth
  3.18 Feet Depth 5.64 Acres

0 70 140
Feet

N
W E
S

Portland General Electric
Portland, Oregon

Harborton Inundation Study

PGE Environmental Services

Date:	Drawn By:	Rev.:
12/12/2021	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Indundation_121021.mxd

Site Location Map

Map Features

Wetland Boundary

May Average Depth
2.81 Feet Depth 3.87 Acres

0 70 140
Feet

N
W E
S

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Portland, Oregon

Harborton Inundation Study

PGE Environmental Services

Date:	Drawn By:	Rev.:
12/12/2021	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Indundation_121021.mxd

Site Location Map

Map Features

Wetland Boundary

1st Week of June
2.74 Feet Depth 3.53 Acres

0 70 140
Feet

N
W E
S

Portland General Electric
Portland, Oregon

Harborton Inundation Study

PGE Environmental Services

Date:	Drawn By:	Rev.:
12/12/2021	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Indundation_121021.mxd

Site Location Map

Map Features

Wetland Boundary

2nd Week of June
2.65 Feet Depth 3.13 Acres

0 70 140
Feet

N
W E
S

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Harborton Inundation Study

PGE Environmental Services

Date:	Drawn By:	Rev.:
12/12/2021	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Indundation_121021.mxd

Site Location Map

Map Features

Wetland Boundary

3rd Week of June
2.84 Feet Depth 4.03 Acres

0 70 140
Feet

N
W E
S

Portland General Electric
Portland, Oregon

Harborton Inundation Study

PGE Environmental Services

Date:	Drawn By:	Rev.:
12/12/2021	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Indundation_121021.mxd

Site Location Map

Map Features

Wetland Boundary

4th Week of June
2.56 Feet Depth 2.76 Acres

0 70 140
Feet

N
W E
S

Portland General Electric
Portland, Oregon

Harborton Inundation Study

PGE Environmental Services

Date:	Drawn By:	Rev.:
12/12/2021	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Indundation_121021.mxd

Site Location Map

Map Features

Wetland Boundary

June 10, 2021
2.527 Feet Depth 2.64 Acres

0 70 140
Feet

N
W E
S

Portland General Electric
Portland, Oregon

Harborton Inundation Study

PGE Environmental Services

Date:	Drawn By:	Rev.:
12/12/2021	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Indundation_121021.mxd

Site Location Map

Map Features

Wetland Boundary

July 10, 2021
2.119 Feet Depth 1.41 Acres

0 70 140
Feet

N
W E
S

Portland General Electric
Portland, Oregon

Harborton Inundation Study

PGE Environmental Services

Date:	Drawn By:	Rev.:
12/12/2021	J.B. Hoy	

Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Indundation_121021.mxd

Site Location Map

Map Features

Wetland Boundary

August 10, 2021
1.2 Feet Depth 0.07 Acres

0 70 140
Feet

N
W E
S

Portland General Electric
Portland, Oregon

Harborton Inundation Study

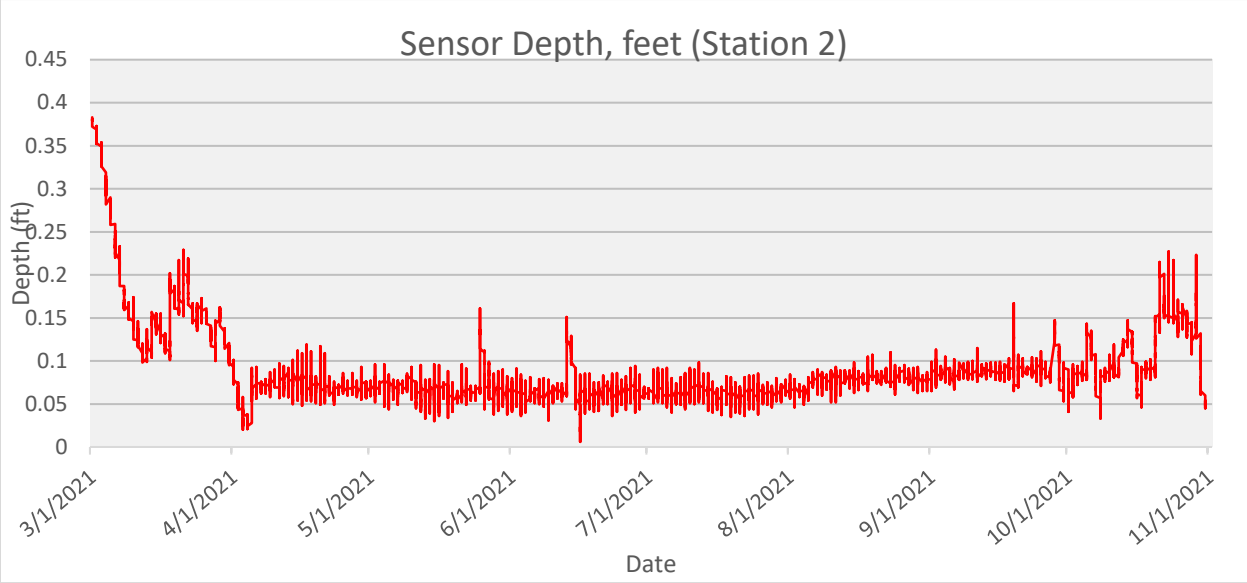
PGE Environmental Services

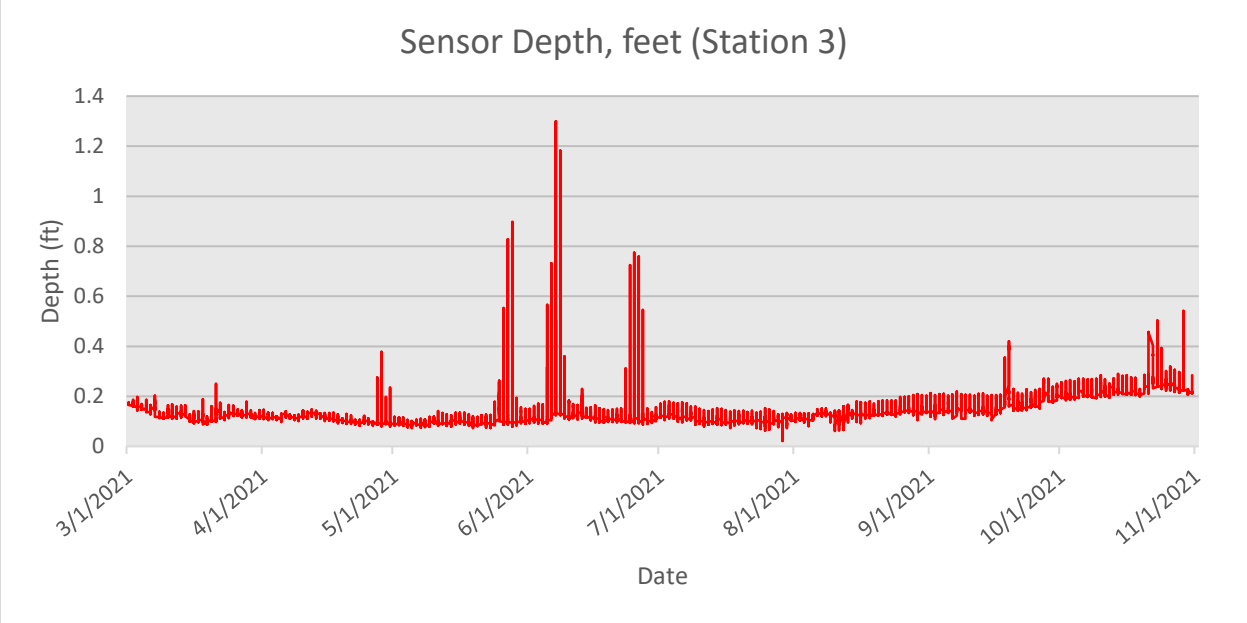
Date:	Drawn By:	Rev.:
12/12/2021	J.B. Hoy	

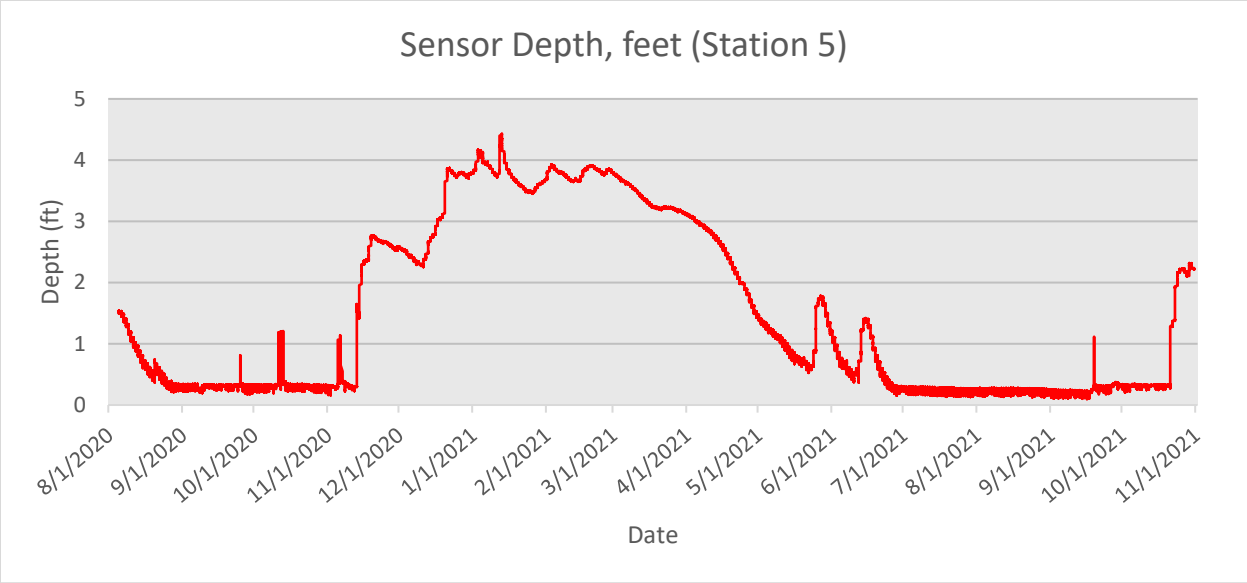
Drawing File: J:\Env_Srvc\Harborton\Maps\Harborton_Indundation_121021.mxd

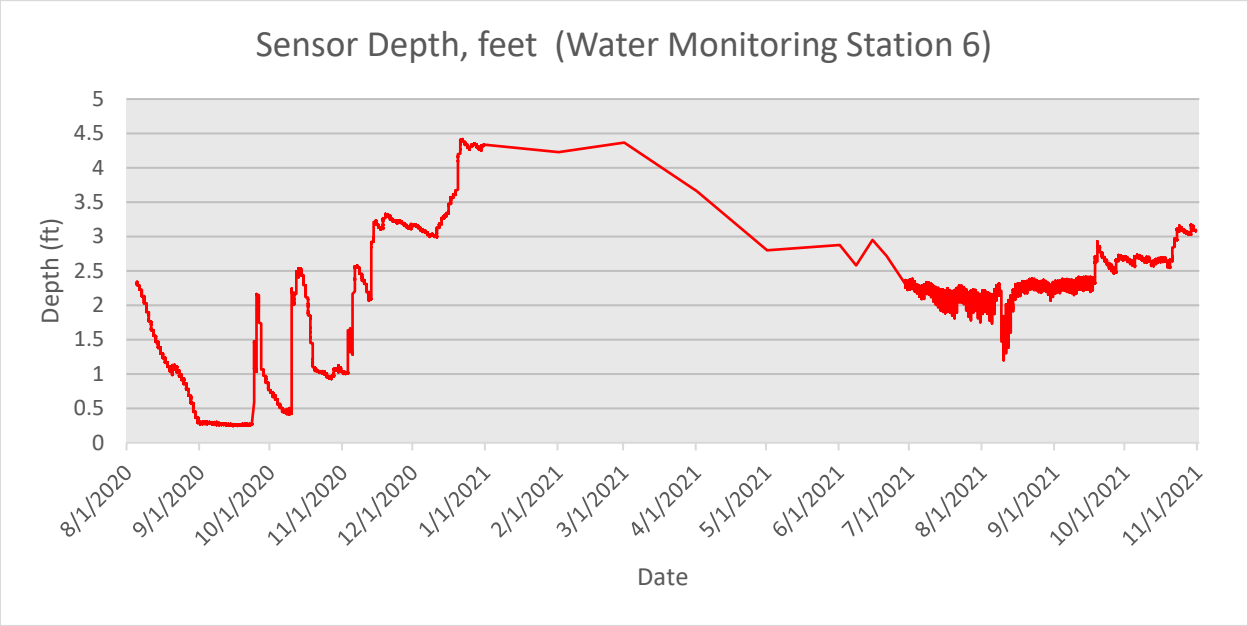
Appendix C – Water Level Data

Appendix C – Water Level Data






Sensor Depth, feet (Station 5)
Depth (ft)
5
4
3
2
1
0
8/1/2020
9/1/2020
10/1/2020
11/1/2020
12/1/2020
1/1/2021
2/1/2021
3/1/2021
4/1/2021
5/1/2021
6/1/2021
7/1/2021
8/1/2021
9/1/2021
10/1/2021
11/1/2021
Date


Sensor Depth, feet (Water Monitoring Station 6)
Depth (ft)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
8/1/2020
9/1/2020
10/1/2020
11/1/2020
12/1/2020
1/1/2021
2/1/2021
3/1/2021
4/1/2021
5/1/2021
6/1/2021
7/1/2021
8/1/2021
9/1/2021
10/1/2021
11/1/2021
Date

Appendix D – Sieve Analysis Report

ASPHALT CONCRETE SOILS TESTING, INC
503.443.3799

PORTLAND GENERAL ELECTRIC
121 SW SALMON
PORTLAND, OR 97204

7409 SW Tech Center Drive - Suite 145
Tigard, OR 97223
Phone: (503) 443-3799 Fax: (503) 620-2748

PROJECT:	HARBORTON	**JOB NO:**	21-L021
LOCATION:	12500 NW MARINE WAY - PORTLAND, OR	**WORK ORDER NO:**	
MATERIAL:	GRAVEL WITH SAND	**LAB NO:**	13746
SAMPLE SOURCE:	NATIVE - C01	**DATE RECEIVED:**	11/18/2021

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES (ASTM C136/C117)

MECHANICAL ANALYSIS

SIEVE SIZE	% PASSING
3 in / 75mm	100
2 in / 50mm	100
1 1/2 in / 37.5mm	89
1 1/4 in / 32 mm	77
1 in / 25 mm	73
3/4 in / 19 mm	65
1/2 in / 12.5 mm	44
3/8 in / 9.5 mm	35
1/4 in / 6.4 mm	29
#4, 4.75mm	26
#8, 2.36mm	20
#10, 2.00mm	16
#16, 1.18mm	14
#30, 0.60mm	11
#40, .425mm	10
#50, .300mm	8
#100, .150mm	5
#200, .075mm	4.0

Reviewed by: Chris Ce

ASPHALT CONCRETE SOILS TESTING, INC
503.443.3799

PORTLAND GENERAL ELECTRIC
121 SW SALMON
PORTLAND, OR 97204

7409 SW Tech Center Drive - Suite 145
Tigard, OR 97223
Phone: (503) 443-3799 Fax: (503) 620-2748

PROJECT:	HARBORTON	**JOB NO:**	21-L021
LOCATION:	12500 NW MARINE WAY - PORTLAND, OR	**WORK ORDER NO:**	
MATERIAL:	GRAVEL WITH SAND	**LAB NO:**	13747
SAMPLE SOURCE:	NATIVE - C02	**DATE RECEIVED:**	11/18/2021

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES (ASTM C136/C117)

MECHANICAL ANALYSIS

SIEVE SIZE	% PASSING
3 in / 75mm	100
2 in / 50mm	100
1 1/2 in / 37.5mm	91
1 1/4 in / 32 mm	87
1 in / 25 mm	58
3/4 in / 19 mm	48
1/2 in / 12.5 mm	34
3/8 in / 9.5 mm	27
1/4 in / 6.4 mm	20
#4, 4.75mm	17
#8, 2.36mm	13
#10, 2.00mm	13
#16, 1.18mm	11
#30, 0.60mm	9
#40, .425mm	8
#50, .300mm	7
#100, .150mm	4
#200, .075mm	3.2

Reviewed by: Paris Ce

ASPHALT CONCRETE SOILS TESTING, INC
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121 SW SALMON
PORTLAND, OR 97204

7409 SW Tech Center Drive - Suite 145
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Phone: (503) 443-3799 Fax: (503) 620-2748

PROJECT:	HARBORTON	**JOB NO:**	21-L021
LOCATION:	12500 NW MARINE WAY - PORTLAND, OR	**WORK ORDER NO:**	
MATERIAL:	GRAVEL WITH SAND	**LAB NO:**	13748
SAMPLE SOURCE:	NATIVE - C03	**DATE RECEIVED:**	11/18/2021

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES (ASTM C136/C117)

MECHANICAL ANALYSIS

SIEVE SIZE	% PASSING
3 in / 75mm	100
2 in / 50mm	84
1 1/2 in / 37.5mm	75
1 1/4 in / 32 mm	75
1 in / 25 mm	60
3/4 in / 19 mm	41
1/2 in / 12.5 mm	25
3/8 in / 9.5 mm	18
1/4 in / 6.4 mm	14
#4, 4.75mm	12
#8, 2.36mm	9
#10, 2.00mm	8
#16, 1.18mm	7
#30, 0.60mm	5
#40, .425mm	5
#50, .300mm	4
#100, .150mm	2
#200, .075mm	1.6

Reviewed by

ASPHALT CONCRETE SOILS TESTING, INC
503.443.3799

PORTLAND GENERAL ELECTRIC
121 SW SALMON
PORTLAND, OR 97204

7409 SW Tech Center Drive - Suite 145
Tigard, OR 97223
Phone: (503) 443-3799 Fax: (503) 620-2748

PROJECT:	HARBORTON	**JOB NO:**	21-L021
LOCATION:	12500 NW MARINE WAY - PORTLAND, OR	**WORK ORDER NO:**	
MATERIAL:	GRAVEL WITH SAND	**LAB NO:**	13749
SAMPLE SOURCE:	NATIVE - C04	**DATE RECEIVED:**	11/18/2021

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES (ASTM C136/C117)

MECHANICAL ANALYSIS

SIEVE SIZE	% PASSING
3 in / 75mm	100
2 in / 50mm	100
1 1/2 in / 37.5mm	81
1 1/4 in / 32 mm	81
1 in / 25 mm	65
3/4 in / 19 mm	45
1/2 in / 12.5 mm	34
3/8 in / 9.5 mm	26
1/4 in / 6.4 mm	20
#4, 4.75mm	19
#8, 2.36mm	14
#10, 2.00mm	13
#16, 1.18mm	10
#30, 0.60mm	7
#40, .425mm	6
#50, .300mm	5
#100, .150mm	3
#200, .075mm	2.4

Reviewed by: Travis Ce

Appendix E – Vegetation Data – Site Transects

Site: Harborton **Sample Date(s):** 2021
Transect 01

Percent Cover

Species	Origin (N, NN, I)	Wetland Status (1 - 5)	1	2	Row Average
Native Herbaceous Species					
Achillea millefolium	N	4	0	0	0
Agrostis exarata	N	3	0	20	10
Alisma plantago aquatica	N	1	0	0	0
Alopecurus geniculatus	N	2	0	0	0
Asclepias speciosa	N	5	0	0	0
Beckmannia syzigachne	N	2	0	0	0
Bidens frondosa	N	2	0	0	0
Bromus carinatus	N	4	0	0	0
Carex obnupta	N	2	0	0	0
Clarkia amoena	N	4	0	0	0
Eleocharis ovara	N	2	0	0	0
Epilobium ciliatum	N	2	0	0	0
Epilobium densiflorum	N	2	0	0	0
Equisetum arvense	N	3	0	0	0
Equisetum fluviatile	N	1	0	0	0
Galium aparine	N	4	0	0	0
Glyceria occidentalis	N	2	0	0	0
Hordeum brachyantherum	N	2	0	0	0
Juncus bufonius	N	2	0	0	0
Juncus oxymeris	N	2	0	0	0
Juncus patens	N	2	0	0	0
Lupinus polyphyllus	N	4	0	0	0
Lupinus rivularis	N	3	0	0	0
Madia gracilis	N	5	0	0	0
Plagiobothyrus figuratus	N	3	0	0	0
Polystichum munitum	N	5	0	0	0
Potentilla gracilis	N	3	0	0	0
Pteridium aquilinum	N	5	0	0	0
Rubus ursinus	N	4	0	0	0
Rumex acetosa	N	3	0	0	0
Rumex aquaticus var *fenestratus*	N	2	0	1	1
Sagiittaria latifolia	N	1	0	0	0
Scirpus microcarpus	N	1	0	0	0
Trifolium wormskjoldii	N	3	0	0	0
Urtica dioica	N	2	0	0	0
Invasive Herbaceous Species					
Lythrum salicaria	I	2	0	0	0
Phalaris arundinacea	I	2	20	40	30
Non-Native Herbaceous Species					
Alopecurus pratensis	NN	2	0	0	0
Cirsium arvense	NN	3	0	0	0
Daucus carota	NN	5	0	0	0
Echinochloa crus-galii	NN	3	0	0	0
Festuca rubra	NN	4	0	0	0
Geranium robertianum	NN	4	0	0	0
Holcus lanatus	NN	2	0	1	1
Hypochaeris radicata	NN	3	0	0	0

Lolium multiflorum	NN	4	0	0	0
Lotus corniculata	NN	3	0	10	5
Matricaria discoidea	NN	4	0	0	0
Poa annua	NN	3	0	0	0
Polypogon monspeliensis	NN	2	0	0	0
Senecio jacobaea	NN	4	0	0	0
Trifolium repens	NN	3	0	0	0
Vicia sativa	NN	5	0	0	0
Vicia tetrasperma	NN	5	0	0	0
Native Shrub and Tree Species					
Acer macrophyllum	N	4	0	0	0
Alnus rubra	N	2	0	0	0
Amelanchier alnifolia	N	4	0	0	0
Cornus alba	N	2	0	1	1
Crataegus douglasii	N	3	0	0	0
Frangula purshiana	N	3	0	0	0
Fraxinus latifolia	N	2	100	20	60
Mahonia nervosa	N	4	0	0	0
Oemleria cerasiformis	N	5	0	0	0
Physocarapus capitatus	N	2	0	0	0
Pinus contorta	N	3	0	0	0
Populus balsamif. var. *trichocarpa*	N	2	0	3	2
Pseudotsuga menziesii	N	4	0	0	0
Quercus garryana	N	5	0	0	0
Ribes divaricatum	N	4	0	0	0
Rosa nutkana	N	3	0	2	1
Rosa pisocarpa	N	4	0	0	0
Salix fluviatilis	N	2	0	0	0
Salix hookeriana	N	2	0	0	0
Salix lasiandra	N	2	0	0	0
Salix sitchensis	N	2	0	10	5
Sambucus racemosa	N	3	0	0	0
Spiraea douglasii	N	2	0	0	0
Symphoricarpos albus	N	4	0	0	0
Non-Native Shrub and Tree Species					
Ilex sp.	NN	4	0	0	0
Invasive Shrub and Tree Species					
Cytisus scoparius	I	5	0	0	0
Rubus armeniacus	I	3	1	2	2
Bare Substrate			80	25	53
			ount (Shrubs) + Stem Count		
Native Shrub and Tree Count					
Acer macrophyllum			0	0	0
Alnus rubra			0	0	0
Amelanchier alnifolia			0	0	0
Cornus alba			0	1	1
Crataegus douglasii			0	0	0
Frangula purshiana			0	0	0
Fraxinus latifolia			8	7	8
Mahonia nervosa			0	0	0
Oemleria cerasiformis			0	0	0
Physocarpus capitatus			0	0	0

Pinus contorta	0	0	0
Populus balsamif. v ar *trichocarpa*	0	1	1
Pseudotsuga menziesii	0	0	0
Quercus garryana	0	0	0
Ribes divaricatum	0	0	0
Rosa nutkana	0	2	1
Rosa pisocarpa	0	0	0
Salix fluviatilis	0	0	0
Salix hookeriana	0	0	0
Salix lasiandra	0	0	0
Salix sitchensis	0	2	1
Sambucus racemosa	0	0	0
Spiraea douglasii	0	0	0
Symphoricarpos albus	0	0	0

Routine Performance Standards	**1**	**2**	**Habitat Average**	**Standard Error**
Cover of Native Herbaceous Species	0	21	11	10.5
Lower CI (80%)			-3	
Upper CI (80%)			24	
Cover of All Non Native Species	1	13	7	6.0
Lower CI (80%)			-1	
Upper CI (80%)			15	
Cover of Reed Canarygrass	20	40	30	10
Lower CI (80%)			17	
Upper CI (80%)			43	
Bare Substrate	80	25	53	28
Lower CI (80%)			17	
Upper CI (80%)			88	
Native Diversity (all layers)			5	N/A
Sum of plant cover	121	110		

Site: Harborton **Sample Date(s):** 2021
Transect 02

Percent Cover

Species	Origin (N, NN, I)	Wetland Status (1 - 5)	1	2	3	4	5	6	7	Row Average
Native Herbaceous Species										
Achillea millefolium	N	4	0	0	0	0	0	0	0	0
Agrostis exarata	N	3	0	0	0	0	0	0	0	0
Alisma plantago aquatica	N	1	0	0	0	0	0	0	0	0
Asclepias speciosa	N	5	0	0	0	0	0	0	0	0
Beckmannia syzigachne	N	2	0	0	0	0	0	0	0	0
Bidens frondosa	N	2	0	0	0	0	0	0	0	0
Bromus carinatus	N	4	0	0	0	0	0	0	0	0
Carex obnupta	N	2	0	0	0	20	0	0	35	8
Clarkia amoena	N	4	0	0	0	0	0	0	0	0
Eleocharis ovara	N	2	0	0	0	0	0	0	0	0
Epilobium ciliatum	N	2	0	0	0	0	0	0	0	0
Epilobium densiflorum	N	2	0	0	0	0	0	0	0	0
Equisetum arvense	N	3	0	0	0	0	0	0	0	0
Equisetum fluviatile	N	1	0	0	0	0	0	0	0	0
Galium aparine	N	4	0	0	0	0	0	0	0	0
Glyceria occidentalis	N	2	0	0	0	0	0	0	0	0
Hordeum brachyantherum	N	2	0	0	0	0	0	0	0	0
Juncus bufonius	N	2	0	0	0	0	0	0	0	0
Juncus oxymeris	N	2	0	0	0	0	0	0	0	0
Juncus patens	N	2	0	0	0	0	0	0	0	0
Lupinus polyphyllus	N	4	0	0	0	0	0	0	0	0
Lupinus rivularis	N	3	0	0	0	0	0	0	0	0
Madia gracilis	N	5	0	0	0	0	0	0	0	0
Plagiobothyrus figuratus	N	3	0	0	0	0	0	0	0	0
Polystichum munitum	N	5	0	0	0	5	0	0	0	1
Potentilla gracilis	N	3	0	0	0	0	0	0	0	0
Pteridium aquilinum	N	5	0	0	0	0	0	5	0	1
Rubus ursinus	N	4	0	0	0	5	5	5	0	2
Rumex acetosa	N	3	0	0	0	0	0	0	0	0
Rumex aquaticus var *fenestratus*	N	2	0	0	0	0	0	0	0	0
Sagiittaria latifolia	N	1	0	0	0	0	0	0	0	0
Scirpus microcarpus	N	1	0	0	0	0	0	0	0	0
Trifolium wormskjoldii	N	3	0	0	0	0	0	0	0	0
Urtica dioica	N	2	0	0	0	0	0	0	0	0
Invasive Herbaceous Species										
Lythrum salicaria	I	2	0	0	0	0	0	0	0	0
Phalaris arundinacea	I	2	70	90	2	15	70	60	2	44
Non-Native Herbaceous Species										
Alopecurus pratensis	NN	2	0	0	40	0	0	0	0	6
Cirsium arvense	NN	3	0	0	0	0	0	0	0	0
Daucus carota	NN	5	0	0	0	0	0	0	0	0
Echinochloa crus-galii	NN	3	0	0	0	0	0	0	0	0
Festuca rubra	NN	4	0	0	0	0	0	0	0	0
Geranium robertianum	NN	4	0	0	0	0	0	0	0	0
Holcus lanatus	NN	2	0	0	0	0	0	0	0	0
Hypochaeris radicata	NN	3	0	0	0	0	0	0	0	0
Lolium multiflorum	NN	4	0	0	0	0	0	0	0	0
Lotus corniculata	NN	3	0	0	0	0	0	0	0	0
Matricaria discoidea	NN	4	0	0	0	0	0	0	0	0
Poa annua	NN	3	0	0	40	0	0	0	0	6
Polypogon monspeliensis	NN	2	0	0	0	0	0	0	0	0
Senecio jacobaea	NN	4	0	0	0	0	0	0	0	0
Trifolium repens	NN	3	0	0	0	0	0	0	0	0
Vicia sativa	NN	5	0	0	0	0	0	0	0	0
Vicia tetrasperma	NN	5	0	0	0	0	0	0	0	0
Native Shrub and Tree Species										
Acer macrophyllum	N	4	0	0	0	0	0	0	0	0
Alnus rubra	N	2	0	0	0	0	0	0	0	0
Amelanchier alnifolia	N	4	0	0	0	0	0	0	0	0
Cornus alba	N	2	0	0	0	1	2	0	0	0
Crataegus douglasii	N	3	0	0	5	0	0	5	0	1
Frangula purshiana	N	3	0	0	0	0	0	0	0	0
Fraxinus latifolia	N	2	80	20	0	50	40	10	10	30
Mahonia nervosa	N	4	0	0	0	0	0	0	0	0
Oemleria cerasiformis	N	5	0	0	0	5	0	0	0	1
Physocarapus capitatus	N	2	0	0	0	0	0	0	2	0

Pinus contorta	N	3	0	0	0	0	0	0	0	0
Populus balsamif. var. *trichocarpa*	N	2	0	0	3	5	20	50	80	23
Pseudotsuga menziesii	N	4	0	0	0	0	0	0	0	0
Quercus garryana	N	5	0	0	0	0	0	0	0	0
Ribes divaricatum	N	4	0	0	0	0	0	2	0	0
Rosa nutkana	N	3	0	0	0	0	0	0	0	0
Rosa pisocarpa	N	4	0	0	0	0	0	0	0	0
Salix fluviatilis	N	2	0	0	0	0	0	0	0	0
Salix hookeriana	N	2	0	0	0	0	0	0	0	0
Salix lasiandra	N	2	0	30	0	0	0	0	0	4
Salix sitchensis	N	2	0	0	0	0	0	0	0	0
Sambucus racemosa	N	3	0	0	0	0	0	0	5	1
Spiraea douglasii	N	2	0	0	0	0	0	0	0	0
Symphoricarpos albus	N	4	0	0	0	40	0	10	50	14
Non-Native Shrub and Tree Species										
Ilex sp.	NN	4	0	0	0	3	0	0	0	0
Invasive Shrub and Tree Species										
Cytisus scoparius	I	5	0	0	0	0	0	0	0	0
Rubus armeniacus	I	3	0	0	0	2	0	0	0	0
Bare Substrate			20	10	5	30	20	40	60	26

Plant Count (Shrubs) + Stem Count (Trees)

Native Shrub and Tree Count								
Acer macrophyllum	0	0	0	0	0	0	0	0
Alnus rubra	0	0	0	0	0	0	0	0
Amelanchier alnifolia	0	0	0	0	0	0	0	0
Cornus alba	0	0	0	1	1	0	0	0
Crataegus douglasii	0	0	2	0	0	2	0	1
Frangula purshiana	0	0	0	0	0	0	0	0
Fraxinus latifolia	7	7	0	8	5	1	3	4
Mahonia nervosa	0	0	0	0	0	0	0	0
Oemleria cerasiformis	0	0	0	5	0	0	0	1
Physocarpus capitatus	0	0	0	0	0	0	1	0
Pinus contorta	0	0	0	0	0	0	0	0
Populus balsamif. v ar *trichocarpa*	0	0	3	2	8	11	10	5
Pseudotsuga menziesii	0	0	0	0	0	0	0	0
Quercus garryana	0	0	0	0	0	0	0	0
Ribes divaricatum	0	0	0	0	0	2	0	0
Rosa nutkana	0	0	0	0	0	0	0	0
Rosa pisocarpa	0	0	0	0	0	0	0	0
Salix fluviatilis	0	0	0	0	0	0	0	0
Salix hookeriana	0	0	0	0	0	0	0	0
Salix lasiandra	0	2	0	0	0	0	0	0
Salix sitchensis	0	0	0	0	0	0	0	0
Sambucus racemosa	0	0	0	0	0	0	1	0
Spiraea douglasii	0	0	0	0	0	0	0	0
Symphoricarpos albus	0	0	0	30	0	6	40	11

Routine Performance Standards	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Habitat Average**	**Standard Error**
Cover of Native Herbaceous Species	0	0	0	30	5	10	35	11	5.6
Lower CI (80%)								4	
Upper CI (80%)								19	
Cover of All Non Native Species	0	0	80	5	0	0	0	12	11.3
Lower CI (80%)								-2	
Upper CI (80%)								27	
Cover of Reed Canarygrass	70	90	2	15	70	60	2	44	14
Lower CI (80%)								26	
Upper CI (80%)								62	
Bare Substrate	20	10	5	30	20	40	60	26	7
Lower CI (80%)								17	
Upper CI (80%)								36	
Native Diversity (all layers)								5	N/A
Sum of plant cover	150	140	90	151	137	147	184		

Site: Harborton **Sample Date(s):** 2021
Transect 03

Percent Cover

Species	Origin (N, NN, I)	Wetland Status (1 - 5)	1	2	3	4	5	6	7	8	9	10	Row Average
Native Herbaceous Species													
Achillea millefolium	N	4	0	0	0	0	0	0	0	0	0	0	0
Agrostis exarata	N	3	0	0	0	0	0	0	0	0	0	0	0
Alisma plantago aquatica	N	1	0	0	0	0	0	0	0	0	0	0	0
Asclepias speciosa	N	5	0	0	0	0	0	0	0	0	0	0	0
Beckmannia syzigachne	N	2	0	0	0	0	0	0	0	0	0	0	0
Bidens frondosa	N	2	0	0	0	0	0	0	0	0	0	0	0
Bromus carinatus	N	4	0	0	0	0	0	0	0	0	0	0	0
Carex obnupta	N	2	0	0	3	0	0	0	0	40	0	0	4
Clarkia amoena	N	4	0	0	0	0	0	0	0	0	0	0	0
Eleocharis ovara	N	2	0	0	0	0	0	0	0	0	0	0	0
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
Equisetum fluviatile	N	1	0	0	0	0	0	0	0	0	0	5	1
Galium aparine	N	4	0	0	0	0	0	0	0	1	1	1	0
Glyceria occidentalis	N	2	0	0	0	0	0	0	0	0	0	0	0
Hordeum brachyantherum	N	2	0	0	0	0	0	0	0	0	0	0	0
Juncus bufonius	N	2	0	0	0	0	0	0	0	0	0	0	0
Juncus oxymeris	N	2	0	0	0	0	0	0	0	0	0	0	0
Juncus patens	N	2	0	0	0	0	0	0	0	0	0	0	0
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
Plagiobothyrus figuratus	N	3	0	0	0	0	0	0	0	0	0	0	0
Potentilla gracilis	N	3	0	0	0	0	0	0	0	0	0	0	0
Rubus ursinus	N	4	0	0	0	0	0	10	5	10	0	0	3
Rumex acetosa	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	0	0	0
Scirpus microcarpus	N	1	0	0	0	0	0	0	0	0	0	0	0
Trifolium wormskjoldii	N	3	0	0	0	0	0	0	0	0	0	0	0
Urtica dioica	N	2	0	0	0	0	0	5	0	0	0	0	1
Invasive Herbaceous Species													
Lythrum salicaria	I	2	0	0	0	0	0	0	0	0	0	0	0
Phalaris arundinacea	I	2	100	100	100	100	65	60	80	2	40	3	65
Non-Native Herbaceous Species													
Alopecurus pratensis	NN	2	0	0	0	0	0	0	0	0	0	0	0
Cirsium arvense	NN	3	0	0	0	0	0	0	0	0	0	0	0
Daucus carota	NN	5	0	0	0	0	0	0	0	0	0	0	0
Echinochloa crus-galii	NN	3	0	0	0	0	0	0	0	0	0	0	0
Festuca rubra	NN	4	0	0	0	0	0	0	0	0	0	0	0
Geranium robertianum	NN	4	0	0	0	0	0	0	0	0	0	4	0
Holcus lanatus	NN	2	0	0	0	0	0	0	0	0	0	0	0
Hypochaeris radicata	NN	3	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
Lotus corniculata	NN	3	0	0	0	0	0	0	0	0	0	0	0
Matricaria discoidea	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
Senecio jacobaea	NN	4	0	0	0	0	0	0	0	0	0	0	0
Trifolium repens	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
Native Shrub and Tree Species													
Acer macrophyllum	N	4	0	0	0	0	0	0	0	0	0	0	0
Alnus rubra	N	2	0	0	0	0	0	0	0	0	0	0	0
Amelanchier alnifolia	N	4	0	0	0	0	0	0	5	4	0	0	1
Cornus alba	N	2	0	0	0	0	0	0	0	0	0	20	2
Crataegus douglasii	N	3	0	0	0	0	0	0	0	2	0	0	0
Frangula purshiana	N	3	0	0	0	0	0	0	0	0	0	0	0
Fraxinus latifolia	N	2	0	20	0	0	80	40	40	50	20	10	26
Mahonia nervosa	N	4	0	0	0	0	0	0	0	0	0	0	0
Physocarapus capitatus	N	2	0	0	0	0	0	0	0	0	0	0	0
Pinus contorta	N	3	0	0	0	0	0	0	0	0	0	0	0
Populus balsamif. var. *trichocarpa*	N	2	0	0	0	0	0	40	20	20	60	30	17
Pseudotsuga menziesii	N	4	0	0	0	0	0	0	0	0	0	0	0
Quercus garryana	N	5	0	0	0	0	0	0	0	0	0	0	0
Rosa nutkana	N	3	0	0	0	0	0	0	0	0	0	0	0
Rosa pisocarpa	N	4	0	0	0	0	0	0	0	0	0	0	0
Salix fluviatilis	N	2	0	0	0	0	0	0	0	0	0	0	0
Salix hookeriana	N	2	0	0	0	0	0	0	0	0	0	0	0
Salix lasiandra	N	2	0	0	0	0	0	0	0	0	0	0	0
Salix sitchensis	N	2	0	0	0	0	0	0	0	0	0	0	0
Sambucus racemosa	N	3	0	0	0	0	0	0	0	0	1	0	0
Spiraea douglasii	N	2	0	0	0	0	0	0	0	0	0	0	0

Symphoricarpos albus	N	4	0	0	0	0	0	4	10	15	20	25	7
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	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			0	0	0	0	20	30	10	25	50	70	21
							Plant Count (Shrubs) + Stem Count (Trees)						
Native Shrub and Tree Count													
Acer macrophyllum			0	0	0	0	0	0	0	0	0	0	0
Alnus rubra			0	0	0	0	0	0	0	0	0	0	0
Amelanchier alnifolia			0	0	0	0	0	0	2	2	0	0	0
Cornus alba			0	0	0	0	0	0	0	0	0	12	1
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	11	0	0	12	10	7	17	7	3	7
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. var trichocarpa			0	0	0	0	0	7	3	3	6	4	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	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0	0
Salix sitchensis			0	0	0	0	0	0	0	0	0	0	0
Sambucus racemosa			0	0	0	0	0	0	0	0	1	0	0
Spiraea douglasii			0	0	0	0	0	0	0	0	0	0	0
Symphoricarpos albus			0	0	0	0	0	2	5	11	14	20	5

Routine Performance Standards	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Habitat Average**	**Standard Error**
Cover of Native Herbaceous Species	0	0	3	0	0	15	5	51	1	6	8	5.0
Lower CI (80%)											2	
Upper CI (80%)											14	
Cover of All Non Native Species	0	0	0	0	0	0	0	0	0	4	0	0.4
Lower CI (80%)											0	
Upper CI (80%)											1	
Cover of Reed Canarygrass	100	100	100	100	65	60	80	2	40	3	65	12
Lower CI (80%)											49	
Upper CI (80%)											81	
Bare Substrate	0	0	0	0	20	30	10	25	50	70	21	8
Lower CI (80%)											11	
Upper CI (80%)											30	
Native Diversity (all layers)											5	N/A
Sum of plant cover	100	120	103	100	145	159	160	144	142	98		
Average												

Site: Harborton **Sample Date(s):** 2021
Transect 04

Percent Cover

Species	Origin (N, NN, I)	Wetland Status (1 - 5)	1	2	3	4	5	6	7	8	9	10	11	Row Average
Native Herbaceous Species														
Achillea millefolium	N	4	0	2	0	0	0	0	0	0	0	0	0	0
Agrostis exarata	N	3	0	30	0	0	0	0	20	0	0	20	0	6
Alisma plantago aquatica	N	1	0	0	0	35	0	0	0	0	0	0	0	3
Alopecurus geniculatus	N	2	0	0	0	0	0	25	0	0	0	0	0	2
Asclepias speciosa	N	5	0	0	0	0	0	0	0	0	0	0	0	0
Beckmannia syzigachne	N	2	0	0	0	5	0	25	0	0	0	0	0	3
Bidens frondosa	N	2	0	0	0	5	0	0	0	0	0	0	0	0
Bromus carinatus	N	4	0	0	0	0	0	0	0	0	0	0	0	0
Carex obnupta	N	2	0	0	0	0	0	0	0	0	0	0	25	2
Clarkia amoena	N	4	0	0	0	0	0	0	0	0	0	0	0	0
Eleocharis ovara	N	2	0	0	0	0	0	0	0	0	0	0	0	0
Epilobium ciliatum	N	2	1	0	0	0	0	0	0	0	10	0	0	1
Epilobium densiflorum	N	2	0	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	15	1
Galium aparine	N	4	0	0	0	0	0	0	0	0	2	0	0	0
Glyceria occidentalis	N	2	0	0	0	0	0	15	0	0	0	0	0	1
Hordeum brachyantherum	N	2	0	0	0	5	0	5	0	0	0	0	0	1
Juncus bufonius	N	2	0	0	10	0	0	0	8	10	0	0	0	3
Juncus oxymeris	N	2	0	0	0	0	0	0	0	0	0	0	0	0
Juncus patens	N	2	0	0	0	0	0	0	0	0	0	0	0	0
Lupinus polyphyllus	N	4	0	10	0	0	0	0	1	0	0	0	0	1
Lupinus rivularis	N	3	0	30	0	0	0	0	0	1	0	10	0	4
Madia gracilis	N	5	30	0	0	0	0	0	0	0	0	0	0	3
Plagiobothyrus figuratus	N	3	0	2	2	0	0	0	30	5	0	2	0	4
Potentilla gracilis	N	3	0	0	0	0	0	0	0	0	0	0	15	1
Rumex acetosa	N	3	0	0	0	0	0	0	0	0	0	3	0	0
Rumex aquaticus var *fenestratus*	N	2	0	0	0	0	0	0	0	0	1	0	0	0
Sagiittaria latifolia	N	1	0	0	0	0	0	0	0	0	0	0	0	0
Scirpus microcarpus	N	1	0	0	0	0	5	0	0	0	0	0	0	0
Trifolium wormskjoldii	N	3	2	0	0	0	0	0	0	0	0	0	0	0
Invasive Herbaceous Species														
Lythrum salicaria	I	2	0	0	0	0	0	0	0	0	0	0	0	0
Phalaris arundinacea	I	2	0	0	0	0	0	0	0	0	60	0	5	6
Non-Native Herbaceous Species														
Alopecurus pratensis	NN	2	0	0	20	0	0	0	0	0	0	0	0	2
Cirsium arvense	NN	3	0	0	0	0	0	0	0	0	5	0	0	0
Daucus carota	NN	5	0	0	0	0	0	0	0	0	0	0	0	0
Echinochloa crus-galii	NN	3	0	0	1	0	0	0	0	0	0	0	0	0
Festuca rubra	NN	4	0	0	0	0	0	0	0	0	0	0	0	0
Holcus lanatus	NN	2	0	0	0	0	0	0	0	0	0	0	0	0
Hypochaeris radicata	NN	3	0	0	0	0	0	0	1	0	0	0	0	0
Lolium multiflorum	NN	4	2	5	0	0	0	0	0	5	0	10	0	2
Lotus corniculata	NN	3	0	2	0	0	0	0	0	0	0	0	0	0
Matricaria discoidea	NN	4	0	0	0	0	0	0	0	0	0	0	0	0
Poa annua	NN	3	0	5	0	0	0	0	0	2	0	0	0	1
Polypogon monspeliensis	NN	2	0	0	0	0	0	0	2	0	0	0	0	0
Senecio jacobaea	NN	4	0	0	0	0	0	0	0	0	2	0	1	0
Trifolium repens	NN	3	0	0	2	0	2	0	1	5	0	2	0	1
Vicia sativa	NN	5	0	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	0
Native Shrub and Tree Species														
Acer macrophyllum	N	4	0	0	0	0	0	0	0	0	0	0	0	0
Alnus rubra	N	2	0	0	0	0	0	0	0	1	0	2	0	0
Amelanchier alnifolia	N	4	5	1	2	0	0	0	3	7	0	0	0	2
Cornus alba	N	2	0	0	13	22	14	0	4	0	15	0	10	7
Crataegus douglasii	N	3	0	0	0	0	0	0	0	3	0	0	0	0
Frangula purshiana	N	3	0	0	0	0	0	0	0	0	0	0	0	0
Fraxinus latifolia	N	2	0	0	0	0	0	0	0	1	0	0	0	0
Mahonia nervosa	N	4	0	0	0	0	0	0	0	0	0	0	0	0
Physocarapus capitatus	N	2	0	0	0	0	0	0	0	0	0	0	0	0
Pinus contorta	N	3	0	1	0	0	0	0	0	2	0	1	0	0
Populus balsamif. var. *trichocarpa*	N	2	0	0	3	0	0	0	2	2	0	10	0	2
Pseudotsuga menziesii	N	4	11	0	0	0	0	0	4	4	0	2	0	2
Quercus garryana	N	5	0	0	0	0	0	0	0	0	0	0	0	0
Rosa nutkana	N	3	6	4	0	0	0	0	3	0	0	5	0	2
Rosa pisocarpa	N	4	0	0	0	0	0	0	0	0	0	0	0	0
Salix fluviatilis	N	2	0	0	0	0	0	0	0	0	0	0	20	2
Salix hookeriana	N	2	0	0	0	0	0	0	0	0	0	0	20	2
Salix lasiandra	N	2	0	0	0	0	0	0	0	0	0	0	0	0
Salix sitchensis	N	2	1	5	7	0	0	0	4	0	0	0	0	2
Sambucus racemosa	N	3	0	0	0	0	0	0	0	3	0	0	0	0
Spiraea douglasii	N	2	0	11	0	0	20	0	0	0	0	1	0	3
Symphoricarpos albus	N	4	0	2	0	0	0	0	5	1	0	0	0	1
Non-Native Shrub and Tree Species														
			0	0	0	0	0	0	0	0	0	0	0	0
Invasive Shrub and Tree Species														
Cytisus scoparius	I	5	0	0	0	0	0	0	0	0	0	1	0	0
Rubus armeniacus	I	3	3	0	0	0	0	0	0	0	20	5	0	3

Bare Substrate	55	15	70	50	95	40	40	70	10	50	25	47

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
Alnus rubra	0	0	0	0	0	0	0	1	0	2	0	0
Amelanchier alnifolia	5	1	2	0	0	0	3	7	0	0	0	2
Cornus alba	0	0	13	22	14	0	4	0	3	0	2	5
Crataegus douglasii	0	0	0	0	0	0	0	3	0	0	0	0
Frangula purshiana	0	0	0	0	0	0	0	0	0	0	0	0
Fraxinus latifolia	0	0	0	0	0	0	0	1	0	0	0	0
Mahonia nervosa	0	0	0	0	0	0	0	0	0	0	0	0
Physocarpus capitatus	0	0	0	0	0	0	0	0	0	0	0	0
Pinus contorta	0	1	0	0	0	0	0	2	0	1	0	0
Populus balsamif. var trichocarpa	0	0	3	0	0	0	2	2	0	2	0	1
Pseudotsuga menziesii	11	0	0	0	0	0	4	4	0	2	0	2
Quercus garryana	0	0	0	0	0	0	0	0	0	0	0	0
Rosa nutkana	6	4	0	0	0	0	3	0	0	5	0	2
Rosa pisocarpa	0	0	0	0	0	0	0	0	0	0	0	0
Salix fluviatilis	0	0	0	0	0	0	0	0	0	0	12	1
Salix hookeriana	0	0	0	0	0	0	0	0	0	0	2	0
Salix lasiandra	0	0	0	0	0	0	0	0	0	0	0	0
Salix sitchensis	1	5	7	0	0	0	4	0	0	0	0	2
Sambucus racemosa	0	0	0	0	0	0	0	3	0	0	0	0
Spiraea douglasii	0	11	0	0	20	0	0	0	0	1	0	3
Symphoricarpos albus	0	2	0	0	0	0	5	1	0	0	0	1

Routine Performance Standards	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**Habitat Average**	**Standard Error**
Cover of Native Herbaceous Species	33	74	12	50	5	70	59	16	13	35	55	38	7.4
Lower CI (80%)												29	
Upper CI (80%)												48	
Cover of All Non Native Species	5	12	23	0	2	0	4	12	27	18	1	9	2.9
Lower CI (80%)												6	
Upper CI (80%)												13	
Cover of Reed Canarygrass	0	0	0	0	0	0	0	0	60	0	5	6	5
Lower CI (80%)												-1	
Upper CI (80%)												13	
Bare Substrate	55	15	70	50	95	40	40	70	10	50	25	47	8
Lower CI (80%)												37	
Upper CI (80%)												57	
Native Diversity (all layers)												5	N/A
Sum of plant cover	61	108	60	72	41	70	88	52	115	74	111		

Site: Harborton **Sample Date(s):** 2021
Transect 05

Percent Cover

Species	Origin (N, NN, I)	Wetland Status (1 - 5)	1	2	3	4	5	6	7	8	9	10	11	Row Average
Native Herbaceous Species														
Achillea millefolium	N	4	0	0	0	0	0	2	0	0	0	0	0	0
Agrostis exarata	N	3	0	0	0	0	0	15	25	5	0	0	0	4
Alisma plantago aquatica	N	1	0	0	0	15	0	0	0	0	0	0	0	1
Alopecurus geniculatus	N	2	0	5	5	0	40	0	0	7	0	0	0	5
Asclepias speciosa	N	5	0	0	0	0	0	0	0	0	0	0	0	0
Beckmannia syzigachne	N	2	0	50	40	40	40	0	0	7	0	0	0	16
Bromus carinatus	N	4	0	0	0	0	0	0	0	0	0	0	0	0
Carex obnupta	N	2	0	0	2	0	0	0	0	0	0	0	0	0
Clarkia amoena	N	4	0	0	0	0	0	0	0	0	0	0	0	0
Eleocharis ovara	N	2	0	0	0	0	0	0	0	5	0	0	0	0
Epilobium ciliatum	N	2	0	0	0	0	1	0	1	1	0	0	0	0
Epilobium densiflorum	N	2	0	0	0	0	0	0	0	1	0	0	0	0
Equisetum arvense	N	3	0	0	0	0	0	0	0	0	0	10	10	2
Glyceria occidentalis	N	2	0	0	0	40	20	0	0	0	0	0	0	5
Hordeum brachyantherum	N	2	0	5	2	0	0	0	0	0	0	0	0	1
Juncus bufonius	N	2	0	5	0	0	0	0	0	10	3	0	0	2
Juncus oxymeris	N	2	0	0	0	0	0	0	0	3	0	0	0	0
Juncus patens	N	2	0	0	0	0	0	0	0	5	0	0	0	0
Lupinus polyphyllus	N	4	5	5	0	0	0	1	30	0	0	0	0	4
Lupinus rivularis	N	3	5	5	10	0	0	0	0	0	30	0	0	5
Madia gracilis	N	5	0	9	0	0	0	10	0	0	0	0	0	2
Plagiobothyrus figuratus	N	3	0	3	0	0	0	20	15	0	0	0	0	3
Sagiittaria latifolia	N	1	0	0	0	0	0	0	0	15	0	0	0	1
Trifolium wormskjoldii	N	3	3	0	0	0	0	0	0	0	0	0	0	0
Invasive Herbaceous Species														
Lythrum salicaria	I	2	0	0	0	0	0	0	0	2	0	0	0	0
Phalaris arundinacea	I	2	0	0	0	0	0	0	0	0	0	0	85	8
Non-Native Herbaceous Species														
Cirsium arvense	NN	3	0	0	0	0	0	0	0	0	0	0	0	0
Daucus carota	NN	5	0	0	0	0	1	0	0	0	0	0	0	0
Festuca rubra	NN	4	0	0	0	0	0	0	0	0	0	0	0	0
Holcus lanatus	NN	2	0	0	0	0	0	0	2	0	0	0	0	0
Hypochaeris radicata	NN	3	0	0	0	0	0	0	0	0	0	0	0	0
Lolium multiflorum	NN	4	20	10	0	0	5	10	5	0	5	0	0	5
Lotus corniculata	NN	3	1	6	20	5	0	0	2	1	0	0	0	3
Matricaria discoidea	NN	4	0	0	0	0	0	0	0	0	0	0	0	0
Poa annua	NN	3	20	0	5	0	0	0	0	0	0	0	0	2
Polypogon monspeliensis	NN	2	0	0	0	0	0	0	5	0	0	0	0	0
Trifolium repens	NN	3	0	2	2	0	0	0	5	1	1	0	0	1
Vicia sativa	NN	5	0	0	1	0	0	0	0	0	0	0	0	0
Vicia tetrasperma	NN	5	0	0	0	0	0	0	1	0	0	0	0	0
Native Shrub and Tree Species														
Acer macrophyllum	N	4	0	0	0	0	0	0	0	0	0	20	0	2
Alnus rubra	N	2	0	0	1	8	0	1	1	0	0	0	0	1
Amelanchier alnifolia	N	4	7	0	0	0	0	1	5	0	1	0	0	1
Cornus alba	N	2	0	0	0	0	4	0	1	0	0	0	0	0
Crataegus douglasii	N	3	4	0	0	0	0	3	0	0	0	0	0	1
Frangula purshiana	N	3	0	0	0	0	0	0	0	0	0	0	0	0
Fraxinus latifolia	N	2	2	0	0	0	1	4	0	0	0	0	0	1
Mahonia nervosa	N	4	0	0	0	0	0	0	0	0	0	0	0	0
Physocarapus capitatus	N	2	0	0	0	0	0	1	0	0	0	0	0	0
Pinus contorta	N	3	1	0	0	0	0	0	0	0	0	0	0	0
Populus balsamif. var. *trichocarpa*	N	2	0	2	3	4	2	6	2	15	6	0	20	5
Pseudotsuga menziesii	N	4	0	0	0	0	0	5	0	0	4	0	0	1
Quercus garryana	N	5	0	0	0	0	0	0	0	0	0	0	0	0
Rosa nutkana	N	3	5	0	0	0	5	5	1	0	0	0	0	1
Rosa pisocarpa	N	4	0	0	0	0	0	0	0	0	0	0	3	0
Salix hookeriana	N	2	0	0	1	0	0	0	0	0	0	0	0	0
Salix lasiandra	N	2	0	0	2	0	4	0	2	12	2	35	60	11
Salix sitchensis	N	2	2	7	6	12	8	0	2	3	2	0	0	4
Sambucus racemosa	N	3	0	0	0	0	0	0	0	0	8	0	0	1
Spiraea douglasii	N	2	3	0	0	0	1	1	1	0	4	0	0	1
Symphoricarpos albus	N	4	0	0	0	0	0	3	0	0	0	0	0	0
Non-Native Shrub and Tree Species														
			0	0	0	0	0	0	0	0	0	0	0	0
Invasive Shrub and Tree Species														
Cytisus scoparius	I	5	0	0	0	0	0	0	0	0	8	0	0	1
Rubus armeniacus	I	3	0	0	0	0	0	0	0	0	0	80	0	7
Bare Substrate			50	5	30	5	5	30	5	40	30	60	5	24

Plant Count (Shrubs) + Stem Count (Trees)

Native Shrub and Tree Count														
Acer macrophyllum			0	0	0	0	0	0	0	0	0	1	0	0
Alnus rubra			0	0	1	8	0	1	1	0	0	0	0	1
Amelanchier alnifolia			7	0	0	0	0	1	5	0	1	0	0	1
Cornus alba			0	0	0	0	4	0	1	0	0	0	0	0
Crataegus douglasii			4	0	0	0	0	3	0	0	0	0	0	1

Frangula purshiana	0	0	0	0	0	0	0	0	0	0	0	0	
Fraxinus latifolia	2	0	0	0	1	4	0	0	0	0	0	1	
Mahonia nervosa	0	0	0	0	0	0	0	0	0	0	0	0	
Physocarpus capitatus	0	0	0	0	0	1	0	0	0	0	0	0	
Pinus contorta	1	0	0	0	0	0	0	0	0	0	0	0	
Populus balsamif. var trichocarpa	0	2	3	4	2	6	2	5	6	0	5	3	
Pseudotsuga menziesii	0	0	0	0	0	5	0	0	4	0	0	1	
Quercus garryana	0	0	0	0	0	0	0	0	0	0	0	0	
Rosa nutkana	5	0	0	0	5	5	1	0	0	0	0	1	
Rosa pisocarpa	0	0	0	0	0	0	0	0	0	0	1	0	
Salix hookeriana	0	0	1	0	0	0	0	0	0	0	0	0	
Salix lasiandra	0	0	2	0	4	0	2	12	2	2	10	3	
Salix sitchensis	2	7	6	12	8	0	2	3	2	0	0	4	
Sambucus racemosa	0	0	0	0	0	0	0	0	8	0	0	1	
Spiraea douglasii	3	0	0	0	1	1	1	0	0	0	0	1	
Symphoricarpos albus	0	0	0	0	0	3	0	0	2	0	0	0	

Routine Performance Standards	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**Habitat Average**	**Standard Error**
Cover of Native Herbaceous Species	13	87	59	95	101	48	71	59	33	10	10	53	10.2
Lower CI (80%)												40	
Upper CI (80%)												66	
Cover of All Non Native Species	41	18	28	5	6	10	20	4	14	80	0	21	7.0
Lower CI (80%)												12	
Upper CI (80%)												29	
Cover of Reed Canarygrass	0	0	0	0	0	0	0	0	0	0	85	8	8
Lower CI (80%)												-2	
Upper CI (80%)												18	
Bare Substrate	50	5	30	5	5	30	5	40	30	60	5	24	6
Lower CI (80%)												16	
Upper CI (80%)												32	
Native Diversity (all layers)												5	N/A
Sum of plant cover	78	114	100	124	132	86	106	93	74	145	178		

Site: Harborton **Sample Date(s):** 2021
Transect 06

Percent Cover

Species	Origin (N, NN, I)	Wetland Status (1 - 5)		**1**	**2**	**3**	**4**	**5**	Row Average
Native Herbaceous Species									
Achillea millefolium	N	4		30	40	50	20	0	28
Agrostis exarata	N	3		0	0	3	0	0	1
Asclepias speciosa	N	5		0	2	0	0		
Bromus carinatus	N	4		0	2	0	5		
Clarkia amoena	N	4		0	0	0	0	0	0
Epilobium congesta	N	3		0	0	0	0	0	0
Lupinus rivularis	N	3		40	5	10	10	0	13
Invasive Herbaceous Species									
Phalaris arundinacea	I	2		0	1	0	0	100	20
Non-Native Herbaceous Species									
Cirsium arvense	NN	3		0	1	0	0		0
Daucus carota	NN	5		0	0	0	0	0	
Festuca rubra	NN	4		10	0	0	0		
Holcus lanatus	NN	2		1	0	2	0	0	
Hypochaeris radicata	NN	3		0	0	1	0		0
Lolium multiflorum	NN	4		5	1	1	5	0	2
Native Shrub and Tree Species									
Acer macrophyllum	N	4		0	1	11	3	0	3
Alnus rubra	N	2		2	2	2	4	0	2
Cornus alba	N	2		0	0	0	0	20	4
Frangula purshiana	N	3		0	0	2	2	0	1
Mahonia nervosa	N	4		0	0	3	0	0	1
Pinus contorta	N	3		0	1	4	4	0	2
Pseudotsuga menziesii	N	4		0	3	2	2	0	1
Quercus garryana	N	5		0	0	5	6	0	2
Rosa nutkana	N	3		0	0	1	0	0	0
Salix lasiandra	N	3		0	0	0	0	60	12
Sambucus racemosa	N	3		1	2	0	0	0	1
Symphoricarpos albus	N	4		2	4	5	1	0	2
Non-Native Shrub and Tree Species									
Invasive Shrub and Tree Species									
Rubus armeniacus	I	4		0	0	0	0	50	10
Bare Substrate				25	50	30	60	80	49

Plant Count (Shrubs) + Stem Count (Trees)

Native Shrub and Tree Count								
Acer macrophyllum	0	1	11	3	0	3		
ahonia nervosa	0	0	3	4	0	1		
Alnus rubra	2	2	2	0	0	1		
Cornus alba	0	0	0	2	9	2		
Frangula purshiana	0	0	2	0	0	0		
Pinus contorta	0	1	4	4	0	2		
Pseudotsuga menziesii	0	3	2	2	0	1		
Quercus garryana	0	0	5	6	0	2		
Rosa nutkana	0	0	1	0	0	0		
Salix lasiandra	0	0	0	0	2	0		
Sambucus racemosa	1	2	0	0	0	1		
Symphoricarpos albus	2	4	5	1	0	2		

Routine Performance Standards	1	2	3	4	5	Habitat Average	Standard Error
Cover of Native Herbaceous Species	70	49	63	35	0	43	12.4
Lower CI (80%)						27	
Upper CI (80%)						59	
Cover of All Non Native Species	16	2	4	5	50	15	9.0
Lower CI (80%)						4	
Upper CI (80%)						27	
Cover of Reed Canarygrass	16	2	4	5	0	5	3
Lower CI (80%)						2	
Upper CI (80%)						9	
Bare Substrate	25	50	30	60	80	49	10
Lower CI (80%)						36	
Upper CI (80%)						62	
Native Diversity (all layers)						5	N/A
Sum of plant cover	61	25	52	42	230		

Site: Harborton	**Sample Date(s):**		2021							
Transect 07			**Percent Cover**							
Species	Origin (N, NN, I)	Wetland Status (1 - 5)	**1**	**2**	**3**	**4**	**5**	Row Average		
Native Herbaceous Species										
Achillea millefolium	N	4	25	25	50	30	0	26		
Agrostis exarata	N	3	15	0	0	0	0	3		
Lupinus rivularis	N	3	20	20	15	15	0	14		
Epilobium congesta	N		0	7	0	0	0	1		
Clarkia amoena	N	4	0	1	0	0	0	0		
Bromus carinatus	N	4	0	0	3	5	0	2		
Juncus bufonius	N	2	0	0	0	1	0	0		
Invasive Herbaceous Species										
Phalaris arundinacea	I	2	1	0	0	0	0	0		
Non-Native Herbaceous Species										
Daucus carota	NN	5	0	0	1	0	0	0		
Holcus lanatus	NN	2	0	0	1	0	0	0		
Lolium multiflorum	NN	4	10	2	0	1	0	3		
Parentucellia viscosa	NN	4	0	3	0	0	0	1		
Native Shrub and Tree Species										
Alnus rubra	N	2	0	6	2	3	0	2		
Acer macrophyllum	N	4	0	0	7	4	0	2		
Cornus alba	N	2	0	0	0	0	30	6		
Frangula purshiana	N	3	0	0	0	3	0	1		
Pinus contorta	N	3	0	0	1	3	0	1		
Pseudotsuga menziesii	N	4	0	0	3	2	0	1		
Quercus garryana	N	5	0	0	3	3	0	1		
Salix lasiandra	N	2	0	0	0	0	70	14		
Sambucus racemosa	N	3	2	1	0	0	0	1		
Symphoricarpos albus	N	4	5	2	1	1	0	2		
Non-Native Shrub and Tree Species										
Invasive Shrub and Tree Species										
Rubus armeniacus	I	4	0	0	0	0	50	10		
Bare Substrate			25	50	30	50	80	47		
			Plant Count (Shrubs) + Stem Count (Trees)							
Native Shrub and Tree Count										
Acer macrophyllum			0	0	7	4	0	2		
Alnus rubra			0	6	2	3	0	2		
Cornus alba			0	0	0	0	6			

Site: Harborton	**Sample Date(s):**		2021							
Transect 07			**Percent Cover**							
Species	Origin (N, NN, I)	Wetland Status (1 - 5)	**1**	**2**	**3**	**4**	**5**	Row Average		
Frangula purshiana			0	0	0	3	0	1		
Pinus contorta			0	0	1	3	0	1		
Pseudotsuga menziesii			0	0	3	2	0	1		
Quercus garryana			0	0	3	3	0	1		
Salix lasiandra			0	0	0	0	3	1		
Sambucus racemosa			2	1	0	0	0	1		
Symphoricarpos albus			5	2	1	1	0	2		
Routine Performance Standards			**1**	**2**	**3**	**4**	**5**	**Habitat Average**	**Standard Error**	
Cover of Native Herbaceous Species			60	53	68	51	0	46	12.0	
Lower CI (80%)								31		
Upper CI (80%)								62		
Cover of All Non Native Species			10	5	2	1	50	14	9.2	
Lower CI (80%)								2		
Upper CI (80%)								25		
Cover of Reed Canarygrass			10	5	2	1	0	4	2	
Lower CI (80%)								1		
Upper CI (80%)								6		
Bare Substrate			25	50	30	50	80	47	10	
Lower CI (80%)								35		
Upper CI (80%)								59		
Native Diversity (all layers)								5	N/A	
Sum of plant cover			53	42	37	41	150			

Site: Harborton	**Sample Date(s):**		2021					
Transect 08			**Percent Cover**					
					T-2			
Species	Origin (N, NN, I)	Wetland Status (1 - 5)	**1**	**2**	**3**	Row Average		
Native Herbaceous Species								
Achillea millefolium	N	4	0	3	0	1		
Lupinus rivularis	N	3	0	0	1	0		
Bromus carinatus	N	4	0	0	0	0		
Epilobium congesta	N	3	0	1	2	1		
Poa palustris	N	3	5	0	0	2		
Polystichum munitum	N	5	0	50	0	17		
Prosartes trachycarpa	N	5	0	0	0	0		
Rubus ursinus	N	4	0	0	3	1		
Urtica dioica	N	3	0	0	0	0		
Vicia americana	N	3	5	0	0	2		
Invasive Herbaceous Species								
Geranium robertianum	I		0	0	0	0		
Hedera helix	I		0	0	5	2		
Phalaris arundinacea	I		15	0	35	17		
Non-Native Herbaceous Species								
Lolium multiflorum	NN		0	0	0	0		
Native Shrub and Tree Species								
Acer macrophyllum	N	2	75	60	80	72		
Alnus rubra	N	3	0	0	8	3		
Corylus cornuta	N	3	0	0	0	0		
Frangula purshiana	N	4	0	0	2	1		
Pseudotsuga menziesii	N	2	0	25	0	8		
Quercur garryana	N	2	0	0	0	0		
Sambucus racemosa	N	4	0	0	0	0		
Symphoricarpos albus	N	4	25	25	4	18		
Non-Native Shrub and Tree Species								
Crataegus monogyna	NN	3	0	1	2	1		
Ilex europaea	NN	4	0	0	0	0		
Invasive Shrub and Tree Species								
Rubus armeniacus	I	2	0	0	0	0		
Bare Substrate			20	25	20	22		
			ıt Count (Shrubs) + Stem Count (Tr					
Native Shrub and Tree Count								

Site: Harborton	**Sample Date(s):**		2021					
Transect 08			**Percent Cover**					
					T-2			
Species	Origin (N, NN, I)	Wetland Status (1 - 5)	**1**	**2**	**3**	Row Average		
Acer macrophyllum	N		5	3	5	4		
Alnus rubra	N		0	0	0	0		
Corylus cornuta	N		0	0	0	0		
Frangula purshiana	N		0	0	2	1		
Pseudotsuga menziesii	N		0	25	0	8		
Quercur garryana	N		0	0	0	0		
Sambucus racemosa	N		0	0	4	1		
Symphoricarpos albus	N		19	11	2	11		
Routine Performance Standards			**1**	**2**	**3**	**Habitat Average**	**Standard Error**	
Cover of Native Herbaceous Species			35	54	6	32	14.0	
Lower CI (80%)						14		
Upper CI (80%)						50		
Cover of All Non-Native Species			0	1	7	3	2.2	
Lower CI (80%)						0		
Upper CI (80%)						5		
Cover of Reed Canarygrass			15	0	35	17	10	
Lower CI (80%)						4		
Upper CI (80%)						30		
Bare Substrate			20	25	20	22	2	
Lower CI (80%)						20		
Upper CI (80%)						24		
Native Diversity (all layers)						6	N/A	
Sum of plant cover			125	165	142			

Site: Harborton **Sample Date(s):** 2021
Transect 09

Percent Cover

Species	Origin (N, NN, I)	Wetland Status (1 - 5)	1	Row Average
Native Herbaceous Species				
Achillea millefolium	N	4	0	0
Agrostis exarata	N	3	0	0
Alisma plantago aquatica	N	1	0	0
Asclepias speciosa	N	5	0	0
Beckmannia syzigachne	N	2	0	0
Bidens frondosa	N	2	0	0
Bromus carinatus	N	4	0	0
Carex obnupta	N	2	0	0
Clarkia amoena	N	4	0	0
Eleocharis ovara	N	2	0	0
Epilobium ciliatum	N	2	0	0
Epilobium densiflorum	N	2	0	0
Equisetum arvense	N	3	0	0
Equisetum fluviatile	N	1	0	0
Galium aparine	N	4	0	0
Glyceria occidentalis	N	2	0	0
Hordeum brachyantherum	N	2	0	0
Juncus bufonius	N	2	0	0
Juncus oxymeris	N	2	0	0
Juncus patens	N	2	0	0
Lupinus polyphyllus	N	4	0	0
Lupinus rivularis	N	3	0	0
Madia gracilis	N	5	0	0
Plagiobothyrus figuratus	N	3	0	0
Polystichum munitum	N	5	5	5
Potentilla gracilis	N	3	0	0
Pteridium aquilinum	N	5	0	0
Rubus ursinus	N	4	0	0
Rumex acetosa	N	3	0	0
Rumex aquaticus var *fenestratus*	N	2	0	0
Sagiittaria latifolia	N	1	0	0
Scirpus microcarpus	N	1	0	0
Trifolium wormskjoldii	N	3	0	0
Urtica dioica	N	2	0	0
Invasive Herbaceous Species				
Lythrum salicaria	I	2	0	0
Phalaris arundinacea	I	2	0	0
Non-Native Herbaceous Species				
Alopecurus pratensis	NN	2	0	0
Cirsium arvense	NN	3	1	1
Daucus carota	NN	5	0	0
Echinochloa crus-galii	NN	3	0	0

Festuca rubra	NN	4	0	0
Geranium robertianum	NN	4	0	0
Holcus lanatus	NN	2	0	0
Hypochaeris radicata	NN	3	0	0
Lolium multiflorum	NN	4	0	0
Lotus corniculata	NN	3	0	0
Matricaria discoidea	NN	4	0	0
Poa annua	NN	3	0	0
Polypogon monspeliensis	NN	2	0	0
Senecio jacobaea	NN	4	0	0
Trifolium repens	NN	3	0	0
Vicia sativa	NN	5	0	0
Vicia tetrasperma	NN	5	0	0
Native Shrub and Tree Species				
Acer macrophyllum	N	4	0	0
Alnus rubra	N	2	0	0
Amelanchier alnifolia	N	4	0	0
Cornus alba	N	2	0	0
Crataegus douglasii	N	3	0	0
Frangula purshiana	N	3	10	10
Fraxinus latifolia	N	2	0	0
Mahonia nervosa	N	4	0	0
Oemleria cerasiformis	N	5	0	0
Physocarapus capitatus	N	2	0	0
Pinus contorta	N	3	0	0
Populus balsamif. var. *trichocarpa*	N	2	30	30
Pseudotsuga menziesii	N	4	0	0
Quercus garryana	N	5	0	0
Ribes divaricatum	N	4	0	0
Rosa nutkana	N	3	0	0
Rosa pisocarpa	N	4	0	0
Salix fluviatilis	N	2	0	0
Salix hookeriana	N	2	0	0
Salix lasiandra	N	2	0	0
Salix sitchensis	N	2	0	0
Sambucus racemosa	N	3	0	0
Spiraea douglasii	N	2	0	0
Symphoricarpos albus	N	4	0	0
Non-Native Shrub and Tree Species				
Ilex sp.	NN	4	0	0
Invasive Shrub and Tree Species				
Cytisus scoparius	I	5	0	0
Rubus armeniacus	I	3	80	80
Bare Substrate			15	15
			(Shrubs) + Stem C	
Native Shrub and Tree Count				
Acer macrophyllum			0	0

Alnus rubra	0	0
Amelanchier alnifolia	0	0
Cornus alba	0	0
Crataegus douglasii	0	0
Frangula purshiana	1	1
Fraxinus latifolia	0	0
Mahonia nervosa	0	0
Oemleria cerasiformis	0	0
Physocarpus capitatus	0	0
Pinus contorta	0	0
Populus balsamif. v ar *trichocarpa*	3	3
Pseudotsuga menziesii	0	0
Quercus garryana	0	0
Ribes divaricatum	0	0
Rosa nutkana	0	0
Rosa pisocarpa	0	0
Salix fluviatilis	0	0
Salix hookeriana	0	0
Salix lasiandra	0	0
Salix sitchensis	0	0
Sambucus racemosa	0	0
Spiraea douglasii	0	0
Symphoricarpos albus	0	0

Routine Performance Standards	**1**	**Habitat Average**	**Standard Error**
Cover of Native Herbaceous Species	5	5	
Lower CI (80%)			
Upper CI (80%)			
Cover of All Non Native Species	81	81	
Lower CI (80%)			
Upper CI (80%)			
Cover of Reed Canaygrass	0	0	
Lower CI (80%)			
Upper CI (80%)			
Bare Substrate	15	15	
Lower CI (80%)			
Upper CI (80%)			
Native Diversity (all layers)		5	N/A
Sum of plant cover	126		

Appendix F – Vegetation Data – Stream Transects

Site: Harborton **Sample Date(s):** August 27-28, 31
Stream Channel Transects

Percent Cover

Species	Origin (N, NN, I)	Wetland Status (1 - 5)	1	2	3	4	5	6	7	8	9	10	Row Average
Native Herbaceous Species													
Achillea millefolium	N	4	0	0	1	0	0	0	0	0	0	1	0
Agrostis exarata	N	3	0	2	0	1	1	2	0	0	0	0	1
Alisma plantago aquatica	N	1	0	1	0	0	0	0	0	3	0	0	0
Alopecurus geniculatus	N	2	0	2	0	3	10	3	5	1	0	1	3
Beckmannia syzigachne	N	2	0	20	3	2	5	2	4	10	5	3	5
Bromus carinatus	N	4	0	0	0	1	1	1	0	0	0	0	0
Carex obnupta	N	2	0	5	0	0	0	0	0	5	0	0	1
Eleocharis ovara	N	2	1	0	0	0	1	0	1	0	0	0	0
Epilobium ciliatum	N	2	0	0	0	1	0	1	1	0	1	1	1
Epilobium densiflorum	N	2	0	0	0	0	0	0	0	0	1	0	0
Equisetum arvense	N	3	3	0	0	0	0	0	0	0	0	0	0
Glyceria occidentalis	N	2	4	0	1	0	2	1	0	5	0	0	1
Hordeum brachyantherum	N	2	0	0	0	1	1	0	0	2	0	0	0
Juncus bufonius	N	2	0	1	0	0	0	1	1	3	0	0	1
Juncus oxymeris	N	2	0	0	1	0	0	0	0	0	0	0	0
Juncus patens	N	2	0	3	7	10	0	2	0	0	0	0	2
Lupinus polyphyllus	N	4	0	0	2	0	0	0	2	1	0	0	1
Lupinus rivularis	N	3	0	3	2	0	2	1	0	0	0	0	1
Plagiobothyrus figuratus	N	3	0	1	1	0	0	1	1	0	1	1	1
Sagiittaria latifolia	N	1	0	1	0	0	0	0	0	2	0	0	0
Trifolium wormskjoldii	N	3	0	0	0	0	0	0	0	2	0	0	0
Invasive Herbaceous Species													
Ludwigia peploides	I	2	0	0	0	0	5	0	0	0	0	0	1
Phalaris arundinacea	I	2	0	0	0	0	0	0	0	0	1	0	0
Non-Native Herbaceous Species													
Cirsium arvense	NN	3	0	0	0	0	0	0	0	1	0	0	0
Daucus carota	NN	5	0	1	0	0	1	1	2	1	0	0	1
Echinochloa crus-galli	NN	4	0	0	3	5	0	5	6	5	0	0	2
Holcus lanatus	NN	2	0	0	2	0	0	1	2	0	0	2	1
Hypericum perforatum	NN	3	1	2	0	1	1	1	1	2	1	1	1
Lolium multiflorum	NN	4	0	0	0	0	0	2	0	0	0	0	0
Lotus corniculata	NN	3	3	2	1	0	3	4	0	0	1	0	1
Matricaria discoidea	NN	4	0	0	1	0	0	0	0	1	0	0	0
Poa annua	NN	3	0	0	0	0	0	0	4	10	0	0	1
Polypogon monspeliensis	NN	2	0	0	0	0	0	0	0	5	0	0	1
Trifolium repens	NN	3	2	1	0	1	1	1	0	1	0	0	1
Vicia sativa	NN	5	2	0	0	1	0	0	1	0	0	0	0
Native Shrub and Tree Species													
Alnus rubra	N	2	0	0	0	1	0	0	0	0	0	0	0
Amelanchier alnifolia	N	4	0	0	0	0	4	5	0	2	0	0	1
Cornus alba	N	2	0	1	0	2	0	0	0	2	0	0	1
Frangula purshiana	N	3	0	0	0	0	0	0	0	0	1	0	0
Fraxinus latifolia	N	2	0	0	0	0	1	1	0	3	0	0	1
Physocarapus capitatus	N	2	0	0	0	1	0	0	0	0	0	0	0
Populus balsamif. var. *trichocarpa*	N	2	3	1	0	0	0	1	0	3	1	1	1
Rosa nutkana	N	3	4	0	0	5	0	5	0	1	0	0	2
Salix lasiandra	N	2	0	5	0	3	0	0	2	0	2	0	1
Sambucus racemosa	N	3	0	0	0	2	0	0	1	0	0	0	0
Spiraea douglasii	N	2	0	0	2	0	1	3	0	1	1	0	1
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	0	0	0	0	0	1	1	1	0	0	0
Rubus armeniacus	I	3	0	0	0	1	0	0	1	0	0	0	0
Bare Substrate			80	50	60	40	50	50	40	20	50	50	49

Routine Performance Standards	1	2	3	4	5	6	7	8	9	10	**Habitat Average**	**Standard Error**
Cover of All Native Species	15	46	20	33	29	30	18	46	13	8	26	4.2
Lower CI (80%)											20	
Upper CI (80%)											31	
Cover of Non Native Herbaceous Species	8	6	7	9	11	16	18	27	2	3	11	2.4
Lower CI (80%)											8	

	Upper CI (80%)											14	
Cover of Reed Canarygrass		0	0	0	0	0	0	0	0	1	0	0	0.1
	Lower CI (80%)											0	
	Upper CI (80%)											0	
Bare Substrate		80	50	60	40	50	50	40	20	50	50	49	5
	Lower CI (80%)											43	
	Upper CI (80%)											55	
Native Diversity (all layers)												5	N/A
Sum of plant cover		23	52	26	42	40	46	36	73	16	10		

Appendix G – Breeding Bird Count Data

Appendix G. 2021 Harborton Breeding Bird Monitoring

		Station														
Name	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	total by day	total by species
American goldfinch	21-May-21												2		2	13
	4-Jun-21	1						3			3		2		9	
	16-Jun-21								2						2	
American kestrel	21-May-21														0	3
	4-Jun-21									2	1				3	
	16-Jun-21														0	
American robin	21-May-21		1		2	1	1		1			1	2	1	10	38
	4-Jun-21	2		2		3				1			1	1	10	
	16-Jun-21	1	2	3	3	2	2	2	2	1					18	
Anna's hummingbird	21-May-21										1				1	1
	4-Jun-21														0	
	16-Jun-21														0	
bald eagle	21-May-21				1										1	2
	4-Jun-21														0	
	16-Jun-21	1													1	
band-tailed pigeon	21-May-21														0	5
	4-Jun-21														0	
	16-Jun-21					5									5	
barn swallow	21-May-21														0	2
	4-Jun-21		1												1	
	16-Jun-21		1												1	
belted kingfisher	21-May-21												1		1	1
	4-Jun-21														0	
	16-Jun-21														0	
Bewick's wren	21-May-21														0	5
	4-Jun-21				1									2	3	
	16-Jun-21				1			1							2	
black-cap chickadee	21-May-21		3								2	1		2	8	13
	4-Jun-21	1										1			2	
	16-Jun-21						2	1							3	
black-headed grossbeak	21-May-21	1		3		2	1		1	1	2	1		2	14	26
	4-Jun-21	2		3			3								8	
	16-Jun-21	2		2											4	
black-throated gray warbler	21-May-21														0	4
	4-Jun-21				1		1	1							3	
	16-Jun-21			1											1	
Brewer's blackbird	21-May-21														0	6
	4-Jun-21		1	1											2	
	16-Jun-21					1		1	1	1					4	
brown-headed cowbird	21-May-21	1		1		1	1								4	10
	4-Jun-21					4	1	1							6	
	16-Jun-21														0	
Bullock's oriole	21-May-21		1									1	1	1	4	6
	4-Jun-21		1			1									2	
	16-Jun-21														0	
	21-May-21							2				2		2	6	

Appendix G. 2021 Harborton Breeding Bird Monitoring

		Station														
Name	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	total by day	total by species
Canada goose	4-Jun-21														0	6
	16-Jun-21														0	
	21-May-21														0	
cedar waxwing	4-Jun-21														0	2
	16-Jun-21										2				2	
	21-May-21	1	1	1		2	1	1	1	1	2				11	
common yellowthroat	4-Jun-21		2												2	16
	16-Jun-21	1	1	1											3	
	21-May-21														0	
great blue heron	4-Jun-21										1				1	3
	16-Jun-21					1		1							2	
	21-May-21	3													3	
great egret	4-Jun-21														0	3
	16-Jun-21														0	
	21-May-21						1								1	
killdeer	4-Jun-21		1			1	2				1				5	6
	16-Jun-21														0	
	21-May-21	2				1									3	
mallard	4-Jun-21														0	3
	16-Jun-21														0	
	21-May-21					1									1	
mourning dove	4-Jun-21									1	2				3	7
	16-Jun-21		1				2								3	
	21-May-21		1		1			1			2	2		1	8	
northern flicker	4-Jun-21														0	8
	16-Jun-21														0	
	21-May-21														0	
osprey	4-Jun-21				1							2	1		4	4
	16-Jun-21														0	
	21-May-21														0	
raven	4-Jun-21														0	1
	16-Jun-21					1									1	
	21-May-21														0	
red crossbill	4-Jun-21									30					30	30
	16-Jun-21														0	
	21-May-21														0	
red-tail hawk	4-Jun-21												2		2	2
	16-Jun-21														0	
	21-May-21	6	2	1		4	2	1	1	2	1	1			21	
red-winged blackbird	4-Jun-21		4			4	3	1		2	1	1			16	54
	16-Jun-21	1	4	1		4	2	1	3	1					17	
	21-May-21								1	1			1		3	
scrub jay	4-Jun-21	1											1		2	8
	16-Jun-21	1	1				1								3	
	21-May-21	1		1	3	2	4	2	1	3	3	1	1	2	24	
song sparrow	4-Jun-21	1			2	1	2	3		1	2	1	1	2	16	58

Appendix G. 2021 Harborton Breeding Bird Monitoring

		Station														
Name	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	total by day	total by species
	16-Jun-21	1	2	2	2	2	2	3	2	2					18	
	21-May-21		1	1										1	3	
spotted towhee	4-Jun-21			1				2		2					5	11
	16-Jun-21						1	2							3	
	21-May-21				1										1	
Stellar's jay	4-Jun-21														0	1
	16-Jun-21														0	
	21-May-21				1										1	
Swainson's thrush	4-Jun-21		1										1		2	5
	16-Jun-21					1			1						2	
	21-May-21														0	
turkey vulture	4-Jun-21												3		3	4
	16-Jun-21									1					1	
	21-May-21														0	
violet-green swallow	4-Jun-21					1				4					5	18
	16-Jun-21						1	12							13	
	21-May-21			1									1	1	3	
western wood peewee	4-Jun-21			2	1						1	1	1	1	7	20
	16-Jun-21	1	2	2	1	2		1	1						10	
white-crowned sparrow	21-May-21			1		4	2		2						9	
	4-Jun-21				1			1							2	11
	16-Jun-21														0	
white-throated gray warbler	21-May-21														0	
	4-Jun-21														0	1
	16-Jun-21	1													1	
	21-May-21			1											1	
willow flycatcher	4-Jun-21														0	1
	16-Jun-21														0	
	21-May-21	1		1	2		1	2			1	1	2	2	13	
Wilsons warbler	4-Jun-21	1		2	1							1	1	2	8	22
	16-Jun-21				1										1	
	21-May-21														0	
wood duck	4-Jun-21					1									1	1
	16-Jun-21														0	
	21-May-21														0	
yellow-rumped warbler	4-Jun-21		1				1								2	2
	16-Jun-21														0	
	Total Species															43
	Total birds/station	35	36	35	27	53	40	46	20	57	28	18	25	23		

Appendix H – Photomonitoring Points

Appendix H – Photomonitoring Points

Photomonitoring Point 1.

July 16, 2021 – photo facing southwest

July 28, 2021 – photo facing southwest


August 8 – photo facing east

Photomonitoring Point 2.

May 12, 2021 – photo facing west

May 12, 2021 – photo facing north

June 3, 2021 – photo facing north

Photomonitoring Point 3.

May 12, 2021 – photo facing south

May 12, 2021 – photo facing southwest

Photomonitoring Point 4.

January 13, 2021 – photo facing south-southeast

January 13, 2021 – photo facing east-northeast

August 8 ,2021 – photo facing west-southwest

August 8, 2021 – photo facing southwest

November 14, 2021 – photo facing west

Photomonitoring Point 5.

January 6, 2021 – photo facing northwest

May 12, 2021 – photo facing northeast

August 8, 2021 – photo facing east

Photomonitoring Point 6.

May 12, 2021 – photo facing north-northeast

May 12, 2021 – photo facing northeast

Photomonitoring Point 7.

June 3, 2021 – photo facing northeast

Photomonitoring Point 8.

August 8, 2021 – photo facing northeast

November 14, 2021 – closeup of SA 4 outlet

Site Photographs

Photo 1. Sub Area 4 during frog survey (Feb 26, 2021; photo credit James Holley)

Photo 2. Frog Survey Crew on Feb 26, 2021 (photo credit J. Holley)

Photo 3. Upper N. Channel 6/3/21

Photo 4. Upper N. Channel 8/13/21

Photo 5. Sub Area 4 on May 12, 2021

Photo 6. Sub Area 4 – June 3, 2021

Photo 7. Sub Area 4 June 3, 2021

Photo 8. Whitetail buck near Sub Area 3 wetland


Photo 9. Nutria documented 7/22/21


Photo 10. Specked dace

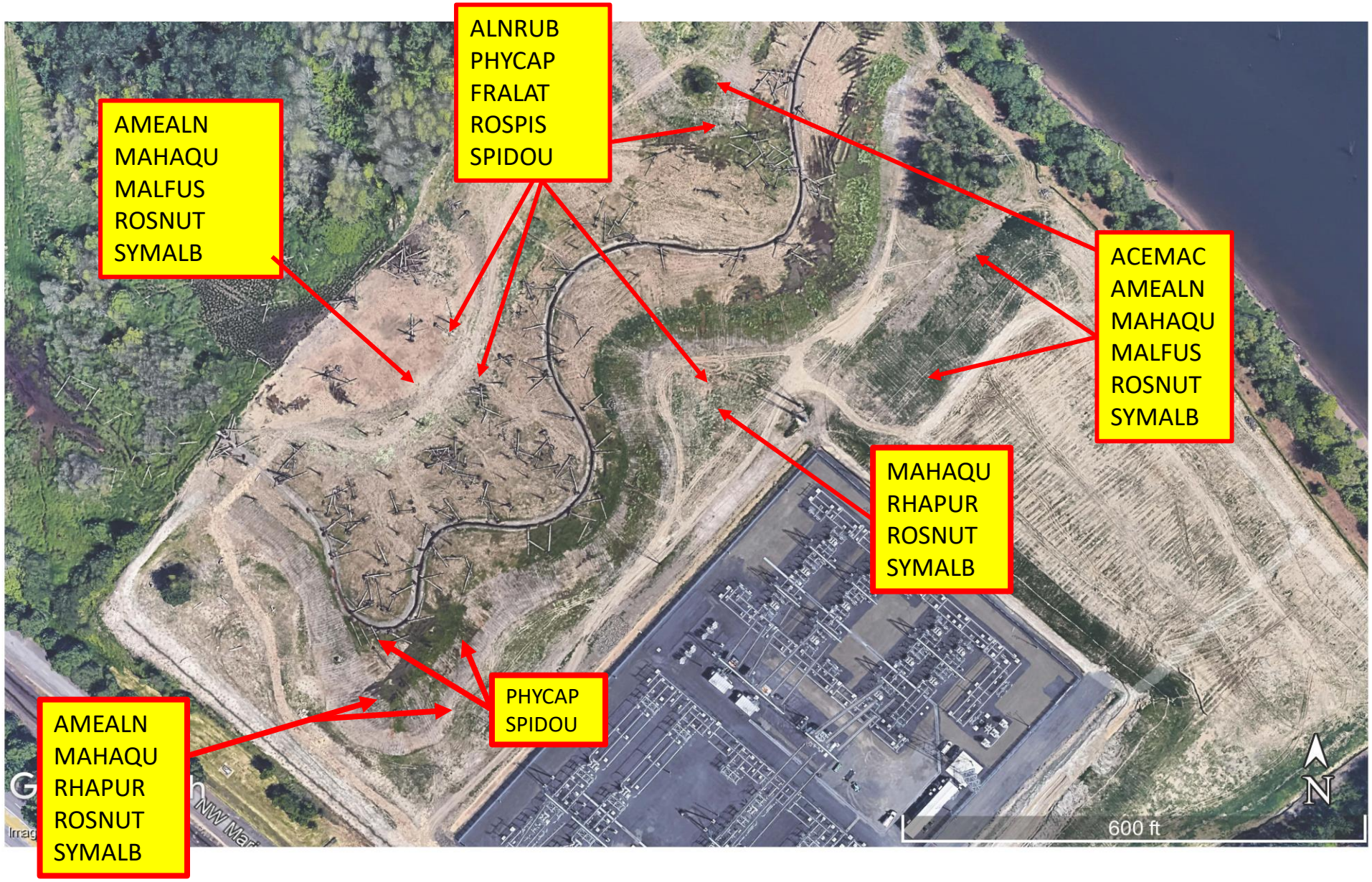

Photo 11. Leech collected from North Channel

Appendix I – Supplemental Plantings

Spring 2022 Supplemental Plantings

SHRUBS/TREES	Key	proposed	#
Serviceberry	AMEALN	#1 or BR (12-16" ht)	300
Pacific Ninebark	PHYCAP	#1 or BR (12-16" ht)	300
pearhip rose	ROSPIS	#1 or BR (12-16" ht)	200
Nootka rose	ROSNUT	#1 or BR (12-16" ht)	400
Douglas' spiraea	SPIDOU	#1 or BR (12-16" ht)	500
common snowberry	SYMALB	#1 or BR (12-16" ht)	400
red alder	ALNRUB	BR (12-16"ht)	200
crabapple	MALFUS	BR (12-16"ht)	250
cascara		BR (12-16"ht)	150
tall Oregon grape	MAHAQU	#1 or BR (12-16" ht)	200
Oregon ash	FRALAT	BR (12-16"ht)	200
bigleaf maple	ACEMAC	BR (12-16"ht)	200
TOTAL			**3,300**

Supplemental 2022 Plantings - approximate planting locations



Appendix J – Summary of 2021 Monitoring Results

Appendix J

Summary of 2021 Monitoring Results

Section	Performance Standard	Performance Standards	Met/ Not Met	Adaptive Management Needed	Notes
2.2.1	Retention of Habitat Features/Elements	Greater than 80% retention of installed elements (including recruitment)	Met	No	
2.2.2	Extent of ACM Habitat	No changes of more than 10% in ACM habitat acreage/linear feet from the as-built survey	Met	No	
2.2.3	Extent and Stability of Channel, Streambank, and Floodplain Habitat	No barriers preventing fish access to channel habitat on the Site (including sediment accretion, subsurface flow, gradient, or other barriers)	Met	No	
		No loss of downstream flow of more than 20% of flow entering Site	Met		
		No changes of more than 10% in channel habitat acreages/linear feet from the as-built surveys	Met		
		No width to depth ratio change of greater than +/-50%	Met		
		No significant erosion in any areas along the North Channel	Met		
2.2.4	Preservation of Fish Passage/Fish Accessibility	North Channel grading and subsequent fluvial geomorphic changes do not create passage barrier	Met	No	
2.3.1	Retention of Wetland Hydrology/Habitat for Use by Northern Red-legged Frog	From January through May, areal extent and depth of the wetland should be no less than 80% of the baseline measurements	Not Met	No	Not met for April/May. Met for all other periods
2.3.2	Extent of High Flow Inundation	Less than 20% reduction from baseline	Met	No	

Section	Performance Standard	Performance Standards	Met/ Not Met	Adaptive Management Needed	Notes
2.5.2	Upland Forest, Upland Scrub-Shrub, Riparian Forest Habitats Vegetation	≥1,200 native woody plants per acre	Not Met	Yes	Density standard not met in Upland Scrub-Shrub Establishment and Riparian Forest Establishment Non-native cover standard not met in Riparian Forest Establishment and Riparian Forest Enhancement Supplemental plantings planned for 2022 Blackberry management in 2021 and 2022
		≥3 native tree species (where applicable) and ≥5 native shrubs	Met		
		≥10% native herbaceous	Met		
		≤10% non-native vegetation (excluding RCG)	Not Met		
2.5.2	Wetland (ACM) Habitats Vegetation	>5 herbaceous species (occupying >5% cover in at least 10% of sample plots)	Not Met	Yes	Diversity and native cover standard non met in Wetland Enhancement Non-native cover standard not met in Wetland Establishment Native herbaceous cover expected to expand in 2022 Weed management to be performed in 2022
		≥50% native herbaceous	Not Met		
		≤10% non-native vegetation (excluding RCG)	Not Met		
2.5.4	North Channel ACM Habitat Vegetation	>5 herbaceous species (occupying >5% cover in at least 10% of sample plots)	Not Met	Yes	Native herbaceous cover expected to expand in 2022 Weed management to be performed in 2022
		≥30% native herbaceous	Not Met		
		≤10% non-native vegetation (excluding RCG)	Not Met		
2.5.5	Reed Canarygrass Across Relevant Habitats	≤30% reed canarygrass cover	Not Met	Yes	RCG management planned for 2022