Kilchis Estuary Preserve Management Plan
2013-2023

Project/Site Name: Kilchis Estuary Preserve

OWEB Grant Numbers: 212-107 (Dooher); 215-9901 (Porter)

Location: Lower Kilchis River, Tillamook County Oregon

Date: October 18, 2013; Revised June 20, 2014; Revised August 8, 2018

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The Nature Conservancy

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Introduction

General description of the easement location

The Kilchis Wetlands site (the Property), now known as the Kilchis Estuary Preserve, is located on the lower Kilchis River near Tillamook Bay in Tillamook County, T1S, R10W, Section 12. The site is located between the cities of Bay City and Tillamook, west of Highway 101 and occupies 126.69 acres in two parcels of 66.43 acres referred to as the Dooher tract and 60.26 acres referred to as the Porter tract (Figure 1). The Property was previously managed as pasture for dairy cows and hay production; portions of the Porter tract remain in native tidal wetland habitat. Recently, the landowners abandoned dairy farming and in 2010, The Nature Conservancy (TNC), with assistance from the Oregon Watershed Enhancement Board (OWEB), purchased the Dooher tract for permanent conservation. A conservation easement granted to OWEB covering the tract, was conveyed on August 13, 2012. The Porter tract was acquired in March 2016 with funds provided by a US Fish & Wildlife Service Coastal Wetlands grant to OWEB; a conservation easement was granted to OWEB on July 13, 2016 to cover the Porter tract of the Property.

General site description

The Property is located within the Tillamook Bay watershed which is comprised of five rivers, the Miami, Kilchis, Wilson, Trask and Tillamook, that drain into Tillamook Bay from the Coast Range. The Property lies between the Kilchis River on the south and west and Hathaway Slough on the north with the eastern boundary being defined by Highway 101, Stasek and Nielson Sloughs. Private farmland borders the western edge of the Porter tract (Figure 2). Squeedunk Slough, one of the least degraded Sitka spruce swamps in the Tillamook Bay system, is located across the Kilchis River from the Dooher tract and serves as a reference site for restoration of the preserve.

The property lies mostly below 11.5’ elevation, which defines the maximum extent of tidal wetlands in coastal Oregon, indicating much of the land was tidally influenced prior to construction of dikes and ditches for agricultural purposes. This is supported by historic vegetation mapping (Figure 3). The Property is essentially flat with little topographic relief evident; this is due to the general nature of tidal wetlands as well as the long history of agricultural use of the site. Active restoration has been underway at the Dooher tract of the Property since 2015 and restoration has been in the planning stages for the Porter tract since 2018.

Like the other four watersheds in the Tillamook Bay basin, the Kilchis River watershed has lost much of its original estuarine, emergent, scrub-shrub, and forested wetland areas to diking, draining and the conversion of land to agriculture and other human uses. Restoring these tidal habitats including tidal channels at the Kilchis Project area will greatly benefit salmon and is the primary management objective for the site.

The Preserve is located at the transition zone between brackish and fresh water tidal wetlands. Lack of rearing habitat in brackish-fresh water transition zones is one of the primary limiting factors for salmonids in the Kilchis River system. The Kilchis River is a free-flowing (undammed) watershed that drains approximately 46,920 acres (65 sq. miles). The watershed drains the west slope of the relatively low elevation Coast Range and consists of steep sub-drainages. Because of the steep slopes, runoff response during rainfall events is relatively quick, especially under saturated soil conditions. For example, peak flows are high in magnitude and occur within 24 hours of the peak precipitation. In contrast, dry season flows are relatively low due to high permeability of the tertiary volcanic soils and sedimentary rocks that underlie much of the watershed. (ESA et al. 2013.)

Description of the team or committee that prepared the plan

The management plan for the Property has been prepared by The Nature Conservancy with assistance from consultants, agencies and other organizations. Individuals responsible for drafting this management plan and/or the restoration plan are:

Dick Vander Schaaf, TNC Associate Director, Coast and Marine Program
Debbie Pickering, TNC Oregon Coast Ecologist
Allison Aldous, TNC Wetlands Scientist
Catherine Dunn, TNC Oregon Coast Stewardship Coordinator

Consultation, advice and restoration plan review has been provided by:

Environmental Science Associates (ESA)
Tillamook Estuaries Partnership (TEP)
Estuary Technical Group, Institute for Applied Ecology (ETG)
Oregon Department of Fish & Wildlife (ODFW)
US Fish & Wildlife Service (USFWS)

Summary of OWEB conservation values

The OWEB Conservation Easement authorizes use of the property for recreation, education, or conservation or scientific studies as long as that use does not impair the conservation values of the property. Any activities or uses of the property that are inconsistent with the purposes of the conservation easement or detrimental to the conservation values of the property are prohibited including: subdividing, commercial activities, construction, altering the land surface or water courses, dumping, off-road vehicle or bicycle use, discharging firearms, and releasing hazardous substances.

<u>Conservation Values from the Kilchis River (Dooher) Conservation Easement Baseline Inventory Documentation Report (Vander Schaaf 2012):</u>

The conservation values of the Dooher tract reside in its tremendous restoration potential for salmon species that utilize tidal wetlands and tidal channels. Since fall 2015 the site has been reconnected to river and tidal flows, agricultural ditches have been filled and revegetation activities have restored historic wetland and riparian habitats.

The 2015 Dooher tract restoration removed dikes from the Kilchis River and Stasek Slough, revegetated riparian habitats along these waterways, re-created tidal channels within the interior of the site, and revegetated the entire site with native tidal marsh species (Figure 9). The riparian habitat supports bird species such as rufous hummingbird, willow flycatcher, and Pacific-slope flycatcher. The site also provides habitat for bald eagle, great-blue heron, and northern red-legged frog. The restored tidal marsh habitat supports wetland bird species, provides resting spots for juvenile salmon during high flows, and is key to the high primary productivity that characterizes coastal estuaries.

Most of the restored Dooher tract is tidally-influenced wetland habitat. Prior to restoration the 66 acre Dooher tract was managed as pasture for dairy farming operations. Tidal channels were no longer present and only a portion of Stasek Slough remained as it had become disconnected from the river. Prior to restoration Stasek Slough drained to Hathaway Slough through a ditch that is on the Porter tract of the Preserve (see Figure 2). Restoration of the Dooher tract focused on reconnecting Stasek Slough to the Kilchis River and restoring hydrologic connectivity throughout the site.

Conservation Values from the Kilchis River (Porter) Conservation Easement Baseline Inventory Documentation Report (Vander Schaaf 2016):

Approximately 33 acres of the 60 acre Porter tract is covered in native tidal wetland vegetation, primarily high salt marsh (Cowardin class E2EMP) grading into scrub-shrub tidal wetlands (Cowardin class E2SSP) on the higher ground. The tidal wetlands are dominated by Lyngby sedge (*Carex lyngbyei*) and Pacific silverweed (*Potentilla anserina*) with Sitka spruce and twinberry (*Lonicera involucrata*) on suitable micro-sites. The native tidal wetland is located between Hathaway Slough and an unnamed tidal channel off the slough (Figure 10). The native marsh is dissected by many sinuous tidal channels that provide high-quality estuarine habitat for fish and wildlife. The remainder of the Porter tract is covered by pastures that are dominated by introduced pasture grasses but still retain patches of native wetland vegetation such as spikerush (*Eleocharis sp*.) and native sedges (*Carex sp*.). The pastures on the property regularly flood during high tides and during high winter-time river flows; ditches and water control structures currently drain the pastures.

Healthy Watershed Function

The restored riparian and wetland habitats on the Property will be very important for future watershed function, because they will shade the Kilchis River and tidal sloughs, serve as a source of wood and vegetative input to the tidal system, provide habitat for wildlife and collect sediment and woody debris during winter storm events. Preserving the eventual integrity of the Property's wetlands will help to maintain water temperature, sediment load, and nutrient balance, thereby benefitting water quality in the Kilchis River and associated tidelands.

Sloughs, tidal marshes, and riparian habitat are important for salmonid species in the Kilchis River which include chum, coho, Chinook, winter steelhead and sea-run cutthroat trout. The salmon utilize these habitats during rearing and migration phases of their lives. During winter high flows, sloughs and tidal wetlands provide off-channel refugia to juvenile salmon, protecting them from floodwaters that may injure juvenile fish and/or transport them prematurely out to sea. Restoring the Property to naturally functioning wetlands will benefit salmonids and a host of other OWEB priority species.

The restored Dooher tract includes 0.8 miles of one side of the Kilchis River to the south and west of the property, and over 3.6 miles of tidal channels including Stasek and Nielson Sloughs, for a total of 4.2 stream miles. In addition to the restored waterways, the entire tract (66 acres) has been planted with native tidal wetland vegetation appropriate to the habitats at the site.

The proposed restoration design (Figure 14) for the Porter tract (Wolf Water Resources 2017) will result in 3700' of recreated tidal channels and 1900' of dikes removed to improve the hydrologic function of the site. Approximately half of the 60-acre site will undergo revegetation activities that will focus on planting native wetland-compatible species and invasive weed treatments. The Porter restoration will also remove and/or correct several water control structures that currently impede normal hydrologic function at the site.

OWEB Priority Ecological Systems- based on the completed restoration for the Dooher tract (Figure 5):

- Tidal Spruce Swamp - 30 acres
- Tidal Marsh (scrub-shrub) - 20 acres
- Riparian Forest/woodland - 16 acres

OWEB Priority Ecological Systems- based on the proposed conceptual restoration plan for the Porter tract (Figure 6):

- Tidal Spruce Swamp - 26 acres
- Tidal Marsh - 32 acres
- Riparian Forest/woodland - 2 acres

The Tidal Marsh ecological system at the Dooher tract is primarily represented by scrub-shrub plant communities dominated by Hookers willow, twinberry, red elderberry and Douglas spirea. At slightly lower elevations in the Project area the Tidal Marsh ecological system is represented by herbaceous plant communities dominated by slough sedge, Lyngby sedge, small-fruited bulrush and tufted hairgrass. The herbaceous tidal marsh plant communities occupy less than an acre on the Dooher tract and are not the primary focus of marsh revegetation activities there. In contrast, the 33 acre native marsh on the Porter tract (Figure 10) is dominated by herbaceous tidal marsh communities with small inclusions of Spruce Swamp habitat, hence, this community is much more prominently represented on this tract. Re-establishing woody vegetation has been the primary focus of our revegetation efforts at both the Dooher and Porter tracts as it is consistent with the goals of restoring the priority ecological systems noted above.

At-risk Plant Communities

This project does not conserve any OWEB priority at-risk plant communities. However, it restores a significant area of potential Sitka spruce swamp habitat which has suffered the greatest percentage losses of any coastal wetland communities in Oregon. Sitka spruce swamps occur at the interface of tidal saltwater and freshwater habitats. Tidal spruce swamps used to dominate the Tillamook Basin and provide protective rearing habitat for salmon smolts during high water. The swamps are also important roosting habitat for raptors and provide potential nesting habitat for marbled murrelets and great blue herons.

OWEB Priority Species

- Chum Salmon
- Coho Salmon (listed as Threatened under the federal Endangered Species Act)
- Steelhead
- Northern red-legged frog
- Marbled murrelet

- Bald Eagle - possible nest sites
- Great-blue Heron - possible nest sites
- Dunlin
- Band-tailed pigeon
- Pacific slope flycatcher
- Willow flycatcher
- Rufous hummingbird

Additional animal species that might benefit from this project are listed in Table 1.

Landowner coordination:
The Kilchis River is bordered by a dike extending westward from Possetti Road that has restricted high flows and floodwaters from accessing the adjacent lands which include the Dooher tract of the Preserve. A non-exclusive access easement with the previous owners, Sean and Judy Dooher, established by Partition Plat 2010-20 and further described by an easement recorded as document #2010-006978, allows for repair and maintenance of approximately 100 feet of the dike beyond the TNC Dooher tract boundary to protect the Dooher barns and structures from flooding in an emergency. This portion of the dike was not removed in the 2015 restoration activities at the site. Along with the sale of the property, the Dooher's also granted two access easements to the Conservancy across their retained home site property and the dike easement the Conservancy granted to them (Figure 7).

A power line was once located on the Dooher tract but has been removed. The holder of the power line easement was not willing to remove the easement from the Property's title.

Private lands border the Dooher tract across Stasek Slough to the east and across the Kilchis River to the south and west of the Preserve. These lands are accessed via roads that are not associated with the Preserve properties.

The Porter tract has a 0.1 acre private inholding owned by Ben and Marylou Hathaway located along the banks of Stasek Slough that does not have a legal access easement attached to it (Figure 11). The small inholding is marked on the ground with corner fence posts and has been located by a recorded survey. The Porter tract is crossed by the Port of Tillamook Bay railroad line that includes a defined ownership along the line that runs parallel to Highway 101 on the eastern edge of the tract. Access to the Porter tract is from Highway 101 and across the railroad tracks at an unimproved crossing (Figure 11). The western edge of the Porter tract borders farmland owned by Gienger Farms. The 8 acre farmland is managed for grass production and is accessed by Geingers by crossing the Kilchis River at a shallow ford during low flows. The northern boundary of the Porter tract lies along Hathaway Slough, a natural tidal waterway that connects with the Kilchis River and Tillamook Bay. Properties on north side of Hathaway Slough include farmland and natural wetlands.

There are no other reserved rights in the deeds or conservation easements for the Property.

The expressed landowner rights that are included in the Kilchis Project properties are managed through regular, informal contacts with the specific landowners. The primary landowners with rights are Shawn and Judy Dooher who live next door to the Dooher tract of the Preserve. TNC staff meets informally with Shawn Dooher several times a year to discuss any management issues that may have arisen. This arrangement has been sufficient and there is no anticipated need to change it. TNC has been meeting with Mike Prince, a neighbor of the Porter tract, regarding restoration plans for the site. As engineering plans are formalized in late 2018, TNC will spend more time with Prince to jointly examine the plans and discuss restoration activities.

TNC has had regular interactions with Geinger Farms who are neighbors across the Kilchis River to the west and own farmland adjacent to the Porter tract. During the Porter acquisition, TNC and Geinger Farms worked together to resolve taxlot boundary discrepancies and to adjust ownerships that resulted in more native wetland habitat in TNC ownership and more farmland in Geinger ownership. We continue to discuss activities with Geinger Farms regularly and have a good working relationship with them.

Adjacent land uses and landscape context

Land use in low-lying portions of the Tillamook Bay watershed is dominated by dairy farming. The uplands are state and private forest lands and are used primarily for timber production. Rural residential development is increasing at the fringes of the lowlands that border the upland forests. Simplification of riparian habitats has resulted in the loss of backwater and tidal channels; reduction in tidal wetland habitat is primarily due to conversion to agriculture, ditching and diking activities. Water quality issues from agricultural land uses are also a concern to the conservation values of the Tillamook Bay watershed.

The Property borders active dairy farms on several sides. Most of the neighboring farmlands are protected by dikes as they mostly lie below the elevation of maximum tidal extent (11.5’). Farmlands not protected by dikes are prone to inundation during higher high tides and high river flows. Three single-family residences are adjacent to the eastern boundary of the Dooher tract but there are no residences adjacent to the Porter tract. (Figure 2).

History

The Property is near a documented Native American village site at Kilchis Point that lies approximately 1 mile to the north (see Figure 3). Historically the Property was at the edge of Tillamook Bay in the early 1900s and may have been too wet for year-round occupancy but it could have been utilized for seasonal fishing and natural resources gathering. Tillamook Basin was settled in the mid to late 1800s with dairy farming becoming the dominant use in the lowlands. A cultural resource survey of the Dooher tract prior to restoration activities in 2015 revealed no cultural resources. Similar surveys will be conducted on the Porter tract before restoration activities begin there.

Past site alterations and disturbances

Historically, the site was covered by tidal marsh and Sitka spruce swamp, but it was diked off from river and tidal flow in the early 1900s to convert the land to agricultural uses. Ditches were dug to drain the wetlands and pasture grasses were planted for improved forage for dairy cows. The land surface has subsided in parts of the Dooher tract relative to historic elevations due to intensive agricultural use. Subsidence does not appear to be as much of an issue on the Porter tract as it wasn’t as intensively farmed as the Dooher tract and tides are not as restricted on this tract.

There are many water control structures including tide gates on the Property that facilitated pasture drainage on the farms, enhancing agricultural use of the site and restricting tidal inundation during most tide cycles. These structures have been removed on the Dooher tract as part of the site restoration and will be removed on the Porter tract as part of the planned restoration work there.

A conceptual restoration plan has been developed for the Porter tract by Wolf Water Resources (W2R 2017). Ditches and low dikes or levees along sloughs exist on half the property with the remaining portion of the site composed of natural tidal marsh with no restrictive dikes (Figure 12). The Porter tract was approximately half spruce swamp and half tidal marsh habitat before conversion to farmland.

In addition to the dikes and ditches mentioned above, the pastures were leveled and smaller tidal channels were obliterated. Farming also required removal of the Sitka spruce and other woody vegetation to support cultivation of forage species for dairy herds. During the restoration work on the Dooher tract, buried logs were regularly encountered as tidal channels were being excavated.

A power line was once located on the Dooher tract but has been removed. The holder of the power line easement was not willing to remove the easement from the Property’s title.

Purpose and Goals

The overall goal of the project is to restore estuarine habitat for special status and other native estuarine-dependent species on the Kilchis Estuary Preserve, to the maximum extent possible while minimizing negative impacts to neighboring properties.

More specifically, the focus at this site is to:

- Restore freshwater and tidal connections
- Provide off-channel rearing habitat for salmonids and marine species
- Provide prudent protection of neighboring properties
- Restore tidal wetland and riparian plant communities
- Increase climate change resilience of the site and its aquatic habitats, through restoration of natural hydrologic and sedimentation processes
- Contribute to the improved understanding of tidal wetland restoration planning, design, and project construction by using a science-based adaptive management approach.

The two tracts will require extensive restoration overall to return them to functioning natural wetlands.

Restoration activities began at the Dooher tract in 2015 and included eliminating agricultural activities, re-creating 8600’ of tidal channels, planting tidal marsh and riparian vegetation across the entire 66 acre site, filling 5000’ of existing ditches and removing water control structures as needed within the Property, and lowering 3700’ of dikes along the Kilchis River and Stasek Sloughs to restore tidal and riverine flows. All this without disturbing or increasing flooding on neighboring properties. Additionally, measures have been taken to control and/or eradicate invasive species from the Property. In 2016 and 2017 re-vegetation of the entire Dooher tract took place. The active phase of the Dooher tract restoration is now completed and the Preserve is now managed for general stewardship goals that include suppression of weedy species, monitoring plantings and tidal channels, maintaining plantings to minimize competing vegetation and responding to major site perturbations such as flooding.

Restoration activities planned for the Porter tract include re-creating tidal channels, filling agricultural ditches and removing water control structures, planting half the site with native wetland species to complement the other half of the site that is in native wetland vegetation, and establishing natural hydrologic function in an existing ditch and box culvert system. The ditch and culvert will be re-engineered to provide natural flows between Stasek Slough and Hathaway Slough. Channel crossings will also be developed at the Porter tract to allow for site management and access (Figure 14).

Inventory and Analysis

Restoration planning for the Property has utilized OWEB Technical Assistance Grants #212-1012) for the Dooher tract and # 215-8005 for the Porter tract. A separate grant from the Wildlife Conservation Society was used to develop a hydrodynamic model for the Dooher tract that incorporated the effects of climate change to determine what restoration strategies or actions provided conditions conducive to tidal wetland development. After the initial restoration construction work was completed on the Dooher tract, a major flood event swept through Tillamook Bay in December 2015. A re-survey project including updated hydrodynamic modeling of the lower Kilchis River was completed in 2017 to assess how conditions may have changed at the site post-restoration and flooding. Results from the re-survey project showed that while river bathometric changes did occur, the projected hydrologic benefits of the restoration were still in force and the newly restored tidal wetlands likely acted to reduce overall flood impacts in the area.

The Kilchis River Tidal Wetlands Restoration Conceptual Plan (ESA et al 2013) included extensive inventory and analysis information for the Dooher tract restoration project. Site reconnaissance was conducted in April 2012. Observations focused on site hydrology and flooding, geomorphology, and vegetation. Some portions of this information are excerpted below.

Inventory and analysis of the Porter tract has also been conducted and is referenced in the Feasibility Analysis and Conceptual Restoration Plan for the site (Wolf Water Resources 2017).

Climate

The Oregon coastal climate is characterized by generally moderate temperatures year-round, significant rainfall that falls mainly from the fall through spring months and ranges from 100 inches per year at immediate coastal areas to 160 inches or more in the coastal mountains, and winter storms that bring high winds and rain to the region. The Kilchis Project area receives typical coastal weather with temperatures further moderated by cool coastal fog in the summer. The climate is not stable at the coast, however, as climate change impacts are resulting in a gradual elevation of temperatures by 2 degrees or more by 2050 (Dalton et al 2017), causing drier summers and lower flows in coastal rivers. In addition, the warming climate is responsible for sea level rise effects that will bring potentially dramatic changes in coastal estuaries and tidelands as those found at the Kilchis Wetlands Project area. Climate change is also expected to result in more extreme temperature events and in changes in overall precipitation, although these precipitation changes may not be significant at the coast (Dalton et al 2017). Of greater concern for the Kilchis Project area is the possibility that climate change will result in more frequent and severe storms in coming years that will cause increased coastal flooding and property damage. Coastal flooding will be exacerbated by sea level rise as well in future years. Climate change effects were modeled for the Kilchis Project and factored into the overall restoration design (ESA 2013).

Geology
The Oregon coast has a relatively recent geologic history with the Coast Range emerging from the ocean only 20 million years ago, being formed mostly as pillow basalts under the sea and then uplifted by tectonic action (Bishop and Allen 1996). The flat terrain of the Kilchis Project area is indicative of the depositional origins of the landscape but to the west at Cape Meares, there remains a prominent basalt headland whose origins date back to Columbia River basalt flows from approximately 15 million years ago. The real story of geology of the Kilchis Project area, though, is with the Kilchis River that flows a short 15 miles from its headwaters in the Coast Range to Tillamook Bay. The Kilchis River carries considerable a bedload of sediment and gravel that has been deposited in what is now the Kilchis tidelands. These river-borne depositions have been matched by ocean depositions brought to the site by tides and storms as well as by much larger events such as tsunamis that can change coastal elevations by as much as three feet or more at one time. Because the depositions continue to occur on a regular basis, there is a deep layer of fine materials which include sediments, gravels and organic matter across the Kilchis Project area.

Vegetation
The 126-acre site initially consisted of mostly pastureland that was diked from the Kilchis River and sloughs since prior to the 1930s. Native wetlands were present on approximately half of the Porter tract (Figure 10) but the remaining lands on the Porter tract and all the Dooher tract were covered by non-native pasture grasses. Pre-restoration vegetative conditions are described in the conceptual restoration plans (ESA 2012 and W2R 2017) from various locations on the project site and included in Table 2. Plant species names from this inventory are summarized in Table 3.

Restoration activities began on the Dooher tract in 2015 and re-vegetation actions over the course of 2016-2017 resulted in the entire 66 acre tract being re-vegetated with native species. Elevation, inundation regime (both tidal and fluvial), and post-restoration salinity and groundwater regimes are key determinants of the post-restoration habitat targets for the site (Figure 5). Plantings included over 16 native species, mostly trees and shrubs, with over 170,000 individual plants installed. The most commonly planted species included:

- 120,000 Hookers willow
- 8500 Sitka spruce
- 15,000 Twinberry
- 11,500 Douglas spirea
- 2800 Red elderberry

Willows were the dominant species planted in the scrub-shrub tidal marsh habitat and were also planted heavily in both the spruce swamp and riparian habitats (Figure 5). Protective cages have been installed on approximately 2200 plants, mostly spruce, redcedar and cottonwood to reduce beaver damage.

On the Porter tract, groundwork restoration activities are in the planning stages as of 2018 but re-vegetation activities began in winter 2018 on approximately 13 acres (Figure 16). The areas of re-vegetation are largely outside of the planned ground-disturbing actions. As with the Dooher tract re-vegetation, the most commonly planted species was Hookers willow with Sitka spruce, Douglas spirea and twinberry also included in the plantings. The remainder of the re-vegetation work on the Porter tract will occur after the groundwork restoration is completed. The native wetlands on the Porter tract (Figure 10) are dominated by slough sedge (*Carex obnupta*) and Lyngby sedge (*Carex lyngbeyi*).

On both the Dooher and Porter tracts, TNC has done some experimental planting of herbaceous plugs in areas that have proved particularly challenging to revegetating with woody species due to low elevations that are impacted by more brackish waters or tend to remain wetter and don't dry out between tides. The planted species have included slough sedge,Lyngby sedge, and small-fruited bulrush, but overall areas covered by these planting actions have been small, less than an acre in total.

Hydrology

The Kilchis Project area is influenced hydrologically by the Kilchis River as well as by Tillamook Bay and nearby tidal sloughs: Hathaway, Stasek, Nielson and Squeedunk, that connect the bay to Project area (Figure 1). The Kilchis River flows through an unimpaired watershed that drains approximately 46,920 acres (65 sq. miles). The steeply-sloped watershed is located on the west slope of the relatively low elevation Coast Range. Because of the steep slope, runoff response during rainfall events is relatively quick, especially under saturated ambient soil conditions. For example, peak flows are high in magnitude and occur with 24 hours of the peak precipitation. In contrast, dry season flows are relatively low due to high permeability of the tertiary volcanic soils and sedimentary rocks that underlie much of the watershed. The results are extreme seasonal flow variability, with high stream flows in the wet season and low flows in the dry season (Follensbee 1998).

One of the primary objectives of the Kilchis restoration project is to restore tidal function to the site which has, for the most part, been cut off from tidal connectivity for 80 years. Connectivity has been restored to the Dooher tract (see restoration plan in Figure 9) that recreated tidal sloughs and connected them to the Kilchis River as well as reconnected the Kilchis River floodplain to the wetlands by lowering dikes. The Porter tract is partially connected to tides along the lower reaches of Hathaway Slough with full connectivity restored across the entire site after the proposed restoration is completed (Figure 14).

Tidal datums and extreme tides for the project site are documented below in Table 1.

Table 1. Tidal and extreme water levels.

Datum / Recurrence Interval	NOAA Gage at Garibaldi – For Reference (Feet NAVD88)	Water Level (Feet NAVD88)
FEMA Base Flood	--	11 – 12*
50-Yr	--	11.8
25-Yr	--	11.6
10-Yr	--	11.5
Highest obs. / Ord. high water (OHW)	11.55	11.42
MHHW	7.93	7.80
MHW	7.22	7.01
MTL	4.10	3.89
MLW	0.98	0.98
NAVD88	--	0.00

MLLW	-0.38	-0.33

Source: ESA PWA 2013

Note that ordinary high water at the site was taken to be approximately equivalent to the recent, observed high water level (i.e., still water level) in the period of record. Storm surge and wave runup may result in total water levels above the still water level that is recorded at NOAA and other gaging stations.

FEMA Flood Characterization

Increasing flood risk to neighboring properties is a primary feasibility consideration because restoration relies upon lowering dikes and removal of tide gates on the property. As with most estuary systems, flooding near the project is a function of tidal water levels in combination with Kilchis River winter flows during high precipitation events. It was noted during the 2012 site visit that it was the perception of the previous landowners (Doohers) that flooding of the site typically originates from Tillamook Bay, when tidal waters overtop the Kilchis River dike and Hathaway Slough located downstream (north) of the project site (ESA 2012).

All properties adjacent to and including the wetland are within the 100-year floodplain. These areas are completely inundated during base flood events by water levels reaching 14 feet and higher NAVD88 according to the FEMA Flood Insurance Rate Map. During events of this magnitude, most of the enhanced levees and dikes are overtopped. Hydrodynamic modeling of the project has shown that restoration will have no impact on flood levels during these extreme events.

Soils

The NRCS maps two soil types on the site: Coquille silt loam (diked) and Nehalem silt loam (frequently flooded) (Figure 8). Coquille silt loams are extensive within Oregon's tidal wetlands (Brophy 2007); Nehalem soils form on alluvium in floodplains of Oregon's coastal rivers.

Fish and Wildlife

The Kilchis Project area is dominated by tidal marshes that provide habitat for number of fish and wildlife species. The Kilchis River hosts several anadromous fish species that pass through the Project area as both out-migrating smolts and incoming adult fish. These species include Pacific chum salmon, Chinook salmon, coho salmon, steelhead and searun cutthroat trout. The restored tidal marshes and tidal channels on the Dooher tract provide critical over-winter habitat for juvenile salmon, giving them refuge during high river flow events in backwater habitats.

In addition to salmon species, there are estuary fish species that are also found in the Project area. These may include three-spine stickleback, shiner perch and sculpin species as well as transient juvenile marine fish species as well (Ellis 2002). At the lower reaches of the site, where tidal influences are strongest there may also be occasional use by juvenile stages of marine invertebrate species such as Dungeness crab.

The tidal wetlands and sloughs also provide habitat for many avian species. Ducks including mallards, canvasbacks, pintails and teal are commonly encountered at the site while common and hooded mergansers along with belted kingfishers can be found in the reach of the Kilchis River that adjoins the Project area. There are also many common wetland and shorebirds such as snipe, great blue heron, egrets, sandpiper and killdeer found at the site as well as western gulls that are ubiquitous throughout the area. Lastly, birds of prey including bald eagle, barn owls and red-

tailed hawks roost in the riparian area and prey on wildlife at the site.
Many other species of wildlife are more secretive than birds and fish species at the Project area but some common ones that are known to frequent the site include beaver, muskrat, nutria, field mice, voles and deer and elk on occasion. The restoration of the tidal marshes and accompanying sloughs at the site is enriching habitats for fish and wildlife leading to more diverse assemblages of species and greatly increased numbers of some of the target fish species such as salmon.

Infrastructure
The Kilchis Project area tracts were previously managed as dairy farms and had related infrastructure associated with such enterprises included in the initial acquisitions. While neither the Dooher nor the Porter tracts had any structures on them (barns, sheds, homes) there were dikes, ditches, fences and water control structures on the properties. In addition, on the Porter tract there is a railroad track located on an elevated berm that spans the property near the eastern boundary (Figure 1).

With restoration of the Dooher tract, all ditches, interior dikes, fencing and water control structures have been removed. The dike that borders the Kilchis River has had two sections removed to allow for flood and tidal flows onto the restored wetlands; the removed sections totaled 1250 linear feet or approximately half of the dike along the river on the Dooher tract.

The proposed restoration for the Porter tract (Figure 14) calls for removal of dikes along Hathaway Slough totally 280 linear feet and removal of low dikes along Stasek Slough. Dike removal will allow for full tidal exchange to occur within the restored wetlands. All dikes removed on Dooher and Porter tracts are being lowered to the 2 year flood elevation or 9 feet.

The existing railroad on the Porter tract is owned by the Port of Tillamook Bay. The railroad is currently leased to the Oregon Coast Scenic Railroad and most recently (2017-2018) is used by a Railriders venture that leads self-propelled rides on specially designed railcars. The rail line is maintained by selective brush cutting by the owner or lease and poses no threats to management or restoration of the Kilchis Preserve.

Cultural, Educational, and Aesthetic Resources
The Kilchis Preserve is located near a culturally rich site, Kilchis Point, in Tillamook Bay. Native Americans were known to use the Bay for its abundant natural resources and land surveys dating back to the GLO land surveys in the mid-1800s identified a village site potentially on the Dooher tract. To reduce the chance of disturbing cultural resources during restoration of the Dooher tract, TNC contracted for a cultural resource survey (Connolly and Hodges 2014). The survey did not detect significant cultural resources but did recommend that a trained archeologist be present during excavation activities associated with the restoration construction in 2015. No significant cultural resources were discovered during restoration. Similar cultural resource surveys will be undertaken during the planned restoration of the Porter tract in the future.

The Kilchis Preserve presents unique educational opportunities for tidal restoration practitioners and for persons interested in tidal wetland function in an agricultural landscape. Tours have been led on both the restored Dooher tract and the yet to be restored Porter tract to highlight these aspects at each site. TNC has given several presentations regarding the planning and restoration of the tidal marsh habitats at both local and national conferences with a special focus on how climate change impacts have been factored into the restoration design.

The Kilchis Preserve is not currently open to the public doe to a lack of suitable public access to the site. However, TNC is available to lead tours of the site to interested parties and can accommodate reasonable requests for visits with advance notification. Aesthetic resources at the Kilchis Preserve are noted by all who visit the site as well as by those who are site managers. The restored wetlands and tidal channels are vibrant examples of the immense productivity of tidal marshes and the ever presence of waterfowl and other bird species coupled with fall salmon runs give one an up-close seat of coastal nature viewing.

Priority Habitats and Current Conditions

The Kilchis Preserve is comprised on two adjoining tracts, the Dooher tract and the Porter tract immediately to the north (Figure 2); the tracts are separated by Stasek Slough which was restored to its former configuration during the Dooher wetland restoration project of 2015. The current condition of the Kilchis Project area is portrayed in a 2017 aerial image (Figure 2) showing the recreated tidal channels, lowered dikes, and complete re-vegetation of the Dooher tract. The 2017 image also shows the site preparation on the Porter tract that has focused on invasive species management; large areas of tan-colored vegetation have been treated and were planted by native wetland species in early 2018 (see Figure 17 for target habitats for revegetation activities).

As noted previously in the Summary of OWEB Conservation Values (p. 5 and Figure 5), the priority habitats at the Kilchis Preserve are the tidal wetlands, tidal channels and riparian areas that are present in either potential, existing or restored conditions depending on location and current restoration status. These habitats function in a complementary fashion with one another and cannot exist alone or without the necessary inputs that can be attributed to the other habitats. The completed restoration of the Dooher tract has led to the immediate use of these habitats by salmon species and other wetland dependent species including waterfowl. The planned restoration of the Porter tract will yield additional benefits for salmon and other species with more priority habitats including tidal wetlands and tidal channels being restored and recreated. The priority wetland habitats for both the Dooher and Porter tracts are shown in Figure 5, the restored tidal channels for the Dooher tract are shown in Figure 2 (2017) and the proposed restored tidal channels for the Porter tract are shown in Figure 14.

Inventory Data Analysis and Prioritized Resource Concerns

The inventory data for the Kilchis Project area and the surrounding Tillamook Bay estuary shows that tidal wetlands and more specifically, tidal freshwater wetland habitats that are characterized as Sitka spruce swamps have been significantly reduced in the area. This loss of habitat has constrained recovery of salmon species in Tillamook Bay which are dependent upon tidal marshes for juvenile rearing and for protection from high winter flows. The Kilchis Project area lies at the intersection of tidal freshwater and tidal saltwater marsh habitats. It provided a unique opportunity restore a transition zone that can serve existing habitat needs as well as future needs when climate change impacts may alter tidal marsh distribution.

Another feature of the Kilchis Project area is that it is located at a reach of the river that can deliver considerable sediment to its floodplain. This is critical for restoration purposes as portions of the Dooher tract have subsided after 80 years of farming activities. Using the river to naturally deliver sediments is an efficient and effective means to return the site elevation back to normal values relative to the surrounding lands.

Site inventory also showed that the Kilchis Project area was uniquely situated in that restoration of the site would have minimal effects on neighboring properties. The Dooher tract is mostly surrounded by waterways with the Kilchis River bordering it on two sides and Stasek and Neilson Sloughs all but surrounding it on the remaining sides. The Porter tract complements the Dooher tract as it includes transitions to lower elevation tidal marshes including emergent tidal marsh habitat that is dominated by Lyngby sedge. Again, restoration of the Porter tract will have minimal impacts on neighboring properties as there are both natural barriers to effects such as sloughs as well as manmade barriers such as Highway 101 on its eastern border.

The highest priority for the Kilchis Project is to restore tidal wetlands and the associated tidal channels to provide habitat for juvenile salmon and other species. As noted above and in previous sections, tidal wetlands have suffered significant losses statewide and within Tillamook Bay these losses are upwards to 80% for tidal marshes (TBNEP 1998). Restoring tidal marshes in the lower Kilchis River will increase the overall area of functional marsh habitat in the Bay and will serve as protective over-winter habitat for juvenile salmonids in the Kilchis River system.

Another resource concern is that the continuing impacts of climate change like sea level rise will make future restoration of tidal marshes more and more difficult when it involves subsided farmlands. Subsided lands can be up to 6 feet lower than native wetlands in the same area due to ongoing farming activities. To restore subsided lands to tidal marshes requires accretion of sediments onto the marsh to elevations that will support emergent and/or woody marsh vegetation. If there is no addition of sediment the areas will become deeper water estuary habitats that are not as important to target salmon species and are much more difficult to restore to tidal marshes after the subsided areas are hydrologically reconnected. Sea level rise is continuing and will flood tidal marshes if they don't continue to receive sediments, even sites that may currently be at elevations that support tidal marsh habitats. The Kilchis Project will continue to receive regular sediment inputs that will dampen impacts of sea level rise on marsh elevations.

Threats to Conservation and Priorities for Restoration
The primary remaining conservation threat to the site that can be addressed by restoration is the lack of hydrologic connectivity across the Porter tract which includes the wetland floodplain, Stasek Slough and tidal influences of Tillamook Bay. The scope and severity of this threat are both very high; it is reversible though with a reasonable commitment of resources for restoration. Without this connectivity there cannot be effective use of the Porter tract by wildlife, especially salmon species that would use the area for juvenile rearing and refuge during periods of high water.

The Dooher tract has been successfully restored and revegetated with native wetland species as of 2018; managing invasive species is a regular stewardship activity for the tract. The previously farmed portion of the Porter tract is dominated by non-native pasture grasses with patches of the invasive reed canarygrass. There are also invasive blackberries, Canada thistle, and a few patches of English ivy mostly along the railroad berm. The scope and severity of the threat of invasive species is medium as revegetation contractors are aggressively attacking these species. Restoration of tidal inundation and return of natural hydrology will help eliminate the pasture grasses. Planting of native species and mowing of competing vegetation around the plantings should eventually suppress the reed canarygrass. The blackberries, thistle, and ivy will require ongoing maintenance. Overall the impacts of this threat are reversible with a commitment of resources for stewardship. Nutria are reported to be present at the site and they can be quite destructive of marsh habitats. More information will be needed about their abundance following restoration to inform appropriate management.

One overarching threat to the Kilchis Project area is the long-term impact of climate change on coastal and estuary ecosystems. Projected climate change in the next 20-50 years is not expected to eliminate the conservation values of the property, making the severity of this threat during the term of this management plan lower. However, projected impacts of climate change between 50-100 years from now on the Oregon Coast include: sea level rise, increased storm intensity, increased temperature, changes in ocean chemistry and changes in the timing and pattern of precipitation. These changes may modify the long-term composition of the preserve's wetlands, but the site will retain important conservation values as habitat for aquatic and estuarine-dependent species. While the irreversibility of climate change itself is very high, its effects can be mitigated to a certain extent through restoration of natural processes such as tidal flows and sedimentation or accretion at the site. Restoration of native vegetation on the property can help reduce long-term threats by providing a natural buffer from the impacts of increased storm intensity. Plans to restore connectivity of the Porter tract wetlands and adjacent tidal sloughs will help to re- establish natural sediment regimes there, which will counteract some of the impacts of sea level rise. Reconnection has occurred on the Dooher tract and benefits from this have already begun with sediment deposition during high winter flows.

In summary, the priority threats to conservation values at the Kilchis Project area include ongoing hydrologic connectivity issues primarily on the Porter tract, and the overarching threat of climate change impacts that impact tidal wetlands and coastal areas in general. If one was to rate these threats, climate change would be the number one threat in scope, severity and irreversibility. That being stated, the Kilchis Project area does have some ability to counteract sea level rise impacts through marsh level accretion, especially on the Dooher tract which can directly receive sediments from the Kilchis River. Restoring hydrologic connectivity is key to mitigating sea level rise impacts; restoring tidal flows to the wetlands will also assist with invasive species management as many species are negatively affected by saline waters.

Desired Future Conditions

Most of the Property is former tidally-influenced wetland habitat. Long-term desired future conditions for the restored property are defined below for each of the tracts.

Dooher Tract

Restoration of the Dooher tract was initiated in 2015 with earthworks construction. Re-vegetation of the site continued for the following two years with plant establishment activities planned to continue until 2020. Restoration activities at the site are shown in Figure 9 with the exception of the low berm that was deemed not needed in the final engineering plan (ESA 2014).

1. Reconnection of Stasek Slough to the Kilchis River and recreating tidal channels will increase the quantity and quality of rearing areas and off-channel refugia available to salmonids as well as provide off-channel habitat for many marine species that are present in Oregon's estuaries;
2. Filled drainage ditches will result in a higher groundwater table, lower water temperatures, and increased base flow;
3. Lowered dikes will allow more natural water flow (both tidal and riverine) and sediment dynamics contributing to restoration of native wetland communities

including tidal marsh, forested swamps, and tidally-influenced freshwater wetlands;

4. Re-established native wetland plant communities will have only a minor component of non-native species thus enhancing their ecological functioning and resilience to climate change;
5. Restored riparian and forested swamp habitats will shade the Kilchis River and Stasek Slough, serve as a source of wood input, and collect sediment and woody debris during winter storm events;
6. Large wood in the channels will add complexity, enhance salmonid rearing and refuge in side channels, and foster invertebrate populations that are important prey for fish;
7. Large wood in the wetland areas will provide important habitat for amphibians, small mammals, birds and reptiles and will serve as establishment sites for spruce, hemlock, and non- wetland understory species, such as salal and huckleberry, adding diversity to the habitat; and
8. The restored site will provide high quality nesting, feeding, and nursery areas for a diverse array of at-risk fish and wildlife species, such as northern red-legged frog, bald eagle, peregrine falcon, Pacific lamprey, chum salmon, and federally threatened Oregon Coast coho salmon.

For a complete discussion of the completed restoration work for the Dooher tract, see Kilchis River (Dooher) Basis of Design Report, Plans and Specifications (ESA et al. 2014) and the Kilchis River (Dooher) As-Constructed Plans (ESA 2014).

<u>Porter Tract</u>

1. Recreated tidal channels will increase the quantity and quality of rearing areas and off-channel refugia available to salmonids as well as provide off-channel habitat for many marine species that are present in Oregon's estuaries;
2. Filled drainage ditches and removed water control structures will result in a higher groundwater table, lower water temperatures, and increased base flow;
3. Lowered dikes along Stasek and Hathaway Sloughs will allow for more regular tidal flows and sediment dynamics contributing to restoration of native wetland communities including tidal marsh, forested swamps, and tidally-influenced freshwater wetlands;
4. Re-established native wetland plant communities will have only a minor component of non-native species thus enhancing their ecological functioning and resilience to climate change;
5. Restored riparian and forested swamp habitats will serve as a source of wood input and collect sediment and woody debris during winter storm events;
6. Large wood in the channels will add complexity, enhance salmonid rearing and refuge in side channels, and foster invertebrate populations that are important prey for fish;
7. Large wood in the wetland areas will provide important habitat for amphibians, small mammals, birds and reptiles and will serve as establishment sites for spruce, hemlock, and non- wetland understory species, such as salal and huckleberry, adding diversity to the habitat;
8. Re-engineered connector ditch between Stasek and Hathaway Sloughs will increase connectivity between the two waterways and allow for greater tidal exchange on the Dooher tract;

9. The restored site will provide high quality nesting, feeding, and nursery areas for a

diverse array of at-risk fish and wildlife species, such as northern red-legged frog, bald eagle, peregrine falcon, Pacific lamprey, chum salmon, and federally threatened Oregon Coast coho salmon; and

10. Restricted-use bridges will create safe access to all parts of the tract over sloughs and channels.

For a more complete discussion of the proposed restoration work on the Porter tract and desired future condition see Porter Tract Restoration Conceptual Plan (W2R 2017).

Priority Management Strategies

The basic management strategy for the Property is to restore hydrologic ecological functions to the site by reconnecting the former wetlands to the river and sloughs through dike lowering and tidal channel reconstruction followed by planting of native species.

Restoration planning for the site was supported by a OWEB Technical Assistance Grants. Contractors (ESA and W2R) provided hydrodynamic modeling, engineering considerations and restoration scenarios evaluation. The contractors met regularly with TNC and other knowledgeable experts (for the Dooher tract) including: Rachel Hagerty, TEP restoration coordinator; Laura Brophy, ETG Director and estuary restoration consultant; and Amy Horstman, USFWS restoration biologist. Restoration principles for the site were developed and many site design factors were discussed and evaluated for use in the final concept plans. OWEB project review teams also were involved in both the Dooher and Porter restoration projects at numerous times. OWEB teams reviewed and commented on plans during acquisition, technical assistance and restoration grant phases of each of the projects. This resulted in input from team members who had varied backgrounds and perspectives and allowed for an iterative process for the development of restoration plans.

The Porter restoration planning benefited significantly from the Dooher tract restoration which was implemented in 2015 with earthworks construction followed by re-vegetation in 2016-2017. Consultation for the Porter tract restoration involved experts from TEP, USFWS and the Army Corps of Engineers. Porter tract restoration construction is planned for 2019-2020.

The Dooher tract restoration plan modeled two potential restoration scenarios. The first scenario would reconnect Stasek Slough to the Kilchis River and create several tidal channels on the Property but wouldn't lower the dike that restricts the Kilchis River from the site and its floodplain. The second scenario included lowering of the Kilchis dike along with the restoration actions in the first scenario. Both restoration scenarios were evaluated using a hydrodynamic model to predict resulting water elevations on the Property, in tidal channels and sloughs, and on adjacent lands under several hydrologic regimes that included: 1) peak river and tidal flows (winter storm), 2) highest tide with normal river flow, and 3) average high tide with normal river flow. In addition, the chosen design was evaluated under projected 2050 and 2100 climate change impacts for precipitation and sea level rise (ESA PWA et al. 2013).

The Kilchis dike lowering design (Figure 9) was selected because it restored full tidal function to the site to a far greater extent than more limited restoration scenarios. The tidal exchange under this design was more extensive on the site even during moderate high tides in summer months, which occur when river flows would not be contributing waters to the wetland habitats.

Highlights of the selected design was: 1) restoration and reconnection of Stasek Slough with the Kilchis River, 2) lowering of the Kilchis dike for a significant portion of its length, 3) creation of 2500' of tidal channels, 4) lowering of interior dikes and filling of ditches, and 5) extensive planting of tidal wetland species with an emphasis on spruce swamp restoration, (ESA PWA et al. 2013).

The Porter tract restoration plan follows along closely with the design that was implemented on the Dooher tract with tidal channel re-creation, dike lowering, marsh re-vegetation and reconnecting Stasek Slough with Hathaway Slough via the connector channel (W2R 2017). There are several water control structures to be removed in the Porter design and there will be tidal channel crossings developed for continued access to all parts of the site. The conceptual restoration plan is shown in Figure 14.

Goal 1. Restore freshwater and tidal connections over at least 90% of the property to provide off-channel habitats for salmonids and marine species while providing prudent protection to neighboring properties.

This goal addresses Desired Future Conditions #1, 2, and 3 for both the Dooher and Porter tracts.

Strategy 1.1: Implement restoration plan

Dooher Tract

The Nature Conservancy implemented the preferred restoration alternative for the Dooher tract and conducted the heavy earth-moving phase of the project in summer of 2015. Site restoration required significant site disturbance with considerable earthmoving using heavy equipment to lower a 1500' dike along the Kilchis River, fill nearly a mile of interior ditches, excavate 1600' of fill from Stasek Slough and recreate 2500' of tidal channels. Lowering of the Kilchis dike required careful engineering to leave a natural levee in place that supported riparian habitat development.

Hydrodynamic modeling for the project showed that in most instances the project will result in quicker dissipation of winter high water events because of the increase in off-channel wetland area available for floodwaters. This will have a positive effect on upstream lands and there will be no discernible impacts to downstream lands. Minor increased tidal heights of less than 1' for very limited durations (1 -2 hours) are projected during summer highest tides in localized areas.

Porter Tract

Restoration of the Porter tract is still in the planning stage but initial funding has been secured to initiate engineering, permitting and re-vegetation activities prior to restoration construction work. This initial work is being conducted in 2018 and may continue into 2019. Earthworks construction for the Porter tract is scheduled to occur in 2019-2020.

Half of the Porter tract is a natural tidal marsh in good condition that requires no major restoration efforts other than invasive species abatement. The remainder of the Porter tract will require extensive restoration akin to that which was conducted on the Dooher tract. One of the major aspects of the Porter tract restoration is restoring connectivity between the connector channel and Stasek Slough. The connector channel is currently a ditch with a failing box culvert that links tidal flows between Hathaway and Stasek Sloughs. Restoration of this channel will also benefit tidal exchange on the Dooher tract and will aid in drainage of upstream properties along Stasek Slough after high river flow events.

Goal 2. Restore the historic character of the site vegetation on 126 acres by planting native wetland and riparian vegetation and controlling competing and invasive species to achieve a 70% survival rate of plantings.

Desired Future Conditions #4 and 5 for both Dooher and Porter tracts will be addressed by these strategies:

Strategy 2.1: Implement restoration plantings

Dooher Tract

This portion of the restoration on the Dooher tract began in 2016 with half the site being planted and the remainder of the site being planted in 2017. For the purposes of defining restoration planting activities, the Property has been divided into three vegetative habitats: 1) tidal spruce swamp, 2) riparian forest, and 3) scrub-shrub and emergent tidal marsh (see Figure 5).

Plantings on the Dooher tract in each habitat included:

1) Sitka spruce tidal swamp: Sitka spruce, black twinberry, crabapple, Hookers willow, cascara, and spirea at the rate of 3000 plants/acre.
2) Riparian forest: Sitka spruce, red alder, cottonwood, western red cedar, red elderberry, salmonberry, willow and twinberry at the rate of 2000 plants/acre.
3) Tidal scrub-shrub marsh: Hooker's willow and twinberry at a rate of 2000 plants/acre.

In addition to the woody species noted above, herbaceous plugs were also installed on the Dooher tract in microhabitats that were either lower elevation than scrub-shrub habitats or tended to hold water due to insufficient drainage. The herbaceous species included slough sedge,Lyngbeyi sedge and small-fruited bulrush.

Planted trees were in the two to three-year-old age class and came as potted stock. Other plants were either potted, bare root or cuttings (willow). Trees were staked and caged near waterways for animal protection. Herbicides are being used to reduce competing vegetation until free to grow stage is reached for target species.

The earthmoving activities associated with dike lowering and ditch-filling resulted in areas dominated by bare ground. Erosion control native grasses were seeded onto the Dooher tract immediately after construction activities ceased in 2015. These seedings were effective during the major flood in December 2015. No additional site preparation for woody species plantings in 2016 was necessary in these areas but weed abatement was important here and willows were useful in reducing erosion and restricting weed encroachment. Preparation of areas not disturbed by heavy equipment included the use of herbicide and hand tools to scarify planting sites for trees and shrubs. In existing dense stands of reed canarygrass, herbicides were followed by dense plantings of woody species, primarily willows.

Willow cuttings were planted in clumps such that two or three individual willow cuttings were planted in one location to foster rapid spread of the plants. The general goal was to have planting densities be approximately 2000 plants (or plant clumps) per acre for all habitats. All planting activities occurred during the plant dormant season from November to April except for seeding of disturbed areas that took place as soon as practical after earthmoving activities were completed in early fall 2015.

Porter Tract
Similar planting specifications are being used on the Porter tract in spruce swamp, riparian and scrub-shrub habitats. Initial plantings in 2018 were made in areas that are expected to be minimally disturbed by proposed restoration construction activities (Figure 15). Planting activities on the Porter tract covered approximately 14 acres in 2018 and protective cages were installed on trees that are near waterways where beavers may be present.

Strategy 2.2: Maintain restoration plantings for successful establishment
Dooher Tract
The plant establishment plan for the Dooher tract was to have crews visit the site two or three times per year for three years to reduce competing vegetation around the plantings. This plant establishment work began the first summer growing season in 2016 after initial planting.

The contractor and crew also checked all plants for animal damage or other signs of stress and performed routine maintenance such as repairing any protective cages. Dead plants, were replaced to retain a 70% survival rate of plantings by the end of the project funding contract. As of 2018, all planted habitats on the Dooher tract were meeting the 70% survivorship rate.

Porter Tract
On the Porter tract, the recent (2018) plantings will have plant establishment treatments including herbicide circle spray and/or mowing 2-3 times a year beginning in Summer 2018. The plant establishment activities will continue for 3 years after planting depending upon need.

Strategy 2.3: Inventory and control priority invasive species
Dooher Tract
Over much of the Dooher tract, the cover of pasture grasses and reed canarygrass is being reduced by the restoration actions described above. A strong revegetation effort of dense willow plantings coupled with targeted herbicide spraying have been key to minimizing reed canarygrass spread and preventing it from dominating the site. Low salinity levels (e.g. less than 10 ppt) made it more difficult to control reed canarygrass after restoration but in some bare ground areas there has been considerable natural recruitment of native plants from seed that has reduced reed canarygrass cover. Willow plantings have been quite effective at providing rapid growth and shading out reed canarygrass in scrub-shrub habitats on the Dooher tract.

The plantings have been followed up with herbicide circle spray treatment to reduce competing vegetation, especially reed canarygrass, during the summer growing seasons for up to three years. Mowing between rows of plantings has also be employed. Effectiveness monitoring on the Dooher tract shows an increase in woody vegetation. Some of the herbaceous wetland species that have naturally recruited to the site such as small-fruited bulrush (*Scirpus microcarpus*) and spikerush (*Eleocharis* sp.) are growing into solid patches of native vegetation, significantly reducing the reed canarygrass in those areas.

There are a few patches of English ivy that were controlled before restoration at the Dooher tract.

The remainder of the invasive species known to be on site such as blackberries and Canada thistle we expect will ultimately be shaded and/or kept at low levels by native plantings. In the meantime, they are being controlled by herbicide spray and cutting to prevent them from going to seed and spreading to neighboring properties.

Porter Tract

Invasive species control on the Porter tract began in summer 2017 with treatments involving herbicide and mechanical cutting activities on reed canarygrass and blackberries. This work was conducted across the entire Porter tract although there were fewer patches of weeds encountered within the native tidal marsh habitats that comprise approximately half of the 60 acre site. Some of the areas slated for revegetation work in 2018 were previously dominated by invasive species. As of summer 2018 the plantings are establishing well.

Within invasive species treatment sites located in low-lying potential scrub-shrub habitat that were not planted in 2018, there has been significant recruitment of Pacific silverweed, a native tidal marsh species. It is likely that these plants did not seed into these invasive species sites but rather they had been present but suppressed by reed canarygrass.

Goal 3. Place large wood into created tidal channels to provide cover for salmonids and habitat for invertebrates, amphibians, small mammals, and reptiles.

This goal addresses Desired Future Conditions #6 & 7 for both Dooher and Porter tracts.

This aspect of the restoration was implemented during the earth-moving activities described in Goal 1 for the Dooher tract and will be put into effect on the Porter tract when tidal channel work is conducted in 2019-2020. The large wood has several purposes in the tidal channels: 1) it anchors the channel walls, 2) at provides a hard surface for channel bends or other higher velocity areas, 3) it creates roughness and hiding cover for aquatic species.

Implementation Plan and Schedule—Dooher Tract

Strategy	Action Steps	Timeframe	Lead	Status	Funding Source
Strategy 1.1: Implement restoration plan	• Facilitate permitting work done by contractors and agencies	Oct. 2013 – June 2014	Dick Vander Schaaf	Completed	DSL, Wildlife Conservation Society, OWEB
	• Finalize engineering plans	Dec. 2013 – June 2014	Dick Vander Schaaf	Completed	
	• Conduct cultural resources inventory	June-July 2014	Dick Vander Schaaf & contractor	Completed	
	• Finalize/sign grant agreement with DSL & OWEB	June – July	Dick Vander Schaaf	Completed	
	• Pre-implementation report to DSL	July 2014	Dick Vander Schaaf	Completed	
	• Develop construction bid specifications & issue	Jan 2015	Dick Vander Schaaf	Completed	
	• Evaluate bids and select contractor(s)	Feb 2015	Dick Vander Schaaf	Completed	
	• Prepare contracts	Mar 2015	Dick Vander Schaaf	Completed	
	• Provide on-site project management during construction	June-Sept 2015	Dick Vander Schaaf	Completed	
	• Seed/stabilize disturbed areas as soon after construction as feasible	Sept 2015	Contractor	Completed	
Strategy 2.1: Implement restoration plantings	• Consult with NORP on plant availability	May 2014	Dick Vander Schaaf, NORP	Completed	OWEB grant proposal
	• Submit OWEB grant proposal	Oct. 2014	Dick Vander Schaaf	Completed	
	• Finalize/sign grant agreement with OWEB	May 2015	Dick Vander Schaaf	Completed	
	• Finalize re-vegetation plans	Oct. 2015	Dick Vander Schaaf, & Partners	Completed	

Strategy	Action Steps	Timeframe	Lead	Status	Funding Source
Strategy 2.1: Implement restoration plantings (cont.)	• Develop planting bid specifications & issue RFB • Evaluate bids and select contractor • Provide on-site management during planting	Oct. 2015 Oct.-Nov. 2015 Nov. 2015-March 2017	Dick Vander Schaaf, NORP Dick Vander Schaaf TNC staff	Completed Completed Completed	OWEB grant proposal
Strategy 2.2: Maintain restoration plantings for successful establishment	• Manage plant release work for 3 years & replant as necessary	May/June 2016-Sept. 2019	TNC staff	On-going	
Strategy 2.3: Inventory and control priority invasive species	• Develop and implement weed mapping across the site • Revisit prior English ivy patches 1-2 times per year and pull any shoots found • Spray Canada thistle plants prior to seed-set	2015 Annually May-July Annually June-July	TNC staff TNC staff TNC staff	Completed Completed On-going	TNC
Monitoring	• Meet with DSL to develop detailed site monitoring plan and sampling locations • Conduct baseline monitoring • Repeat photography at photo points following earth-moving & plantings	July 2014 August 2015 Sept./Oct. 2015	Dick Vander Schaaf, Debbie Pickering & other TNC staff TNC staff TNC staff	Completed Completed Completed	DSL/TNC DSL/WCS OWEB

Implementation Plan and Schedule—Porter Tract

Strategy	Action Steps	Timeframe	Lead	Status	Funding Source
Strategy 1.1: Implement restoration plan	• Facilitate permitting work done by contractors and agencies	June 2018-Jan 2020	Dick Vander Schaaf	On going	OWEB
	• Finalize engineering plans	August 2018	Dick Vander Schaaf	Planned	
	• Conduct cultural resources inventory	October 2018	Dick Vander Schaaf & contractor	Planned	
	• Finalize/sign grant agreement with OWEB (Coastal Wetlands)	Jan 2018	Dick Vander Schaaf	Planned	
	• Develop construction bid specifications &	Jan 2019	Dick Vander Schaaf	Planned	
	• Evaluate bids and select contractor(s)	Feb 2019	Dick Vander Schaaf	Planned	
	• Prepare contracts	Mar 2019	Dick Vander Schaaf	Planned	
	• Provide on-site project management during construction	June-Sept 2019	Dick Vander Schaaf	Planned	
	• Consult with OWEB for significant design changes	August 2018-Sept 2019	Dick Vander Schaaf	Planned	
	• Seed/stabilize disturbed areas as soon after construction as feasible	Sept 2019	Construction contractor	Planned	
Strategy 2.1: Implement restoration plantings	• Consult with NORP on plant availability	May 2018	Dick Vander Schaaf, NORP	Ongoing	OWEB grant proposal
	• Submit OWEB grant proposal	Oct. 2018	Dick Vander Schaaf	Planned	
	• Finalize/sign grant agreement with OWEB	April 2019	Dick Vander Schaaf	Planned	
	• Finalize re-vegetation plans	Oct. 2019	Dick Vander Schaaf & Partners	Planned	

Strategy	**Action Steps**	**Timeframe**	**Lead**	**Status**	**Funding Source**
Strategy 2.1: Implement restoration plantings (cont.)	• Develop planting bid specifications & issue RFB	Oct. 2018	Dick Vander Schaaf	Ongoing	OWEB grant proposal
	• Evaluate bids and select contractor • Provide on-site management during planting	Oct.-Nov. 2018 Nov. 2017-March 2020	Dick Vander Schaaf TNC staff	Planned Ongoing	
Strategy 2.2: Maintain restoration plantings for successful establishment	• Manage plant release work for 3 years & replant as necessary	May/June 2018-Sept. 2022	TNC staff	On-going	
Strategy 2.3: Inventory and control priority invasive species	• Develop and implement weed mapping across the site	2019	TNC staff	Planned	TNC
	• Spray Canada thistle plants prior to seed-set	Annually June-July	TNC staff	On-going	
	• Conduct baseline monitoring	August 2019	TNC staff	Planned	OWEB
	• Repeat photography at photo points following earth-moving & plantings	Sept./Oct. 2019	TNC staff	Planned	OWEB
	• Initiate groundwater and salinity monitoring	Oct.-Nov. 2019	TNC staff	Planned	OWEB

Monitoring, Maintenance and Adaptive Management

Site monitoring involves several parameters that reflect ecological function in estuary wetlands as recommended in Brophy 2007, restoration concept plans (ESA et al. 2013) and by the granting organizations, OWEB and DSL (for Dooher tract only). The primary hydrologic parameter is assessed by monitoring water levels in the river and tidal sloughs with water level loggers. Locations of water level loggers have evolved as site restoration has been undertaken on the Dooher tract and is being planned on the Porter tract; the current locations of loggers as of 2018 is shown in Figure 17. A second set of parameters reflect progress in the restoration of native vegetation at the Property. Another potential parameter is the response of salmonids and other wildlife to the restored hydrology and wetlands although we are not actively monitoring this response at the site.

A monitoring plan has been developed and implemented for the Dooher tract and is included in the Appendix A. A monitoring plan for the Porter tract has been drafted and included in Appendix B; it will be finalized before the restoration activities at Porter have been completed. Monitoring activities are underway at the Porter tract including permanent photo points (Figure 12) and hydrologic monitoring in sloughs and ditches (Figure 17). Re-vegetation monitoring will begin at the Porter tract in Summer 2018 using 10 X 10 meter plots.

Monitoring plans will be adapted as needed to reflect changes in site management or recognition of a need to include additional monitoring parameters to meet observed site conditions. TNC has a yearly meeting for staff working on restoration and monitoring of the Kilchis Preserve to discuss findings and recommend any changes of management and/or monitoring. As monitoring plans change, TNC will notify OWEB and/or other funders and seek input from them for best ways to meet monitoring needs. Depending on the significance of the recommended management changes, TNC will notify OWEB when such changes may affect management direction or impact OWEB policies and principles. Before any significant management changes are made, TNC will meet with OWEB for consultation.

Dooher Tract Monitoring Parameters

1) Hydrology: continuous measurements to demonstrate tidal connectivity in the restored wetland are monitored by eight in-channel pressure transducers (*Solinst* Levelogger Edge) to measure depth and temperature. This data is used to compare temporal components of tidal hydrodynamics (e.g. periodicity and timing) of the constructed channels to the mainstem Kilchis River. Ambient barometric pressure is measured using an on-site barometer (*Solinst* Levelogger Gold). Instruments logged continuously at 30-minute intervals. The barometer and four original transducers on the Dooher tract started logging data on April 1, 2016. Site visits occur roughly on 3-month intervals, during which data are downloaded and transducers were cleaned to prevent fouling. The locations of the water level loggers are shown in Figure 17.

2) Native Vegetation:
    - Survivorship: Planting survivorship monitoring will occur annually for 3 years after vegetation is planted on both the Dooher and Porter tracts. In early fall, late the growing season but before leaf senescence, temporary 100m^2 plots are randomly selected to cover 1% of the planting area. The sampling is stratified to ensure that each planting habitat includes a proportionate share of the total sampling plots. In these plots, every plant is assessed for mortality and a

percentage of survival is calculated. If survivorship falls below 70%, adaptive management efforts will be considered.

- Vegetative cover: Plant community response and conversion from non-native to native species will be monitored using permanent line intercept transects. This intensive effort to sample the cover of key native and invasive species will occur for up to ten years on the Dooher tract. The details of this monitoring program are included in Appendix A.

3) Salmon Response: sampling salmon smolts in tidal channels will occur whenever ODFW can work the Property into their sampling schedule.
4) Photo Points: Photo points were established for the Dooher tract easement Baseline Documentation Report in February 2012 (Vander Schaaf 2012). After restoration designs were completed, 14 permanent photo monitoring points were established on the Dooher tract to capture structural changes in the plant communities and alterations in the channels over time (Figure 12 & Table 4). There are 28 photo monitoring points, half located on each property. Photographs are taken immediately after the earth-moving work is completed and repeated every 2 years thereafter.
5) Additional potential parameters may include: sediment accretion, channel morphology, ground surface elevations, soil organic matter content, & bird species occurrence.

Porter Tract Monitoring Parameters

1) Hydrology: monitored through recording water level logger gages in the river and in tidal channels on the tract (Figure 17). Water levels and temperature are monitored to determine tidal and river connections within the wetlands Four additional transducers were installed on April 6, 2017 to collect baseline data for the Porter tract. After restoration activities are completed on the Porter tract, water level logger locations may change to meet site conditions.
2) Native Vegetation: Plant survivorship monitoring within planting habitats will occur for 3 years after planting activities have occurred following OWEB protocols. In early fall, before leaf senescence, temporary 100 m^2 plots are randomly selected to cover 1% of the planting area. The sampling is stratified to ensure that each planting habitat includes a proportionate share of the total sampling plots. In these plots, every plant is assessed for mortality and a percentage of survival is calculated. If survivorship falls below 70%, adaptive management efforts will be considered.
3) Salmon Response: sampling salmon smolts in tidal channels will occur whenever ODFW can include the Property in their sampling schedule.
4) Photo Points: Fourteen permanent photo points (Figure 12 & Table 5) were established for the Porter tract easement Baseline Documentation Report in October 2015 (Rofsky 2015). Repeat photography at these locations will be used to track structural changes in the plant communities and alterations in the channels over time. Photo point photography will be repeated every 2 years through the active restoration phase of the project.
5) Additional potential parameters may include: sediment accretion, channel morphology, ground surface elevations, soil organic matter content, & bird species occurrence.

Plan Updates

Given the significant alterations planned for the site during the restoration, it is reasonable to expect this plan to cover just a 10 year period beginning when restoration actions were initiated on the Dooher tract (2013) with an opportunity to update it after five years to incorporate any early results from monitoring. This timeframe should give TNC a better sense of how the site is adjusting to the restoration and if any further site management modifications are needed, which can be addressed in the next version of this management plan in 2023. By 2023 it is expected that active restoration activities will be completed for the Porter tract and the restored Dooher tract will be completely re-vegetated and functioning as a native tidal wetland. The current 2018 version of the Management Plan suffices as the five-year update. TNC will notify OWEB in 2023 before the scheduled 10 year plan update to include any new plan requirements.

Community Involvement and/or Educational Opportunities

This project has generated considerable interest in the local community and elsewhere on the North Coast. TNC has used the project as an opportunity to develop outreach materials and meet with landowners, agencies and local community groups to discuss the specific restoration goals and how the planned activities have met these goals and what challenges still exist. Outreach has also included presentations at regional or national meetings to discuss how climate change parameters were factored into hydrologic models that were in turn used in developing site restoration plans.

There have also been tours conducted at the site, particularly at the Dooher tract where restoration actions have been completed and where tidal marsh restoration is well established, and it is expected that tours will continue to be held on an as need basis. TNC responds to all formal requests for tours of the Kilchis Project area depending on availability of staff. Past tours have included County Commissioners, elected officials, state and national resource agency staff, project partners, community partners and private donors. Because of ongoing restoration activities, tours have not purposefully reached out to education-oriented groups at this time. TNC doesn’t actively engage in environmental education but we make our preserves available for such activities to other groups.

The project has also interfaced with the local community as it grapples with how to accommodate wetland restoration in and amongst farmlands, especially in the Tillamook basin area. In 2016 the Oregon Legislature enacted SB1517 that directed Tillamook County to assess wetland restoration that falls within zoned EFU farmlands. Much of the Kilchis Project area is on EFU farmlands, however, the estuary conservation overlay zoning covers portions of the area including much of the Porter tract. The Nature Conservancy serves on a technical advisory committee that is assisting the County with implementing the Act. The experiences learned from the Kilchis Wetlands Restoration Project are playing a role in recommendations that the committee is making to the County. A progress report on the County progress is due to the Oregon Legislature in September 2018.

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FIGURES

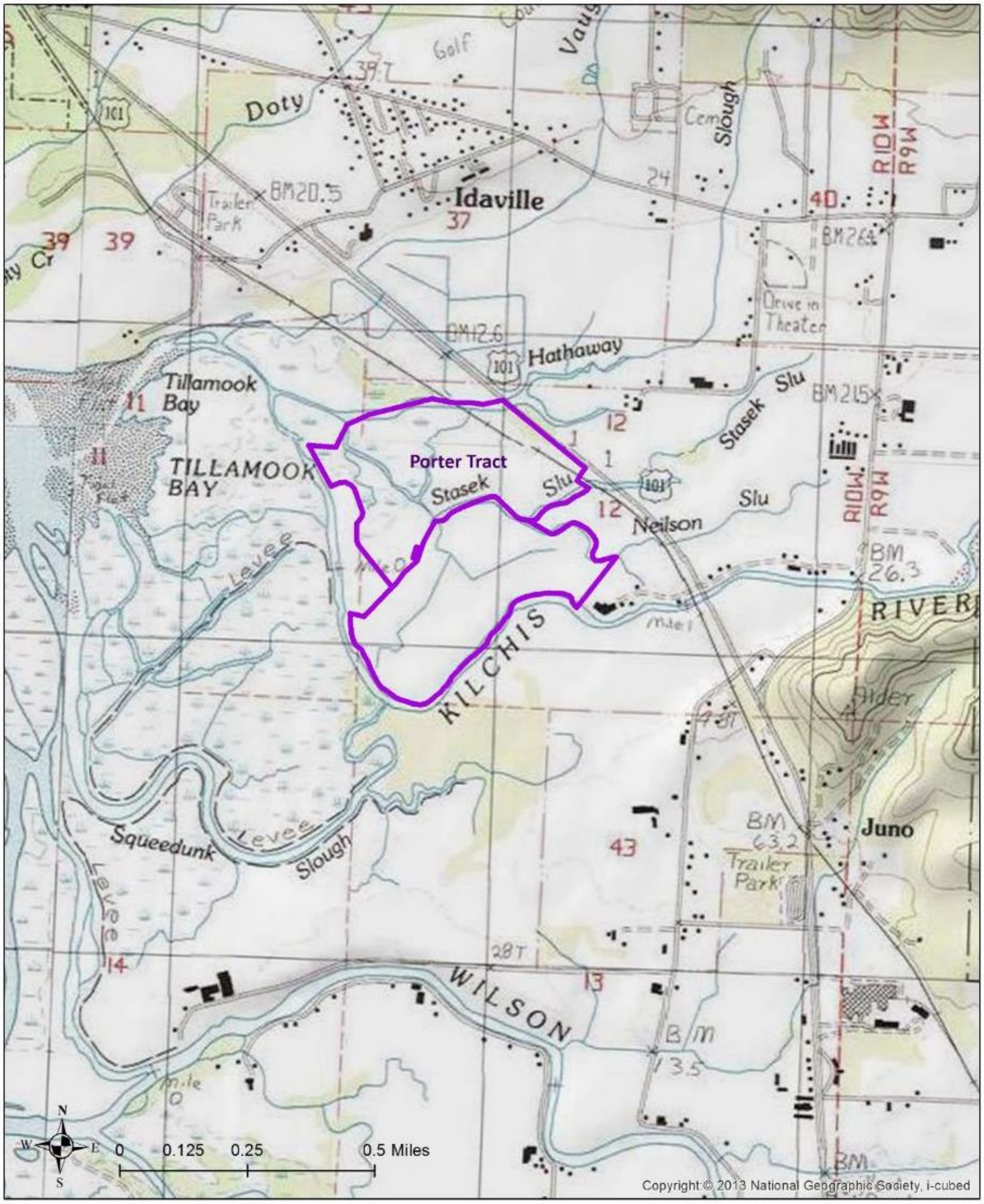

Figure 1. Kilchis Estuary Preserve, Tillamook County, Oregon

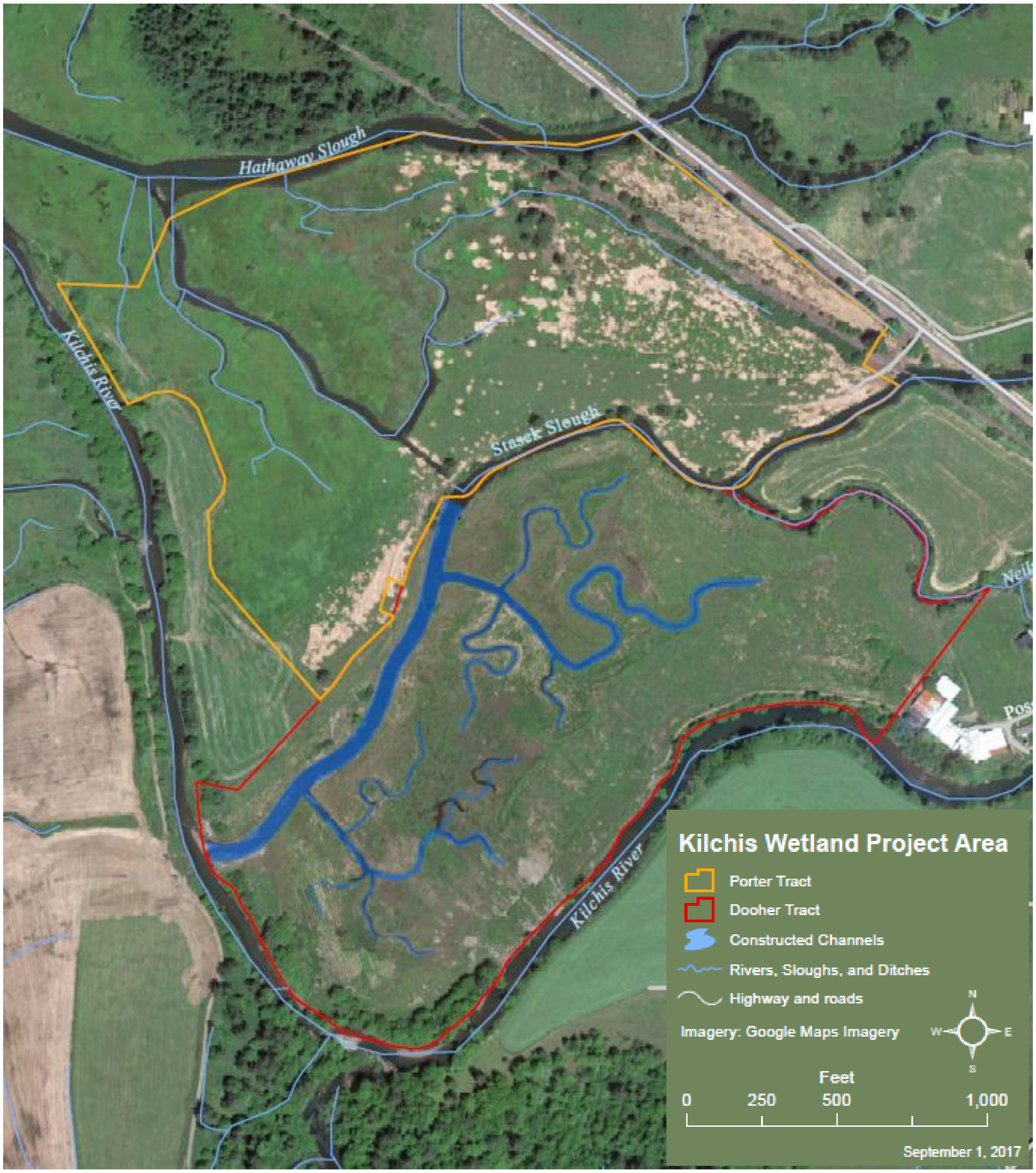

Figure 2 Kilchis Estuary Preserve aerial view

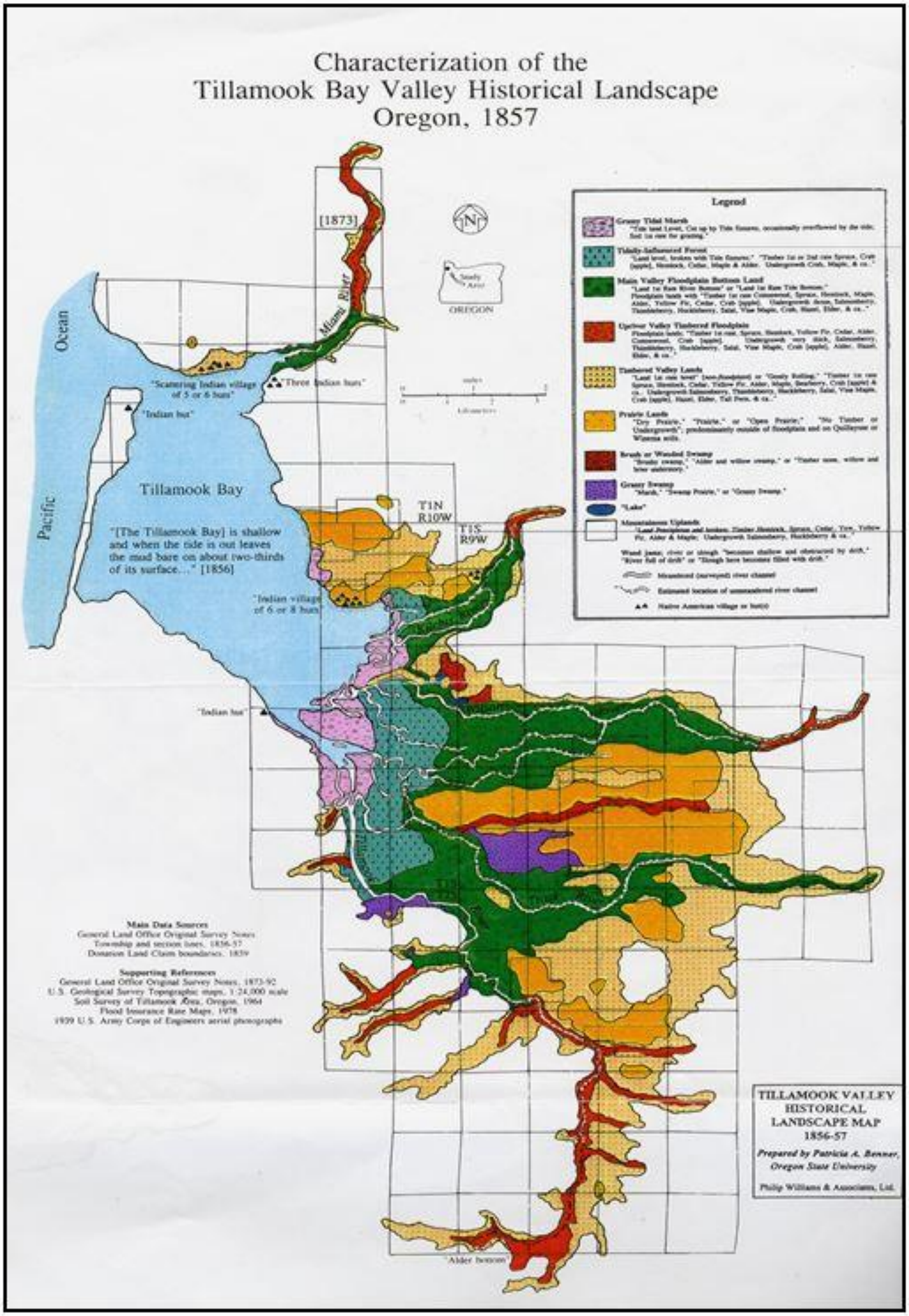

Figure 3. Historic vegetation map (by Patricia Benner; OSU)

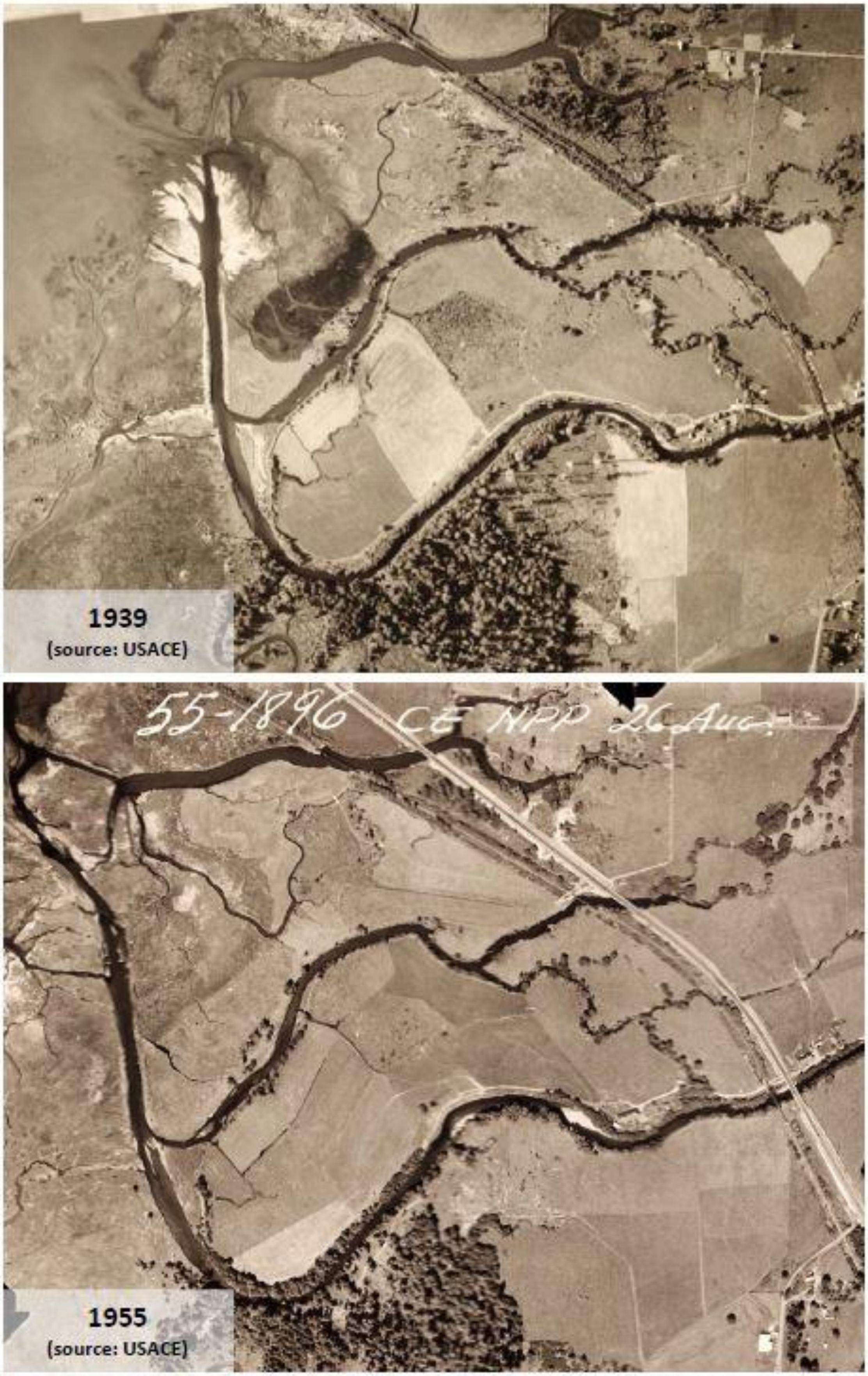

Figure 4. 1939 and 1955 air photos of the mouth of the Kilchis River

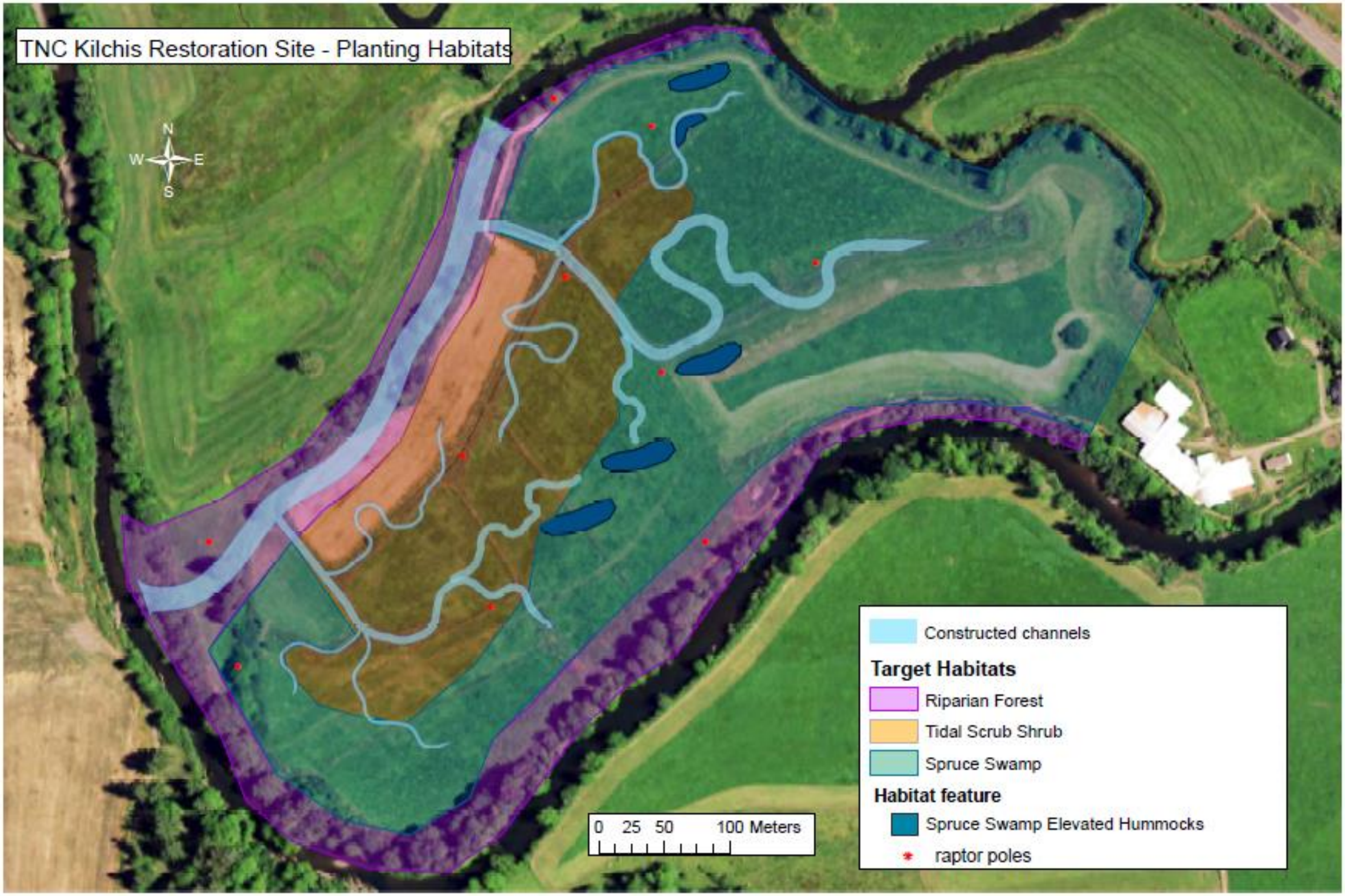

Figure 5. Dooher Tract Restored Habitats. Priority Ecological Systems and Constructed Channels.

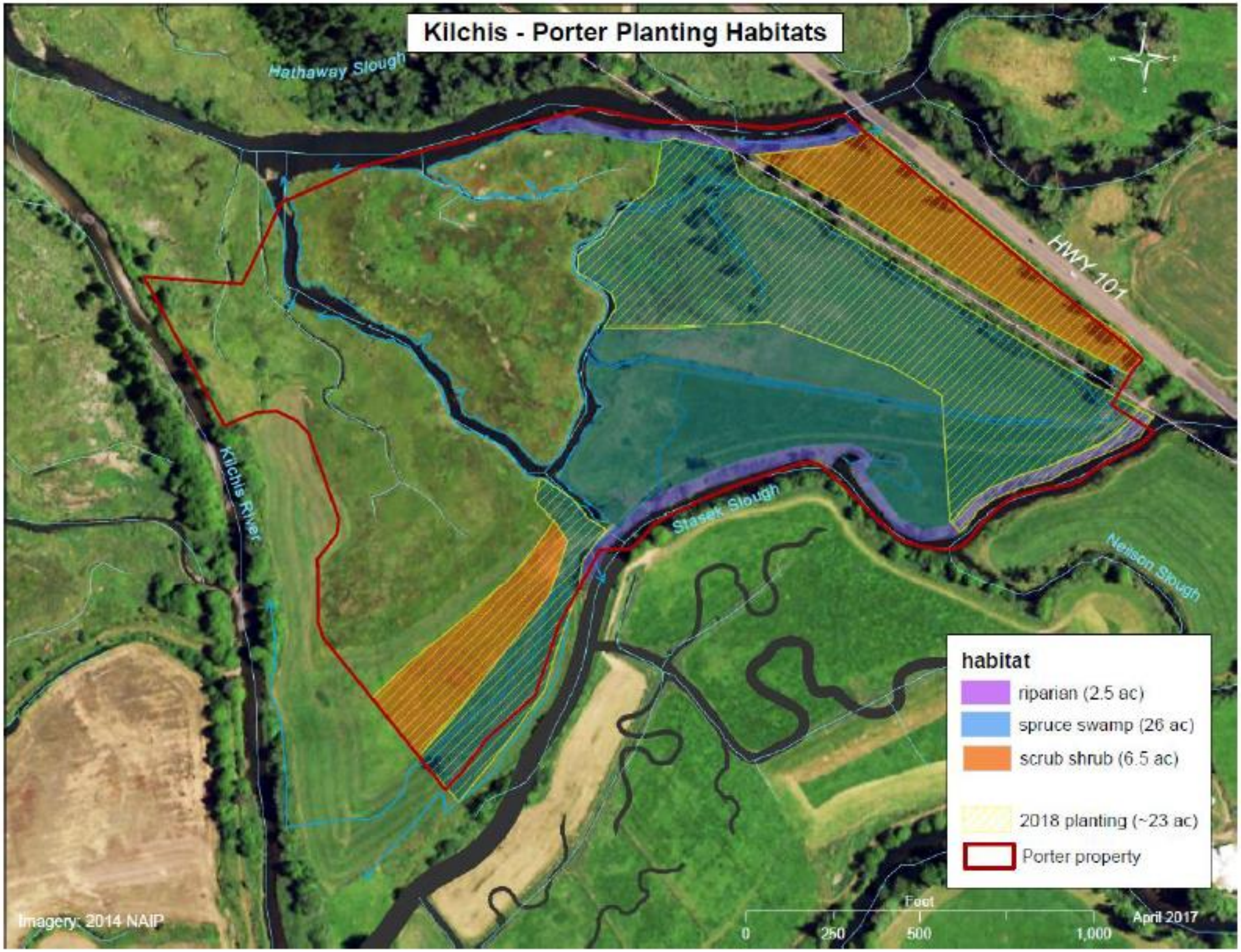

Figure 6. Porter Tract Proposed Restoration Habitats and OWEB Priority Ecological Systems.

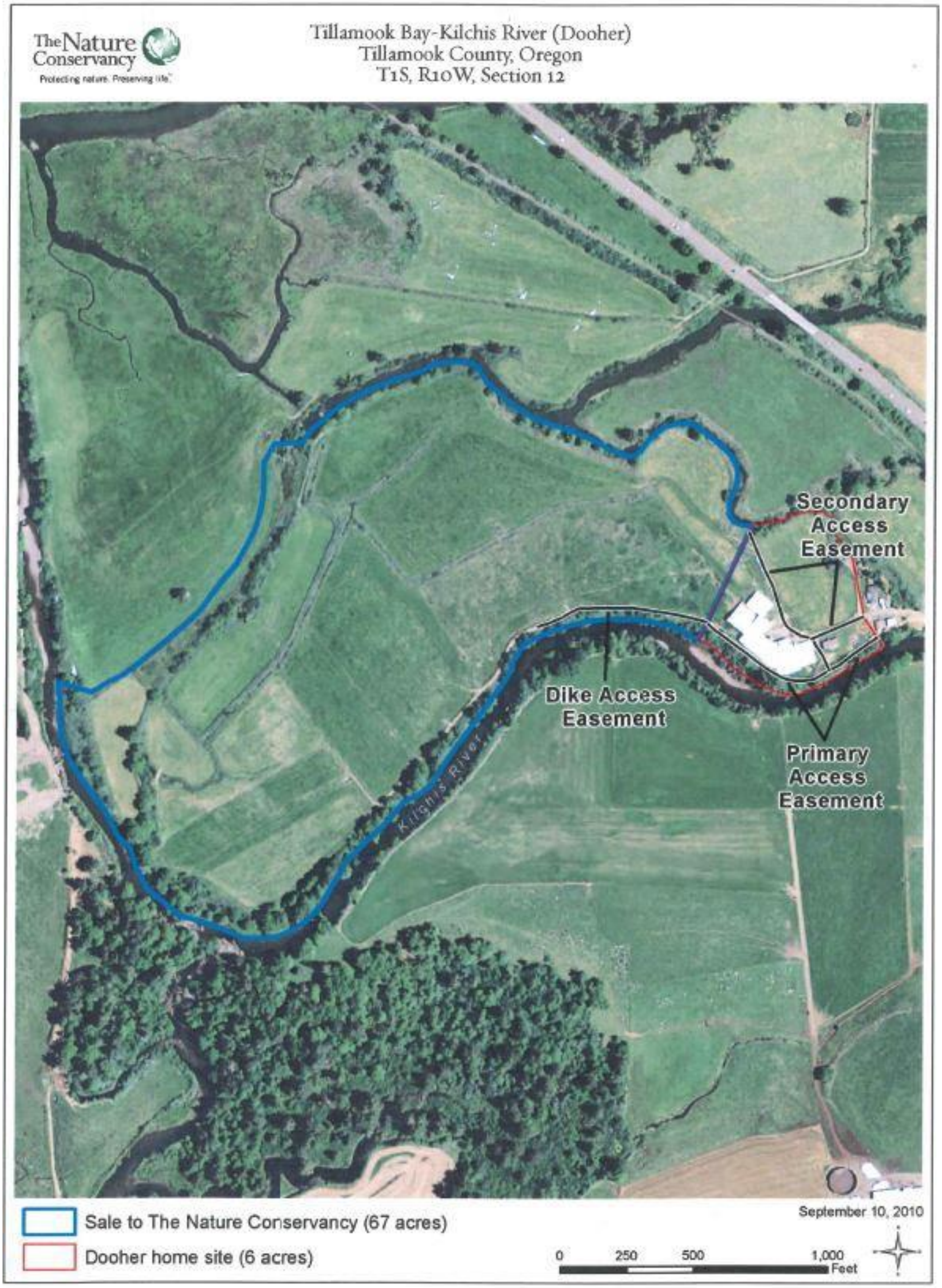

Figure 7. Location of TNC access easements and Dooher dike maintenance easement.

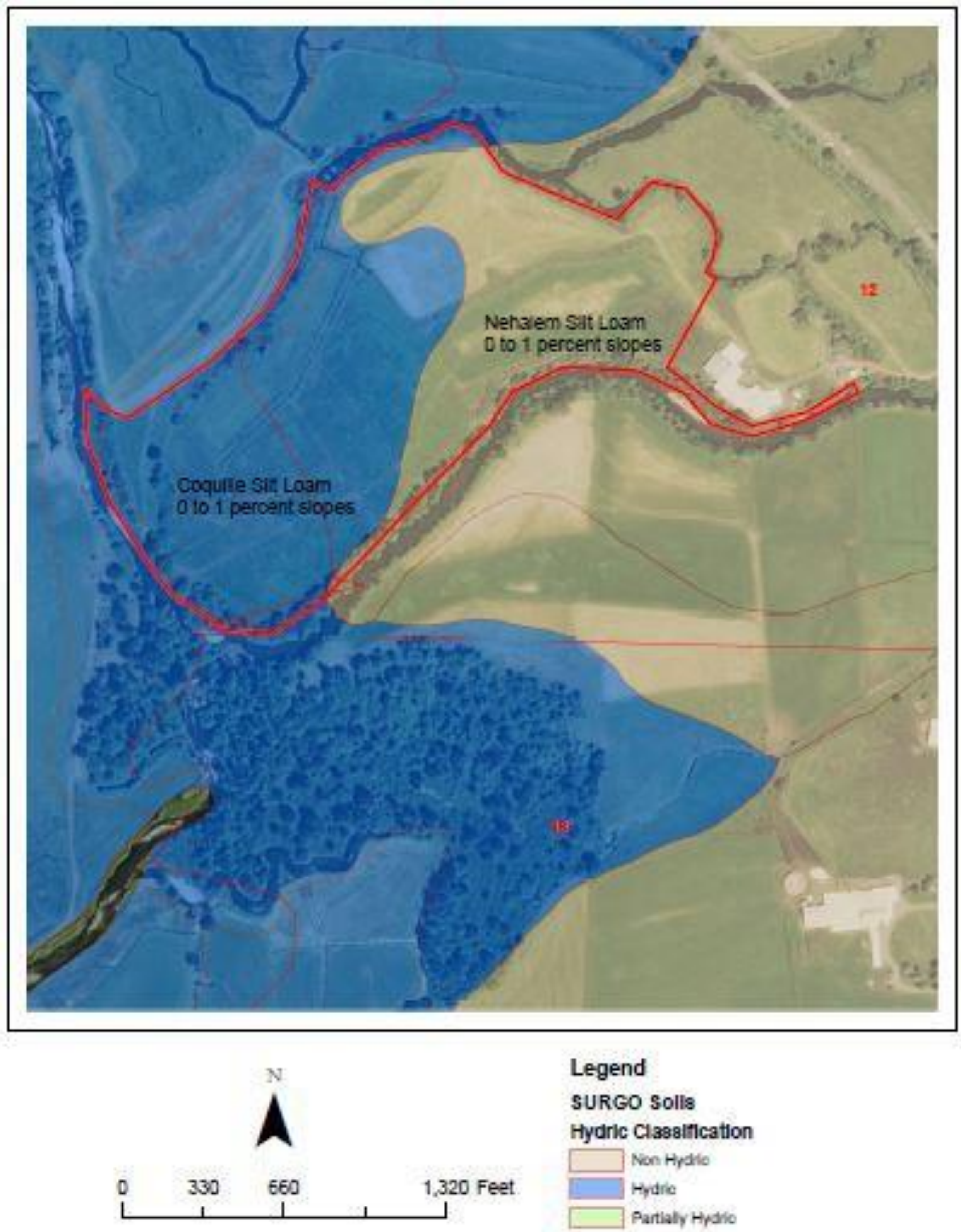

Figure 8. NRCS soils map of Kilchis Estuary Preserve.

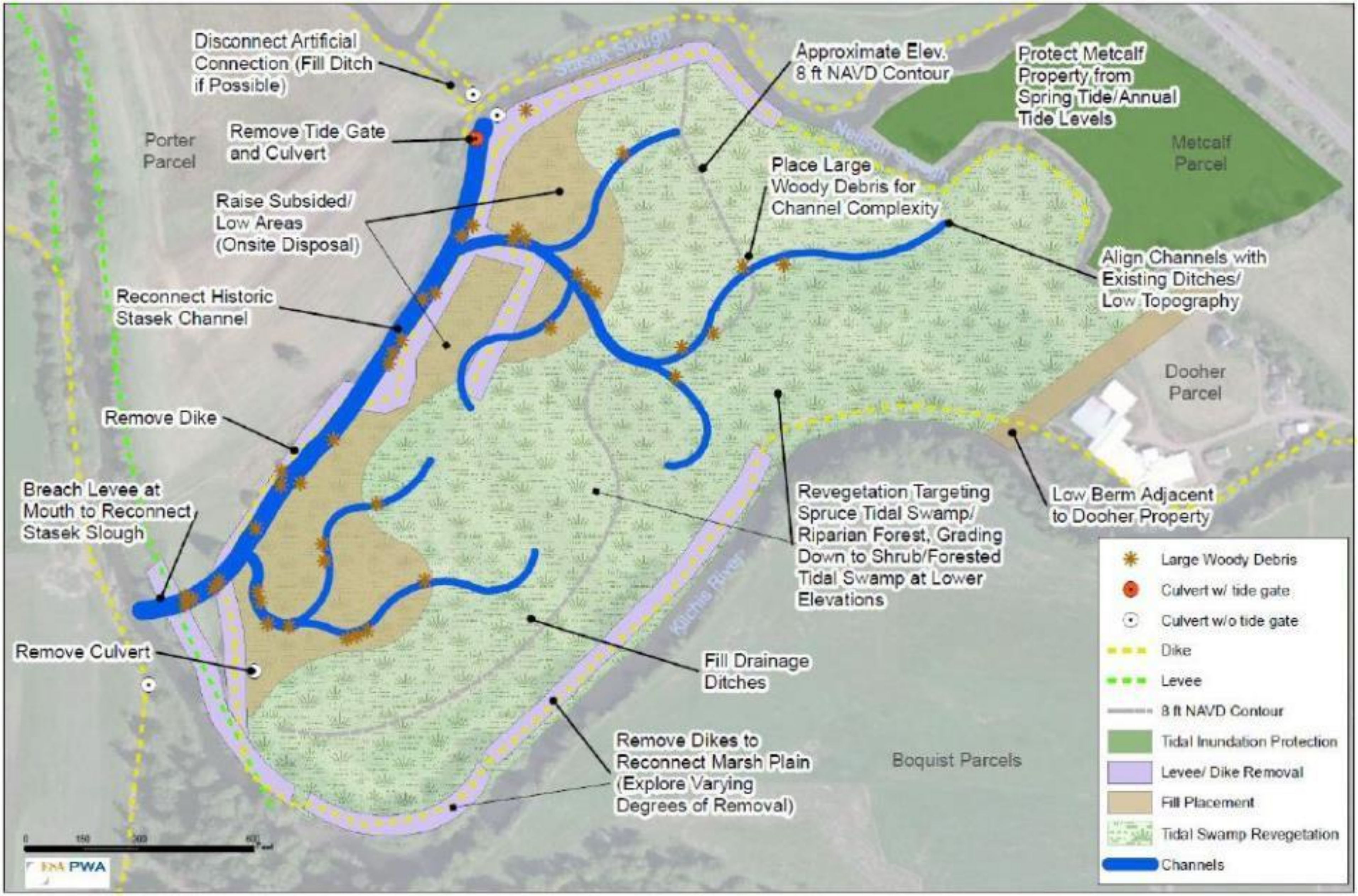

Figure 9. Dooher Tract Restoration Concept Plan Map (from ESA PWA et al. 2013)

Figure 10. Native Tidal Wetlands on Porter Tract

Figure 11 Porter Tract 0.1 acre Inholding shown as small rectangular area on southern boundary adjacent to Stasek Slough

Figure 12. Photo Point Monitoring Locations for Dooher and Porter Tracts

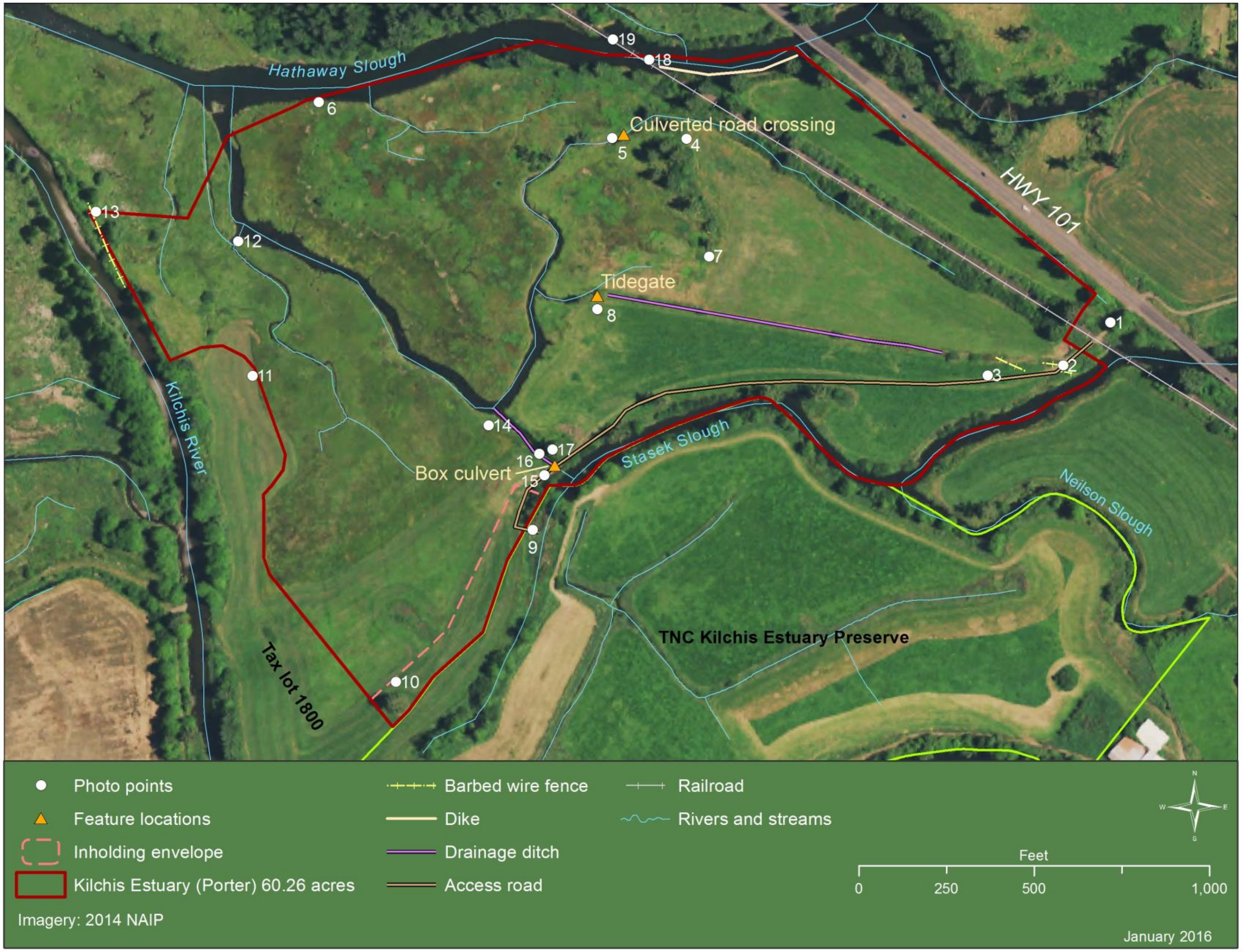

Figure 13. Porter Tract Past Site Alterations

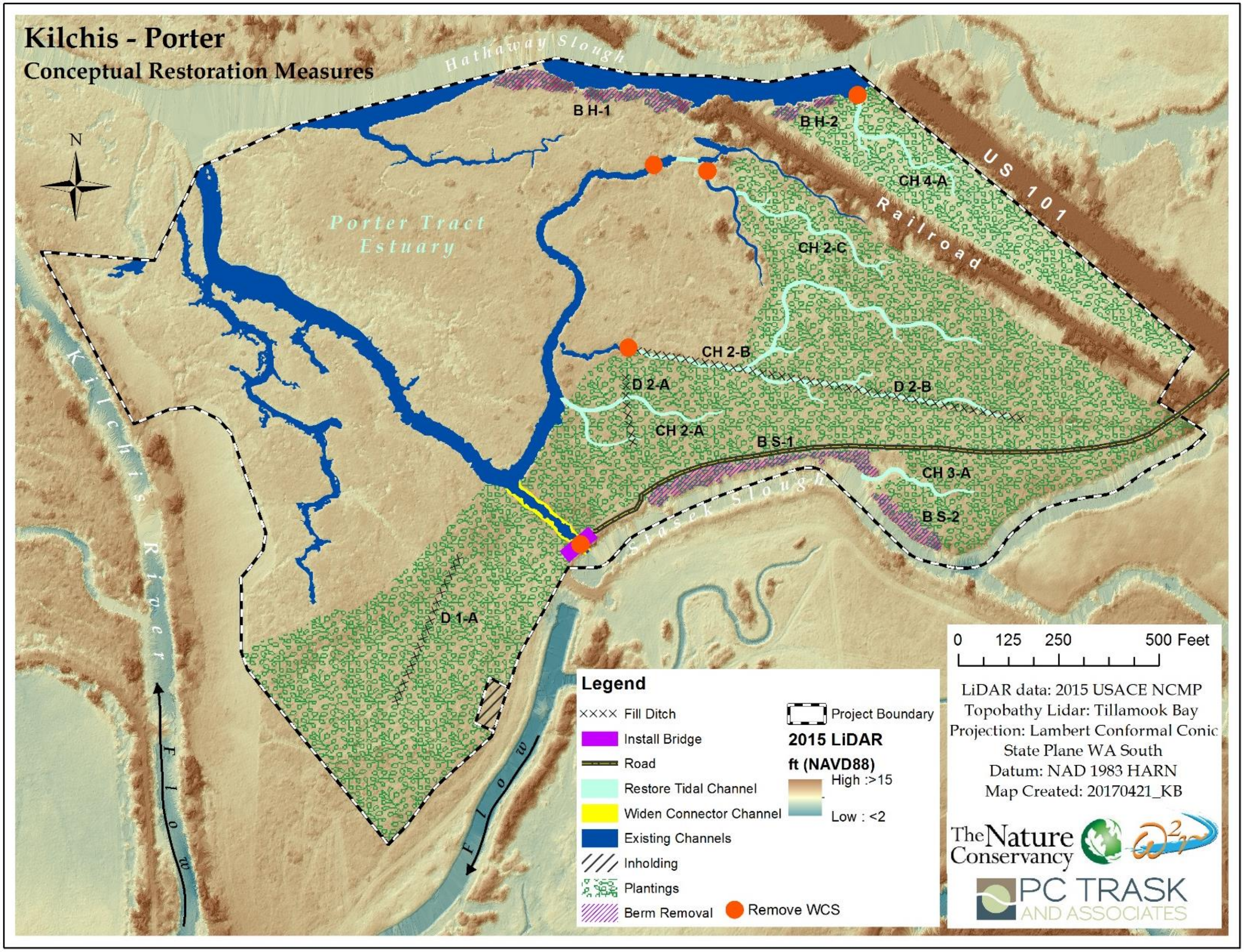

Figure 14 Porter Tract Conceptual Restoration Plan

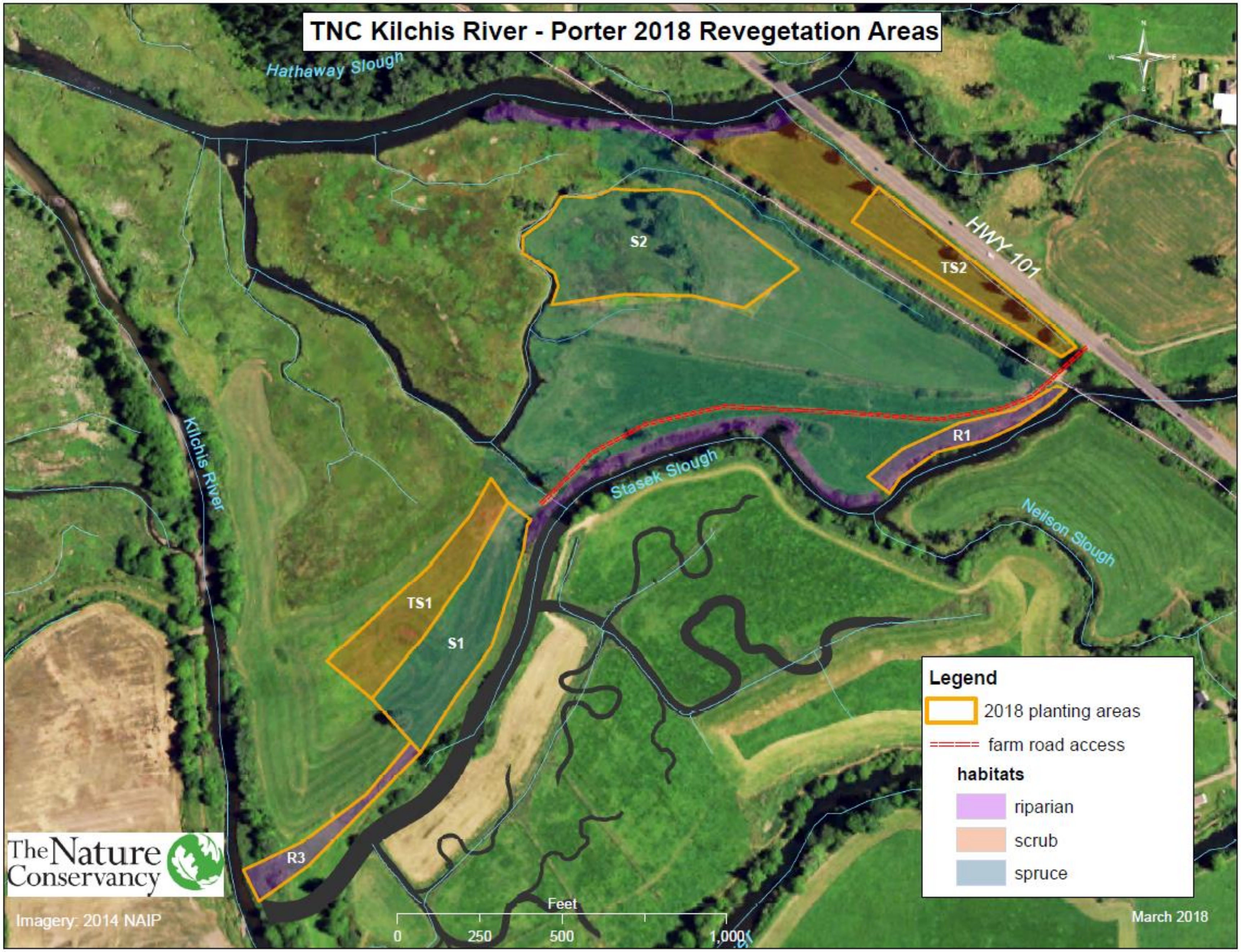

Figure 15 Kilchis Porter Tract 2018 Re-vegetation Areas

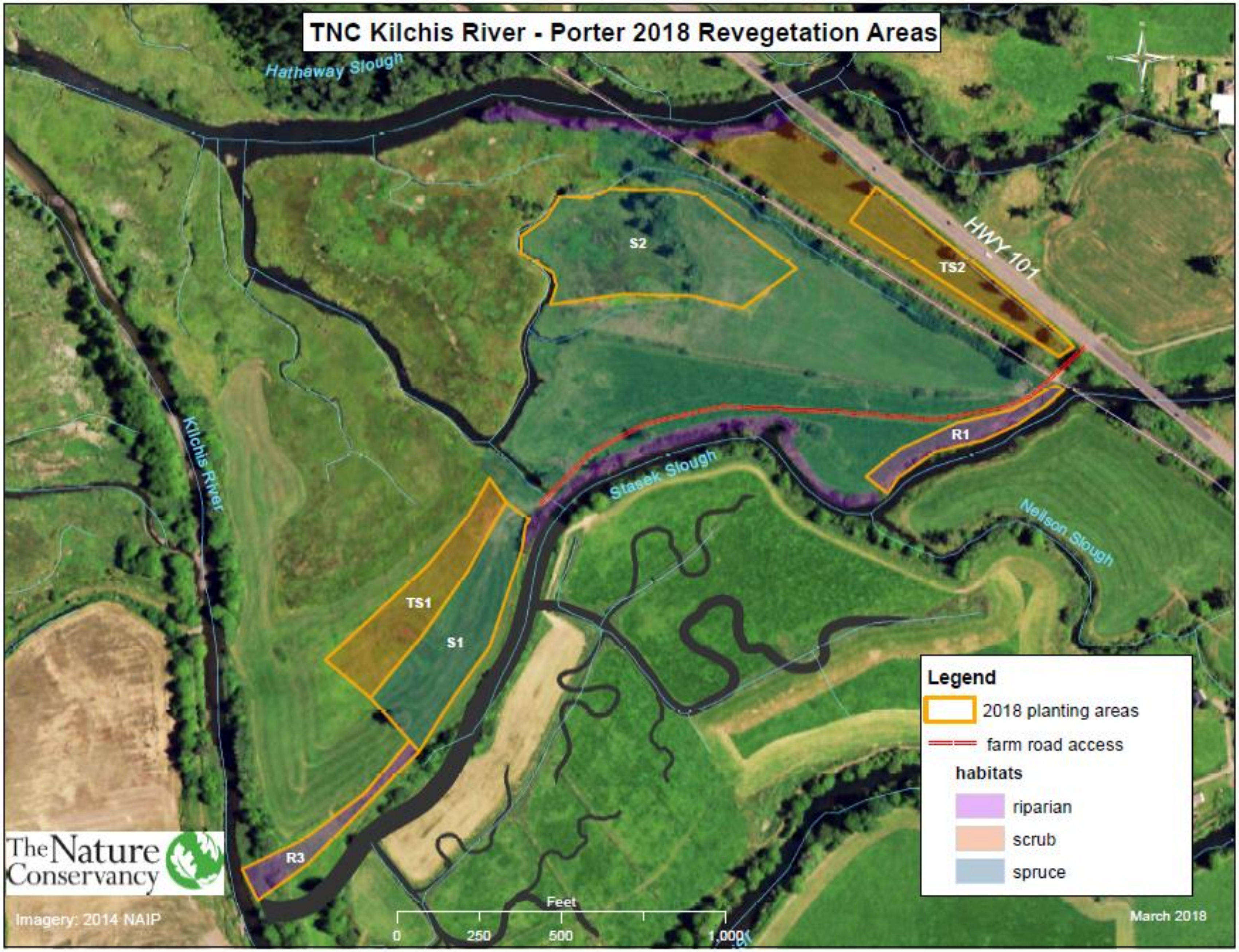

Figure 16. Kilchis Porter 2018 Revegetation Areas

Figure 17. Locations of Water Level Loggers at Kilchis Preserve for Hydrologic Monitoring

Table 1. Non-priority animals expected to benefit from Kilchis Estuary restoration

Fish/Aquatic species	Birds	Mammals
American shad	Bald eagle	Harbor seals
Bat ray	Osprey	Beaver
Bay goby	Northern harrier	River otter
Bay pipefish	Peregrine falcon	Raccoons
Bay shrimp	Great blue heron	Roosevelt elk
Blue mussel	Band-tailed pigeon	Black-tailed deer
Brown rockfish	Great egret	Little brown bat
California halibut	Snowy egret	
Chinook salmon	Canada goose	
Chum salmon	Mallard	
Coastal cutthroat trout	Northern pintail	
Coho salmon	American widgeon	
Copper rockfish	Cinnamon teal	
Deepbody anchovy	Brandt’s cormorant	
Dungeness crab	Green heron	
English sole	Western sandpiper	
Eulachon	Dunlin	
Grass rockfish	Killdeer	
Green sturgeon	Greater yellowlegs	
Jacksmelt	Common snipe	
Leopard shark	Whimbrel	
Lingcod	Black-bellied plover	
Longfin smelt	Willet	
Night smelt	Vaux’s swift	
Northern anchovy	Tree swallow	
Olympia oyster	Purple martin	
Pacific herring	Willow flycatcher	
Pacific lamprey	Swainson’s thrush	
Pacific littleneck clam	Red-breasted sapsucker	
Pacific sand lance	Downy woodpecker	
Pacific sanddab	Pacific slope flycatcher	

Pacific staghorn sculpin
Shiner perch
Slough anchovy
Speckled sanddab
Spotted sandbass
Starry flounder
Steelhead
Surf smelt
Threadfin shad
Threespine stickleback
Topsmelt
White seabass
White sturgeon

Wilson’s warbler
Chestnut-backed chickadee
Pacific wren
Yellow warbler
Hermit warbler
Black-throated grey warbler
Orange-crowned warbler
Rufus hummingbird

Table 2. ETG field notes, Kilchis restoration 4/16/12 site visit (from ESA PWA 2012). See Table 3 for plant species codes.

Map code	Notes
A	Vegetation dominated by reed canarygrass (PHAARU), meadow foxtail (ALOPRA), creeping bentgrass (AGRSTO). Veg indicates little or no salinity under current diked/tide gated conditions.
B	Vegetation dominated by creeping bentgrass (AGRSTO) and water foxtail (ALOGEN). Vegetation indicates little or no salinity under current diked/tide gated conditions.
C	Vegetation along channel at C = PHAARU, slough sedge (CAROBN), JUNEFF. Based on LiDAR, this area is probably subsided.
D	Vegetation dominated by ALOPRA, tall fescue (FESARU), AGRSTO
E	Veg in triangle between mowed area and channel = PHAARU
F	Vegetation dominated by ALOPRA and AGRSTO, with Pacific silverweed (POTANS) and Baltic rush (JUNBAL) interspersed
G	CAROBN; impounded area
H1	Large wooden box culvert, possible former tide gate; see photos; blocked by woody debris. Channel between H1 and H2 appears to be an excavated artificial connection between Stasek and Hathaway sloughs
H2	Wood and rock remnants from likely former tide control structure
I	Fully tidal marsh; vegetation largely native, dominated by typical high marsh species (CARLYN, AGRSTO, JUNBAL, ARGEGE, OENSAR, LOTCOR, Rumex sp., HERMAX, DESCES, GALAPA). Channel edges dominated by CARLYN.
J	Tide gate on small sub-tributary to Hathaway Sl -- see photos
K	Forb-rich high marsh, indicating very slightly brackish conditions; dominants include FESARU, ARGEGE, JUNBAL; common forbs includes ANGLUC, SYMSUB, ACHMILL; some CAROBN clones. Likely appropriate area for SIDHEN introductions if landowner is interested.
L	Veg is similar to K; soil has hydric indicators at 4" below surface
M	FESARU, AGRSTO; likely freshwater wetland or transitional to upland
N	House here has never flooded, according to information received by Dick V.
P	TCCA culverts layer indicates culvert here (but no tide gate). Not viewed in the field.
Q	Stasek Slough "sediment bench." Veg is introduced pasture grass, mostly FESARU and ALOPRA; soil looks like typical coastal alluvium deposit (likely silt loam), no obvious hydric indicators in surface 12"
R	Viewed the Squeedunk Swamp from this location; see photos.
S	Based on LiDAR, this area is probably subsided.
T	Tide gate between Stasek Slough and the diked pasture to the south. This tide gate is functional -- see photos.
U	Upstream limit of Neilson Slough dike as mapped by Mattison. Appears accurate, based on LiDAR.
V	Tide gate on upper end of tributary to Hathaway Slough. Appears to be functional -- see photos.

Table 3. Plant species codes used in field notes in Table 2. Kilchis restoration 4/16/12 site visit (from ESA PWA 2012).

Code	Sci. name	common name	Other names
AGRSTO	*Agrostis stolonifera*	creeping bentgrass	
ALOGEN	*Alopecurus geniculatus*	water foxtail	
ALOPRA	*Alopecurus pratensis*	meadow foxtail	
ANGLUC	*Angelica lucida*	sea-watch angelica	
CARLYN	*Carex lyngbyei*	Lyngbye's sedge	
CAROBN	*Carex obnupta*	slough sedge	
DESCES	*Deschampsia cespitosa*	tufted hairgrass	
FESARU	*Festuca arundinacea*	tall fescue	*Schedonorus phoenix, Lolium arundinaceum*
GALAPA	*Galium aparine*	common bedstraw	
HERMAX	*Heracleum maximum*	cow parsnip	
JUNBAL	*Juncus balticus*	Baltic rush	
JUNEFF	*Juncus effusus*	soft rush	
LOTCOR	*Lotus corniculatus*	birdsfoot trefoil	
OENSAR	*Oenanthe sarmentosa*	water parsley	
POTANS	*Potentilla anserina*	Pacific silverweed	*Argentina egedii*
PHAARU	*Phalaris arundinacea*	reed canarygrass	
Rumex	*Rumex sp.*	Dock	
SYMSUB	*Symphyotrichum subspicatum*	Douglas' aster	

Table 4. Monitoring Photo Point Locations Table

Photo Point #	Photograph #s	Description (view and location)	Latitude	Longitude
1	1.1 north 1.2 northwest	At southeastern boundary of subject property, east of photo point #2, north of Kilchis River, along dike road.	45° 29' 44.405"	123° 51' 20.001"
2	2.1 east 2.2 northwest 2.3 southwest	West of photo point #1, along bend in dike road, subject property to the north, river to the south.	45° 29' 44.526"	123° 51' 27.172"
3	3.1 northeast 3.2 northwest 3.3 southwest	Southwest of photo point #2, along dike road, subject property to the north, river to the south.	45° 29' 42.213"	123° 51' 30.706"
4	4.1 northwest	Looking northwest at interior mowed path running north and south across subject property.	45° 29' 37.579"	123° 51' 36.552"
5	5.1 southeast 5.2 northeast 5.3 west	Near western boundary of subject property, northwest of river bend.	45° 29' 35.093"	123° 51' 46.334"
6	6.1 southeast	Western boundary of subject property looking southeast, agricultural field on the left, riparian trees and vegetation on the right.	45° 29' 35.747"	123° 51' 48.499"
7	7.1 southeast 7.2 northeast 7.3 south	Western end of northern boundary of subject property.	45° 29' 41.147"	123° 51' 51.685"
8	8.1 north 8.2 east 8.3 south 8.4 west	Center of northern boundary of subject property, on bank of Stasek Slough near big Sitka spruce; building across the slough.	45° 29' 52.404"	123° 51' 37.036"
9	9.1 north 9.2 east 9.3 south 9.4 west	In the bend of Stasek Slough, in the northeastern portion of subject property.	45° 29' 50.560"	123° 51' 19.314"
10-19	Exact locations to be determined after restoration construction phase			

Table 5 Porter Photo Point Locations

Photo Point #	Photo Point Location	Latitude/Longitude	Photo #	Direction	Description of View
P1	Railroad bridge over Stasek Slough	45.498759° N 123.854970° W	1.1	280°	View of north bank of Stasek Slough on eastern portion of property
P2	Driveway northeast of railroad crossing	45.499086° N 123.855291° W	2.1	NW	Area between railroad and highway formerly dominated by reed canary grass.
P3	Railroad tracks, close to halfway between Stasek and Hathaway Sloughs	45.499783° N 123.857506° W	3.1	205°	Area north of drainage ditch where two new parallel channels will be excavated
			3.2	90°	Area between railroad and highway that occassionally floods in winter.
P4	Railroad tracks, NW of photo point 3	45.500543° N 123.859393° W	4.1	200°	View of the wet field southeast of one of two water control structures to be removed
			4.2	65°	Looking towards tide gate on Hathaway Slough
P5	Railroad tracks, NW of photo point 4	45.500613° N 123.859650° W	5.1	240°	Looking towards channel restoration area between two water control structures and Hathaway berm removal
P6	Railroad tracks, NW of photo point 5, about 10 ft from Hathaway Slough bridge	45.500824° N 123.860126° W	6.1	230°	Berm along Hathaway Slough
			6.2	195°	Channel restoration area near two water control structures
			6.pano	155-240°	Hathaway Slough bank near railroad bridge
P7	Railroad bridge over Hathaway Slough, close to south bank	needs to be re-GPS'ed	7.1	210°	Berm along Hathaway Slough
			7.pano	140-250°	Berm along Hathaway Slough
P8	Railroad bridge over Hathaway Slough, close to north bank	45.501176° N 123.861032° W	8.1	215°	Berm along Hathaway Slough
			8.2	150°	Berm along Hathaway Slough
			8.3	110°	Hathaway Slough bank around railroad bridge. Tide gate structure is on the bank left of the railroad.
P9	North bank of Hathaway Slough, northwest of railroad bridge	45.501355° N 123.861499° W	9.1	250°	Bank of Hathaway Slough

P10	Along eastern fork of Porter Slough, west of WCS	45.500252° N 123.861163° W	10.1	50°	Channel flowing into water control structure
P11	Berm on Stasek Slough NE of Porter Slough box culvert	45.497942° N 123.861167° W	11.1	280°	Porter Slough channel prior to widening
			11.2	215°	Porter Slough crossing over box culvert prior to bridge installation
			11.3	20°	Driest portion of property south of drainage dike
P12	Berm on Stasek Slough SW of Porter Slough box culvert	45.497625° N 123.861493° W	12.1	35°	Stasek Slough bank prior to installation of bridge over Porter Slough
			12.2	340°	Porter Slough channel prior to widening
			12.3	265°	Planting area on SW portion of property. Willows planted weeks prior to this photo are sticking out of the high tide flood
P13	North corner of Hathaway inholding	45.496821° N 123.862133° W	13.1	170° (seems wrong)	Planting area on southwest portion of property
			13.2	50°	View of Stasek Slough at confluence with Dooher tract Channel 2
P14	Near northeastern boundary of Geinger property boundary	45.498373° N 123.864665° W	14.1	230°	TNC property adjacent to Kilchis river. Round wooden post marks Geinger/TNC property boundary
			14.2	190°	Looking into center of property
			14.3	100°	Property line with Geinger is marked by large wooden posts. Mowed line and metal t-posts mark old property boundary.

Appendix A. Dooher Tract Monitoring Plan

1. Performance Standards—Hydrology

Performance Standard 1: Tidal effects, as measured by tidal levels, duration, and timing, in constructed tidal channels (for average high tides without influence of river flooding) mimic tidal effects occurring at control gages on the Kilchis River located on river mile 1.0.

Performance Standard 2: There shall be no fish entrapment in isolated pools at low tide (LMW).

Performance Standard 3: Floodwaters overtop constructed natural river levees during floods that reach or exceed river flood stage levels. Ordinary High Water (OHW) is 11.42 feet such that floodwaters exceeding this level will overtop the constructed levees.

Performance Standard 4: A wetland delineation light (DSL parameters) shall be conducted during a normal precipitation year, at least three growing seasons after construction, to identify the new wetland boundary and wetland acreage. Sampling will demonstrate that any areas filled during construction and located at a lower elevation than the upper edge of the new wetland boundary, meet wetland criteria.

2. Performance Standards—Vegetation

All cover standards are absolute cover unless stated otherwise. Habitats are distinguished by elevation and planting zones and include scrub-shrub (7-8.5' NAVD88), Sitka spruce tidal swamp (8.5' to wetland upper boundary) and Sitka spruce riparian forest (above wetland boundary).

Performance Standard 1: Cover of native species increases from initial planting levels after 5 years and is as least 25% after 10 years.

Performance Standard 2: Cover of key invasive species[1] does not increase from baseline levels after 5 years and is reduced by at least 15% from baseline after 10 years.

Performance Standard 3: Bare ground decreases to 20% or less after 5 years.

Performance Standard 4: Survival of planting stock is greater than 70% after 3 years (OWEB standard)[2].

Performance Standard 5: By Year 5 and thereafter, there are at least 3 different native species established in each habitat type. To qualify, a species must have at least 5% average cover in the habitat class and occur in at least 10% of the plots sampled.

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[1] Key invasive species include reed canary grass, non-native blackberries, Canada thistle, English ivy, bindweed, policeman's helmet, jewelweed, yellow-flag iris, purple loosestrife, and spartina.

[2] 70% survival (OWEB standard) of the planted individuals and/or clumps of willows:

- 1345 native plant stems per acre in Spruce Swamp habitat,
- 922 stems per acre in Riparian Forest habitat, and
- 467 stems per acre in Scrub-Shrub Tidal marsh habitat

Dooher Tract Vegetation Monitoring Objectives and Methods

Vegetation Monitoring Objectives

1) Be 80% confident of detecting a 25% change in cover estimates of native plant species between pretreatment and 10 years post restoration plantings.
2) Be 80% confident of detecting a 15% change in cover estimates of non-native plant species between pretreatment and every other year post restoration plantings.
3) Be 80% confident of detecting a 10% change in cover estimates of bare ground between pretreatment and 5 years post restoration plantings.
4) Document mortality of planted stock each year for 3 years after planting.
5) Monitor for species diversity

Vegetation Monitoring Methods

Line intercept transects will be used to measure absolute percent cover of key native and key invasive species. This measurement comprises all instances where the species intersects the line, including ground and canopy cover. Species intercepting the measuring tape are recorded if they meet the gap size standards. The gap size sets rules for the minimum amount of cover a species must intercept the line to be measured. It also indicates the maximum size of gaps within a cover recording that can be ignored. The gap sizes are:

Bare soil: 5 cm
Gramminoids: 5 cm
Invasive species except blackberries: 5 cm
Blackberries: 10 cm
Trees and shrubs: 10 cm

Plants intercepting the transect line will be recorded as either native or invasive to measure cover for Vegetation Performance Standards 1 and 2. Key invasive species to be included in this measurement are listed below. Key native species noted below will be recorded individually to track native plant establishment for Vegetation Performance Standard 5.

i. Key invasive species include
   a. Reed canary grass, *Phalaris* arundinacea
   b. Non-native blackberries, *Rubus armeniacus* and *Rubus lacinatus*
   c. Canada thistle, *Cirsium arvense*
   d. English ivy, *Hedera helix*
   e. Bindweeds, *Convolvulus arvensis* and *Convolvulus sepium*
   f. Policeman's helmet and jewelweed, *Impatiens glandulifera* and *Impatiens noli-tangere*
   g. Yellow-flag iris, *Iris pseudacorus*
   h. Purple loosestrife, *Lythrum salicaria*
   i. Saltmeadow cordgrass, *Spartina patens*

ii. All trees and shrubs are to be recorded to species.
iii. Native gramminoids are to be recorded to genus. If several native species within a genus are adjacent, they will be recorded together. This is common for rushes in *Juncus*.
iv. Non-native gramminoids (except reed canary grass) are to be lumped together into a category called “other pasture grass”

Twenty 50-meter long permanent line intercept transects are established on the Dooher tract (Figure A). The random sampling is stratified by the three planting schemes for habitats based on elevation: Spruce swamp, scrub shrub, and riparian. In the spruce swamp habitat, the sampling was further stratified into diked, undiked, and constructed hummock habitats. In the scrub shrub habitat, the transects off a baseline captured samples in higher and lower elevations off the excavated reconnection of Stasek slough to the Kilchis River. The riparian habitat, the planting zone was too narrow and irregular to use a baseline so random points were selected along the major channel boundaries to establish start points for 50-meter transects angled so they would fit into the riparian planting zone.

Monitoring will occur every other year for up to 10 years. When the performance standards are met for a habitat zone, line intercept transects in that habitat zone can be dropped.

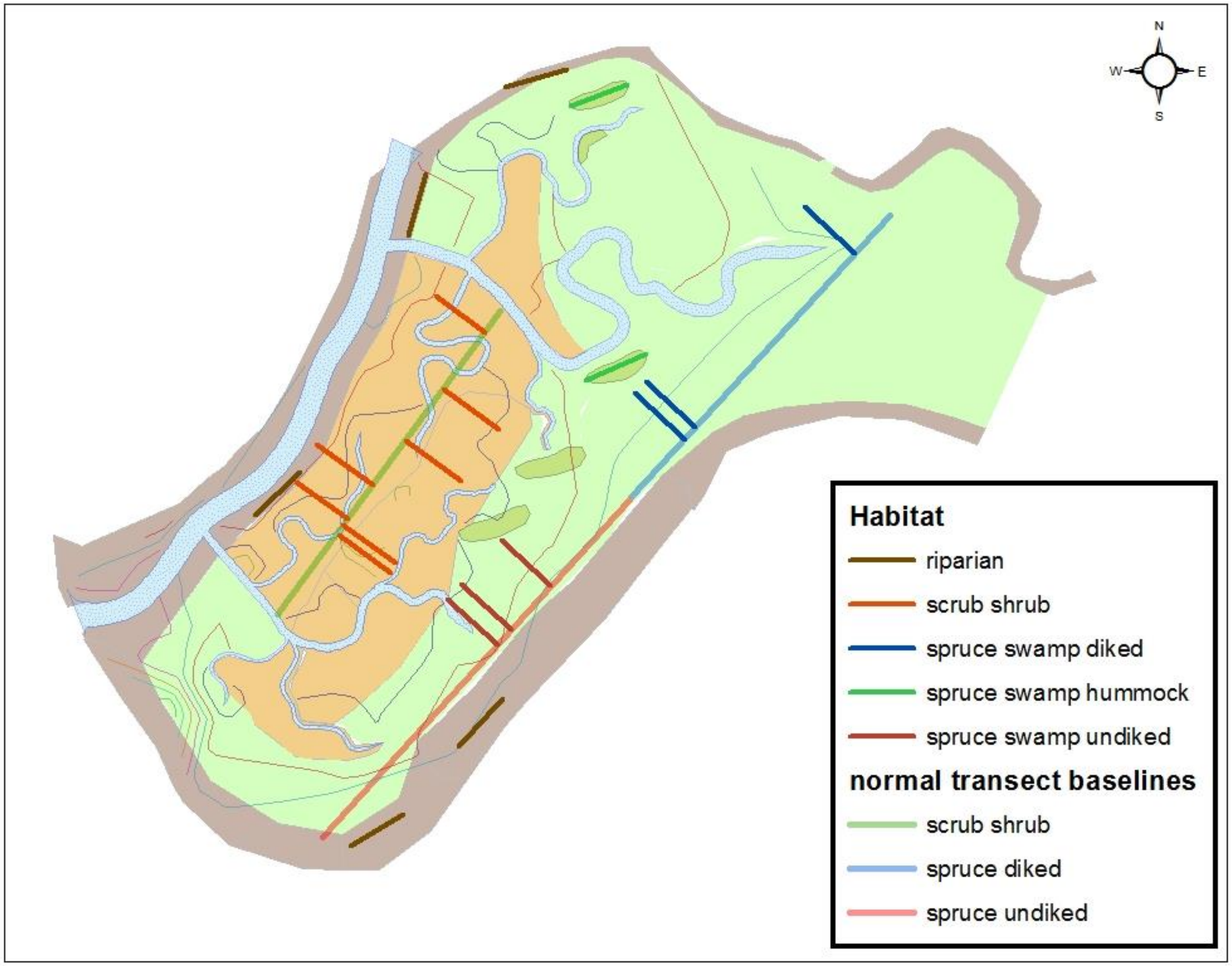

Figure A. Dooher tract line intercept vegetation monitoring locations

Random plots are used to monitor for survivorship of planted species. The plot locations are determined using a GPS to identify a cite a starting point for a 10 X 10 meter plot. Sufficient plots are taken to insure coverage in each of the target habitats (OWEB priority ecological systems).

Appendix B. Porter Tract Draft Monitoring Plan

Performance Standards

1. Vegetation Standards

Performance Standard 1: Survival of planting stock is greater than 70% after 3 years (OWEB standard)[3].

2. Hydrology Standards

Performance Standard 1: Tidal effects, as measured by tidal levels, duration, and timing, in constructed tidal channels (for average high tides without influence of river flooding) mimic tidal effects occurring at control gages on the Hathaway Slough.

Performance Standard 2: Floodwaters overtop constructed natural river levees during floods that reach or exceed 2 year exceedance river flood stage levels.

Vegetation Monitoring Methods

10 X 10 M (100m2) Plots: Randomly located plots will be used to determine survivorship of planted species in revegetated wetlands. Coordinates for randomly located plots will be generated by GPS unit. A sufficient number of plots will be placed in each of the major habitat types: riparian, scrub-shrub tidal marsh, and Sitka spruce swamp, to cover approximately 1% of the total revegetated area. This should insure repeatable values of survivorship that will identify any trends indicating if the re-vegetation standard is being met. If the standard is not being met in a given habitat, further analysis and consultation with OWEB will occur.

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[3] 70% survival (OWEB standard) of the planted individuals and/or clumps of willows:

- 1345 native plant stems per acre in Spruce Swamp habitat,
- 922 stems per acre in Riparian Forest habitat, and
- 467 stems per acre in Scrub-Shrub Tidal marsh habitat