New River, Sixes River, Elk River, and Euchre Creek Tidal Wetlands Assessment

September 20, 2016

In partial Fulfillment of requirements of OWEB grant #214-2050
Prepared for the South Coast Watershed Council

Cindy Ricks Myers
Curry Watersheds Water Quality Monitoring Program
info@currywatersheds.org
With Assistance by Ken Bierly, Bierly & Associates

CURRY WATERSHEDS PARTNERSHIP

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INTRODUCTION

Background

A recent evaluation of Oregon's Coastal Management Program (Cogan Owens Cogan LLC, 2014) has concluded: "*Available evidence on the health of Oregon's estuaries is mixed. Some estuarine indicators demonstrate the significant adverse effects of past and present human activities; conversely, others show the positive impact of recent protective measures. Other indicators suggest continued threats and risks to estuaries, or raise concerns about long-term, cumulative effects of change. Limited data availability for most indicators makes for high scientific uncertainty and underscores the need for more focused research and regular monitoring.*

- *Historic loss of tidal wetlands is high, but restoration of diked former wetlands is reversing loss trends, increasing habitat availability and the functionality of estuaries for juvenile salmon and other estuary-dependent species.*
- *Estuarine habitats are well protected from some potential disturbances like dredging, filling, and other major physical alterations.*
- *Aquatic nuisance species are already well established in most Oregon estuaries; new arrivals and potential introductions pose unknown threats to native species and estuarine ecosystem function generally.*
- *Freshwater inflow to estuaries is below historic levels, particularly during summer months, based on appropriated withdrawals. The ecological impacts of these changes are not known, but projected growth in coastal population and water use suggest the need for research to determine impacts and the need for minimum estuary inflows.*
- *Water quality is insufficiently monitored to draw conclusions about the condition and risks associated with increasing point source and runoff pollution introductions that can be expected as population grows.*
- *Principal threats to estuaries today are continued physical alterations, mostly shoreline modifications for upland development and dredging for navigation projects; invasions of aquatic nuisance species; excessive sediment and runoff pollution from local and watershed sources, and other pressures associated with population and tourism growth.*"

This report helps to identify opportunities to further improve the health of Oregon's estuaries along the South Coast. It is a companion to the Oregon South Coast Estuaries: Hunter Creek, Pistol River, Chetco River, & Winchuck River Tidal Wetland Assessment (Myers, 2015a) and Rogue River Estuary Tidal Wetlands Assessment (Myers, 2015b).

Purpose

In 2014, the South Coast and Lower Rogue Watershed Councils were awarded OWEB funding in part to assess tidal wetlands in the New River, Sixes River, Elk River and Euchre Creek estuaries. This tidal wetlands/estuary assessment is part of a larger effort to develop a strategic plan to guide restoration and conservation efforts in the South Coast watersheds and

engage the community in the effort.

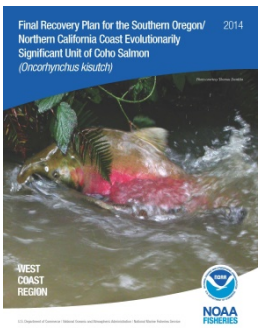
The OWEB grant application (# 214-2050) identified a number of components. This report covers only the tidal wetlands assessment work with the focus on identifying restoration opportunities and priorities.

In 2004 a set of refined and updated maps of tidally-influenced wetlands on the Oregon Coast with hydrogeomorphic (HGM) classification of wetland types were developed (Scranton, 2004). The HGM classification was used as the basis for a Tidal Wetland Rapid Assessment Method, developed by Adamus (2006), for wetland function, risk, and integrity.

In 2007 the Oregon Watershed Enhancement Board and the Department of State Lands added an Estuary Assessment Component to the Oregon Watershed Assessment Manual in 2007 (Brophy).

This current Tidal Wetlands Assessment combines both approaches (HGM and Estuary Assessment) to quantify the extent and causes of habitat loss and hydrogeomorphic changes in tidal wetlands of the four estuaries. The potential for restoring critical habitat and wetland functions is ranked using Ecological Prioritization Criteria (Brophy, 2007), while indicators of function, risk, and integrity are evaluated using scoring models from the HGM method (Adamus, 2006).

One of the specific uses of this work will be associated with the work necessary to recover native anadromous fish populations. All portions of the aquatic environment are important for these fish during portions of their life cycle. Both historic research (Reimers, 1971) and recent research (Jones et.at., 2014) have shown the significance of lower river habitats for multiple species of native fish and expanded our knowledge of the complexity of uses and habitats used by juvenile coho salmon.



Alterations by destruction (loss of area) or modification (loss of complexity and connectivity) of estuarine subtidal and intertidal habitats, and associated tidal wetlands has resulted in the loss of important rearing and migration corridor habitat functions for coho and other salmon in Oregon estuaries. This factor for decline is identified in both the draft Oregon Coastal Coho Salmon and the final Southern Oregon/Northern California Coast Coho Salmon ESU recovery plans.

The recovery plans are available at:
http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/recovery_planning_and_implementation/southern_oregon_northern_california_coast/SONCC_recovery_plan.html
and
http://www.nmfs.noaa.gov/pr/hot_topics/2015/Oct/proposed_recovery_plan_for_coho_salmon.pdf

Project Objectives

1. Provide data that promotes strategic planning for conservation and restoration of tidal wetlands, and facilitates outreach about wetland functions, historic extent, and alterations.
2. Select tidal wetlands in each estuary and conduct surveys of hydrogeomorphic indicators (rapid assessment method) to determine functions and values provided by each wetland.
3. Evaluate risks to integrity and sustainability of the tidal wetlands evaluated.
4. Provide baseline data on indicators of wetland function that can be used to predict and monitor effectiveness.
5. Provide baseline data on species composition and cover to assist with project planning and implementation.

Study Area

The four smaller ocean front drainages to the Pacific Ocean on both sides of Cape Blanco of this study (Figure 1) differ from the drowned river mouth estuaries of the more northern coast of Oregon. General information about each watershed comes from Watershed Assessments completed by the South Coast Watershed Council (Maguire, 2001a, 2001b, and 2001c) and other watershed assessments and special area plans (USFS, 1997; USFS, 1998; USBLM, 1987, 1995, and 2004).

The New River/Floras Lake and Euchre Creek systems have large areas of lowland marsh and sandy uplands fronting the Ocean. Recent mapping and characterization of Pacific Coast estuaries (Heady et.al., 2014) classify the New River, Sixes River and Elk River as lagonal estuaries and Euchre Creek estuary as riverine estuary. Seasonal closure of New River, Sixes River and Elk River to the ocean is common. The aquatic biota is adapted to these closures and resulting changes in salinity and flow regime. The Elk River and upper Sixes Rivers drain the Siskiyou Mountains and have steep, rugged mountainous upper slopes with steep, confined headwater reaches.

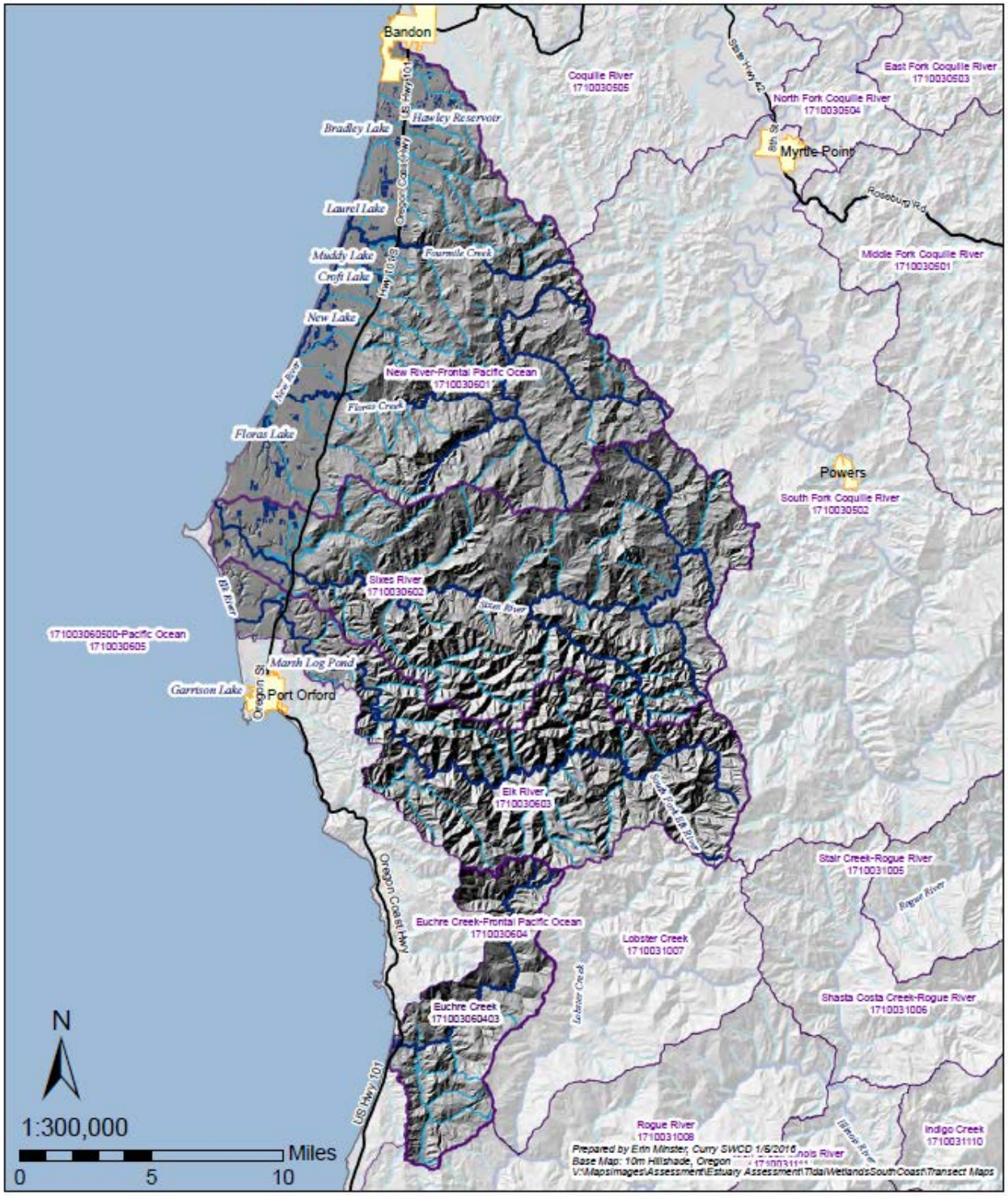
Russell Scranton (2004) has calculated the area (in acres) for each estuary in Oregon. Table 1 displays the areal data for the four estuaries of this analysis.

Estuary	Marine Sourced Low Tidal Wetland	Marine Sourced High Tidal Wetland	Restoration Consideration Area	Potential Forested Tidal Wetland	River Sources Tidal Wetland	Fill	Water	Total
New River	**67.80**	**138.27**	**1132.57**	**100.69**	**4.19**	**5.38**	**302.59**	**1751.51**
Sixes River	**0.89**	**5.11**	**240.98**	**0.67**	**3.39**	**5.46**	**102.58**	**359.08**
Elk River	**1.32**	**13.06**	**214.46**	**21.63**	**4.08**	**13.32**	**86.52**	**354.39**
Euchre Creek	**6.18**	**0.00**	**19.08**	**2.19**	**0.19**	**20.89**	**25.74**	**74.27**

Table 1: Calculated Tidal Wetland Types by Estuary (from Scranton, 2004).

Figure 1: Study Area Watersheds

Tidal Wetland Assessment
New River, Sixes River, Elk Rivers
& Euchre Creek Watersheds



The Environmental Protection Agency has developed an analysis of Pacific Northwest Estuaries and compiled comparison information on watershed area and resource production (Lee and Brown, 2009). The information they developed for the four estuaries of this study are portrayed in Tables 2 and 3.

ESTUARY	LATITUDE	WATERSHED AREA (km^2)	AREA (km^2)				ESTUARY TYPE
			MARINE	ESTUARINE	TIDAL RIVERINE	TOTAL ESTUARY	
New River	43.001	329.0	0.0	1.63	0.04	1.67	Blind – Drowned river mouth
Sixes River	42.853	347.5	0.0	0.31	0.08	0.39	Blind – Drowned river mouth
Elk River	42.793	236.4	0.0	0.51	0.16	0.66	Blind – Drowned river mouth
Euchre Creek	42.564	96.6	0.0	0.11	0.001	0.12	Tidally restricted coastal creek

Table 2: Watershed and estuarine habitats of the South Coast Estuaries (Lee and Brown, 2009).

ESTUARY	ESTUARY AREA (km^2)	NWI ESTUARINE EMERGENT WETLAND (km^2)	NWI ESTUARINE AQUATIC BED (km^2)	NOAA ESTUARINE EMERGENT WETLAND (km^2)	NOAA ESTUARINE AQUATIC BED (km^2)	OYSTER CULTURE	SALMON PRESENT (# COHO SMOLTS)	BIRD HABITAT
New River	1.67	0.48	0.0	0.27	0.02	N	Y (396,00	SPC/IBA
Sixes River	0.39	0.03	0.0	0.05	0.0	N	Y (372,00	
Elk River	0.66	0.05	0.0	0.01	0.0	N	Y*	
Euchre Creek	0.12	0.02	0.0	0.08	0.0	N	Y*	

Table 3: South Coast Estuarine Resources (Lee and Brown, 2009). The "# smolts" is the historical potential number of Coho smolts predicted to have occurred within Oregon estuaries (Lawson et al., 2004). *Elk River and Euchre Creek smolt numbers were not reported because the data was only for the Oregon Coast Coho ESU. SCP = listed as important site in the Shorebird Conservation Plan, IBA = Important Bird Area.

By most measures these estuaries are relatively small when compared to other estuaries in Oregon or the Pacific Coast generally but provide important ecological services. As reported by Lee and Brown (2009): "*These smaller estuaries are important for native salmon, a critical regional resource and management issue. Forty-six of the 73 estuaries <1 km^2 have reported salmon runs. An analysis of the predicted historical number of Coho smolts produced per watershed along the Oregon coast (Lawson et al., 2004) indicated that the small estuaries produced a proportionally greater number of smolts than the larger estuaries when normalized to estuarine area. Estuaries <1 km^2 were contributing about 8% to total Coho runs*

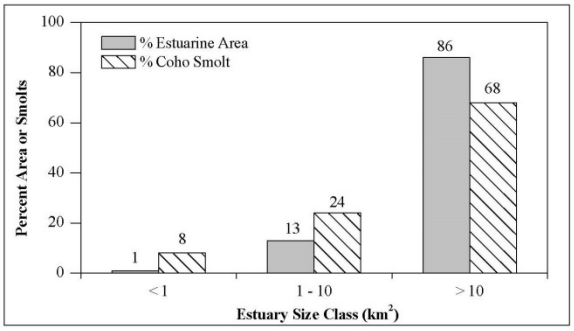


Figure 2: Distribution of the projected historical number of Coho smolts by estuary size classes in 29 Oregon estuaries. Coho smolt data from Lawson et al. (2004)

while estuaries <10 km^2 were contributing about 24%. These smaller coastal watersheds and estuaries may also serve as a future refuge for wild salmon with the increasing development and alteration of the larger estuaries and watersheds."

Lee and Brown (2009) conclude: "*The final reason for the inclusion of these small water bodies is that they are likely to require different management strategies. Factors such as their smaller volumes, differences in seasonal and tidal variability in exchange and salinity, and different biotic communities are all likely to result in different exposures and vulnerabilities. Research focused on these largely ignored small systems is required to better understand how they function, but it is possible to speculate that their small size makes them more vulnerable to certain types of stressors while at the same time offering greater opportunities for cost-effective protection and/or mitigation efforts."* This evaluation of tidal marshes of the smaller estuaries in the South Coast by the Curry Watersheds Partnership is intended to assist in the management of these important areas into the future.

Assessment Methodologies

The OWEB Estuary Assessment, Component XII of the Oregon Watershed Assessment Manual, is designed to identify, characterize, and prioritize tidal wetlands within individual Oregon estuaries (Brophy, 2007). The method is intended for use within a single estuary. It compares the Size of the estuary, Tidal channel condition, Wetland connectivity, Salmonid diversity, and Historic wetland types. These characteristics are scored and summed for a site score that can be compared with other sites using the same scoring criteria.

The Hydrogeomorphic Assessment methodology developed for Oregon tidal wetlands (Adamus, 2006) is intended as a: "*method for assigning scores to a tidal wetland based on twelve functions that are (potentially) performed naturally by wetlands. This method also assesses: 1) the potential values of these functions, 2) the indicators of a wetland's biological and geomorphic condition, and 3) the potential risks to a wetland's integrity.*" The method has three sequential components:

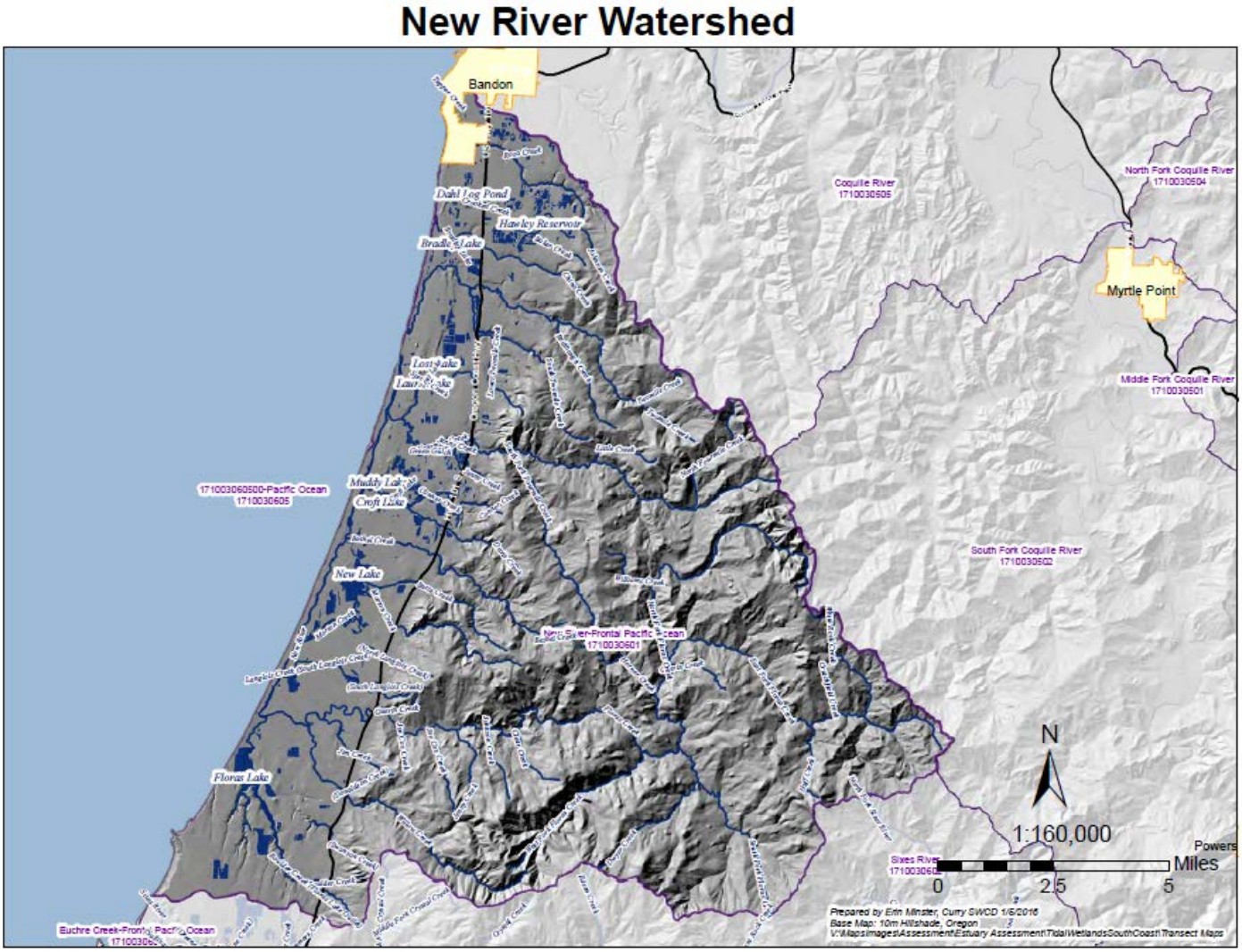
1) recording field observations on standardized data sheets,
2) entering the calculated numeric scores (with a measure of relative certainty) into a specially designed Excel™ spreadsheet, and
3) employing the spreadsheet to derive numbers that represent the relative level of function of the wetland assessed.

Four sites in the New River complex of wetlands, three sites in the Sixes River estuary, a site in the Elk River estuary and a site in the Euchre Creek estuary were sampled using the methods of Adamus (2006). The findings are presented below in a discussion of each estuary.

SOUTH COAST ESTUARIES

Figure 3: New River Watershed

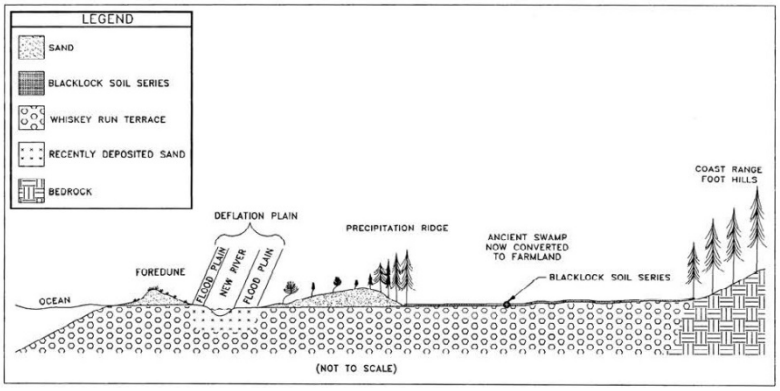
New River



The "mouth" of New River is dynamic -- as it often breaks out (or is breached) in differing locations along its 12-mile length. The estuarine effect often only occurs from mid-October to the end of July when the mouth of the river is open to ocean flow. A small tidal effect which is most dramatic from Fourmile Creek to the New River mouth provides various sized sand/mudflats for shorebird foraging. Some sand/mudflats are flooded by tides during the fall and spring and are critical feeding sites for large numbers of resident and migratory shorebirds.

The New River/Floras Lake area is formed on a dune sheet covering a marine terrace. A typical cross section illustrates the sandy terrace and dune formations that create the wetland conditions of the New River/Floras Lake area (Figure 4, taken from BLM, 1995). New River is "trapped" behind a foredune created primarily from marine sands accumulated by the spread

Figure 4: Typical geological formation of the New River area (from BLM, 1995)

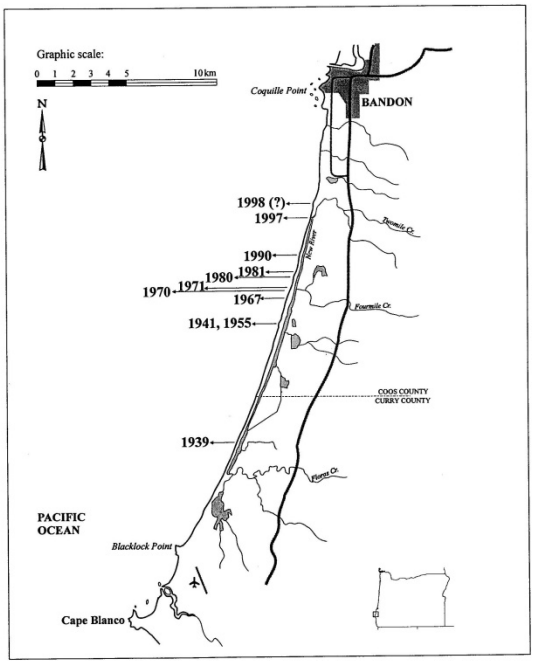


of European beachgrass (*Ammophila arenaria*), a 20th century phenomenon.

The formation of the foredune affects both the location of the winter breach which has generally trended northward since the introduction of European beachgrass. The history of the spit from 1939 to 1998 has been documented (Figure 5) by Diaz- Mendez (1998) and Komar et.al. (1999). As the foredune grew, the area of wetlands behind the dune grew. This dynamic system is subject to changes from the management of the foredune. Figure 5 shows the winter breach generally retreating southward as European beachgrass is removed. These changes affect the estuarine interactions of the New River and tributary creeks.

The Bureau of Land Management manages their ownership as an Area of Critical Environmental Concern (BLM, 1995; BLM, 2004). The current management plan (BLM, 2004) is being updated to reflect current conditions and uses and to take into consideration information gained from monitoring over the last decade. The BLM has found that: "*Over the last decade the New River ACEC has experienced changes in: vegetation patterns, invasive species, federally protected species, and recreation use trends. The BLM has formed a planning team to evaluate these changes, define management issues, and work with the public in an effort to develop an updated management plan. The planning process is expected to span at least two years…*" The public planning process was just started in the summer of 2015.

Figure 5: Historic locations of the New River mouth, recorded from aerial photos, and additional historic documents. From (Diaz-Medez, 1998).



A portion of the management of the ACEC is to reduce the effect of European beachgrass on New River. Figure 6 shows the area of the foredune treated for the removal of beachgrass that will likely result in a more dynamic interaction between the drainages that make up New River, the wetlands behind the foredune, and the ocean. The complicated effect of European beachgrass removal has been reviewed by Zarnetske and coworkers (2010).

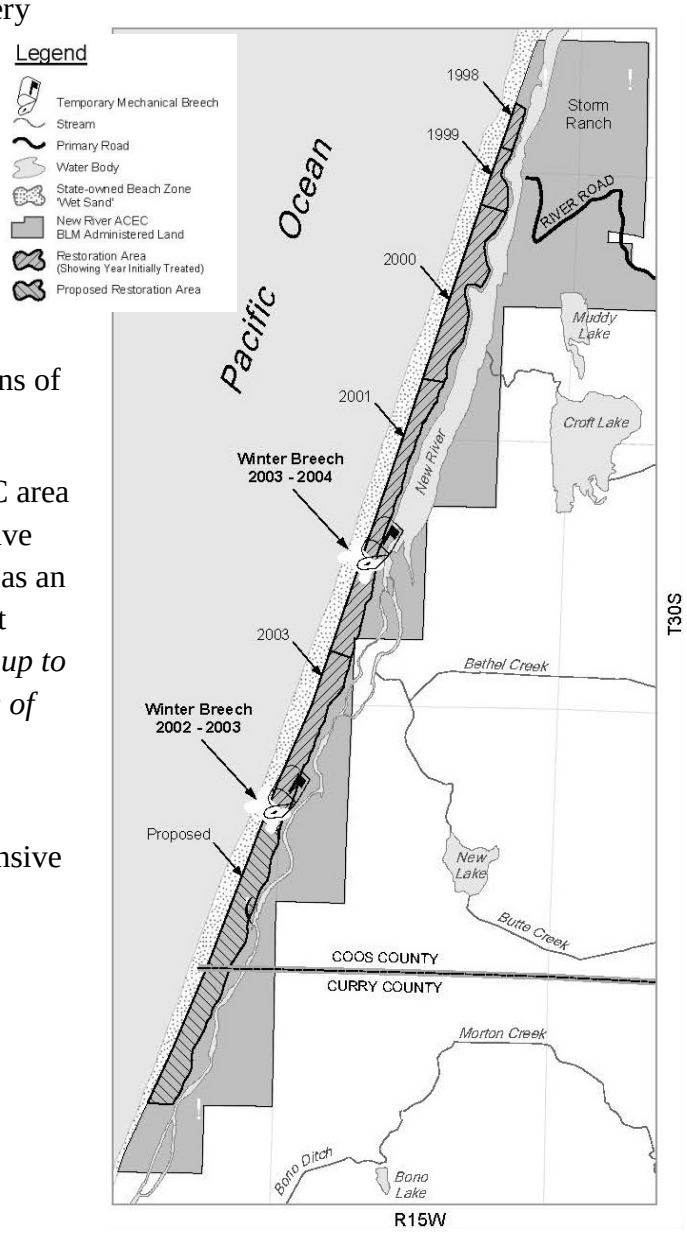
When assessing the wetland functions of this area consideration must be made of the dynamic nature of the dune system that is affected by relatively high rates of uplift, meager offshore sand supply, and European beachgrass colonization and management.

The Lower Floras Creek/New River complex has the most area of wetlands of any of the South Coast watersheds. More than 2,300 acres are identified within 67 different wetlands. Nearly two-thirds are highly altered and a third are altered very little.

Salmon use in the middle and upper portions of the watershed is limited by a natural barrier. Steelhead and cutthroat are well distributed throughout the watershed. Coho habitat is identified in the Lower Floras, Willow Creek, and Floras Lake subwatersheds, with the best available habitat in Bethel, Butte, and Morton Creeks (near New Lake). Chinook use the lower mainstem of Floras and portions of Willow Creek and Morton Creek.

New River wetlands have been mapped for the ACEC area on BLM lands (BLM, 1995). New River wetlands have been recognized by the Audubon Society of Portland as an Important Bird Area. The designation recognizes that "*Snowy Plover is present year round. During spring, up to 20,000 Aleutian Canada Geese and tens of thousands of shorebirds (peaks up to 100,000) can be observed. Numbers are usually smaller in fall.*"

Wetland mapping for the New River area shows extensive wetland systems behind the foredune (Figure 7).



Four sites were sampled for Tidal Wetland HGM evaluation. The following site descriptions provide information about each site and are accompanied by site maps showing both HGM mapping and NWI wetland mapping. Restoration opportunities identified by Scranton (2004) are shown in Figure 8.

Figure 7: New River Wetland Mapping

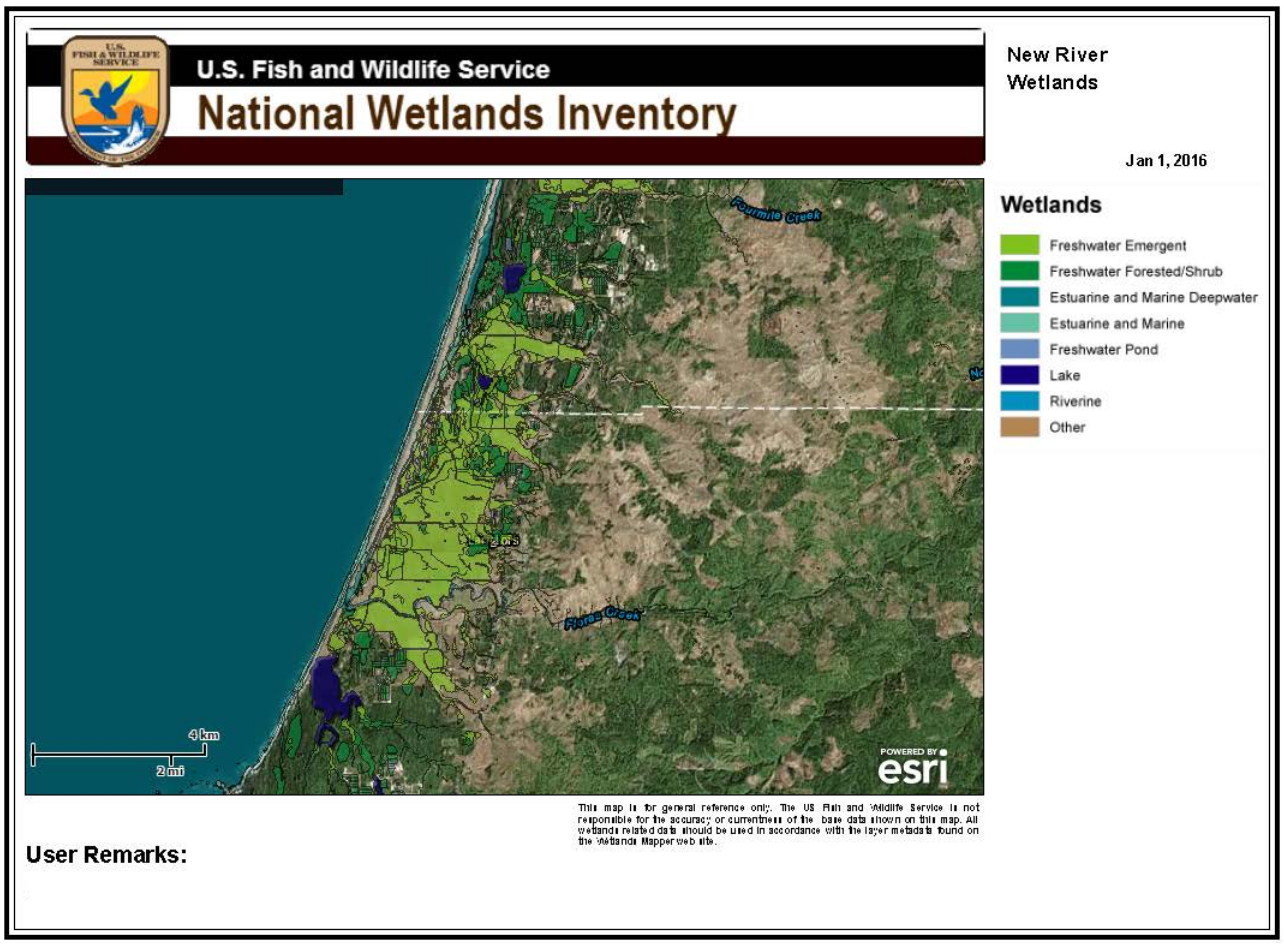


Figure 8: New River Restoration Opportunities

New River Hanson Slough
Wetland Name: New River-Floras / Hanson Slough **Site ID: NR-1**

Botany Survey Date(s): 9/9/2014

This site is located at the beginning of New River where Floras creek turns north against the foredune. The wetland is bounded by upland vegetation on a vegetated berm with actively grazed pasture land inland to the East. New River borders the sample location to the West. The banks of New River are typically steep, up to 1m high with very minimal (5%) low marsh habitat bench near the river. A narrow strip of high marsh habitat (>15m wide) constitutes 95% of this wetland. A 2-3m high berm covered in *Salix* species separates the high marsh from the inland pasture. Soils tended to be compacted clay as the site is accessible to livestock. A well-used trail close to the bank runs through the entire length of high marsh habitat. The transect sites are not clearly mapped as estuarine marsh (Figures 9 and 10).

Transect locations

Transect #1, Quadrats # 1-6: This transect is the furthest south (downstream) and starts at water's edge in the wrack line and is poriented to the east over a steep bank (Figure 9) then through high marsh vegetation. *Eleocharis palustris* and *Schoenoplectus americanus* comprise the majority of the low marsh vegetation. Quadrats in the high marsh were dominated by *Potentilla anserina* spp *pacifica* and *Agrostis stolonifera*, the dominant species. At the upper end of the transect the species transition to highly grazed pasture grasses.

Transect #2 Quadrats # 7-12: Located to the north of Transect 1 (Figure 9), Transect 2 showed a similar pattern of vegetation. The start of the transect was dominated by *Eleocharis palustris* and *Schoenoplectus americanus* low marsh habitat near water's edge. These species continued to be present throughout high marsh, however, *Potentilla anserina* spp *pacifica* and *Agrostis stolonifera* dominate the high marsh quadrats. The transect ended at the base of the berm dominated by *Salix* species.

Transect #3 Quadrats# 13-17: This transect is the furthest north (Figure 9) and the species sampled were comprised almost entirely of *Eleocharis palustris*, *Potentilla anserina* spp *pacifica*, and *Agrostis stolonifera*. Present in low percentages were *Schoenoplectus americanus*, *Phalaris arundinacea*, and *Ranunculus repens*.

Management Observations

The banks of the river are unstable, apparently from seasonal flooding. There is little active management necessary. Additions of large wood could enhance habitat for juvenile fish in the New River.

Soil compaction from livestock is of concern. Evaluation of grazing management options should be considered to work with the landowner to evaluate the options for reducing effects.

Figure 9: New River Vegetation Transects South of Hanson Slough

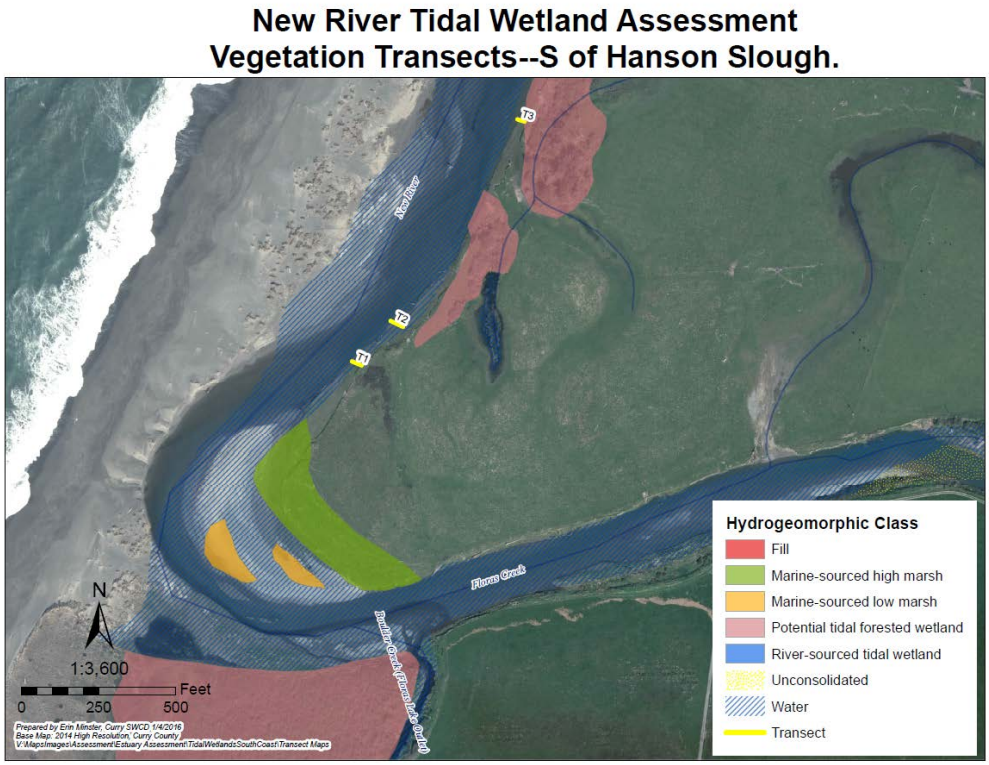


Figure 10: Wetlands of the Floras Lake-New River Confluence

New River New Lake Outlet

Wetland Name: New River-New Lake Outlet **Site ID: NR-2**

Botany Survey Date(s): 8/28/2014

Located over 5.5 miles south of the New River mouth, this site is comprised of a peninsula between two channels of New River. Ranging from 80m – 130m wide this wetland is bounded by New River to the east, south and west. To the north is upland vegetation. A small ditch/channel runs through the northern section of the wetland. This wetland is unevenly distributed between high and low marsh habitats with the majority being covered in *Carex obnupta* in the higher marshes and *Eleocharis palustris* in the lower marshes. The wetland is mapped as Marine sourced high and low marsh (Figure 11).

Transect Location

Transect #1 Quadrats # 1-10: This transect starts at the water's edge on the east side bank of the wetland and heads west. The steep bank between the marsh and the river is ~ 1m high.

At the water's edge, the first quadrat is dominated by *Oenanthe sarmentosa* (23%), *Eleochais palustris* (21%) and *Potentilla anserina* spp *pacifica* (19%). *Juncus balticus* (15%) and *Lotus corniculatus* (12%) were also present. *Sparganium emersum* (4%) populated several areas along the eastern bank.

Transect #2 Quadrats # 11-18: This transect starts on the western water's edge with gentle slopes and heads east. The transect is dominated by sedge marsh with *Carex obnupta* and *Potentialla anserina* as dominant species. Quadrat # 13 crosses the edge of a pond with *Eleochais palustris* (58%), *Sparganium emersum* (19%) and *Nuphar lutia* (12%). Quadrat # 18 at the end of the transect is located at the water's edge and, was dominated by *Potentilla anserina* spp *pacifica* (26%), *Carex obnupta* (22%) and *Callitriche* spp (20%). Due to the isolation of this wetland, little disturbance was observed.

The greatest diversity of vegetation was found on the western bank of the wetland with close proximity to the water and a gentle sandy/loam slope. The seasonal influx of the river contributes to the abundance of species; *Rumex crispus*, *Epilobium ciliatum*, *Hordeum brachyantherum*, *Salix* spp, *Phalaris arundinacea* and *Deschampsia caespitosa*.

This peninsula wetland provides beneficial habitat to birds due to its isolation.

Figure 11: New River Vegetation Transects New Lake Outlet

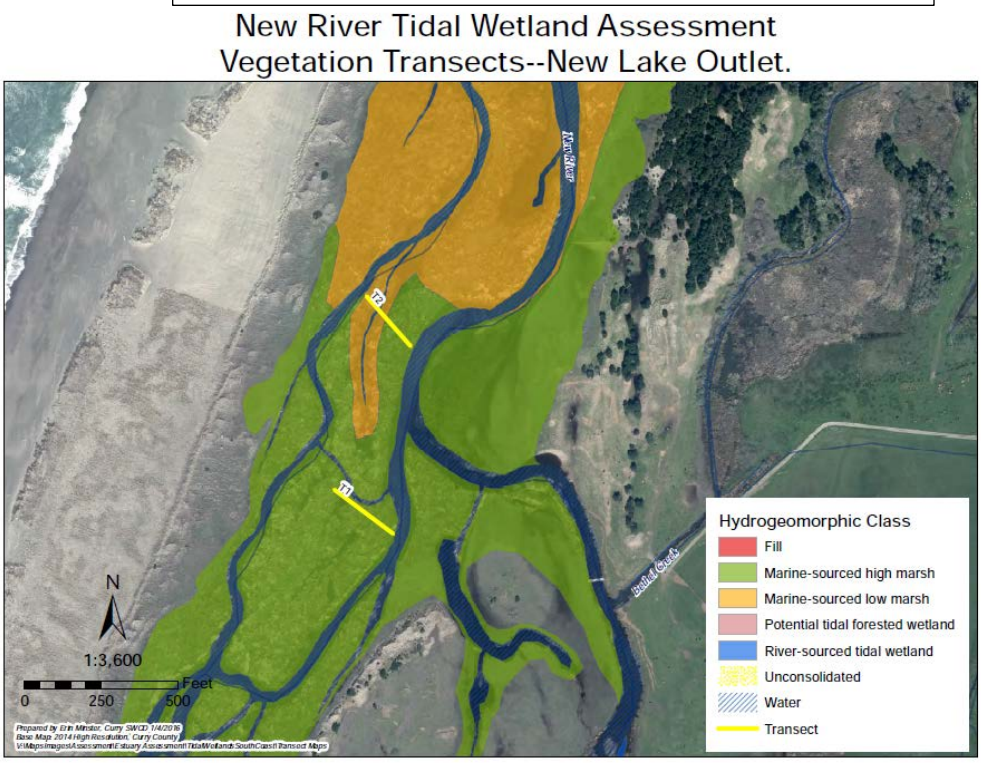
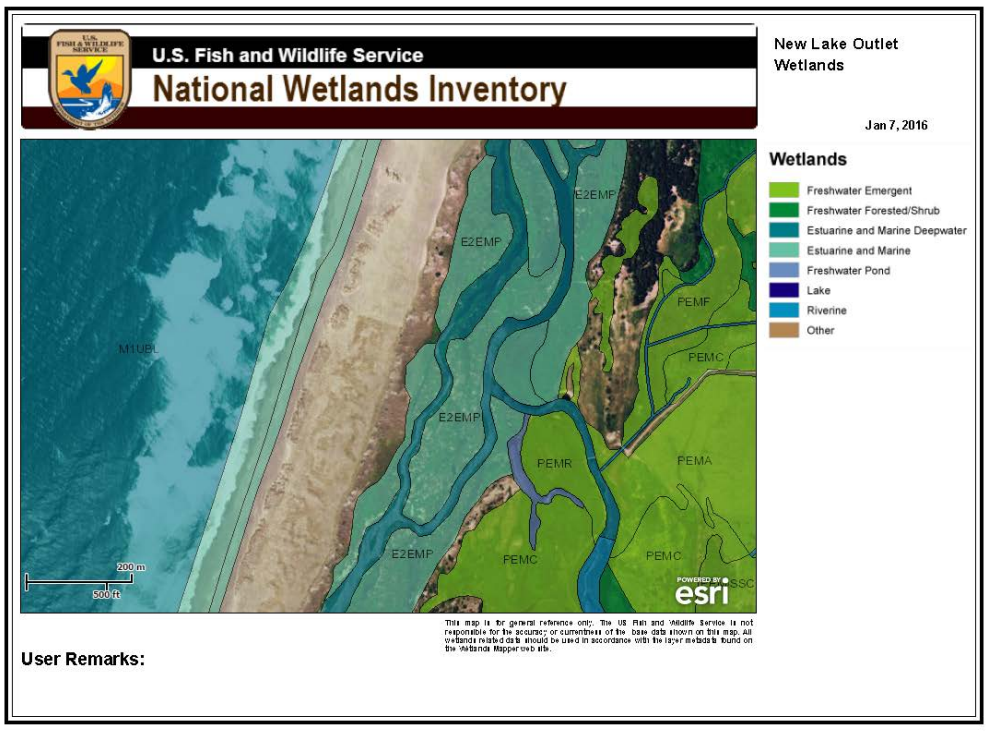


Figure 12: New Lake Outlet Wetlands



New River Fourmile Creek

Wetland Name: New River-Fourmile Creek **Site ID: NR-3**

Botany Survey Date(s): 8/11/2014

Located about 2.5 miles south of the mouth of New River, this wetland is immediately north of Fourmile Creek. Confined on the north and west by New River, to the east by upland vegetation and the south by Fourmile Creek, this wetland is comprised of 90% high marsh and 10% low marsh. A pond occurs on the northern half of the wetland, which is privately owned. The pond provides an additional aquatic element with *Nuphar* spp. and *Sparganium demersum*, which were observed off transect. A public trail leading to the shore of New River accesses the southern portion of the wetland.

Transect Locations

Transect #1 Quadrats # 1-10: The transect starts on the west shore of the southern portion of the wetland. The transect heads to the east for ~50m were it ends at an upland *Salix* grove. *Eleocharis palustris* dominated the first 6 quadrats while *Phalaris arundinacea* and *Potentilla anserina* spp *pacifica* dominated quads 7 – 10. *Agrostis stolonifera*, *Lotus corniculatus* and *Scirpus microcarpus* were also present throughout transect. *Juncus bufonius* Q#1 (4%) and *Juncus effusus* spp *pacificus* Q#6 (15%) were present. This transects crosses a rush dominated marsh and has a reed canarygrass dominated inclusion and ends in a pasture dominated by introduced species.

Transect #2 Quadrats # 11-20: This transect starts to the north of Transect 1 (Figure 13) on the west shore and crosses a sedge marsh. The transect heads to the east for ~50m. *Potentilla anserina* spp *pacifica*, *Agrostis oregonensis*, *Carex obnupta* and *Lotus corniculatus* were the dominant species. *Juncus balticus* was present in quads 17, 18, 19. The transect ends at a *Salix* grove with the ponded area beyond the end of the transect. Further east are private residences.

Species observed off transect in the surrounding wetland are typical of high marsh environments. The following were observed; *Eleocharis acicularis*, *Juncus ensifolius*, *Triglochin maritima*, *Scirpus cernuus*, *Deschampsia caespitosa*, *Callitriche* spp, and *Trifolium wormskioldii*.

The shore of the western edge of the wetland experiences light foot traffic from a developed access trail. The highest diversity of species occurred in this section. Invasive species observed in the area include: Italian thistle (*Carduus pycnocephalus*), teasel (*Dipsacus fullonum*), and tansy ragwort (*Senecio jacobaea*).

Soils ranged from mostly loam with pockets of clay to sandy/loam near the shore.

Figure 13: New River Vegetation Transects –Fourmile Creek

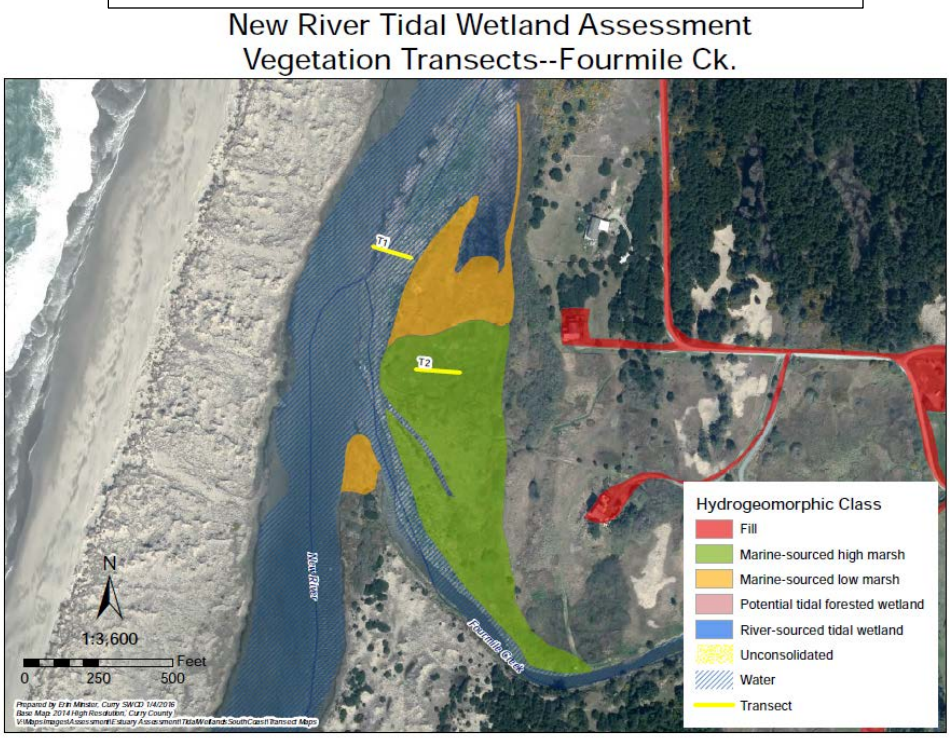
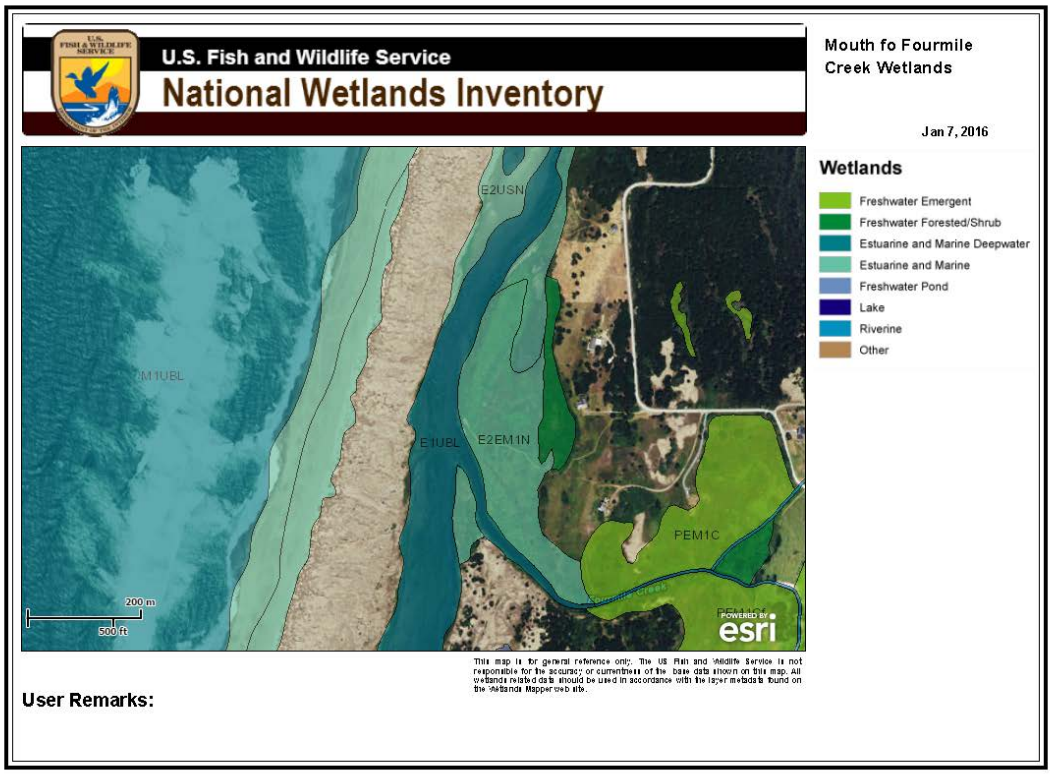


Figure 14: New River Wetlands Mouth of Fourmile Creek



New River Clay Island Breach

Wetland Name: New River-Clay Island Breach **Site ID: NR-4**

Botany Survey Date(s): 9/12/2014

Located 7 miles south of the mouth at New River, this wetland area occurs on a peninsula. The wetland is an island between foredune upland vegetation to the north and New River to the south. The wetland is 70m wide at its widest section. The wetland is 95% high marsh habitat with small pockets of low marsh at the edges and interior. The east bank along the channel consists mostly of clay and is steep with an average height of 1m. *Sparganium emersum* and *Carex obnupta* dominate the east bank. The west bank across from Clay Island Breach and lagoon, is predominantly gentle in slope and consists mostly of sand deposits. Tidal influence was observed by evidence of ocean ferrying *Velella velella* organisms washed up on the shore.

Locations of transects

Transect #1 Quadrats #1-8: The transect sampling began on the east bank and heads to the west. The transect ends at upland vegetation. The transect begins at the waters edge and the first sampled quadrat contained 95% *Sparganium emersum* and 5% *Carex obnupta*. The transect crosses a sedge marsh dominated by *Carex obnupta* in quadrats 2, 3 and 4. *Potentilla anserina* spp *pacifica*, *Agrostis stolonifera*, *Deschampsia caespitosa*, and *Juncus ensifolius* were the sub-dominant species of this transect.

Transect #2 Quadrats # 9-20: Transect 2 starts on west shore bank near the southern end of island and extends approximately 65 feet east. The transect begins in a site partially submerged containing *Lilaeopsis occidentalis* (67%), *Potamogeton crispus* (28%), *Myriophyllum spicatum* (5%), *Eleocharis palusris* (5%) and *Schoenoplectus americanus* (4%). The transect crossed a high marsh dominated by *Potentilla anserina* spp *pacifica*, *Agrostis stolonifera*, *Lotus corniculatus*, *Hordium brachyantherum* and J*uncus balticus*. The west bank of the island showed the greatest diversity of species; *Gnaphalium* spp, *Holcus lanatus*, *Juncus bufonius*, *Oenanthe sarmentosa*, *Trifolium rapens*, and *Achillea millefolium*.

Figure 15: New River Vegetation Transects – Clay Island Breach Site

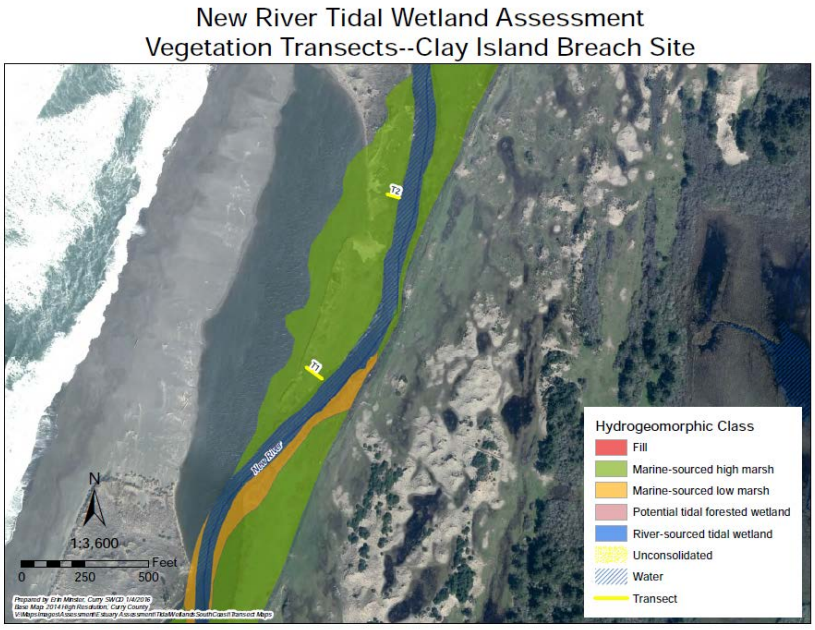


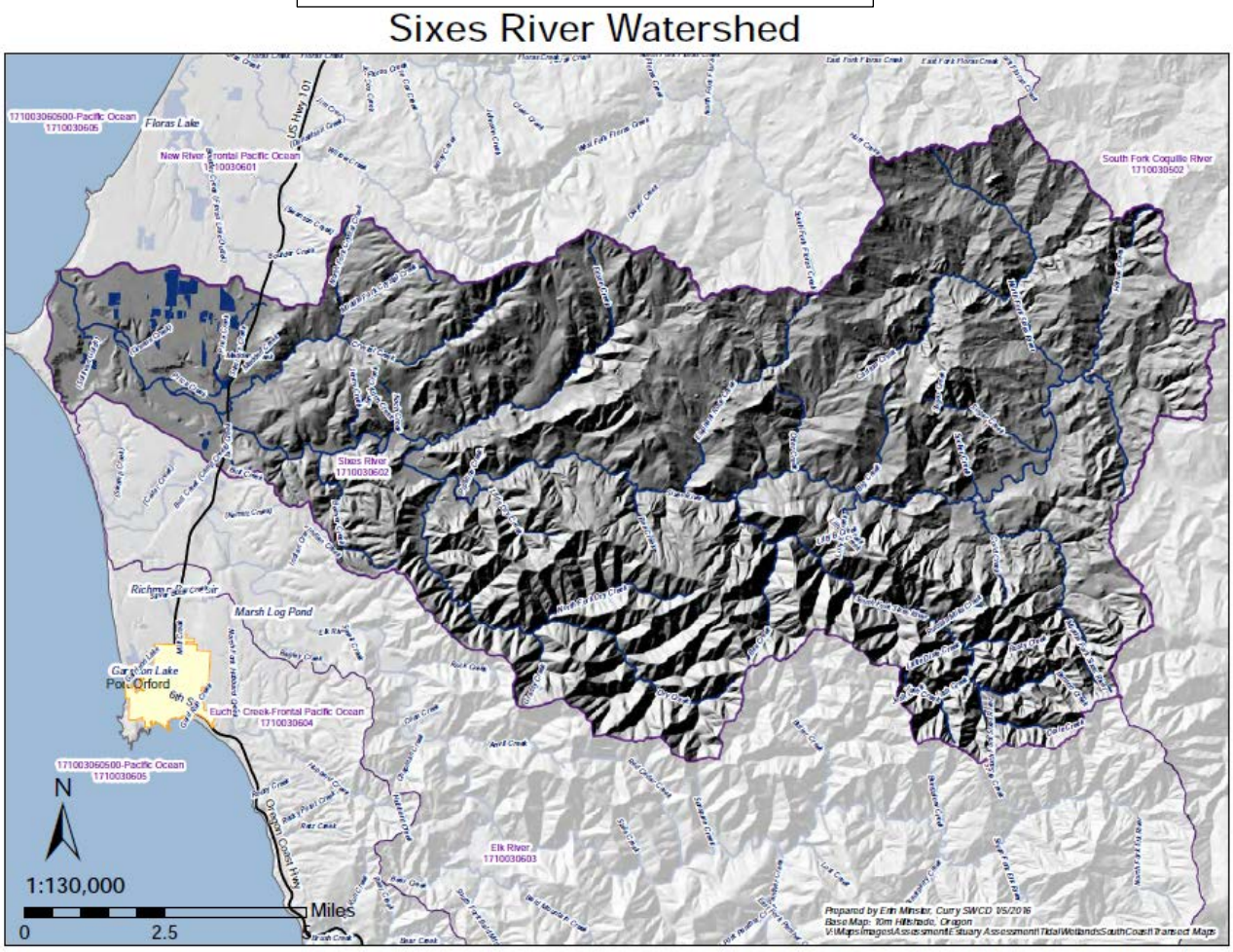
Figure 16: New River Wetlands –Clay Island Breach

Restoration Actions Proposed

The Curry Soil and Water Conservation District is proposing to design and permit restoration projects in the New River watershed that address limiting factors in 7 miles of New River, 4 miles of Floras Creek, 1 mile of Willow Creek, and 0.4 miles of Jim Creek.

Sixes River

Figure 17: Sixes River Watershed



The name Sixes is most likely derived from the native name of the river as Sekwetse. The Sixes River headwaters come from the Siskiyou Mountains and have a relatively small but steep watershed (Maguire, 2001). Forestry and agriculture dominate the watershed with forestlands in the steeper headwaters (approximately 92% of the surface of the watershed) and agriculture and rural residential land uses dominating the lower portion (8%) of the watershed. Only a small proportion of the stream channels of the Sixes River are responsive to alteration or restoration with most channel forms confined and steep gradient. "*Sixes River has the greatest diversity of channel habitat types and the most miles of low gradient, moderately confined (LM) and moderate gradient, moderately confined (MM) channels among those assessed in Curry County. LM and MM channels are scattered throughout the watershed with significant opportunities to protect and restore adjacent riparian areas*" (Maguire, 2001).

The Sixes River supports steelhead, Chinook salmon and coho salmon as well as other native fish species. "*Winter steelhead are well distributed throughout the basin and extend into all subwatersheds including the headwaters of Sixes River. Fall chinook are also found well*

distributed throughout the watershed although not to the extent of steelhead. Fall chinook migrate to all subwatersheds except for the South Fork. Coho share a similar distribution to chinook in the Sixes River basin. Like chinook, coho are found in all subwatersheds except for the South Fork" (Maguire, 2001). Approximately 40 species of fish use the estuary and freshwater portions of Sixes River (Reimers and Baxter, 1976). Research in the late 1980's indicated that high temperatures were a significant limitation to the survival of juvenile Chinook salmon (Nawa etal., 1988). Nawa and others (1988) conclude: "*prevention of further elevation of water temperature throughout Sixes River basin is necessary to allow continued recovery of its fisheries*." Frissell (1992) found: "*Juvenile chinook salmon are no longer found during summer in warm, mainstem reaches* (of Sixes River tributaries) *where they were formerly present. The number of species and age-classes present and density of juvenile salmonids in stream segments were inversely related to maximum summer temperature, with progressive loss of species and age classes indicating ecologically consistent response to thermal stress*."

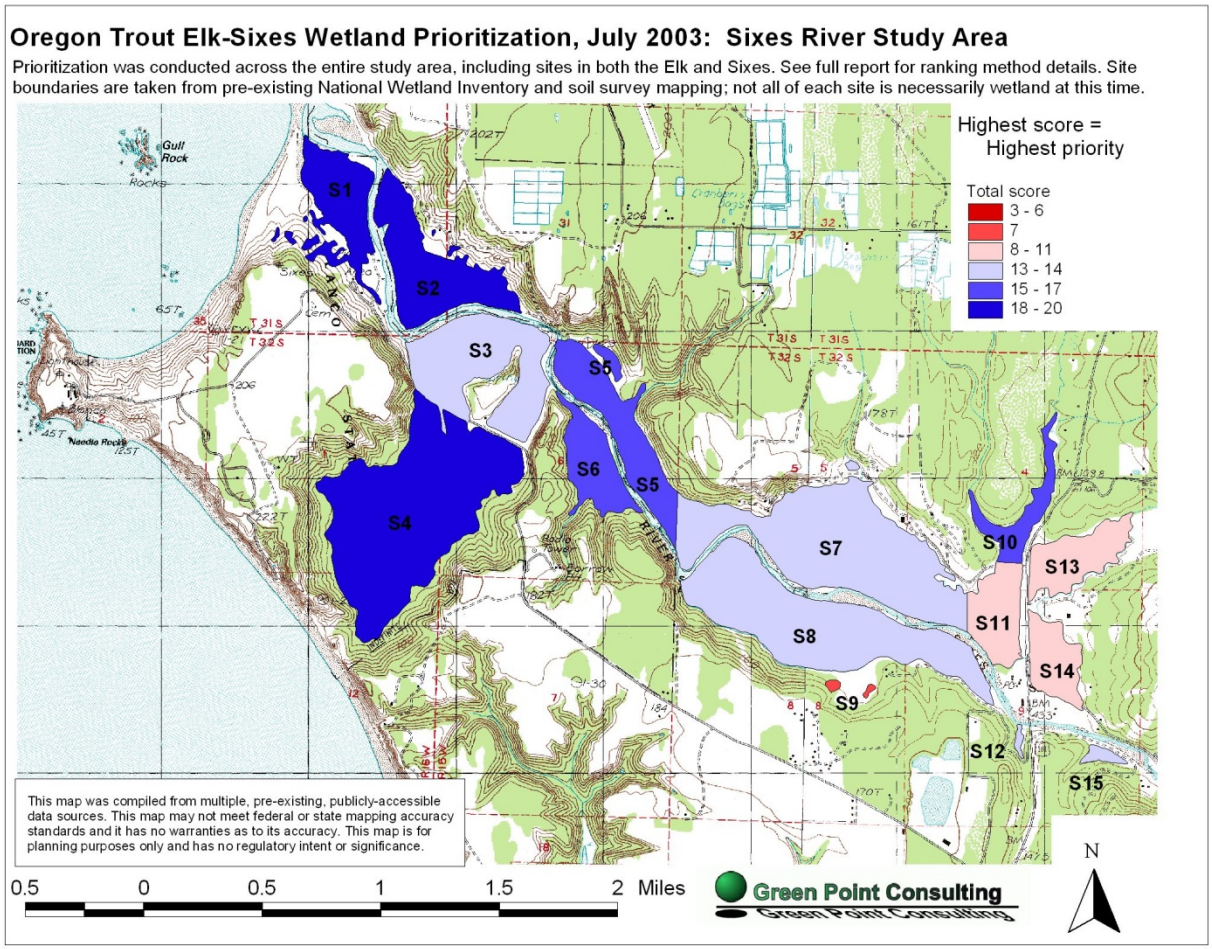
The lower 2.5 miles of the river are subject to tidal influence, creating an estuarine area. During the summer, prevailing northwest winds form a sand bar or sill, at the mouth of the river. Blockage of surface connection to the ocean tides creates an embayment with cold salt water beneath warmer fresh water. As the sill builds, the embayment expands, trapping nutrients and enlarging the area available for rearing of juvenile fish (Reimers 1973). The combined fresh water flow and tidal ebb current rapidly opens a new channel. The importance of quality estuarine habitats on salmonid survival for both adults and juveniles are well documented (Meehan 1991). In his work on the Sixes River, Reimers (1971) identified five life cycles traits for fall chinook. He found the most successful escapement returns came from juveniles that spent approximately 3 months rearing in fresh water and 3 months rearing in the estuary before entering the ocean. He concluded that freshwater and estuarine rearing were equally important to fall chinook salmon survival in the Sixes River.

An estimated 1,372.5 acres of wetlands were identified in the Sixes River Watershed Assessment (Maguire, 2001). The Sixes estuary is the most complex of any on the South Coast, with large wood, large size and a variety of habitats available. Rapid uplift and a narrow foreshore limit the development of a low gradient estuarine reach of the Sixes River.

Scranton (2004) found a significant area of restoration opportunity in the lower estuary (Figure 18). A wetland site prioritization study was completed for the Sixes River watershed in 2003 (Brophy, 2003). Using a series of mapping and evaluation factors, thirteen sites were identified for prioritization for conservation and/or restoration. Figure 19 shows the results of the analysis.

Figure 18: Hydrogeomorphic Mapping for Sixes River and Elk River

Figure 19: Wetland Prioritization for Sixes River from (Brophy, 2003)



From the site descriptions in Brophy (2003), the sites are described as:

- **Site S-1** This pasture site is a mosaic of upland and wetland with some tidal influence.
- **Site S-2** Characterized as an excellent restoration opportunity, the site is has hydric soils and skunk cabbage that indicates wetland hydrology. Based on historical aerial photographs it is suggested at least a portion of the site was historically a spruce swamp.
- **Site S-3** This site is significantly altered with an indication that the hydrology has been altered by both historic ditching and blockage of ditches.
- **Site S-4** This spruce swamp is relatively undisturbed and contains the only known reedgrass fen in Oregon containing many rare and unusual plant species. The surrounding spruce swamp is characterized as being "the only known stand of its type remaining in Curry County, and probably the best remaining example on the entire coast of Oregon".
- **Site S-5** This site has been converted to pasture but retains wetland hydrology and vegetation in some portions of the site. It may have winter habitat potential for juvenile anadromous fish.
- **Site S-6** This wetland apparently was a forested site but was historically cleared and grazed but retains many wetland features, especially on the downstream end of the site where high waters flood the lower end of the site.

- **Site S-7** This site is bisected by Summers Creek which may flow in a remnant channel of the Sixes River. The pasture site has been ditched and drained.
- **Site S-8** Mirroring Site S-7, this site is a drained pasture, which has what appears to be an old meander scar from the Sixes River.
- **Site S-9** These depressional wetlands are small and isolated in the adjacent uplands.
- **Site S-10** This wetland at the confluence of Summers Creek and Price Creek appears to be partially impounded by Childers Road.
- **Site S-11** Summers Creek below the confluence with Price Creek and beyond the culvert on Childers Road also appears to be partially impounded by Highway 101.
- **Site S-12** This small wetland along the lower portion of Bull Creek is likely influenced by the Sixes River flow and tidal influences. It is only slightly affected by Highway 101 embankment but is otherwise little altered.
- **Site S-13** This site is bordered by Crystal Creek, used as a pasture and has been ditched and drained.
- **Site S-14** Similar to Site S-13 this pasture site is intersected by roads and dominated by agricultural uses.
- **Site S-15** Another isolated wetland. This depressional wetland is isolated from Sixes River by Sweet Ranch Road.

Brophy (2003) provides more detailed recommendations for conservation activities for each site and identified sites S-4, S-2 and S-1 as the highest priority conservation sites. Sites S-5, S-6 and S-10 are in a second priority for conservation action.

The following site descriptions provide data on the sample sites for the Tidal Wetland HGM evaluation. Three of the sites were sampled in 2014 an additional site sampled in 2013 is also presented.

Sixes River Orchard Hole

Wetland Name: Sixes River-Orchard Hole **Site ID: SR-1**

Botany Survey Date(s): 8/21/2014

This site is located on the north bank of the Sixes River about 1.7 miles from the mouth. Situated at the confluence of an unnamed Creek and Sixes River, this wetland comprises of 50% high marsh on both edges and 50% low marsh with a pond in the center. The site is bounded by a forested hillside to the north, an access road with culvert to the east, upland pasture land to the south and Sixes River mainstem to the west. Large wood has been placed near the east side of wetland. *Salix* spp 1-3m tall provides the only solar cover. A few planted conifer trees have survived and will eventually provide more shade.

Transect Locations

Transect #1 Quadrats #1-13: The transect starts near the edge of a gravel bar and is laid out to the northwest. The transect crosses high marsh vegetation for the first four quadrats (*Potentilla anserina* spp *pacifica*, *Salix* spp, *Schedonorus arundinaceus*, *Lotus corniculatus* and *Equisetum* spp.) then transitions into low marsh habit (*Eleocharis palustris*) and then to ponded water (*Eleocharis palustris*, *Callitriche* spp, and *Sparganium emersum*). The transect then slopes back up to high marsh dominated by *Phalaris arundinacea* with a 92% cover for quadrat #13 ending at the edge of a forested hillslope.

Transect #2 Quadrats # 14-20: This transect starts on the southern edge of the high marsh near planted conifer trees and heads to the east. The transect crosses low marsh and the edge of a pond at the Southeast corner and ends on hillslope near placed large wood.

HGM indicator #25 scored high for accessibility of young anadromous fish due to the pond and surrounding low marsh being connected to Sixes River.

Replanting of coniferous and hardwood trees on South side would be beneficial for solar cover and production of leaf litter.

Figure 20: Sixes River Vegetation Transects Orchard Hole

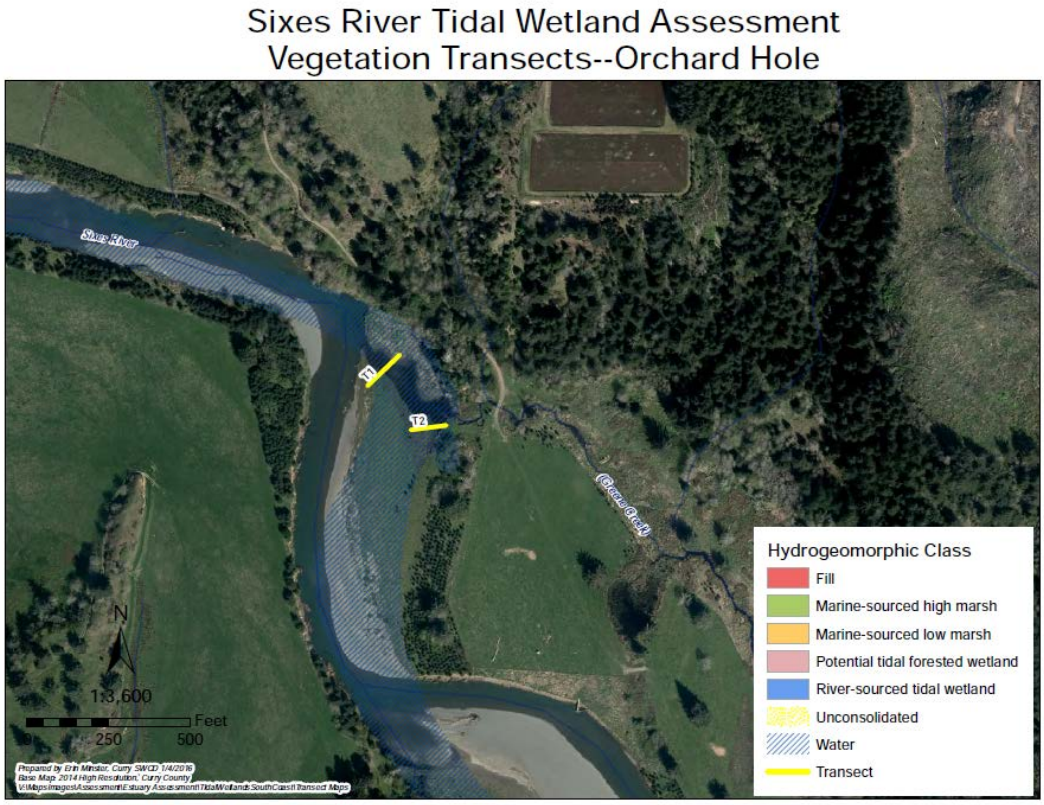


Figure 21: Sixes River - Orchard Hole Wetlands

Sixes River Sweet Ranch

Wetland Name: Sixes River -Sweet Ranch **Site ID: SR-2**

Botany Survey Date(s): 8/21/2014

Located about ½ mile upstream from Sixes River mouth, this wetland is divided in half by a creek channel. The low marsh habitat is mostly confined to the areas closest to the creek channel. The wetland is bounded by a moderate hillside to the north, upland pastures to the east and south and the Sixes River to the west. Soils at this site consisted of heavy clay and appeared to have impeded drainage.

Transect Locations

Transect #1 Quadrats #1-10: The transect start at the base of the hillslope on the north side, heads south across a channel and ends in the upland pasture. *Juncus balticus* and *Agrostis stolonifera* dominated the first three quadrats. *Schoenoplectus americanus* (55% / 63%) and *Eleocharis palustris* (20% / 34%) dominated the two quadratss closest to channel. Bare soil and algae mat cover were also present near channel. *Carex obnupta* and *Juncus balticus* dominated the high marsh habitat south of the channel. *Potentilla anserina* spp *pacifica* and *Deschampsia caespitosa* were also present in the high marsh.

Transect #2 Quadrats #11-20: The second transect was taken 40m east of Transect #1. The transect starts on the south side of the creek channel heading north toward hillside. *Agrostis stolonifera*, *Potentilla anserina* spp *pacifica*, *Juncus balticus* and *Deschampsia caespitosa* dominated the high marsh habitat. *Eleocharis palustris* was only found in abundance near the creek channel.

A well-defined channel bank with a depth from 0.5-0.75 m was characteristic of the creek channel bounding both transects. Forage fish (bait fish) were observed in channel off Transect #2.

Management Observations

Nutrient exposure from upstream cattle pastures could be an influence on water quality and vegetation patterns of this site. Solar cover was nearly non-existent. Riparian planting could be prescribed.

Figure 22: Sixes River Vegetation Transects Mouth and Sweet Ranch

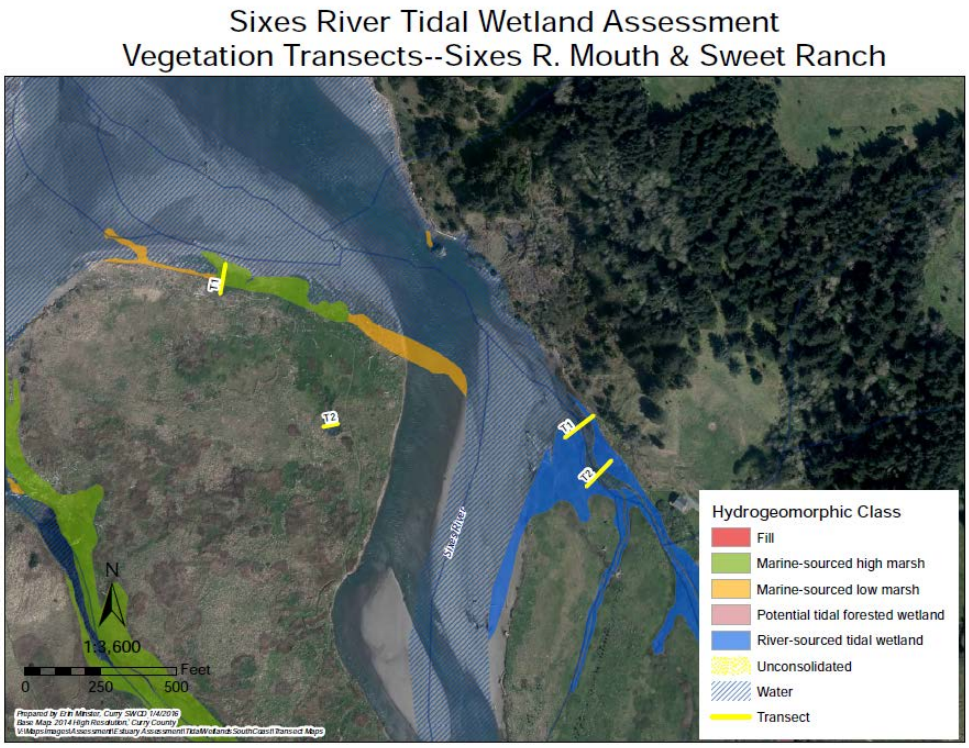
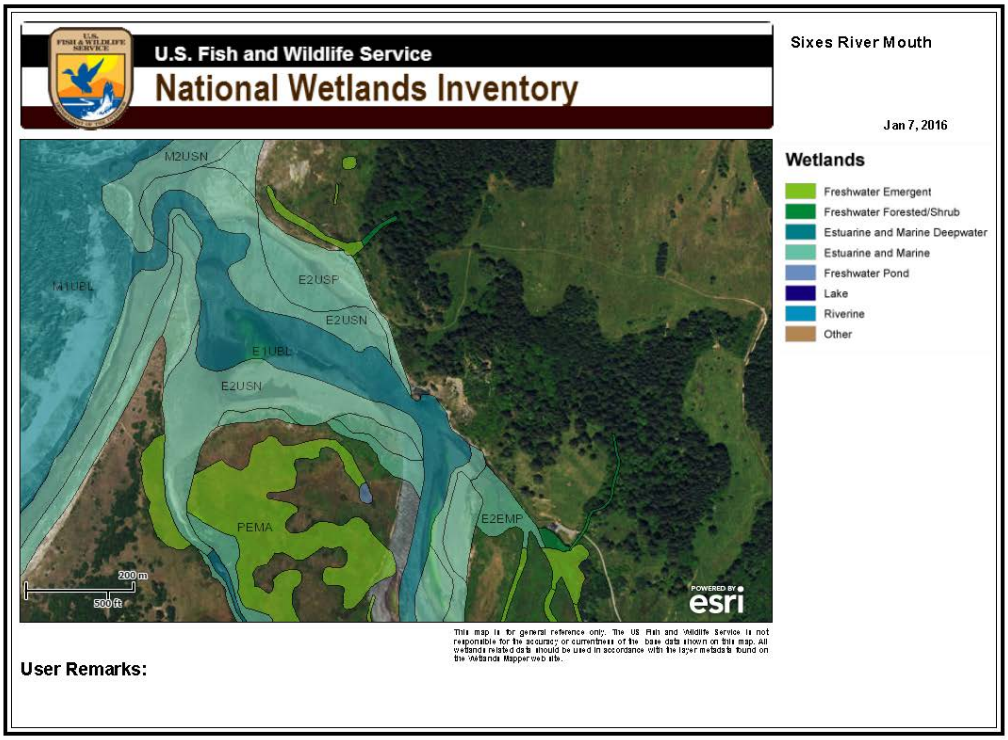


Figure 23: Sixes River Mouth and Sweet Ranch Wetlands



Sixes River Mouth

Wetland Name: Sixes River - near mouth **Site ID: SR-3**

Botany Survey Date(s): 8/4/2014

Located less than 400 meters from the ocean, this site is bounded by the Sixes River, with gravel bars to the north and west and upland vegetation to the east and south. This wetland is comprised mainly of high marsh habitat with a low marsh pond and adjoining swale in the southwest section. A BLM trail leads through the northern edge of the wetland. Soils seemed to be comprised of mainly compacted clay with pockets of sandy/loam. Flooding was evident by several wrack drift lines on the western edge as well as a few pieces of large wood scattered throughout wetland. Solar cover was non-existent.

Transect Locations

Transect #1 Quadrats# 1-10: The transect starts on the western edge of the wetland adjacent to the gravel bar/beach and heads to the east. The entire transect traverses high marsh, with the dominant species**;** *Potentilla anserina* spp pacifica, *Deschampsia caespitosa*, *Agrostis stolonifera*, and *Juncus balticus*. *Phalaris aruninacea* was heavy in quadrats 7 (32%) 8 (79%) and 9 (90%) where the transect transitioned into upland vegetation. *Ipomoea purpura* (morning glory), an invasive species, was also found in quadrats 6 (10%) 7 (15%) and 8 (10%).

Transect #2 Quadrats # 11-19: The second transect started near the pond and consisted mainly of low marsh vegetation. *Eleocharis palustris* and *Potentilla anserina* spp *pacifica* dominated this transect. *Holcus lanatus*, *Galluim* spp, and *Deschampsia caespitosa*, high marsh species, were also present in low quantities.

Management Observations

A possible contribution to the compacted soils could be from the site being used historically as pasture for livestock.

The pond is seasonal and was mostly dry with moist soil at time of survey.

Several invasive plant species, Japanese knotweed (*Polygomun cuspidatum*), tansey (*Tanacetum vulgare*) and European beach grass (*Ammophila arenaria*) were found off each transect.

Sixes River Sullivan Gulch

Wetland Name: Sixes River - Sullivan Gulch **Site ID: 10**

Botany Survey Date(s): 9/13/13

One field day was allocated for a rapid assessment of botanical resources in the restoration project area of Sullivan Gulch. Two transects were located in backwater restoration areas identified by the Project Manager, Matt Swanson (Figure 27).

Transect Locations and Habitats

Figure 24: *Juncus* dominated pasture

Transect 1 Quadrats #1-15:

The transect starts in the shade of a spruce tree at the base of a hill at the pasture margin. Within this transect, open pasture is dominated by non-native facultative species: *Agrostis stolonifera* (bentgrass), *Ranunculus repens* (buttercup), and *Lotus corniculatus* (birdsfoot trefoil). Non-natives distributed locally and with less cover include *Trifolium repens* (white clover), *Holcus lanatus* (velvet grass), and *Rumex crispus* (curly dock). Wetland indicator species increased to the north, consisting of wetland obligate *Potentilla anserina* (silverweed), and facultative wetland species, *Juncus hesperius* (bog rush) and *J. effusus* (soft rush). In two quadrats, *Carex obnupta* (slough sedge) dominated the *Juncus* species (79% maximum cover). See Figure 24.

Quadrat #3 is located in a wet swale, pugged by livestock, accounting for the estimated 10% bare soil cover. Wetland obligate species in the swale include *Eleocharis palustris* (25%), *Oenanthe sarmentosa* (10%), *Veronica americana* (8%), *Carex obnupta* (4%), and *Callitriche spp* (3%). Facultative wetland species include *Juncus hesperius* (15%), *Juncus balticus* (10%), and *Epilobium ciliatum* (3%).

Transect 2 Quadrats #16-26: The photo (Figure 25) shows the view along transect 2, from the end on Cape Blanco Road to the beginning at the base of the hill. Wetland obligate, *Carex obnupta* dominates most of the quadrats, while *Juncus hesperius* is also abundant. In more open areas, *Oenanthe sarmentosa* comprises up to 35% and *Potentilla*

anserina up to 40%. In less than half of the quadrats, *Lotus corniculatus* is present and covers up to 15%.

Figure 25: *Carex* dominated wetland

Figure 25 is a photograph taken from a quadrat dominated by *Carex obnupta*.

Off Transect Surveys

Plants recorded during off- transect observations are documented elsewhere. At the crossing of the oxbow, native wetland obligate species *Carex obnupta* (slough sedge), *Eleocharis palustris* (spike rush), and *Callitriche spp* (water starwort), are associated with *Potomogeton crispus* (curly pondweed), a non-native aquatic plant.

Along the margin of the ponded area to the east of the oxbow, near the hill, both wetland and upland species are in close proximity. Native wetland obligates include *Lysichiton americanus* (skunk cabbage), *Oenanthe sarmentosa* (water parsley), and *Potentilla anserina* (silverweed). Additional observations and plant collections would be required to determine whether the bur reed, *Sparganium*, is the native *S. eurycarpum* (broadfruit bur reed) or the introduced *S. emersum* (European bur reed). Also to be determined is whether the *Persicaria spp* (smartweed) is native, among 5-7 species in Curry County. From a distance, the pond lily (Figure 26) was tentatively identified as the invasive *Nuphar lutea*.

Figure 26: Ponded site

Also adjacent to the pond, *Stachys mexicana* (hedge-nettle) is a native facultative wetland species. Facultative species include the trees, *Alnus rubra* (red alder) and *Frangula purshiana* (cascara), as well as shrubs, *Rubus spectabilis* (salmonberry) and *Ribes spp* (gooseberry). On the hill, in the facultative upland, *Pteridium aquilinum* (bracken fern), and *Fragaria vesca* (woodland strawberry) are present. Genera containing field species, *Rumex spp* and R*anunculus spp*, have unknown moisture requirements. The only additional non-native species noted in this area was *Digitalis purpurea* (purple foxglove), a facultative upland type.

At the end of the second transect, species growing on the road fill were noted. These plants are among those that would colonize newly disturbed fill. Native species, from wetter to dryer include *Equisetum spp* (horsetail), *Symphyotrichum chilense* (aster), *Rubus ursinus* (blackberry), and *Polystichum munitum* (swordfern). Non-native species that could overtake the fill include *Agrostis stolonifera* (creeping bentgrass), *Rumex crispus* (curly dock), *Cirsium arvense* (thistle), and *Vinca major* (periwinkle).

Along the ditch at the margin of the wetland, a mix of wetland obligates and upland species were observed. Native wetland obligates include *Typha latifolia* (cattail) and *Scirpus microcarpus* (bulrush). *Phalaris arundinacea* (reed canarygrass) is a facultative wetland species, but is known as an aggressive colonizer, and once established, is difficult to control. Native facultative species include *Heracleum maximum* (cow-parsnip), *Lupinus rivularis* (river-bank lupine) and the tree *Frangula purshiana* (cascara). Native *Lupinus* may have value as a nitrogen-fixing cover for exposed soils. Moisture needs for the local *Salix spp* (willow) and a possible arnica species (leopardbane) are unknown. Non-native species include *Dipsacus fullonum* (teasel) and *Daucus carota* (wild carrot or Queen Anne's-lace).

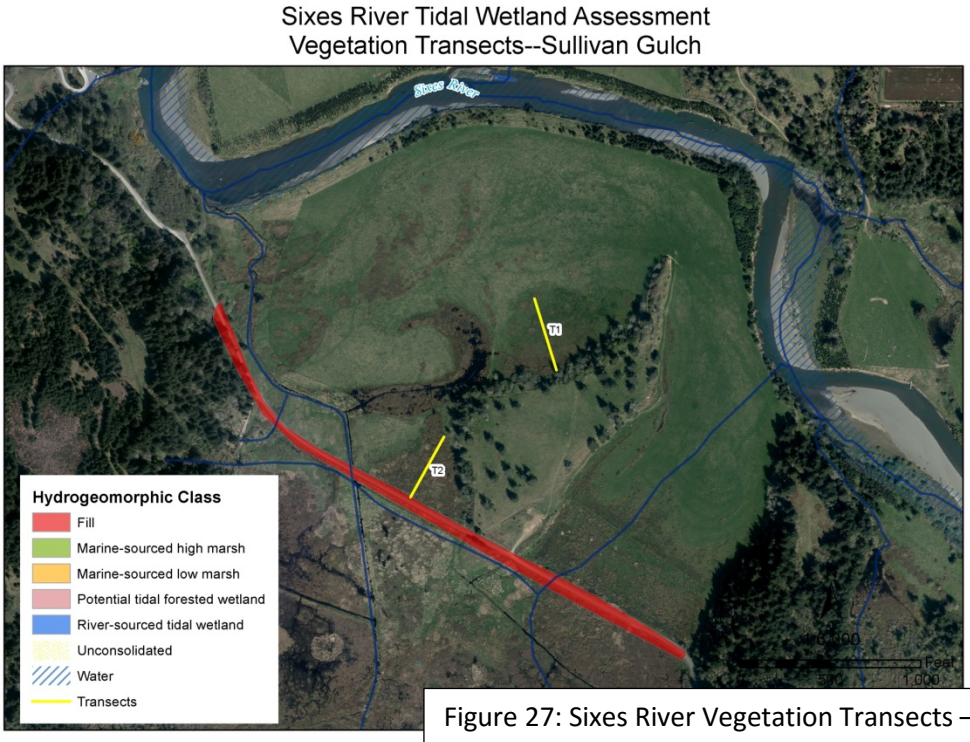
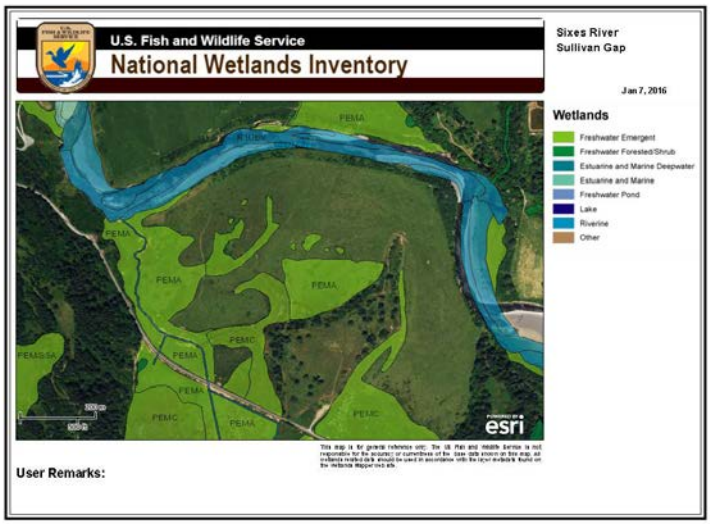


Figure 27: Sixes River Vegetation Transects – Sullivan Gulch

Figure 28: Sixes River – Sullivan Gulch Wetland



Recent Restoration Actions

In 2015 Curry Soil and Water Conservation District replaced 1,000 feet of ditch on the north side of Cape Blanco Road with 2,650 feet of meandering channel and placed some 120 logs with root wads, 215 smooth cylinder logs, and 150 individual root wads in the drainage between Sullivan Gulch and Sixes River. Roughly 70% of the root wad logs and cylinder logs, and all of the individual root wads, were buried into the banks and beds of the channels and backwater areas to prevent them from floating; the remaining 30% were pinned in place with small diameter logs that were pushed into the ground like pilings. The wood was typically placed in clusters of 2-4 pieces, to create approximately 143 log structures (Figure 27). Logs were also buried perpendicular to the channel, in multiple riffles, to serve as grade control "sill logs" in the event that a head cut initiates within a new section of channel. The channel included a reconnected meander bend that added significant length to the channel.

The project was designed to provide seasonal fish access and restore both fish and waterfowl habitat on a 200 acre wetland complex. The project was funded with a combination of funds from Oregon Watershed Enhancement Board, U.S. Fish and Wildlife Service, Oregon Department of Fish and Wildlife, Wild Rivers Coast Alliance, Oregon Parks and Recreation Department, and the Bureau of Land Management.

Figure 29: Sullivan Gulch Channel Realignment

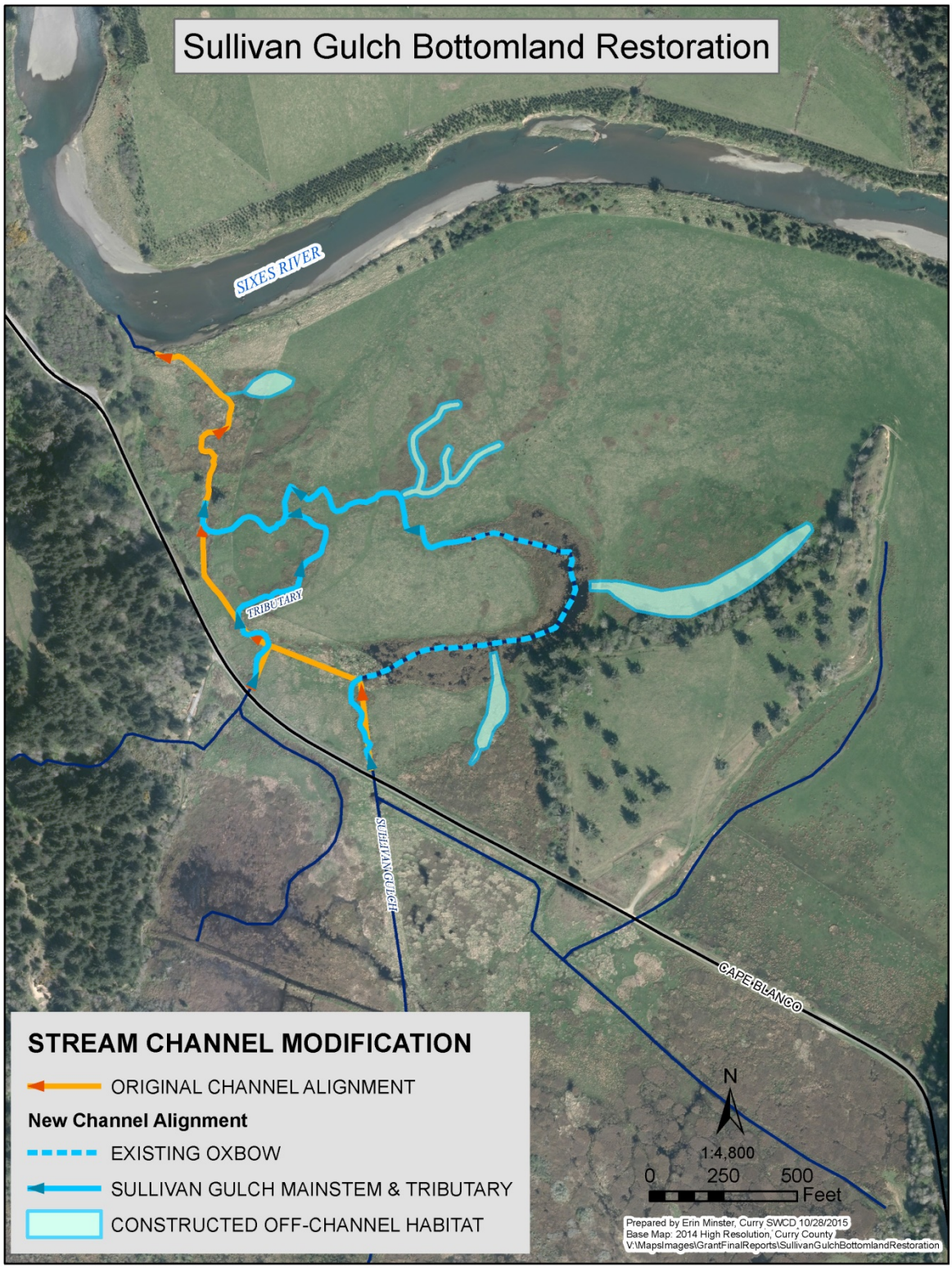
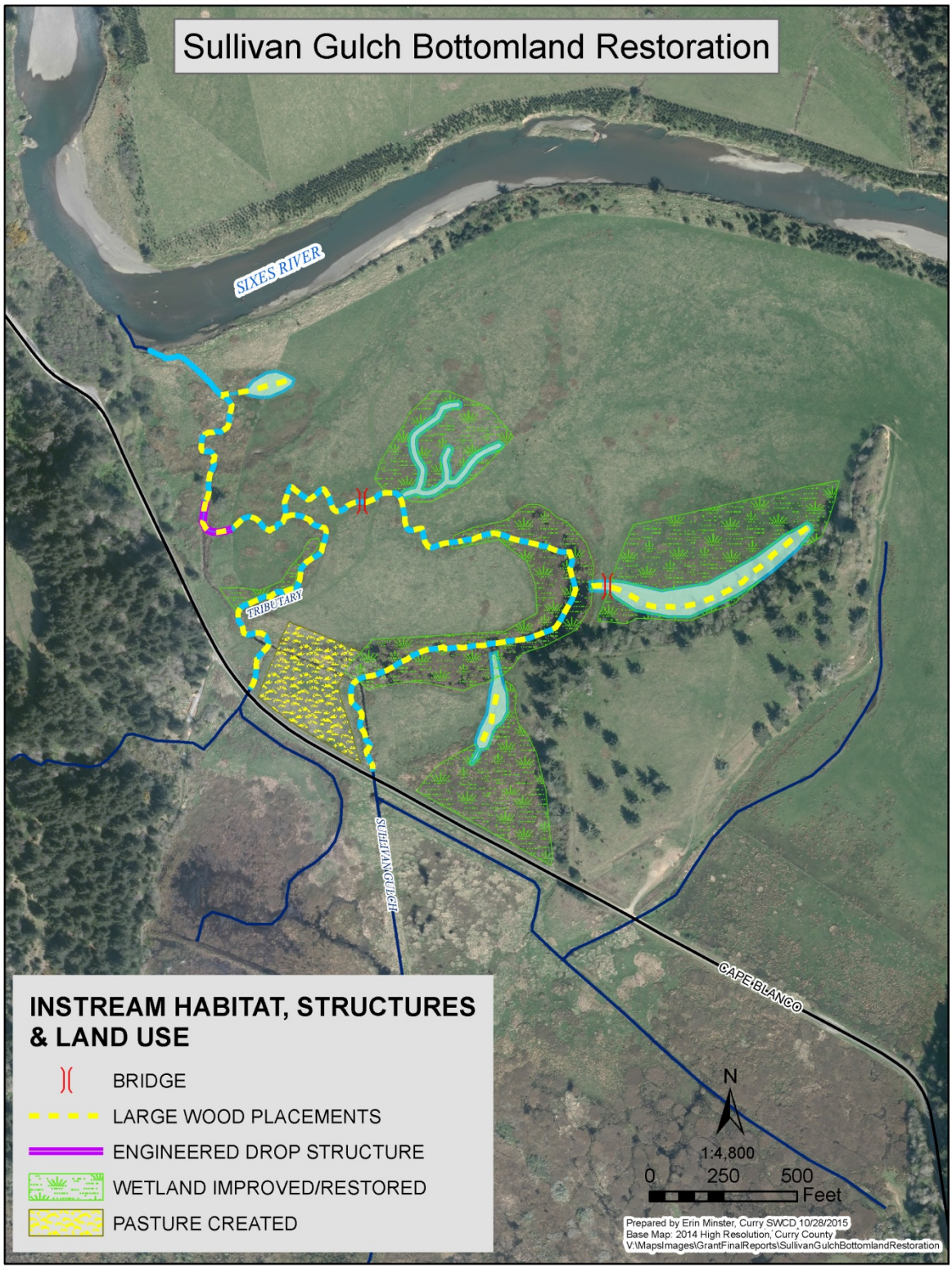


Figure 30: Sullivan Gulch Habitat Restoration



Sullivan Gulch
Channel Realignment
Summer 2015

Photo point 4.
Looking Northeast.

Grade control drop structure with large wood placement.

During and after construction.

Figure 31: Sullivan Gulch Channel Realignment and large wood placement

Sullivan Gulch
Channel Realignment
Summer 2015

Photo point 1.
Looking South.

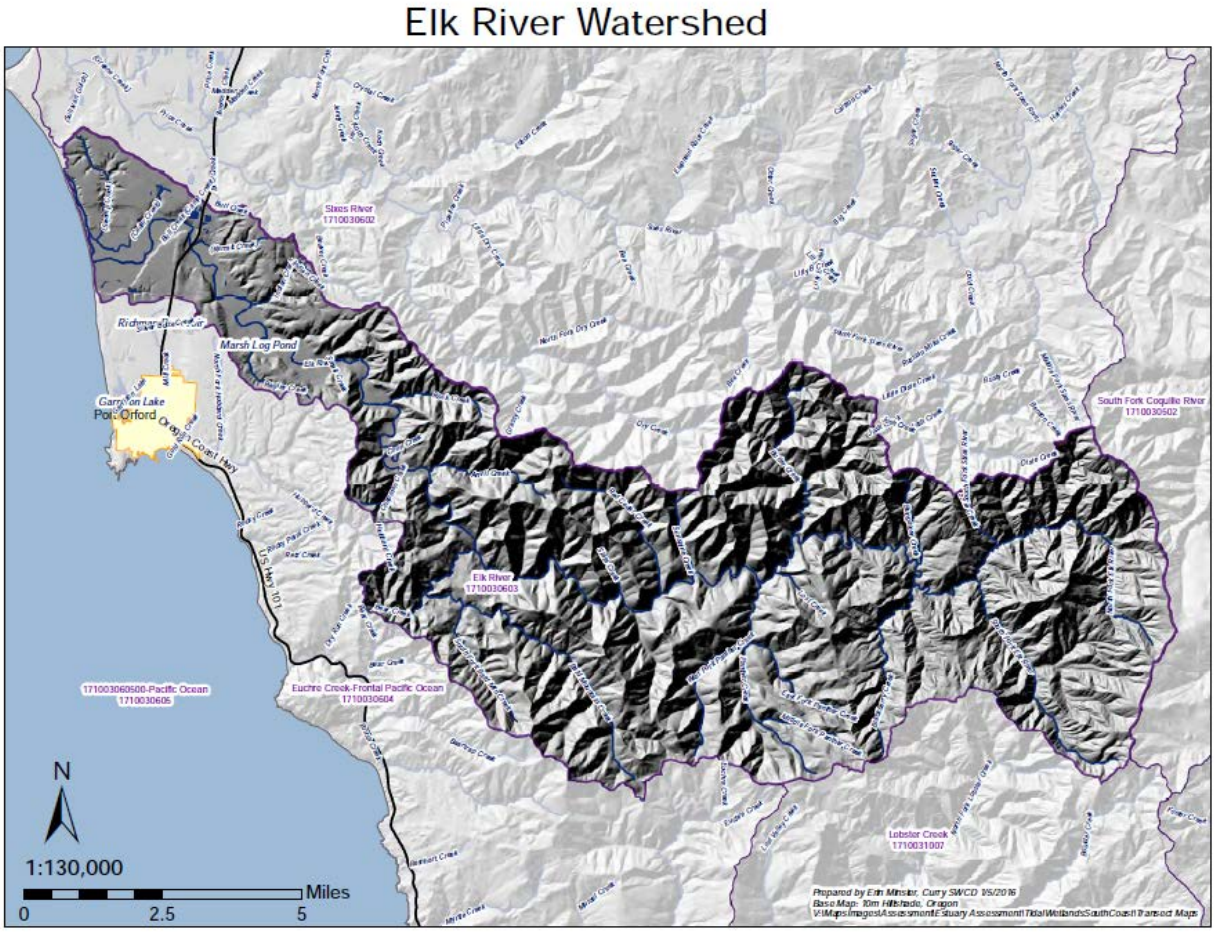
Backwater area 4 with Cape Blanco Road in background. Before and after construction.

Recommendations

Continued restoration actions could better link the habitat above Cape Blanco Road to Sixes River. Improving fish passage and fish access to the Spruce swamp could add to the rearing habitat for juvenile salmon in the Sixes during winter high water periods.

Elk River

Figure 32: Elk River Watershed



The Elk River drains approximately 92 square miles and the main river is approximately 40 miles long. The upper portion of the basin is characterized by steeply sloped forested areas with narrow valleys and tributary streams that have moderately steep to very steep gradient. Grazing, rural residential development and other agricultural uses are the dominant land uses in the lower portion of the basin. Over one half of the Elk River basin is situated in a designated wilderness area and over 75% of the watershed is managed by the federal government. Agricultural and rural residential private lands comprise some 8% of the watershed, dominantly the lower portion of the watershed.

The headwater streams are steep to very steep and not particularly responsive to disturbance and restoration. Many of these streams are in wilderness or late successional reserve managed areas. The low gradient moderately confined stream channels of the lower river present the greatest opportunities for restoration along with the low gradient small floodplain channels and estuarine channel reaches in the lower river.

Chinook, coho, steelhead and cutthroat are all native to the Elk River watershed. The historic abundance and distribution of these salmonids, within the watershed, is poorly understood.

However, coho were historically more abundant in the Elk River basin, and likely more abundant than chinook. Contemporary distributions of coho are likely much reduced from the early settlement period due to habitat modification in the lower reaches. Abundance of coho has also been affected by habitat modifications, primarily in the lower reaches, where overwintering habitat has been lost. Coho populations, however, probably did not exceed more than several thousand fish in the Elk River watershed.

In the Coastal Multispecies Plan (ODFW, 2014) reviewing the operation of the Elk River Hatchery, Oregon Department of Fish and Wildlife has concluded that the Elk River fall Chinook was not viable with interactions with hatchery fish the primary limiting factor. In response to this, ODFW reduced the hatchery release, is taking a suite of additional actions to reduce hatchery fish on the spawning ground while implementing new research out of the Oregon Hatchery Research Center to address the issue of straying.

The Elk River watershed has been the site of extensive evaluation of the factors associated with anadromous fish abundance and habitat associations (Burnett, 2001). Her research points towards the conservation objectives of recognizing large scale structures (valley form and channel confinement) as well as fine scale features (pools, riffles, etc.) that affect different species differently. She emphasizes the importance of addressing underlying processes that create the features that are associated with salmonid abundance. Her research found that "*unconstrained valleys and nearby valley segments were the most consistently and highly used by*" Chinook salmon. She developed recommendations for conservation that used this information as a foundation for a strategy for recovery.

Her research was concluded by: "*Habitat selection and use by juvenile salmonids were influenced by characteristics at the stream system and valley segment scales. Ocean-type chinook salmon always selected for the mainstem, coastal cutthroat trout and steelhead selected for the tributaries or were randomly distributed at the stream system scale, and coho salmon selected for the mainstem in some years but for tributaries in others. Although juvenile salmonids appeared not to differentiate between the two valley segment types in the mainstem, unconstrained valleys in the tributaries were either selected or avoided by all four species. Chinook salmon, coho salmon, and cutthroat trout often selected unconstrained valleys, but steelhead often avoided these. Additionally, the influence of unconstrained valleys was the most statistically significant variable distinguishing between valley segments that were highly used by juvenile chinook salmon and those that were not.*"

While the research focused on the freshwater portion of the life history of native salmon and steelhead, research in a similar small Oregon Coastal stream system (Salmon River) has demonstrated the significance of estuarine conditions to native salmonids (Jones et al., 2014). Thus focus on habitat conditions on the unconfined floodplain and tidally influenced wetlands of the Elk River can assist in the expression of the complex life histories of salmon and steelhead.

Elk River Swamp Creek

Wetland Name: Mouth of Swamp Creek / Elk River **Site ID: ER-1**

Botany Survey Date(s): 8/8/2014

Located at the mouth of Swamp Creek, 1.25 mile from the mouth of the Elk River, this wetland is comprised mainly of the low lying banks of Swamp creek. Elk River mainstem is to the west and a pond with submerged aquatic species (*Nuphar* spp, *Potamogeton* spp) is to the east. An additional wetland component, dominated by *Carex obnupta* and *Eleocharis palustris* is established to the northeast approximately 100 meters and is surrounded by pasture. Soil structure is mainly compacted clay/loam and is very stable. Solar cover is almost non-existent. *Ulex europaeus* (gorse) is growing on hillsides to the north and south.

Transect Locations

Transect #1 Quadrats #1 - #11: The transect starts approximately 25m from mouth of Swamp Creek at the base of a hillslope with steep pasture behind. The two grasses *Agrostis stolonifera* (37%) and *Holcus lanatus* (21%) dominate, with young shoots of *Carex obnupta* (17%) and established *Lotus corniculatus* (16%) respectively.

The transect continues south toward the bank of Swamp Creek through high marsh habitat comprised mainly of *Agrostis stolonifera, Lotus corniculatus, Phalaris arundinacea, Holcus lanatus* and *Carex obnupta*. *Gallium* spp and *Potentilla anserina* spp *pacifica* were also represented in several quadrats.

Quadrat #11 ended the transect at the bank of Swamp Creek with *Eleocharis palustris* (31%) and *Juncus balticus* (21%). *Callitriche* spp was observed off transect in Swamp Creek.

Transect #2 Quadrats #12 - #18: The second transect is located downstream of the pond ~ 10m and starts at the base of the gorse-covered hillside. The transect runs north-south and ends at edge of the bank of Swamp Creek.

Transect #2 alternates being dominated by *Carex obnupta,* Phalaris *arundinacea* and *Lotus corniculatus*. *Agrostis stolonifera*, *Cirsium* spp and *Ranunculus repens* were also represented in several quads. Transect ended at water's edge. *Typha latifolia, Iris pseudacorus* (yellow flag) invasive, *Ipomoea purpura* (morning glory) invasive, *Potamogeton* spp, *Deschampsia caespitosa* and *Alnus rubra* were all observed off the transect.

Management Observations

Transect #1 is accessible to livestock and showed signs of grazing. Upstream of the wetland is intensively used sheep pastures. The risk of chemical and nutrient runoff exposure is a potential.

Transect #2 is surrounded by thick *Carex obnupta* and gorse and has no real threat of grazing potential, however presents the problem of domination by gorse, a noxious weed.

Figure 33: Elk River Vegetation Transects – Swamp Creek

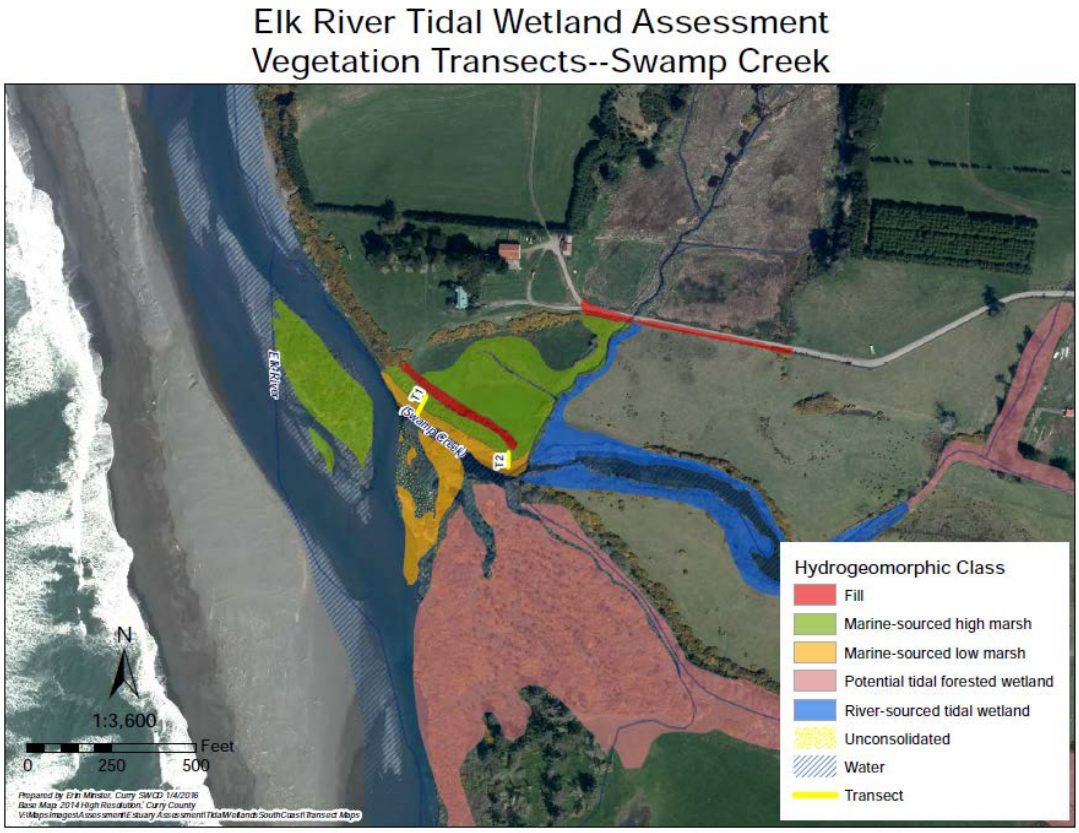


Figure 34: Elk River Mouth Wetlands

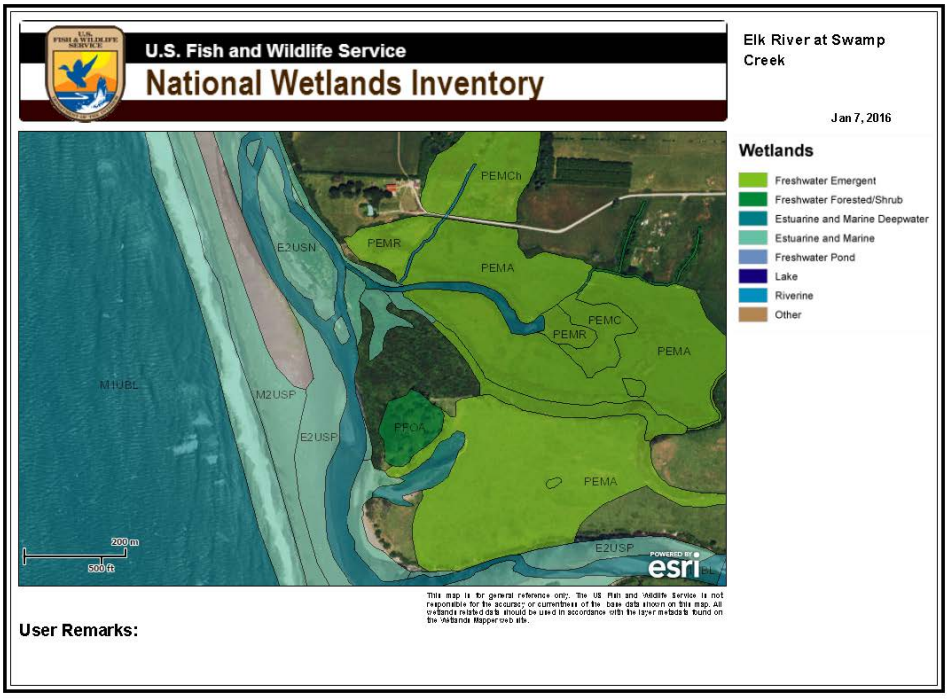
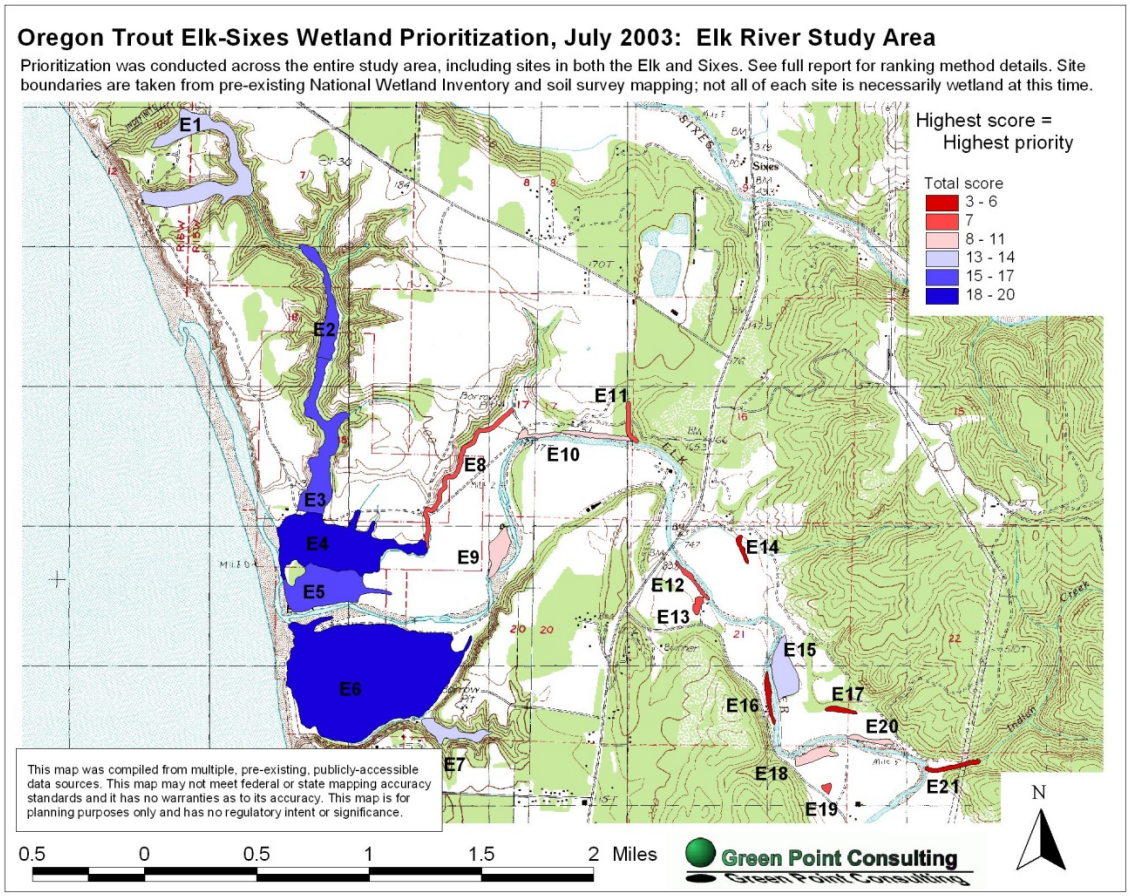


Figure 35: Wetland Prioritization for Elk River from (Brophy, 2003)

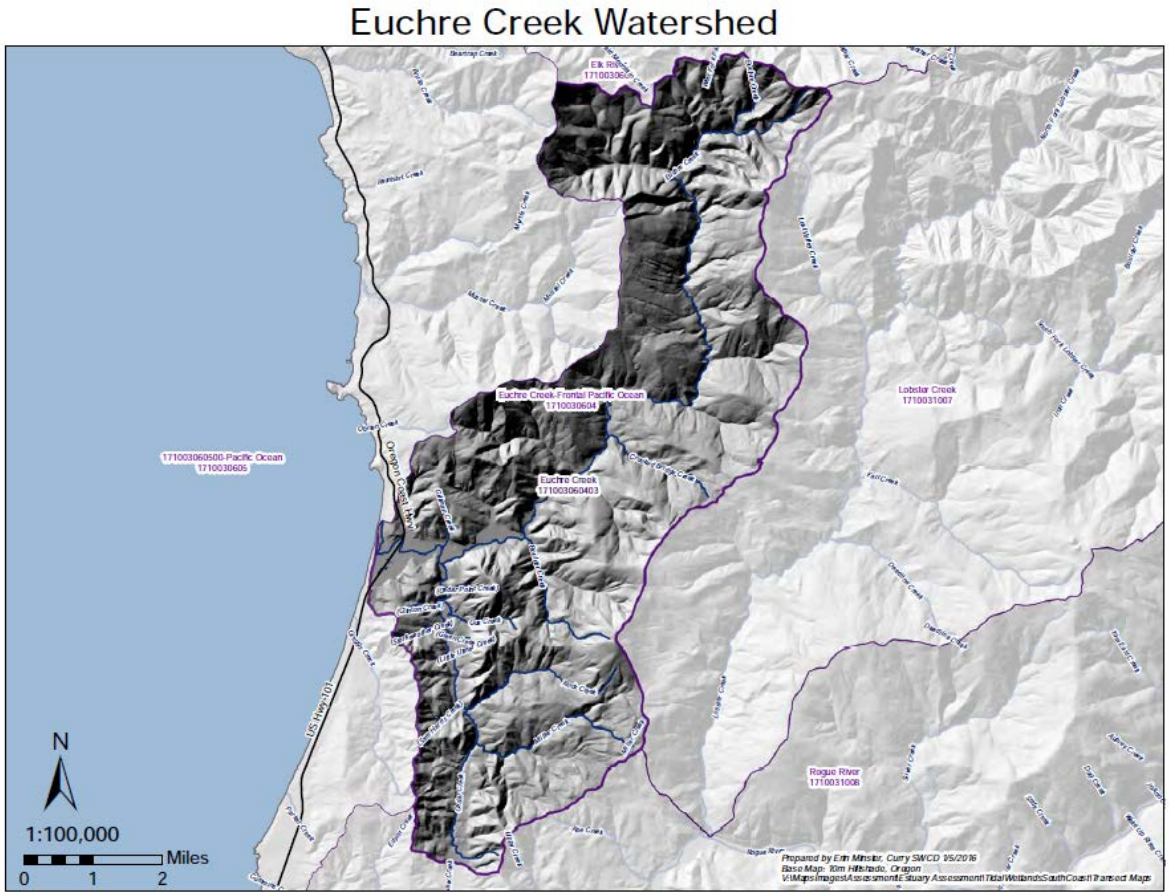


From the site descriptions in Brophy (2003), the sites are described as:

- **Site E1** Limited access prevented full evaluation; however she observed that the site "may not be very wet. Soil has up to 22% hydric components and inclusions."
- **Site E-4** This site encompasses three drainages: the lower three hundred feet of Swamp Creek, a small drainage that flows into the "Duck Pond", and the lower portion of Cedar Creek. The report lists a series of restoration opportunities and further evaluations that would help to focus restoration opportunities.
- **Site E-5** This site is characterized as being impacted by heavy grazing and due to lack of access the restoration opportunities were not fully evaluated. The site is shown as wetland on the National Wetlands Inventory and the soils are partially hydric.
- **Site E-6** Similar to E-5, this site is grazed and limited access prevented a full evaluation. The site does have a greater prevalence of hydric soils and evidence of meander scars indicating historic inundation.
- **Site E-10** This site is a narrow band of wetland and riparian habitat along the river. The riparian area was planted by the landowner (Wahl family).
- **Site E-14** The wetland is larger than the mapped site, however the site has been ditched to partially drain it.

Euchre Creek

Figure 36: Euchre Creek Watershed



As characterized by Maguire (2001b): "*The Euchre Creek watershed is among the smallest coastal rivers in southern Oregon. Euchre Creek is approximately 14 miles long and drains about 23,831 acres or 37 square miles. Flowing in a southwesterly direction the Euchre mainstem empties into the Pacific Ocean at Ophir, Oregon. Elevations in the watershed range from sea level to approximately 3,080 feet. Major tributaries include Cedar Creek and Boulder Creek. The lower few miles of the river lies on a relatively low gradient coastal floodplain. The upper portion of the basin is characterized by steeply sloped forested areas with narrow valleys and tributary streams that have moderately steep to very steep gradient. Rural residential development, grazing, and other agricultural uses are the dominant land uses in the lower portion of the basin.*"

One percent of the channel length inventoried was classified as small estuarine channel (ES), the first 0.8 miles of the Euchre Creek mainstem. This channel type is unconfined and responds to variations in sediment and weather patterns from both upstream and ocean. Restoration and enhancement activities often focus on long-term preservation of habitat for unique biological

communities through techniques such as limiting future development and reconnecting wetlands isolated by manmade dikes.

Maguire (2001b) summarizes: "*Ninety acres of wetlands are found in Euchre Creek watershed, mostly in the lower portion, near the estuary. Less than half are highly altered, with more than a third altered very little.*"

A single wetland site near the mouth of Euchre Creek was sampled for HGM analysis.

Euchre Creek Mouth

Wetland Name: Euchre Creek at Mouth **Site ID: EC-1**

Botany Survey Date(s): 7/28/2014

Located between Highway 101 and the mouth of Euchre Creek, this wetland is 50 meters wide from east to west and approximately 80 meters long. The Highway bisects the wetland from a larger non- tidal wetland on the east side. The majority of the wetland is high marsh abutted by a small low marsh area and pond on the Southern edge. A ditch with 0.5 meter high cut banks runs through the center of the wetland providing a narrow corridor of low marsh habitat which has significant tidal influence. The vertical bank of Euchre Creek to the high marsh wetland is 1-1.5 meters tall and relatively unstable. Solar cover is very minimal.

Transect Locations

Transect #1 Quadrats# 1-10: The transect is located near the center of the wetland and starts at the bank of Euchre Creek. The transect heads east toward Highway 101 bisecting the ditch within 15 meters then continues to base of Highway 101 fill slope. The transect is ~ 50m long and is dominated by four high marsh species; *Potentilla anserina* spp *pacifica*, *Holcus lanatus*, *Juncus balticus* and *Lotus corniculatus*.

Quadrat # 3 crosses a ditch and is dominated by *Carex obnupta* (55%) and *Eleocharis palustris* (25%). *Callitriche* spp was also present at (5%).

T**ransect #2 Quadrats# 11-20:** The second transect is located just South of the first one and starts at the bank of Euchre Creek, crosses the low marsh and edge of pond before ending at Highway fill slope.

Quadrats #12 and #13 are dominated by *Eleocharis palustris* at (66% and 59%) as the transect skirts the edge of a pond.

Quadrat #15 is dominated by *Schoenoplectus americanus* (64%) and *Agrostis stolonifera* (20%).

Quadrat #19 is partially submerged and dominated by *Myriophyllum* spp (58%) and *Eleocharis palustris* (40%)

Management Observations

A culvert connects wetlands on either side of Highway 101. The culvert failed in 2014 and was replaced by three 36" culverts that appear to be perched and impound water on the east side of the highway. Provision of fish passage should be considered at this location. The wetland is currently fenced on the north side and inaccessible to livestock.

The presence of a wrack line against the fill slope and old fence line indicates seasonal flooding.

Figure 37: Euchre Creek Vegetation Transects – Creek Mouth

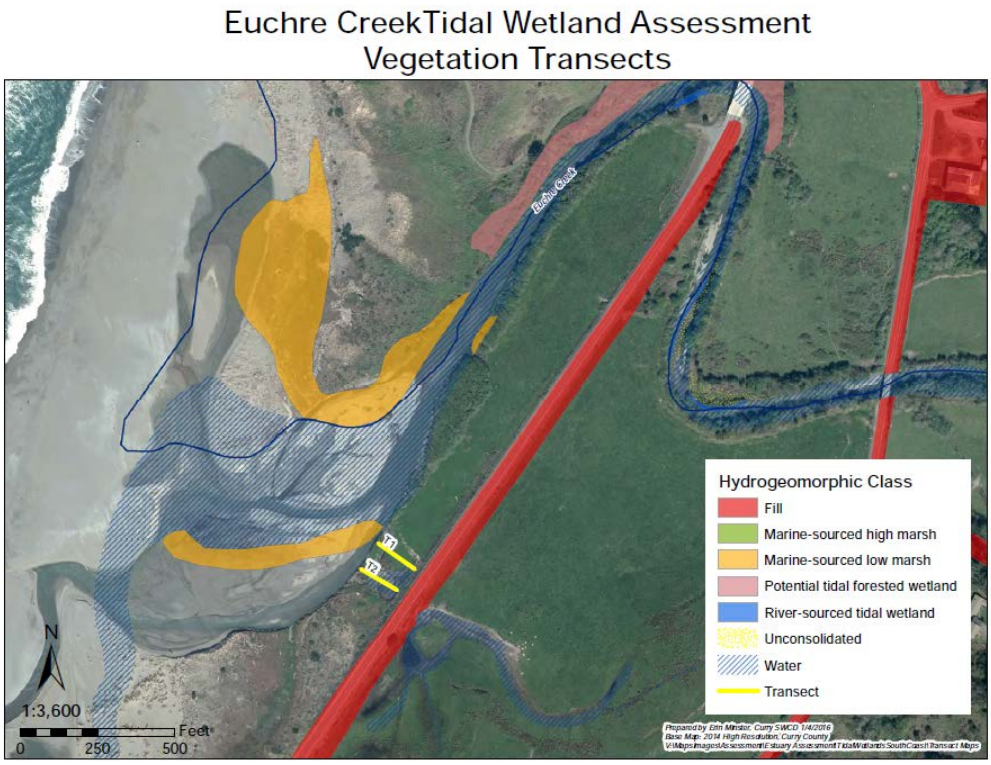
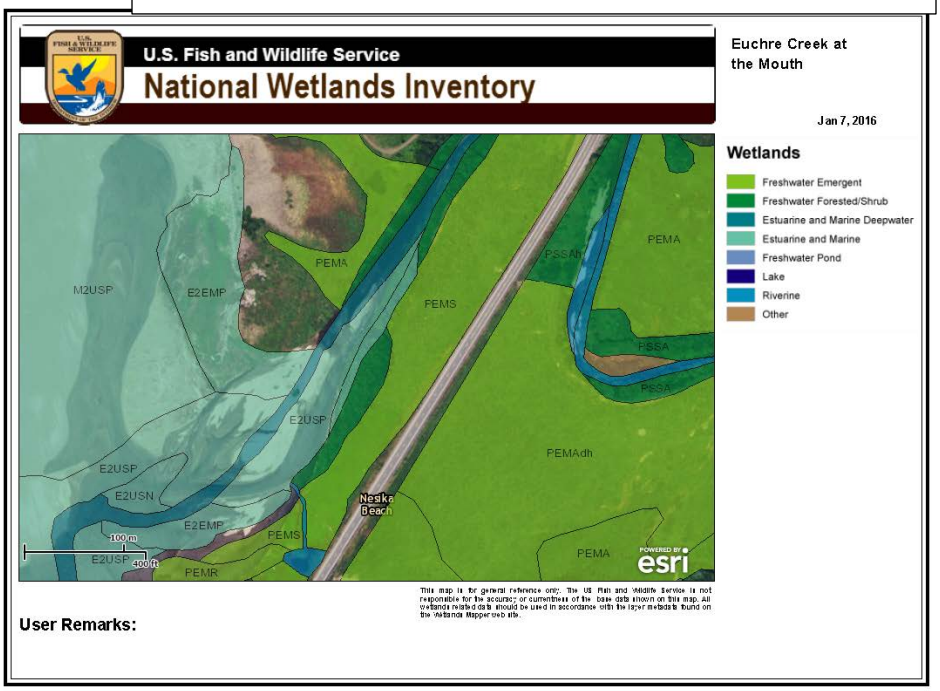


Figure 38: Euchre Creek Wetlands – Creek Mouth



Hydrogeomorphic Tidal Wetlands Rapid Assessment Method

Methods

The Hydrogeomorphic Tidal Wetlands Rapid Assessment Method (HGM RAM) as developed by Adamus (2006; Adamus, 2005; Adamus et al., 2005) was used to evaluate nine sites (data from an additional site in the Sixes River drainage; Sullivan Gulch was used as well) using at least two transects for each site. See Myers, 2015 for detailed description of methods used for these South Coast estuaries.

Botanical transects and off-transect observations were previously conducted in advance of a restoration project at Sullivan Gulch, in the Sixes River Estuary (Myers, 2015). Details of the transect locations and quadrats is attached as Attachment A.

South Coast Estuary Tidal Wetland Transects

Estuary	Transects	Habitats
New River	Four locations along New River from the outlet to the Floras Lake confluence	freshwater backwater flooding across floodplain, brackish outlet near the mouth, tidal influenced floodplain
Sixes River	Four locations from the mouth to Sullivan Gulch	fringing marsh, backwater restoration site and tributary channel locations
Elk River	A single location at the confluence of Swamp Creek and Elk river	Floodplain of Swamp Creek
Euchre Creek	A single location at the mouth of Euchre Creek	high marsh at the mouth of the estuary

Table 4: Vegetation Sampling Tansects for South Coast Estuary HGM evaluations

Forms and analytical tools developed by Adamus (2006) were used to monitor indicators of wetland function, biological and geomorphic condition, and potential risks to the wetland's integrity. Field indicators address potential risks to wetland integrity and functions. For example the function of fish habitat depends on a network of wetland services, such as trapping sediment, immobilizing sediment/pollutants (locations of road drainage, stormwater runoff), supporting food webs, slowing floodwaters, and thermal regulation by groundwater exchange.

The surveys consist of assigning values for indicators using definitions provided by Adamus (2006), at http://www.oregon.gov/dsl/WETLAND/docs/tidal_HGM_pt1.pdf (Appendix A Data Forms). Eleven botanical indicators are included, requiring surveys of species presence and abundance on 10 quadrats (one-meter plots) along each of two transects (shown above in figures). Each indicator score and the vegetation percent cover data were entered into TidalWet_Calculator _HGM_Oregon June 2010.xls. The calculator

uses scoring models (Appendix C) to combine the indicators for scores of 12 wetland functions, wetland condition, and potential risks to wetland integrity.

Tidal Wetland Quadrats Surveyed

Location	Quadrats
New River-Clay Island Breach	20
New River – Fourmile Creek	20
New River – New Lake Outlet	18
New River – Hanson Slough	17
Sixes River – Sullivan Gulch	26
Sixes River – Orchard Hole	20
Sixes River – Sweet Ranch	20
Sixes River - Mouth	19
Elk River – Mouth of Swamp Creek	18
Euchre Creek - Mouth	20

Table 5: Vegetation Samples for HGM Evaluations

The analysis used the same procedure described in Myers (2015).

Wetland Integrity

The Wetland integrity score is an average of scores for the difference from predicted values (statistically accounting for natural factors, discussed below)

- Positive influence: species per quad, mean % cover of tap-rooted wetland species, mean % cover of tuft-rooted wetland species
- Negative influence: proportion of plots that contain plant species with 90% or greater cover (dominance), proportion of plots that contain non-native species with 20% or greater cover, proportion of plots that contain annuals, mean % cover of stoloniferous species

Wetland Integrity Value Comparison

Indicator	NR Clay	NR Four	NR NL	NR Hanson	SR Mouth	SR Sullivan	SR Orchard	SR Sweet	ER Swamp	EC Mouth
SpDeficit	0.25	1.0	1.0	1.0	1.0	0.5	1.0	1.0	1.0	1.0
DomDef	0.50	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
NnDef	1.0	0.50	1.0	0.75	0.75	0.5	0.75	0.50	0.01	0.5
AnnSp	0.01	0.01	0.01	0.01	0.01	1.0	0.01	0.01	0.01	.01
TapSp	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.01	1.0
StoSp	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.25
TuftSp	0.01	1.0	1.0	0.75	0.75	.01	1.0	1.0	1.0	1.0
Mean Score	0.54	0.79	0.86	0.79	0.79	0.72	0.82	0.79	0.72	0.68

Table 6: Wetland Integrity Values **SpDeficit** = Difference between actual and predicted species per plot, **DomDef** = Difference between actual & predicted dominance proportion of plots with>90% cover, **NnDef** = Difference between actual & predicted proportion of plots containing non-native species with >20% cover, **AnnSp** = Proportion of quadrats that contain annuals, **TapSp** = Mean percent-cover of tap-rooted wetland species among all quadrats, **StoSp** = Mean percent-cover of stoloniferous species among all quadrats, **TuftSp** = Mean percent-cover of tuft-rooted wetland species among all quadrats. **NR** = New River, **SR** = Sixes River, **ER** = Elk River, **EC** = Euchre Creek

The highest ranking wetland integrity scores were for New River at the New Lake outlet and for Sixes River at Orchards Hole. Both locations were adjacent to other waterbodies and had a more constant water regime. Three additional New River sites (Fourmile Creek, Hanson Slough, and mouth of the New River) also ranked relative high for wetland integrity. New River at Clay Island breach site was the lowest ranked, likely reflecting the sand island nature of the site that is subject to drainage with water level changes.

The wetland integrity values for three other south coast estuaries (Hunter Creek, Pistol River and Winchuck River) have similar mean integrity values and all sites except one are above 0.50. Three of the New River sites (New River at New Lake, Hanson Slough and Fourmile Creek) and three of the four Sixes River sites (Mouth of Sixes River, Orchard Hole, and Sweet Ranch) have higher mean scores than any of the previously evaluated estuaries.

In general the evaluation shows the South Coast estuaries to have relatively high integrity values which reflects their relatively intact conditions and is reflected in the designation as Natural estuaries by the Land Conservation and Development Commission (Cortright et al., 1987).

Risk Assessment Existing Potential Risks to Wetland Integrity

Scoring for risk to wetland integrity is scored on a scale from 0.0 to 1.0; higher scores indicate higher potential risks to wetland integrity. The scores (Attachment B) for fish support (marine, anadromous and native freshwater) have low risk from stressors, the ability to maintain botanical conditions shows the greatest risk when compared to theoretical scores, while above ground organic production is at greatest risk when using reference sites. Maintaining element cycling rates and pollutant processing is at relatively high risk for most sites as well.

The table shows four categories of risk by color with greener tones being lower risk (higher rating) and red tones being higher risk (lower rating). Risk category averages are lowest for Sixes River (Orchards Hole, Sweet Ranch) and New River at the New Lake outlet.

Assessment of Wetland Functions and Restoration Recommendations

The risk scores for wetland functions are shown in Attachment B. The following describes the implications for restoration actions for each function.

<u>Production of Above Ground Organic Matter (AProd)</u>

Factors that disturb the vegetation and soil surface (grazing, trampling, flood overflow, etc.) reduce the production of aboveground organic matter. All sites show a relatively low risk of loss of function from loss of production of above ground organic matter. Orchard Hole on the Sixes River and the mouth of Euchre Creek has the highest loss of above ground organic matter. The Euchre Creek site has evidence of seasonal flooding which may affect this indicator. The transects at the Orchard Hole; Sixes River cross a pond which may have

affected the value.

The impacts of grazing could be reduced for New River (Hansen), Elk River at Swamp Creek, Sixes River at Orchards Hole, Sweet Ranch, and at the mouth. All of these sites had indications of grazing impacts.

Export Aboveground Plant and Animal Production (XPT)

All sites show relatively good resilience for export of biological materials. Those closer to the mouth of Sixes River and New River had highest function values (lowest scores). Orchard Hole site on the Sixes River had the lowest score, likely because it is the furthest upstream site on the River.

Maintain Element Cycling Rates & Pollutant Processing; Stabilize Sediment (WQ)

Since a variety of factors affect this function there may be different explanations for some of the sites showing greater risk. Some of the New River sites has narrow wetland widths, especially the New Lake outlet site. Active grazing may have affected the values of other sites (Sixes Orchard Hole and Sweet Ranch, Elk River Mouth of Swamp Creek, and New River Fourmile Creek).

Maintain Habitat for Native Invertebrates (INV)

Most sites were not high risk for this wetland attribute. The lack of fine sediment input, relatively good vegetation cover and other factors do not make this attribute particularly useful for developing restoration recommendations.

Maintain Habitat for Anadromous Fish (AF)

All sites had good habitat attributes for maintaining anadromous fish despite the relatively small size of the estuaries involved.

Maintain Habitat for Marine Fish (Mfish) and for Other Visiting and Resident Fish (Rfish)

Similar to anadromous fish, marine fish and resident fish values are high and not particularly diagnostic for restoration actions.

Maintain Habitat for Nekton-feeding Wildlife (NFW)

This wetland function is poorly understood and not particularly useful for diagnosing restoration needs.

Maintain Habitat for Ducks and Geese (Dux)

There are no protected habitats except for the relatively poor access to some of the New River sites. Sweet Ranch on the Sixes River and New River outlet site have the highest risk

scores. New River is known to support up to 20,000 Aleutian Canada Geese each spring.

Maintain Habitat for Shorebirds (Sbird)

New Lake at New Lake Outlet and Fourmile Creek have the highest risk rating. The other sites evaluated have significantly lower risk to shorebird habitat. New River has been identified as an Important Bird Area by the Portland Audubon Society. The area is characterized as having: "*Snowy Plover is present year round. During spring, up to 20,000 Aleutian Canada Geese and tens of thousands of shorebirds (peaks up to 100,000) can be observed*."

Each of the estuaries on the South Coast have a similar range of shorebird habitat scores when comparing those of Myers (2015) to the New River, Sixes River, Elk River, and Euchre Creek.

Maintain Habitat for Native Landbirds, Small Mammals, & Their Predators (LBM)

Similar to shorebirds, the range of values is similar across all the South Coast estuaries. The values show limited risk with Orchard hole on the Sixes showing the greatest risk.

Maintain Habitat for Native Botanical Conditions

The scoring for this wetland function varied quite widely between methods used to calculate it. Assessing measures against theoretical values leads to significantly higher scores (greater risk). This is true for all South Coast estuaries evaluated (Myer, 2015).

Data from a limited number of transects indicate that the tidal wetlands evaluated along the South Coast have relatively low risk of losing wetland functions.

Restoration Opportunities/Limitations

While the HGM site evaluations identify deficits from reference or theoretical, the recommendations for restoration would be limited to site condition improvements such as reduction of grazing, treatment of invasive species, etc. Looking at the estuaries as a whole and looking to maintain the ecological processes that produce the ecosystem services of these South Coast Estuaries leads to a broader set of recommendations.

New River Estuary
The BLM work on foredune management is a central factor in the extent and function of the New River estuarine environment. As the New River Area of Critical Environmental Concern (ACEC) Management Plan update goes forward the conditions of the New River estuary will be established through decisions on foredune breaching, European Beachgrass control, and public access development or limitation. Increasing coordination with respect to riparian restoration is an issue identified in public feedback early in the planning process.

Sixes River Estuary
A number of opportunities for wetland restoration exist along the lower river. Conservation acquisition through easement or fee will be a critical tool to allow for the opportunities to be accomplished. Protection of the Spruce Swamp south of Sullivan Gulch is an important priority. "This spruce swamp is relatively undisturbed and contains the only known reedgrass fen in Oregon containing many rare and unusual plant species. The surrounding spruce swamp is characterized as being "the only known stand of its type remaining in Curry County, and probably the best remaining example on the entire coast of Oregon"(Brophy, 2003).

Elk River Estuary
Restoration opportunities at the mouth of Elk Creek would, like Sixes River require conservation acquisition to allow for restoration of complex channel habitats that have been simplified through time. While much of the upper watershed is federally managed or has conservation status through ownership of the Wild Rivers Land Trust, the lower river is dominantly privately owned and managed for values other than ecological outputs.

Euchre Creek Estuary
The primary barrier to restoration actions in the Euchre Creek Estuary is the location of Highway 101 that bisects the estuary and isolates the historic tidal marshes from tidal influence. The minimal restoration effort would be to work with ODOT to assure fish passage in all culverts on Highway 101.

Literature Cited

Adamus, P.R. 2006. Hydrogeomorphic (HGM) Assessment Guidebook for Tidal Wetlands of the Oregon Coast, Part 1: Rapid Assessment Method, Produced for the Coos Watershed Association, Oregon Department of State Lands, and U.S. E.P.A.-Region 10. Charleston, OR: Coos Watershed Association.

Adamus, P.R. 2005. Science Review and Data Analysis for Tidal Wetlands of the Oregon Coast. Part 2 of a Hydrogeomorphic Guidebook. Report to Coos Watershed Association, US Environmental Protection Agency, and Oregon Dept. of State Lands, Salem.

Adamus, P.R., J. Larsen, and R. Scranton. 2005. Wetland Profiles of Oregon's Coastal Watersheds and Estuaries. Part 3 of a Hydrogeomorphic Guidebook. Report to Coos Watershed Association, US Environmental Protection Agency, and Oregon Dept. of State Lands, Salem.

Brophy, Laura S. 2003. Wetland Site Prioritization, Lower Elk and Sixes Rivers, Curry County, Oregon. Produced for Oregon Trout by Laura Brophy, Green Point Consulting, Corvallis, OR,. 52 pp, plus 18 pp. tables.

Brophy, L.S. (Green Point Consulting). 2007. Estuary Assessment: Component XII of the Oregon Watershed Assessment Manual. Prepared for the Oregon Department of Land Conservation and Development, Salem, OR and the Oregon Watershed Enhancement Board, Salem, OR.

Bureau of Land Management. 1995. Final ACEC Management Plan. Coos Bay District Office. Bureau of Land Management. Department of the Interior. May 1995.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service, Washington, D.C. FWS/OBS-79/31.

Burnett, K. M. 2001. Relationships among juvenile anadromous salmonids, their freshwater habitat, and landscape characteristics over multiple years and spatial scales in Elk River, Oregon. Ph.D. Dissertation. Oregon State University, Corvallis, Oregon. 244 pp.

Christy, J.A. 1981. Plant Community Evaluation, New River and Environs. Unpublished report submitted to Bureau of Land Management, Coos Bay District Office.

Christy, J. A. 2000. Interpretation of transcriptions of General Land Office Survey data. Unpublished report submitted to Coos Bay District Office, North Bend, OR.

Christy, J. A. 2002. Classification of historic vegetation in New River-Cape Blanco Area, Oregon as recorded by General Land Office Surveyors. Unpublished report submitted to Coos Bay District Office, North Bend, OR.

Cogan Owens Cogan, LLC. 2014. Assessment Of Trends Affecting Planning for Oregon's Estuaries And Shorelands. Report Prepared For The Oregon Coastal Management Program, Oregon Department Of Land Conservation And Development. Salem, Oregon. March 2014. 101 pp.

Cooper, W.S. 1958. Coastal Sand Dunes of Oregon and Washington, The Geological Society of America. Memoir 72. 169 pp.

Cortright, R., J. Weber and R. Bailey. 1987. Oregon Estuary Plan Book. Oregon Department of Land Conservation and Development. Salem. 126 pp.

Cowardin, L. M., V. Carter, F. C. Golet, E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. USDI, Fish and Wildlife Service, Washington, DC. 131 pp.

Diaz-Mendez, Guillermo M. 1998. Analysis of coastal changes along the New River Spit, Bandon Littoral Cell, relevant to an adjustment of the Statutory Vegetation Line on the south coast of Oregon. Marine Resource Management Program Research Report. Oregon State Universty. Corvallis, Oregon. 104 pp.

Frissell, C.A., and W.J. Liss. 1986. Classification of stream habitat and watershed systems in south coastal Oregon. Oregon State University Oak Creek Laboratory of Biology, Annual Progress Report submitted to Oregon Department of Fish and Wildlife, Corvallis.

Frissell, C.A., W.J. Liss, and R.K. Nawa. 1987. Life history and persistence of anadromous salmonid stocks in relation to stream habitats and watershed classification. Oregon State University Oak Creek Laboratory of Biology, Annual Progress Report submitted to Oregon Department of Fish and Widlife, Portland, Oregon.

Frissell, C.A. 1992. Cumulative Effects of Land Use on Salmon Habitat in Southwest Oregon Coastal Streams. PhD dissertation. Oregon State University. Corvallis, Oregon. 227 pp.

Heady, W.N., K. O'Connor, J. Kassakian, K. Doiron, C. Endris, D. Hudgens, R. P. Clark, J. Carter, and M. G. Gleason. 2014. An Inventory and Classification of U.S. West Coast Estuaries. The Nature Conservancy, Arlington, VA. 81pp.

Jones, K.K., T. J. Cornwell, D. L. Bottom, L. A. Campbell, and S. Stein. 2014. The contribution of estuary-resident life histories to the return of adult Oncorhynchus kisutch. Journal of Fish Biology 85(1): 52-80.

Komar, P. D., J. J. Marra, and G. Diaz-Mendez. 1999. A study of the New River spit, Oregon, to acquire information relevant to an adjustment of the statutory vegetation line. Report to the Oregon Parks & Recreation Department, Salem, OR. 44 pp.

Lawson, P.W., E. Bjorkstedt, M. Chilcote, C. Huntington, J. Mills, K. Moore, T.E. Nickelson,

G.H. Reeves, H.A. Stout, and T.C. Wainwright. 2004. Identification of historical populations of Coho Salmon (Oncorhynchus kisutch) in the Oregon coast evolutionarily significant unit. Review Draft. Oregon Northern California Coast Technical Recovery Team. United States Department of Commerce, National Oceanic and Atmospheric Administration NOAA/NMFS/NWFSC. 129 pp.

Lee II, H. and Brown, C.A. (eds.) 2009. Classification of Regional Patterns of Environmental Drivers And Benthic Habitats in Pacific Northwest Estuaries. U.S. EPA, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Western Ecology Division. EPA/600/R-09/140. 298 p.

Maguire, M., 2001a, Elk River Watershed Assessment: Prepared by South Coast Watershed Council. http://www.currywatersheds.org/elk_river_huc10.aspx

Maguire, M., 2001b, Euchre Creek Watershed Assessment: Prepared by South Coast Watershed Council.
http://www.currywatersheds.org/euchre_creek_frontal_pacific_ocean_huc10.aspx

Maguire, M., 2001c, Sixes River Watershed Assessment: Prepared by South Coast Watershed Council. http://www.currywatersheds.org/sixes_river_huc10.aspx

Myers, Cindy R. 2015a. Oregon South Coast Estuaries: Hunter Creek, Pistol River, Chetco River, & Winchuck River Tidal Wetland Assessment. A report for the South Coast Watershed Council. 103pp.

Myers, Cindy R. 2015b. Rogue River Estuary Tidal Wetlands Assessment. A report for the South Coast Watershed Council. 70pp.

Nawa, R. K., C.A. Frissell, and W.J. Liss. 1988. Life history and persistence of anadromous salmonid stocks in relation to stream habitats and watershed classification. Oregon State University Oak Creek Laboratory of Biology, Annual Progress Report submitted to Oregon Department of Fish and Widlife, Portland, Oregon.

Oregon Department of Fish and Wildlife. 2014. Coastal Multi-Species Conservation and Management Plan. June 2014. Oregon Department of Fish and Wildlife, Salem, Oregon. 221 pp.

Reimers. P. E. 1971. The length of residence of juvenile Chinook salmon in Sixes River, Oregon. Ph.D. dissertation, Oregon State University, Corvallis, OR.

Reimers, P. E. and Kim J. Baxter. 1976 Fishes of the Sixes River, Oregon. Information Report Series, Fisheries 76-4. Oregon Department of Fish and Wildlife. 7 pp.

Scranton, R. 2004. The application of Geographic Information Systems for delineation and classification of tidal wetlands for resource management of Oregon's coastal watersheds. Marine Resource Management Program, Oregon State University, Corvallis. 97pp.

Timchak, K.L. and C.R. Myers. 2015 (unpublished). Rogue River Estuary Strategic Plan. Lower Rogue Watershed Council. 38 pp.

US Department of Agriculture, Forest Service. 1998. Elk River Watershed Analysis. Iteration 2.0. Siskiyou National Forest. 167 pp.

US Department of Agriculture, Forest Service. 1997. Sixes River Watershed Analysis. Iteration 1.0. Siskiyou National Forest. 173 pp.

US Department of Interior, Bureau of Land Management. 1987. Management plan for New River area of Critical Environmental Concern. Coos Bay District Office, North Bend, OR.

US Department of Interior, Bureau of Land Management. 1995. Final New River ACEC management plan.

US Department of Interior, Bureau of Land Management. 2004. New River area of Critical Environmental Concern Management Plan Updated May 2004. Coos Bay District Office, North Bend, OR.

Zarnetske, P. L., E. W. Seabloom, and S. D. Hacker. 2010. Non-target effects of invasive species management: beachgrass, birds, and bulldozers in coastal dunes. Ecosphere 1(5): 1-20.

Attachment A

Vegetation Sampling Transects and Quadrats

Site	Quadrat Numbers	Total Quadrats	Location
Euchre Creek at "Wilbur Creek"	1-10	10	transect across ditched channel
Euchre Creek at "Wilbur Creek"	11-20	10	low marsh and edge of pond
Rogue at Indian Creek east	1-6	6	furthest upstream
Rogue at Indian Creek east	7-10	4	between other two transects
Rogue at Indian Creek east	11-14	4	closest to Indian Creek
Sixes River near mouth	1-10	10	west edge adjacent to beach, to east crossing high marsh
Sixes River near mouth	11-19	9	near pond, primarily low marsh
Elk River at Swamp Creek	1-11	11	hillslope pasture to edge of Swamp Creek
Elk River at Swamp Creek	12-18	7	~10 m downstream of pond, N-S transect
New River at Fourmile Creek	11-20	10	north of first transect
New River at Fourmile Creek	1-10	10	southern portion of wetland, west bank to east to upland willow grove
Rogue River at Elephant Bar ds islands	12-15	4	Edge of cobble bar to high marsh & upland
Rogue River at Elephant Bar ds islands	1-11	11	Salix hillside to channel and high marsh island
Sixes River at Orchard Hole	1-13	13	gravel bar NW to high marsh, low marsh & high marsh to forested hillslope
Sixes River at Orchard Hole	14-20	7	S edge wetland to east, cross low marsh & edge of pond, to hillslope
Sixes River at Sweet Ranch	1-10	10	base of north hillsope, across channel, & into upland pasture
Sixes River at Sweet Ranch	11-20	10	40 m east of first transect
New River at New Lake Outlet	1-10	10	peninsula between 2 channels, WE of east side bank to west
New River at New Lake Outlet	11-18	8	western WE with gentle slopes, heading east, crosses pond edge
New River nr mouth of Floras (S of Hanson Slough)	1-6	6	furthest south (downstream) WE over steep bank and through high marsh
New River nr mouth of Floras (S of Hanson Slough)	7-12	6	WE to low marsh, high marsh, to willow berm
New River nr mouth of Floras (S of Hanson Slough)	13-17	5	furthest north (upstream)
New River at Clay Island Breach	1-8	8	peninsula, east bank to west, end in upland vegetation
New River at Clay Island Breach	9-20	12	peninsula, southern end, west bank to east

Wetland Function Scores using ODSL Hydrogeomorphic Method Rapid Assessment Method

Wetland Function Scores, HGM Rapid Assessment Method											
Function	**New River**				**Sixes River**				**Elk River**	**Euchre Creek**	
	Hansen Slough	New Lake Outlet	Fourmile Creek	Clay Island Breach	Orchard Hole	Sweet Ranch	Sullivan Gulch	Mouth	Mouth of Swamp Creek	Mouth	
	Function capacity compared to theoretical score for function										**Average**
Produce Aboveground Organic Matter	0.39	0.37	0.40	0.43	0.47	0.40	0.33	0.33	0.41	0.42	0.395
Export Aboveground Plant & Animal Production	0.37	0.34	0.29	0.45	0.53	0.38	0.25	0.23	0.41	0.41	0.366
Maintain Element Cycling Rates & Pollutant Processing; Stabilize Sediment	0.42	0.58	0.64	0.41	0.68	0.64	0.22	0.35	0.64	0.43	0.501
Maintain Habitat for Native Invertebrates	0.46	0.43	0.46	0.41	0.63	0.38	0.40	0.52	0.45	0.47	0.461
Maintain Habitat for Anadromous Fish	0.28	0.28	0.03	0.08	0.32	0.29	0.00	0.26	0.18	0.17	0.189
Maintain Habitat for Visiting Marine Fish	0.23	0.04	0.01	0.03	0.15	0.21	0.00	0.18	0.13	0.02	0.1
Maintain Habitat for Other Visiting & Resident Fish	0.22	0.20	0.03	0.10	0.39	0.27	0.00	0.00	0.34	0.13	0.168
Maintain Habitat for Nekton-feeding Wildlife	0.21	N/A	N/A	N/A	0.22	0.30	N/A	0.21	0.22	N/A	0.232
Maintain Habitat for Ducks and Geese	0.34	0.45	0.38	0.17	0.36	0.50	0.42	0.28	0.37	0.31	0.358
Maintain Habitat for Shorebirds	0.42	0.70	0.53	0.39	0.49	0.40	0.36	0.42	0.40	0.42	0.453
Maintain Habitat for Native Landbirds, Small Mammals, & Their Predators	0.53	0.42	0.49	0.52	0.55	0.37	0.37	0.53	0.41	0.29	0.448
Maintain Natural Botanical Conditions	0.75	N/A	0.70	0.95	1.00	0.85	0.85	0.85	0.80	1.00	0.861111
Average	0.385	0.385	0.36	0.36	0.48	0.42	0.29	0.35	0.40	0.37	

Wetland Function Scores, HGM Rapid Assessment Method											
Function	**New River**				**Sixes River**				**Elk River**	**Euchre Creek**	
	Hansen Slough	New Lake Outlet	Fourmile Creek	Clay Island Breach	Orchard Hole	Sweet Ranch	Sullivan Gulch	Mouth	Mouth of Swamp Creek	Mouth	
	Function capacity compared to best reference tidal wetland										
Produce Aboveground Organic Matter	0.54	0.47	0.00	0.69	0.81	0.56	0.34	0.33	0.60	0.63	0.554
Export Aboveground Plant & Animal Production	0.38	0.33	0.26	0.49	0.60	0.38	0.20	0.17	0.44	0.44	0.369
Maintain Element Cycling Rates & Pollutant Processing; Stabilize Sediment	0.32	0.55	0.66	0.31	0.71	0.64	0.02	0.23	0.64	0.33	0.441
Maintain Habitat for Native Invertebrates	0.35	0.28	0.34	0.21	0.74	0.15	0.20	0.48	0.32	0.37	0.344
Maintain Habitat for Anadromous Fish	0.37	0.37	0.01	0.09	0.43	0.39	N/A	0.34	0.23	0.21	0.271111
Maintain Habitat for Visiting Marine Fish	0.24	N/A	N/A	N/A	0.13	0.21	N/A	0.17	0.10	N/A	0.17
Maintain Habitat for Other Visiting & Resident Fish	0.24	0.21	0.03	0.10	0.43	0.30	N/A	0.00	0.37	0.14	0.202222
Maintain Habitat for Nekton-feeding Wildlife	0.12	N/A	N/A	N/A	0.13	0.24	N/A	0.12	0.13	N/A	0.148
Maintain Habitat for Ducks and Geese	0.40	0.58	0.46	0.13	0.43	0.66	0.53	0.31	0.45	0.36	0.431
Maintain Habitat for Shorebirds	0.22	0.69	0.41	0.17	0.33	0.20	0.13	0.22	0.19	0.22	0.278
Maintain Habitat for Native Landbirds, Small Mammals, & Their Predators	0.58	0.37	0.52	0.58	0.62	0.29	0.28	0.59	0.35	0.14	0.432
Maintain Natural Botanical Conditions	0.25	0.55	0.20	0.45	0.50	0.35	0.35	0.35	0.30	0.50	0.38
	0.33	0.44	0.29	0.32	0.49	0.36	0.26	0.28	0.34	0.33	