Coos Bay Tidal Wetlands Assessment:
Isthmus Slough, Coalbank Slough, Catching Slough and Echo Creek Sub-basins

Coalbank Slough wetland, CoosWA 2009

May 5, 2010 Draft
OWEB Grant 208-2007
Coos Watershed Association

SUMMARY

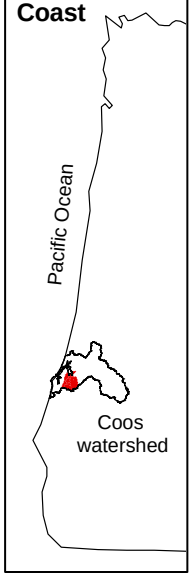
This project assessed tidal wetlands in the areas of the Isthmus, Coalbank, Catching and Echo sub-basins to the south and southeast of the Coos estuary. Two assessment methods were applied; a site-specific functional analysis using the HGM Rapid Assessment Methods (HGM RAM) for Tidal Wetlands of the Oregon Coast (Adamus 2006), and Estuary Assessment: Component XII of the Oregon Watershed Enhancement Assessment Manual (Brophy 2007). Wetlands in these areas have been altered over time by the effects of fill, dikes, tide gates, ditching, culverts, vegetation management and property development activities that have changed their overall hydrology and tidal influence.

Most of this loss is due to filling for development and hydrologic alterations for purposes of constraining tidal fluctuation and essentially efforts to drain surface water away from the land for agricultural, residential and other uses. This study concludes that within the 3,852 acre assessment area 3,085 acres have some level of restoration potential, while 479 acres have current conservation value, and at least 287 acres are roads and or dikes. Field checks and outreach to landowners is needed to thoroughly complete the assessment and plan for restoration implementation.

Results of the HGM RAM indicate that seven of the fifteen selected wetlands in the assessment area are above the median scores for wetland integrity for reference sites. The class of river sourced tidal wetlands in the project area scored the best for wetland integrity.

Through use of these two assessment tools, it has become clear that the Estuary Assessment methods are most appropriate for a broad initial scoping of wetland alterations at the sub-basin or watershed scale. This would be most useful in determining, for example, which region of a watershed to focus limited outreach and restoration efforts. The HGM rapid assessment methods could then be used on a site by site basis for measuring function to identify specific restoration goals and actions, and for tracking change in function over a long period of time. An HGM assessment interval of between two to ten years would be most appropriate for tracking changes in function over time at a specific site.

Figure 1: Project Location, Oregon Coast



INTRODUCTION

Purpose

This assessment project was designed to address the need for data and models of local, long-term wetland function post restoration; inconsistent mitigation files and monitoring records; and the need for application and review of newly-developed assessment methods at the local sub-basin level.

Tidal wetlands perform myriad natural processes essential to the health of the state's ecology and economy. The economic value of tidal marsh services alone is valued at $4,000 per acre (Constanza et.al, 1997). These services, i.e. primary production (food source), water purification, sediment stabilization (Adamus, 2005) and flood attenuation (Hoffnagle, 1976), are needed to help offset non-point source pollution (project waterbodies are 303(d) listed for fecal coliform, and potentially listed for many toxic substances and sedimentation), flood drainage, upland sediment, and compensation for wetland losses due to development. Tidal wetlands also provide extremely productive salmonid rearing habitat. An average one-fifth, and as much as 43%, of coho on the Oregon Coast ESU pass through the Coos estuary during migration (ODFW, 2005). Coos Watershed Association's (CoosWA) recently completed watershed assessments (CoosWA, 2006, and CoosWA, 2008) indicate primary coho habitat limiting factors as the

lack of over-wintering habitat, and high summer temperatures. These habitat limitations can be addressed through improved function of tidal wetlands (Miller & Sadro, 2003).

Historic losses of tidal wetlands give these habitats a unique and desirable status. In Coos Bay, the largest Oregon estuary south of the Columbia River, 80% of tidal wetlands and 90% of salt marshes have been lost since the 1850s. The sub-basins in the project area (Coalbank, Isthmus, Catching and Echo) represent the most severe loss in the watershed: 88%, or 1875 acres, was lost between 1890 and 1970 (Hoffnagle, 1976). In recent years, the area's increasing economic pressures and changing demographics have spurred development, especially along the Bay's waterfront.

The 38,317-acre project area was chosen due to the relative concentration of existing and potential mitigation sites, abundance of tidal wetlands in varying conditions, and the high percentage of HGM-classified 'potential restoration' areas. The project area encompasses a diversity of land uses from forestry, ranching and hobby farms to heavy industry, urban and residential areas, natural areas and development sites. US Highway 101 and State Highway 42 spans along the entire length of Davis and Isthmus Slough.

These assessments were conducted as preliminary tests of the assessment tools. Results were not intended to be final, or to require implementation of restoration actions by any person, group or agency.

Background ecology

The Coos Bay estuary, approximately 13,348 acres, is a drowned river mouth variety where winter floods discharge high volumes of sediment into and through the estuary. In summer, seawater inflow dominates the estuary due to low streamflow. The Coos Bay estuary is designated as a Deep Draft Development estuary under the Oregon Estuary Classification system.

The bay portion of the estuary is characterized by broad mud flats which are exposed to the air at low tide and flooded by a mix of salt and fresh waters at high tide. Sediments carried from the mountains by the river are deposited in the upper bay and along the edges of main channels, while finer particles of silt and clay drift farther to the edges of the flats near the fringing marshes. Marine sand carried along the ocean front in the "longshore current" is swept into the estuary on incoming tides and may be deposited as far as several miles upstream. Coos Bay has a relatively large bay as part of its estuarine system.

Sloughs, of which the Coos estuary has many, are low-gradient tributaries to the main bay and river channels. They have little freshwater inflow. Tidal flushing may not be as complete as in parts of the estuary that are closer to the ocean or main channel. Generally, sloughs consist of meandering channels that wind through fringing marshes and across mud flats to the main bay. It is these small channels that, when unrestrained, brought the tide up into the marsh and to the edge of the forest. All mainstem streams in the assessment area display slough characteristics near their confluence with the estuary, however altered by land use practices such as tide gates, dredging and diking. In the past these sloughs and streams were generally deeper and navigable by boat.

Land Management

A large proportion of the early European population settled in what became urban areas surrounding the estuary, sloughs and rivers. These urban areas are largely built on filled estuarine tidal marshes. Urban development has resulted in periodic storm water drainage and sewerage overflows into the estuary, which, combined with failing septic systems and agricultural run-off have caused high levels of fecal

coliform bacteria in water. This has affected the use of parts of the estuary for recreation, fishing and oyster cultivation.

Farming and logging practices have affected these basins similar to other Coast Range drainages. Channelization, draining of wetlands, dredging, diking and tide gate placement on low-gradient reaches to create pasture and croplands have eliminated much of the riparian vegetation, decreased channel complexity and productivity, and interrupted the natural cycle of sediment flushing.

In addition, the cumulative effects of upland forestry activities, such as riparian tree removal, soil disturbance, and historical large wood removal have damaged salmonid spawning gravels, decreased stream complexity, increased sediment introductions, and raised water temperatures. Low-gradient reaches are affected by both the adjacent land use practices and the down-stream effects of upland land use practices.

METHODS

The two assessment methods implemented in this project both addressed tidal wetlands, yet they differed on their approach, scale and nature of results. The estuary assessment took a broad look at alterations to historic tidal wetlands, best used at the 7th to 5th field HUC levels. The HGM RAM addressed individual wetland sites, calculated site integrity, and scored a series of wetland functions.

Estuary Assessment

The Estuary Assessment: Component XII of the Oregon Watershed Enhancement Manual (Brophy 2007) addressed all tidal fringe wetlands in the selected sub-basins. This method relied heavily on GIS analysis with recommended field checks. The Estuary Assessment organized current and historic indicators of tidal influence for wetlands using the coastal Oregon HGM wetland GIS layer (Scranton, 2004) as a base. Wetland polygons missing from the HGM layer were supplimented with the 1979 National Wetlands Inventory GIS layer. This added 124.77 acres of assessment wetlands missing from the HGM layer. Information about each of the 674 assessed wetland polygons was gathered from the following GIS databases:

- Historic aerial photos, 1939 and 1942
- Hydrogeomorphic tidal wetlands map (Scranton, 2004)
- Color Infrared (CIR) aerial photos, 2005
- National Wetlands Inventory map
- Natural Resource Conservation Service soil survey map
- Oregon Estuary Plan Book map
- Oregon Natural Heritage Information Center historic vegetation map
- USGS topographic maps

Information for each polygon was tallied in an attribute table and used to develop tidal wetland status scores and ultimatly to designate restoration priority rankings based on level of alteration. The map in Figure 2, above, shows the location and resulting rank of wetlands assessed using the Estuary Assessment methods. Definitions of the rankings are shown below in Table 1.

A small addition was made to Brophy's methods that considered, on a gross scale, potential for stormwater influence adjacent to a larger water body. While all wetlands are subject to surface runoff, wetlands in close proximity to heavily-used impervious surfaces were identified and a modifier for 'stormwater potential' or SWP was added to the final rankings and maps. In choosing wetland management actions, stormwater potential should be considered both as a threat to wetland health and as a

possible wetland service. Because of their location in the lower watershed, coastal wetlands are frequently impacted by stormwater runoff and wastewater inputs (Zedler, 2001). Polluted or excessive stormwater can overwhelm a wetland beyond its capacity, or, with certain management techniques, wetlands can function to reduce stormwater pollutants and the causes of erosion. The Oregon Department of State Lands regulates activities in wetlands and discharging pollutants into designated wetlands is generally prohibited. This 'stormwater potential' modifier is not part of any existing implementation plan, and is simply based on approximate location identified on aerial photos and intended for consideration in future restoration planning.

Table 1: Restoration Rank Definitions	
Conservation	Wetlands showing intact features that should be considered for permanent protection in current condition. Ditching, diking and culverts were not apparent.
Restoration, High	Heavily altered wetlands with all three alterations: ditching, diking and culverts.
Restoration, Med	Altered wetlands with two alterations.
Restoration, Low	Lightly altered wetlands with one alteration.
Stormwater Potential (SWP) modifier	Wetland is located on or adjacent to a developed area such as a city, state highway, or cluster of homes and a water body.

Tidal and historically tidal wetlands were ranked for restoration priority level, or were designated as being solely a road or dike and were therefore not ranked but remained in the assessment. Ranks ranged from conservation to high, medium and low priority restoration (see Table 2). Ranking levels were assigned to each assessment wetland polygon according to the number of alterations apparent on the CIR 2005 infrared aerial images. Alterations considered in this ranking were ditched channels, dikes (including breached dikes) and presence of culverts. Sites with no apparent alterations were then checked for HGM classification. If the unaltered site was a marine sourced low or high marsh it was then ranked as a Conservation site, and if the HGM class was Restoration Potential it was then ranked as a Low Restoration priority site. Some apparently unaltered sites were not present on the HGM database and had to rely on NWI information. In these cases, if the site's NWI classification contained a modifier indicative of current or past tidal influence it was ranked as Conservation, and sites with no NWI tidal modifier were ranked as Low Restoration priority.

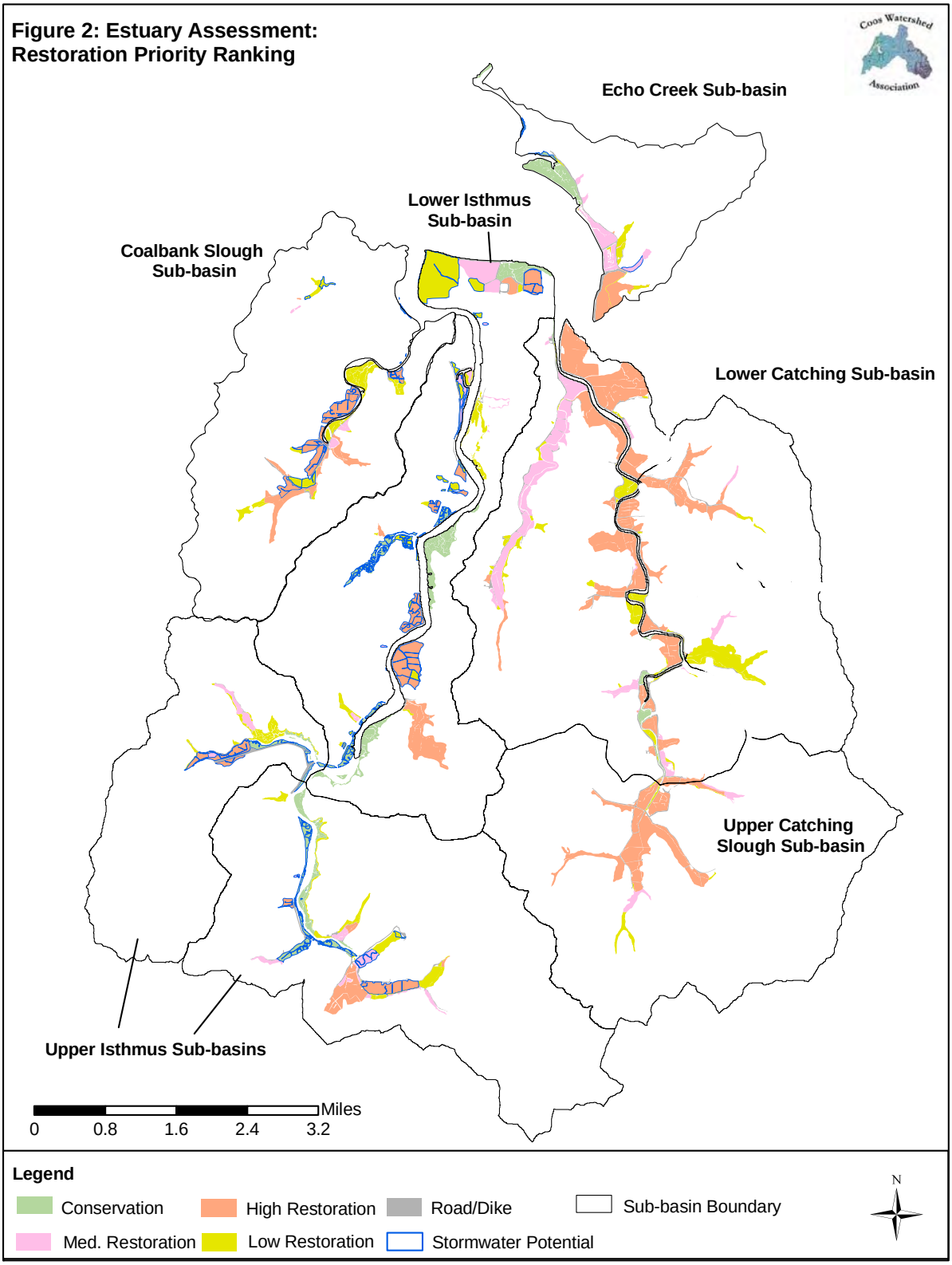
The order of the ranks or priority should be considered in terms of a chosen restoration approach or strategy. The Coos Watershed Association's approach to restoration places conservation of intact habitats as a first priority, followed by restoration of heavily altered habitats where feasible, and restoration of the least altered habitats as a lower priority. This hierarchy is reflected in the rank priority for this assessment.

Some wetland polygons were removed, as directed by Brophy, from the assessment analysis due to their level of alteration and unliklihood that restoration actions would be feasible. Polygons were removed or clipped if they were: fill material with development on it, such as houses or a city; or US Highway 101.

Sub-basins were split or grouped for ease of discussing location information. Upper Isthmus sub-basin consists of the Davis Slough and Noble Creek drainages. Lower Isthmus sub-basin is the main stem of Isthmus Slough, from the mouth of Davis Slough to the confluence with the Coos estuary. The Catching Slough sub-basin was split into Upper and Lower Catching with the transecting boundary near the community of Sumner. Most wetland polygons associated with Blossom Gulch, just north of Coalbank Slough, were dropped from the assessment due to urban development.

The Estuary Assessment concluded that (see Figure 2, above) within the 3,852 acre assessment area 3,085 acres have some level of restoration potential, while 479 acres have current conservation value, and at least 287 acres are roads and or dikes. Field checks and outreach to landowners is needed to thoroughly complete the assessment and plan for restoration implementation.

Figure 2: Estuary Assessment: Restoration Priority Ranking



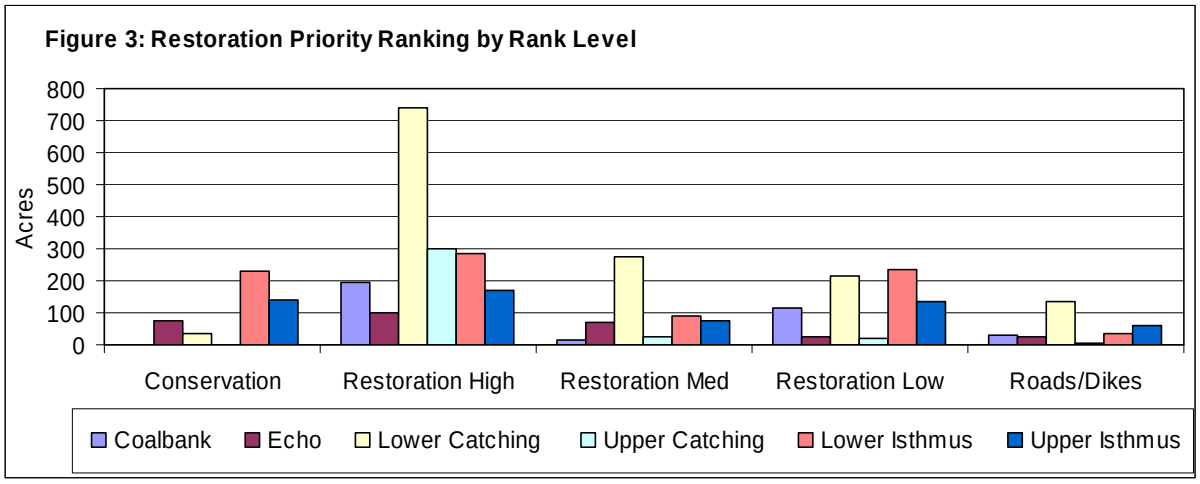
RESULTS

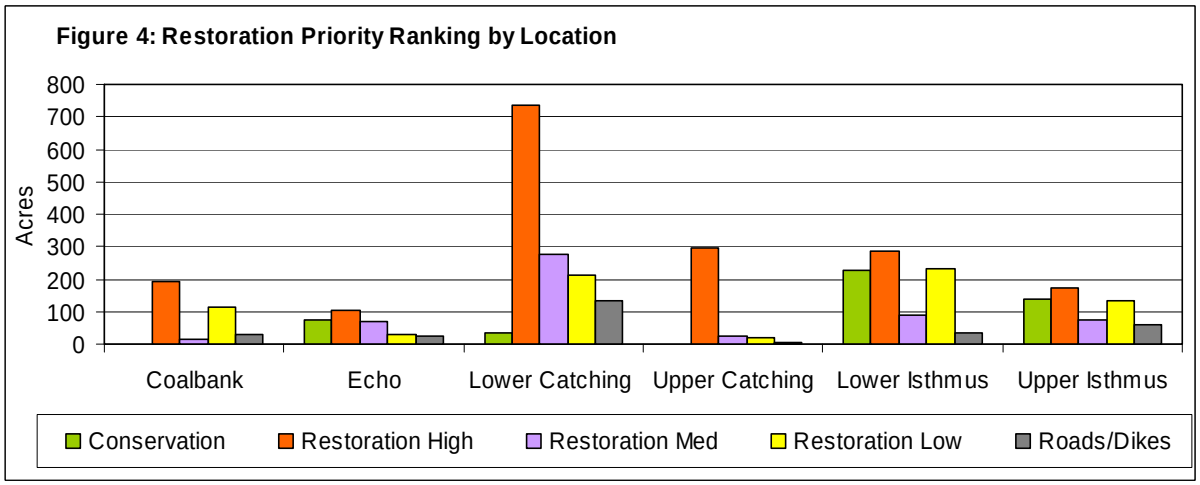
Estuary Assessment

The 674 wetland polygons assessed in this process, those not deleted (see Methods), cover an area of 3,852 acres or 10% of the total assessment sub-basins extent, not including open water. Results of the restoration priority rankings and amount of SWP (stormwater potential) for each rank in each sub-basin area are shown in Figure 2, above, and Table 2, below. Stormwater potential was assigned to 766 acres or 20% of the assessed wetland area as an optional modifier to the other rank designations. Figures 3 and 4, below, compare the acreage of the restoration priority ranks by rank level and by sub-basin location, respectively.

Table 2: Restoration Priority Rank Acres and Amount Stormwater Potential

	Conservation		Restoration High		Restoration Med		Restoration Low		Rds/Dks	Totals
Sub-basin	%SWP	Acres	%SWP	Acres	%SWP	Acres	%SWP	Acres	Acres	Acres
Coalbank	74%	1.70	55%	193.97	0%	13.46	20%	112.84	28.17	350.13
Echo	8%	73.70	0%	101.69	11%	69.78	0%	27.27	25.14	297.58
Lower Catching	0%	33.61	0%	737.65	0%	276.27	0%	213.27	133.34	1,394.14
Upper Catching	0%	0.00	0%	298.14	0%	25.54	0%	21.41	6.65	351.74
Lower Isthmus	29%	229.62	56%	285.63	16%	91.29	78%	234.17	34.86	875.57
Upper Isthmus	56%	140.38	55%	172.46	24%	76.27	3%	134.38	59.25	582.73
Totals	32%	479.00	20%	1,789.54	7%	552.61	28%	743.34	287.41	3,851.90





Conservation Priority

Conservation priority ranking composes 479 acres, or 12%, of the assessed wetland area overall. The Lower Isthmus sub-basin contains the largest area of this ranking, 230 acres, and 29% of that area shows stormwater potential. Conservation areas in Lower Isthmus are along the eastern edge of the main slough opposite US Highway 101, Shinglehouse Slough, and the undiked area of the Millicoma marsh near Eastside. Shinglehouse Slough is not tide-gated at the mouth and is not densely developed, however, there are small industrial areas, an auto wrecking yard, and a non-operational landfill immediately adjacent to the slough which provided enough 'development' to assign stormwater potential to that area. Upper Isthmus sub-basin had just over 140 acres of conservation priority wetlands; most of this area is fringed along the main stem slough and 56% of that area, along US Highway 101 and Highway 42, is considered to have stormwater potential. Coalbank sub-basin has less than 2 acres in conservation priority, and Upper Catching Slough has zero conservation acreage.

High Priority Restoration

High priority restoration ranking was assigned to 46%, 1789 acres, of the wetland area in the assessment. All sub-basins had more acreage in this rank than any other rank. Lower Catching has 738 acres and Upper Catching has 298 acres in the high priority rank. Lower and Upper Catching combined encompass 56% of the high priority rankings. While the Catching Slough sub-basin as a whole, including Ross Slough (tide-gated at the mouth), is less developed near waterways, it *is* heavily tide-gated, many roads there serve as dikes, and wetlands are commonly ditched, culverted and managed for pasture. The Lower Isthmus sub-basin also had a high amount of high priority rankings, 286 acres, and 56% of that acreage was considered to have stormwater potential near where industrial, commercial and residential developments are expanding. Coalbank sub-basin contained 194 high priority acres, and 55% of that area was designated for stormwater potential. Echo had a relatively high amount of high priority ranked acreage concentrated in the altered wetlands near the mouth of Echo Creek.

Medium Priority Restoration

Medium priority ranking made up 14%, 553 acres, of the assessed wetland area. Lower Catching sub-basin had the largest share, 50%, of medium priority acreage with 276 acres. Most of those acres are concentrated along Ross Slough – a tide-gated stream heavily diked with many ditches and culverts. Other areas with significant amounts of medium priority ranking include Echo and Lower Isthmus sub-basins. In the Echo area, wetlands with breached dikes form most of this rank, and in the Lower Isthmus a portion of the Millicoma marsh is in this rank. Stormwater potential was assigned to 7% of the area within the medium priority rank. Most stormwater potential opportunities are clustered along US Highway 101 and developed areas in the Lower Isthmus and Coalbank sub-basins.

Low Priority Restoration

Low priority ranking made up 19%, or 743 acres, of the assessed wetlands. Most low priority rankings are located in the Lower Isthmus sub-basin, with 234 acres, and the Lower Catching sub-basin, with 213 acres. Many of these wetland areas would have been ranked as conservation wetlands but either the National Wetlands Inventory or the HGM database classified them as palustrine (non-estuarine) or other than tidal marsh. The Matson creek wetlands and some low priority rank wetlands fringing along conservation rank wetlands on Upper Isthmus and Davis Sloughs, are an example of this. Also, many other wetlands in this rank are relatively unaltered except for a breached dike. Upper and Lower Isthmus and Coalbank sub-basins were the only areas within this rank showing stormwater potential. Most of this

is a large, diked wetland area at the mouth of Isthmus Slough, (on fill material) below the community of Eastside.

Roads and Dikes

Many wetland polygons in the assessment area were classified as fill and designated as a road, a dike or a dike-road serving both purposes. A total of 287 acres, or 7%, of the assessment area was in this category and the majority of those acres were in the Lower Catching sub-basin. It was considered important to retain the formally-tidal, road/dike acreage in the assessment, but with the understanding that any treatment of roads/dikes would, in most cases, be significantly different from treatment of the adjacent wetlands.

Tidal HGM Rapid Assessment Method (HGM RAM)

The HGM Tidal Wetlands Rapid Assessment Method was conducted at 15 tidal wetland sites covering an area of 341 acres and spanning four sub-basins on the south east side of the Coos estuary, see Figure 5, below. At each site, two vegetation transects were surveyed for species presence and abundance, main channel width and depth was recorded at five points beginning with the channel mouth, and a 55-question multiple choice worksheet was completed. Resulting data were entered into a calculating Excel spreadsheet developed by Paul Adamus, 2009, version TidalWet_Calculator_HGM_Oregon_fixed Jan09, resulting in scores for wetland integrity and the twelve wetland functions addressed in the protocol. The method uses information from 120 reference wetlands on the Oregon coast normalized on a scale of 0-1. A compilation of resulting function scores for each tidal HGM class is shown in Table 3, below.

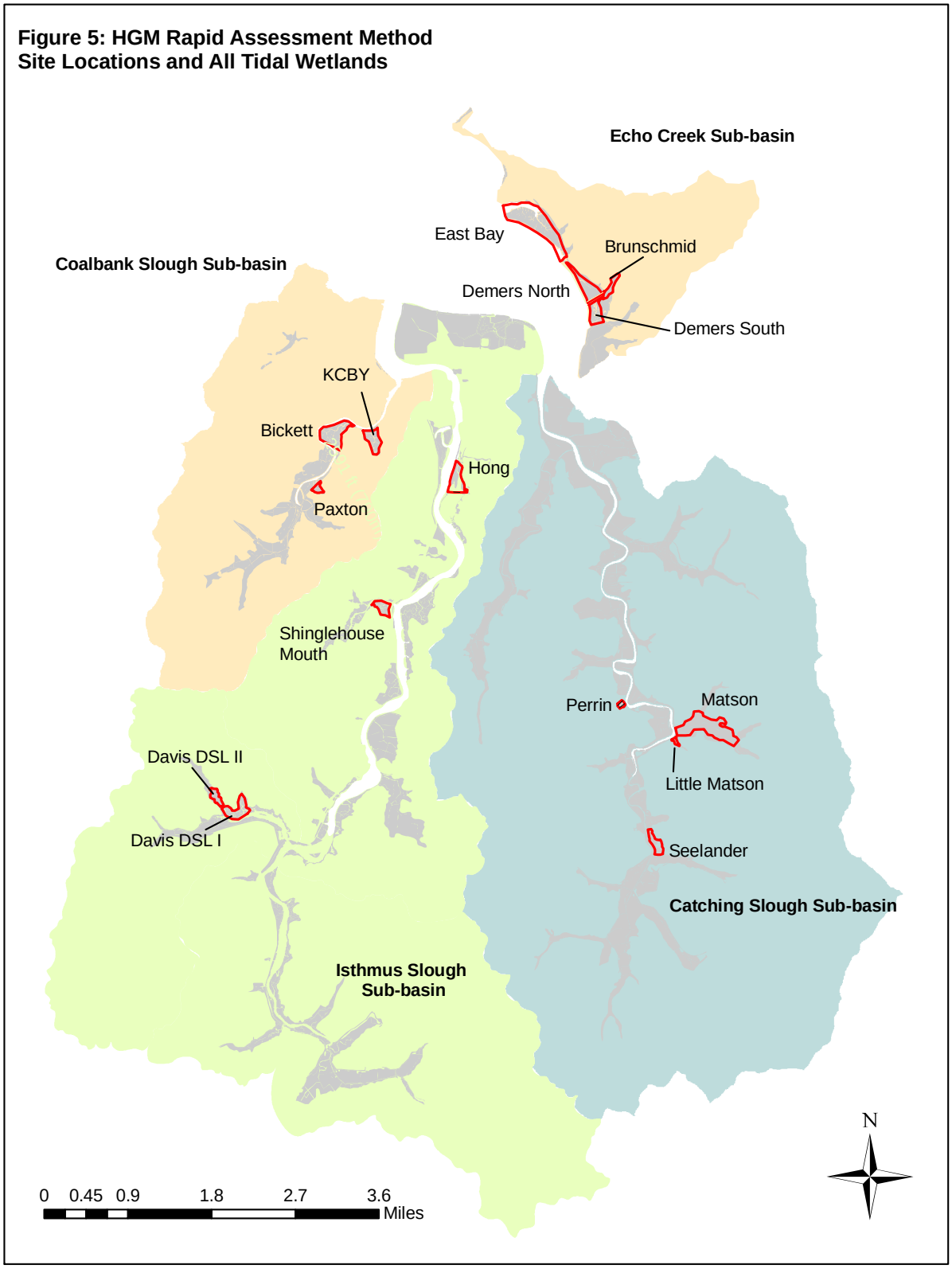
Table 3: Tidal HGM Rapid Assessment Score Results 2008 (scale 0-1)

	River Sourced Tidal							High Marsh			Low Marsh				
	Brun-schmid	Matson	Paxton	Little "Matson"	Davis DSL II	See-lander	Perrin	Davis DSL I	KCBY	Shingle-house Mouth	Bickett	Demers North	Demers South	East Bay	Hong
Wetland Overall Integrity	0.34	0.48	0.58	0.59	0.63	0.63	0.66	0.61	0.45	0.46	0.43	0.35	0.46	0.43	0.43
Above-ground Production	0.39	0.44	0.49	0.32	0.35	0.34	0.67	0.34	0.38	0.37	0.41	0.33	0.32	0.51	0.41
Production Export	0.37	0.55	0.66	0.48	0.46	0.47	0.67	0.45	0.52	0.57	0.52	0.30	0.47	0.76	0.52
Process C, Nutrients, Metals, Sediment	0.61	0.78	0.79	0.42	0.70	0.74	0.78	0.68	0.83	0.72	0.73	0.69	0.76	0.85	0.75
Invertebrate Habitat	0.50	0.57	0.48	0.47	0.45	0.51	0.38	0.51	0.49	0.54	0.55	0.43	0.51	0.63	0.47
Anadromous Fish Habitat	0.35	0.64	0.44	0.61	0.68	0.69	1.00	0.60	0.62	0.59	0.54	0.50	0.68	0.63	0.70
Marine Fish Habitat	0.24	0.73	0.24	0.40	0.43	0.68	0.39	0.72	0.51	0.61	0.61	0.40	0.63	0.56	0.40
Resident & Other Fish Habitat	0.39	0.63	0.28	0.36	0.64	0.66	0.31	0.65	0.82	0.51	0.46	0.35	0.81	0.64	0.58
Nekton-feeding Wildlife Habitat	0.57	0.49	0.49	0.68	0.63	0.63	0.56	0.52	0.64	0.53	0.61	0.62	0.67	0.77	0.65
Ducks & Geese Habitat	0.58	0.59	0.54	0.61	0.55	0.61	0.70	0.58	0.69	0.58	0.67	0.65	0.64	0.67	0.68
Shore-bird Habitat	0.62	0.65	0.40	0.60	0.47	0.65	0.12	0.68	0.59	0.66	0.73	0.76	0.54	0.68	0.59
Landbird, Mammal, Predator Habitat	0.41	0.39	0.37	0.37	0.43	0.35	0.45	0.38	0.34	0.22	0.39	0.38	0.36	0.60	0.48
Botanical Condition	0.59	0.43	0.60	0.90	0.67	0.56	0.30	0.67	1.00	0.76	0.25	0.56	0.90	0.83	0.76

While many sites contained multiple HGM classes, sites were assigned a single HGM class according to the majority class on the site. Under these class assignments, the assessed area consisted of 111 acres of river sourced tidal wetlands, 172 acres of marine sourced low marsh, and 57 acres of marine sourced high marsh. HGM assessment results for the study sites are compared to scores for Oregon Coast reference sites separately for each class, followed by a short description of each site, in the following sections.

The Oregon Coast HGM Tidal Wetlands Rapid Assessment Method protocol is located at http://www.cooswatershed.org/publications.html, and updates to the calculating spreadsheets are posted at http://people.oregonstate.edu/~adamusp/HGMtidal/.

Figure 5: HGM Rapid Assessment Method Site Locations and All Tidal Wetlands



River Sourced Tidal Wetlands

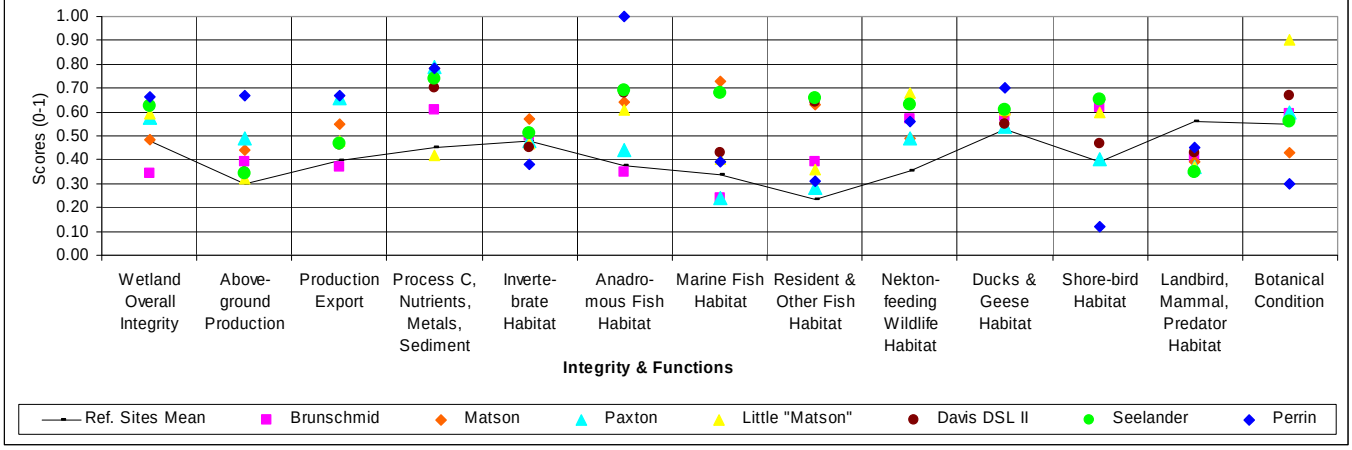
River sourced tidal wetlands have significant influence from incoming inland freshwater flow. This can allow for a wider diversity of vegetation, and also often makes these areas more desirable for other types of land use such as pasture management. It is interesting to note that of the seven assessed study sites in this class, five have a history of various wetland restoration actions. Only the Little Matson and Paxton sites do not have a record of restoration activity. Restoration sites with relatively lower overall integrity scores, i.e. Matson and Brunschmid, were in the first or second year of restored tidal inundation at the time of assessment, and active transitioning of the vegetation dynamics, ie., changing back from freshwater to saline tolerant species, may have influenced integrity scores.

Data in Table 4 below, show that, for all HGM scores, study sites averaged 0.11 higher than the reference sites for this class. The only function parameter that study sites scored lower (-0.17) than reference sites was for *Landbird, Mammal, Predator Habitat*. Study sites received the same score, on average, as the reference sites for *Invertebrate Habitat*, while the largest overall variance (0.25) was for *Anadromous Fish Habitat.* This high mean for study sites was influenced by the high score for the Perrin restoration site. The graph in Figure 6 plots the mean scores of study sites in comparison to reference site mean scores.

Table 4: Comparison to Reference Sites of Class, Tidal HGM Rapid Assessment River Sourced Tidal Wetland Sites 2008 (scale 0-1)

	Study Sites Mean	Ref. Sites Mean	Variance from Ref.	St. Dev. Study Sites
Wetland Overall Integrity	0.56	0.48	0.08	0.11
Above-ground Production	0.43	0.30	0.13	0.12
Production Export	0.52	0.40	0.13	0.11
Process C, Nutrients, Metals, Sediment	0.69	0.45	0.24	0.13
Invertebrate Habitat	0.48	0.48	0.00	0.06
Anadromous Fish Habitat	0.63	0.38	0.25	0.21
Marine Fish Habitat	0.44	0.34	0.11	0.19
Resident & Other Fish Habitat	0.47	0.23	0.23	0.17
Nekton-feeding Wildlife Habitat	0.58	0.35	0.23	0.07
Ducks & Geese Habitat	0.60	0.53	0.07	0.05
Shore-bird Habitat	0.50	0.39	0.11	0.19
Landbird, Mammal, Predator Habitat	0.40	0.56	-0.17	0.04
Botanical Condition	0.58	0.55	0.03	0.19
Overall Average			0.11	0.13

Figure 6: Functional Capacity Scores Comparison - River Sourced Tidal Wetland



Perrin Wetland, Catching Slough Sub-basin

Wetland integrity score: 0.66

2.9 acres fed by ditched stream channels along both sides of wetland.

This site was reconnected to Catching Slough in 2003 by removing the broken tide gate and replacing the perched stream-crossing culvert under Old Wagon Road. Old cedar culverts draining either side of the site were filled and channels routed to the main culvert. The dike on which the county road is built separates the wetland edge from the mainstem Catching Slough, while the new culvert serves as the main conduit for tidal inundation. The project was intended to open access to 0.75 miles of salmon habitat in two tributaries above the wetland.

Perrin wetland from Old Wagon Road dike, August 2008.

This site's boundaries are defined by the forested uplands to the south, the driveway on the upland slope to the north, the county road/dike to the east between the site and the main slough, and the western, upland boundary came to just below the garden in front/east of the house (roof is barely visible in photo).

For assessment purposes, the stream channel on the southern edge of the site was considered to be the main channel, however, a smaller channel along the northern border looks to be more tidally influenced due to its shape and vegetation. Blind channel incisions are beginning to develop adjacent to the culvert's large scour pool within the site (see photo foreground). No isolated pools were observed. The garden area near the western border was considered a "disturbed area". Inferences made include past soil compaction due to previous livestock/pasture use, and the site is likely to have subsided due to tidal restriction during that time. Similar to other sites, heavy bark substrate was noted nearby along the slough and in the main channel of this site. While fifteen vegetation species were recorded in the transects, 41% consisted of *Carex lyngbyei* (lyngby sedge).

Species Percent in Vegetation Transects, Perrin	
9	*Agrostis stolonifera (A. alba)*
3	*Argentina egedii (Potentilla pacifica)*
41	*Carex lyngbyei*
1	*Eleocharis palustris*
3	*Galium trifidum*
3	*Holcus lanatus*
2	*Juncus effusus*
1	*Lilaeopsis occidentalis*
2	*Oenanthe sarmentosa*
7	*Phalaris arundinacea*
2	*Ranunculus repens*
14	*Schoenoplectus (Scirpus) acutus*
1	*Symphyotrichum (Aster) subspicatus*
12	*Typha latifolia*
2	*Veronica americana*

Davis DSL II Wetland, Isthmus Slough Sub-basin

Wetland integrity score: 0.63

This 9.6-acre site is fed by freshwater stream channels along both sides of the wetland.

This site has been highly altered with dikes separating it from previously contiguous wetlands up and down stream. Evidence exists which indicate some degree of tidal restoration due to a culvert replacement. The upper boundary dike is relatively small and has been breached at the stream running along the southern border of the valley.

The lower boundary is diked, disconnecting it from the larger Davis Slough marsh immediately to the east (also assessed here - see Davis DSL I). The lower boundary dike supports a gravel road and the main, upgraded exit culvert. After exiting through the culvert, the channel is directed to the mainstem of Davis Slough rather than thru the marsh. Upstream of this site is a pasture/palustrine wetland, owned by Menasha/Campbell. This site and the Menasha property are separated by a low dike across the width of the valley – the dike is breached at the stream. There are small beaver dams in this area and the stream is ponded (incised channel). The Manasha wetland is dominated by *Phalaris arundinacea* (Reed canary grass), a marked contrast from the assessment site vegetation – almost completely composed of *Carex lyngbyei* (94%) (lyngby sedge). Other tidal wetland species are noted around the site edges, especially near the exit culvert, as evident in the photo above. The upper portion of this site has a significant population of *Typha latifolia* (cattails) that is not well represented in the transects.

Scour pool and blind channel in front of main exit culvert, Davis DSL II site, 2008

Species Percent in Vegetation Transects, Davis DSL II	
94	*Carex lyngbyei*
6	*Typha latifolia*

The main fresh water channel exits through a culvert under the gravel road/dike. Within the last few years the culvert was replaced with a larger one, and therefore tidal inundation has increased - changing the vegetation community and channel structure. The 2005 aerial photos show a more pasture-like appearance than there was at the time of assessment. A natural blind channel is forming directly adjacent to the culvert's inside scour pool (shown in photo), but the channel running along the south side of the site was used for assessment measurements.

Seelander Wetland, Catching Slough Sub-basin

Wetland integrity score: 0.63

Perimeters of this 13.8-acres site were determined by the diked county roads bordering the west and south sides, the upland to the east and a diked driveway on the north end. The three constructed boundaries constrain the wetland from its pre-settlement extent. At the time of assessment, freshwater inputs appeared to be entering the wetland from the south east. Large ditches border most of the site with straightened channels passing through the site as well. The perimeter ditch appeared to be impounding water, especially along the base of the uplands to the east. The site's main outlet is through the pipe arch culvert under the diked county road which separates the wetland edge from the slough.

Seelander wetland, August 2008.

Thirteen species were recorded in vegetation transects with nearly half (47%) of the transect area in *Eleocharis palustris* (common spikerush). Two other species were present in the transects but were not included in the analysis since the HGM data input form did not list them: *Myriophyllum* (water milfoil) was observed in three plots; and Leersia orysoides (rice cutgrass) was observed in one plot and Phalaris

arundinacea (Reed canary grass) was used as a substitute. This was the only transect in the assessment with *Sparganium* spp. (water bur-reed).

This site was tidally reconnected in 2003. At that time a small, flow-constricting culvert was replaced with a large pipe arch directly joining Catching Slough. That project increased tidal inundation while decreasing the flow velocities associated with the undersized culvert.

The history of land use at the site is quite interesting. The site has been inundated as a freshwater marsh for at least ten years. The area inundated was originally within the channel of Catching Slough, as indicated by the State of Oregon owning a meandered portion through the existing pond. A railroad track on trestles bisected the original channel, and according to locals, a pond was created to store logs. A noteworthy characteristic of this wetland is the high amount of large wood debris observed in one of the ditched channels along the western perimeter of the site (see photo). The wood may be relicts of the site's history as a log storage pond.

Another characteristic of the Seelander site is the relatively large, un-vegetated mud flat in the middle of the site. At the time of assessment migratory geese were observed using the mud flat.

Large wood at Seelander wetland, August 2008 (note loosestrife in foreground).

Species Percent in Vegetation Transects, Seelander	
7	*Agrostis stolonifera (A. alba)*
2	*Argentina egedii (Potentilla pacifica)*
1	*Carex lyngbyei*
47	*Eleocharis palustris*
2	*Eleocharis parvula*
1	*Grindelia stricta*
2	*Lilaeopsis occidentalis*
5	*Lythrum salicaria*
5	*Phalaris arundinacea*
1	*Rumex crispus*
16	*Schoenoplectus (Scirpus) acutus*
5	*Sparganium spp.*
8	*Typha latifolia*

Little Matson Wetland, Catching Slough Sub-basin

Wetland integrity: 0.59

Boundaries of this 2.1-acre site were simply forested uplands on three sides and the diked road on the western side. The only exit was through the culvert under the road. The site's hydrology was characterized by the relatively large pool/channel (see photo foreground) that divided into many small meandering channels making the dense, swampy vegetation all the more treacherous to traverse. A stream entered the wetland from the southeast. An old road bed is apparent along the southeast perimeter of the wetland. This site was not on Scranton's HGM GIS base layer, and HGM class was estimated to be River Sourced tidal wetland.

Little Matson wetland culvert's tidal scour pool, August 2008.

The site appears to have strong fresh water influence, evident by the amount of freshwater wetland plants. Twelve species were recorded in the transects, yet several species observed in the plots were not on the input form and therefore were not included in analysis. *Carex lyngbyei* (lyngby sedge 23%) and *Agrostis stolonifera* (creeping bentgrass 22%) combined composed almost half of the vegetation plot area. Tidal inundation may be improved through culvert replacement.

Species Percent in Vegetation Transects, Little Matson	
22	*Agrostis stolonifera (A. alba)*
5	*Argentina egedii (Potentilla pacifica)*
23	*Carex lyngbyei*
1	*Carex obnupta*
3	*Eleocharis palustris*
4	*Galium aparine*
1	*Lonicera involucrata*
10	*Oenanthe sarmentosa*
4	*Phalaris arundinacea*
6	*Schoenoplectus (Scirpus) acutus*
10	*Symphyotrichum (Aster) subspicatus*
13	*Typha latifolia*

Paxton Wetland, Coalbank Slough sub-basin

Wetland integrity: 0.58

Boundaries of this 5.0-acre site were determined by the presence of uplands on the south and northeast borders, the dominance of fresh water inputs and vegetation on the eastern tip, and the diked road to the northwest.

Paxton wetland from Red Dike Road, August 2008.

Nearby roads, housing, and septic systems (known bacteria leakage) were considered as potential pollutant contributors. The site's main outlet is through the culvert under the dike road that separates the site from the main slough. A scoured retention pool exists on the wetland side of the culvert, and a relatively deep (for site) body of impounded water lies on the eastern side of the site; a historical channel remnant.

This site had a sharp vegetation gradient, essentially changing from mostly *Carex lygnbyei* (lyngby sedge, 51%) to mostly *Typha latifolia* (cattails, 32%) at a line across the northern end of the site (see background in photo) where tidal influence dropped significantly. Culvert upgrade to a bridge would improve this site significantly. Neighboring landowners indicated a tide gate was planned for installation.

Species Percent in Vegetation Transects, Paxton	
1	*Angelica lucida*
51	*Carex lyngbyei*
2	*Carex obnupta*
2	*Deschampsia caespitosa*
6	*Eleocharis parvula*
1	*Juncus effusus*
4	*Lythrum salicaria*
1	*Oenanthe sarmentosa*
1	*Schoenoplectus (Scirpus) americanus*
2	*Schoenoplectus (Scirpus) maritimus*
32	*Typha latifolia*

Matson Wetland, Catching Slough sub-basin

Wetland integrity: 0.48

The perimeters of this 67.4-acre site were determined by the dike along most of the northern edge, the end of tidal influence along the eastern side, uplands along the southern side and the county road dike on the short, western border. The east side continues up into some narrower valleys. Flow now exits the site through a single bridge opening under the county road – formerly, the exits were through two tide gated culverts.

Matson wetland from Catching Slough road, August 2008.

The site, now owned by the Wetlands Conservancy, had been a dairy under previous ownership. A major restoration /

compensatory mitigation project was completed earlier in the summer, 2008. Major restoration actions at that time included; filling of ditches and one culvert, removal of two tide gates, placement of a tide gate on a ditched channel draining into the site near the mouth, bridge installation where tide-gated culvert had been, and planting on portions of the southern border uplands.

At the time of assessment the site was in heavy transition. The near-mouth channels were actively eroding due to the sudden reintroduction of tidal action. In the middle of the site, the valley width was covered with water at low tide making foot access to the center of the site very unsafe. Additionally, the channels were not clearly defined and therefore the upper channel measurements were estimated.

Vegetation transects included 14 species. *Typha latifolia* (cattails) and *Eleocharis palustris* (common spikerush), the most abundant species, were both recorded at 20% each. Other species commonly found in the transects included *Agrostis stolonifera* (creeping bentgrass 13%), *Juncus effuses* (soft rush 15%), and *Phalaris arundinacea* (Reed canary grass 13%). This site is expected to change over time as the channel morphology and vegetation communities adjust to tidal action and salinity changes.

Species Percent in Vegetation Transects, Matson	
13	*Agrostis stolonifera (A. alba)*
6	*Carex lyngbyei*
4	*Carex obnupta*
1	*Deschampsia caespitosa*
20	*Eleocharis palustris*
1	*Epilobium ciliata*
2	*Holcus lanatus*
15	*Juncus effusus*
1	*Lotus corniculatus*
13	*Phalaris arundinacea*
3	*Rumex crispus*
1	*Schoenoplectus (Scirpus) maritimus*
2	*Schoenoplectus (Scirpus) microcarpus*
20	*Typha latifolia*

Brunschmid Wetland, Echo Creek sub-basin

Wetland integrity: 0.34

Boundaries of this 10.5-acre site were defined by the uplands along the sides of the narrow valley, the dominance of freshwater influence and vegetation on the northeastern tip, and the dike road on the western edge which separates the site from the adjacent wetlands and the Cooston Channel of the Coos estuary. The Brunschmid site hydrology is connected to the large, diked ditch across the road, and to a lesser extent to the adjacent Demers wetland sites on either side of this diked ditch. Connection is through a cement box culvert and significant seeps near and under the culvert.

Brunschmid wetland near new outlet channel, August 2008.

Tidal inundation was restored to this site just previous to the assessment (summer 2008). Culverts and ditches along the sides of the valley were filled, and a new meandering channel was constructed through the mid valley. Intensive planting and seeding was conducted during 2008/2009.

Vegetation was dominated by *Agrostis stolonifere* (creeping bentgrass 41%), *Holcus lanatus* (velvet grass 17%) and *Phalaris arundinacia* (Reed canary grass 14%). However, a notable amount of *Eliocharis palustris* (common spikerush) existing on the site was not observed in the transects, and much of the surface was unvegetated.

Species Percent in Vegetation Transects, Brunschmid	
41	*Agrostis stolonifera (A. alba)*
4	*Eleocharis palustris*
17	*Holcus lanatus*
5	*Juncus effusus*
9	*Lotus corniculatus*
15	*Phalaris arundinacea*
4	*Potentilla pacifica*
2	*Ranunculus repens*
3	*Veronica americana*

Marine Sourced High Marsh

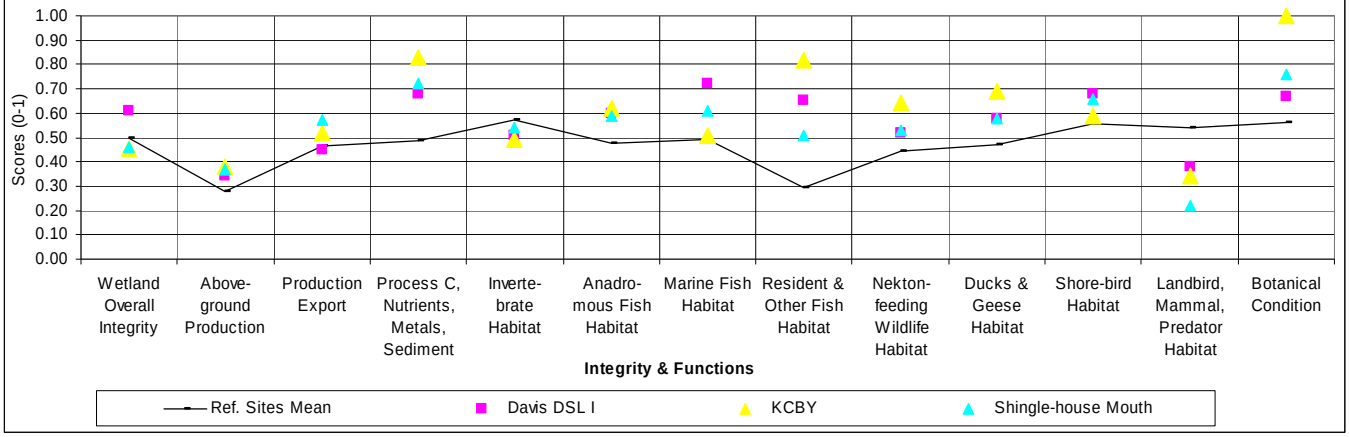
Marine sourced high marsh is flooded relatively less often than low marsh, making it generally more feasible for hydrologic alterations, pasture management and waterfront development. All three sites in this class have a history of different restoration actions.

Data in Table 5 below, show that, for all HGM scores, study sites averaged 0.10 higher than reference sites. Only scores for *Invertebrate Habitat* and *Landbird, Mammal, Predator Habitat* were lower, on average, than the reference sites. Mean scores for *Wetland Overall Integrity* for study sites was only 0.01 higher than reference sites. The graph in Figure 7 plots the mean scores of study sites in comparison to reference site mean scores.

Table 5: Comparison to Reference Sites of Class, Tidal HGM Rapid Assessment Marine Sourced High Marsh Sites 2008 (scale 0-1)

	Study Sites Mean	Ref. Sites Mean	Variance from Ref.	St. Dev. Study Sites
Wetland Overall Integrity	0.51	0.50	0.01	0.09
Above-ground Production	0.36	0.28	0.09	0.02
Production Export	0.51	0.47	0.05	0.06
Process C, Nutrients, Metals, Sediment	0.74	0.49	0.26	0.08
Invertebrate Habitat	0.51	0.57	-0.06	0.03
Anadromous Fish Habitat	0.60	0.47	0.13	0.02
Marine Fish Habitat	0.61	0.49	0.12	0.11
Resident & Other Fish Habitat	0.66	0.30	0.36	0.16
Nekton-feeding Wildlife Habitat	0.56	0.45	0.12	0.07
Ducks & Geese Habitat	0.62	0.47	0.15	0.06
Shore-bird Habitat	0.64	0.55	0.09	0.05
Landbird, Mammal, Predator Habitat	0.31	0.54	-0.23	0.08
Botanical Condition	0.81	0.56	0.25	0.17
Overall Average			0.10	0.08

Figure 7: Functional Capacity Scores Comparison - Marine Sourced High Marsh



Davis DSL I Wetland, Davis Slough sub-basin

Wetland integrity: 0.61

The perimeter of this 24.5-acre site was defined by the forested upland along most of the northern edge and a dike borders the remaining edge up to where the main channel enters the site. The dike likely blocked the channel at some time in the past.

Davis DSL I Wetland near dike-breach where main channel enters site, Davis Slough Sub-basin, August 2008.

This site is characterized by myriad natural tidal channels throughout the site, along with pieces of the wider, natural remnant channels, remaining from the pre-dike era. A ditch runs along extent of the northern upland edge and shows signs of possible dredge spoils deposited on the wetland side (i.e., slight berm with some upland vegetation).

While the perimeters of the site contained a diversity of plant species, the vegetation transects at this sight consisted almost entirely of *Carex lyngbyei* (lyngby sedge 88%), with 10 other species present in the transects in very small amounts. Eel grasses were extensive throughout the channels.

Species Percent in Vegetation Transects, Davis DSL I	
1	*Achillea millefolium*
1	*Argentina egedii*
88	*Carex lyngbyei*
3	*Deschampsia caespitosa*
1	*Distichlis spicata*
3	*Eleocharis parvula*
3	*Grindelia stricta*
2	*Lilaeopsis occidentalis*
1	*Schoenoplectus (Scirpus) acutus*
1	*Schoenoplectus (Scirpus) maritimus*

Upon site investigation, there did not appear to be hydrological connection between this site and the Davis DSL II site immediately 'upstream' to the west, and the only outlet for this site is at the channel mouth that was measured for the survey.

Shinglehouse Mouth Wetland, Isthmus Slough Sub-basin

Wetland integrity: 0.46

This 12.6-acre site was bordered by Highway 101 and a paved parking lot on the eastern edge. On the upland edge to the south there was a road and a few residences. There were tidal wetlands upstream of this site on both sides of the Shinglehouse channel, and the assessment site boundary to the west was considered to be at the eastern end of a narrow strip of upland woody vegetation along the main channel that separates this site from the upstream sites. Scranton's HGM polygon includes this narrow strip but stops before connecting with the next wetland site.

Main channel at Shinglehouse Mouth wetland, Isthmus Slough Sub-basin, August, 2008.

There was a small amount of observable freshwater inputs, seeps, coming in from the upland side. Faulty septic systems were assumed to be a potential problem on the border and upstream. Directly across the Shinglehouse channel was a small industrial area, a county road, and dispersed residences. Also upstream less than half a mile was an auto wrecking yard, non-operational land fill, tide-gated wetland pasture and logging operations.

The site was used for mitigation of wetland disturbance resulting from nearby Highway 101 bridge work conducted in 1988 – 1989. At the time of assessment, specific goals and actions of the mitigation project were not identified in the DSL mitigation records. However, there appears to be a low berm within the site parallel to the Shinglehouse channel but not obviously a dike.

Ten species were recorded in the vegetation transects. *Distichlis spicata* (saltgrass 36%) was the most abundant, followed by *Salicornia virginica* (pickleweed 23%) and *Carex lyngbyei* (lyngby sedge 13%).

Species Percent in Vegetation Transects, Shinglehouse Mouth	
1	*Atriplex patula*
13	*Carex lyngbyei*
7	*Deschampsia caespitosa*
36	*Distichlis spicata*
1	*Eleocharis palustris*
10	*Festuca rubra*
1	*Grindelia stricta*
23	*Salicornia virginica*
1	*Spergularia salina (marina)*
9	*Triglochin maritimum*

KCBY Wetland, Coalbank Slough Sub-basin

Wetland integrity: 0.45

The boundaries of this 19.9-acre site are the surrounding uplands on all but the north side, which is a dike road and divides this site from Coalbank Slough. The site drains into the slough through the main culvert under the county road. Freshwater inputs were observed flowing into the south end of the site.

The large scour pool with active erosion and sediment deposition (see photo) indicated that the exit culvert was heavily restricting flow. Enlarging this exit channel would improve the estuarine salt marsh habitat and improve fish access to the habitat.

The site also showed definite signs (i.e., berm next to straight channel) of historical ditching and dredging near the center of the site.

Vegetation transects included nine species with *Carex lyngbyei* (lyngby sedge) covering 45%, followed by *Distichlis spicata* (saltgrass 19%) and *Salicornia virginica* (pickleweed 14%).

KCBY Wetland. Sediment deposition and main culvert scour pool, August, 2008.

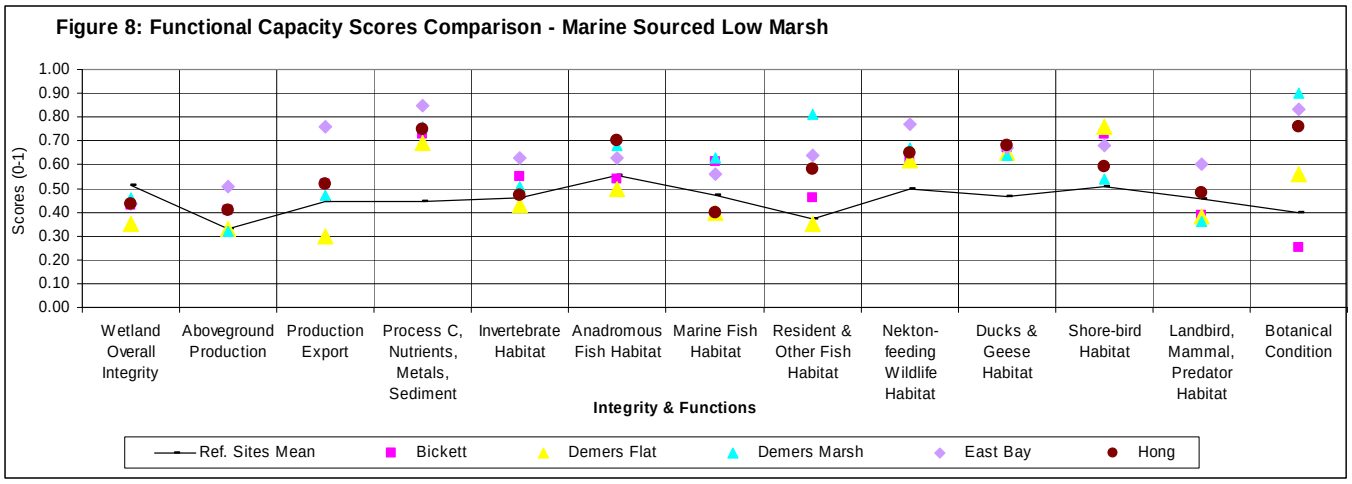
Species Percent in Vegetation Transects, 'KCBY'	
45	*Carex lyngbyei*
2	*Cuscuta salina*
1	*Deschampsia caespitosa*
19	*Distichlis spicata*
1	*Eleocharis palustris*
7	*Festuca rubra*
3	*Grindelia stricta*
14	*Salicornia virginica*
9	*Triglochin maritimum*

Marine Sourced Low Marsh

Marine sourced low marsh is the most abundant HGM class found in Oregon and the most common in this assessment. Four of the five low marsh sites currently have breached dikes between the site and the main water body. The East Bay site is considered to be in the most natural condition of the low marsh sites, while also influenced by nearby roads and residential development. Data in Table 6 show that, overall, low marsh study sites averaged scores 0.11 higher than reference sites. However, for *Wetland Overall Integrity*, study sites scored 0.09 below the reference site mean. *Landbird, Mannal, Predator Habitat* was also lower than reference site mean by 0.01. The graph in Figure 8 shows the study sites scores plotted with the reference site mean.

Table 6 : Comparison to Reference Sites of Class, Tidal HGM Rapid Assessment Marine Sourced Low Marsh Sites 2008 (scale 0-1)

	Study Sites Mean	Ref. Sites Mean	Variance from Ref.	St. Dev. Study Sites
Wetland Overall Integrity	0.42	0.51	-0.09	0.04
Aboveground Production	0.40	0.33	0.07	0.08
Production Export	0.51	0.44	0.07	0.16
Process C, Nutrients, Metals, Sediment	0.76	0.44	0.31	0.06
Invertebrate Habitat	0.52	0.46	0.06	0.08
Anadromous Fish Habitat	0.61	0.55	0.06	0.09
Marine Fish Habitat	0.52	0.47	0.05	0.11
Resident & Other Fish Habitat	0.57	0.37	0.20	0.18
Nekton-feeding Wildlife Habitat	0.66	0.50	0.17	0.06
Ducks & Geese Habitat	0.66	0.47	0.20	0.02
Shore-bird Habitat	0.66	0.51	0.15	0.09
Landbird, Mammal, Predator Habitat	0.44	0.45	-0.01	0.10
Botanical Condition	0.66	0.40	0.26	0.26
Overall Average			0.11	0.10



Demers South (Marsh) Wetland, Echo Creek Sub-basin

Wetland integrity: 0.46

This 18.8-acre site had altered hydrologic connectivity to Demer's Flat to the north, Brunschmid wetland to the east, and another, un-assessed wetland to the south - through ditches, dike breaches, culverts and subsurface seepage.

Main channel into Demers Marsh, left. Demers Flat wetland is to the right. August, 2008.

At time of this assessment the site boundaries were the dikes on the north, south and west sides. However, restoration activities may eventually reconnect many of the surrounding marshes.

The site had ponded, impounded water in pannes, and in old ditches (i.e. east edge of site). The 2005 aerial images showed a contiguous dike on the Cooston Channel border, since then the dike was breached at the north end ditch. There also appeared to be some hydrologic connection with the neighboring marsh to the south evidenced by surface flow from this site to the ditch on the far side of the south end dike, and that ditch's connection to the neighboring marsh through an internal dike breach. Fresh water seepage at low tide was observed flowing under East Bay Drive from the Brunschmid marsh draining, not thru the box culvert, but seeping sub-surface near an old buried culvert.

Species Percent in Vegetation Transects, Demers Marsh	
64	*Carex lyngbyei*
3	*Cotula coronopifolia*
2	*Distichlis spicata*
3	*Eleocharis palustris*
5	*Eleocharis parvula*
3	*Juncus effusus*
15	*Salicornia virginica*
1	*Schoenoplectus (Scirpus) maritimus*
5	*Spergularia salina (marina)*
2	*Triglochin maritimum*

This site was estimated to be in the midst of transitioning from a farmed wetland to a marine sourced low marsh due to the breached dike. Ten species were recorded in vegetation transects, but the site was heavily dominated by *Carex lyngbyei* (lyngby sedge 64%). *Salicornia verginica* (pickleweed) composed 15% and all other species were at 5% or less.

This site and the Demers South (Flat) site are currently under consideration for restoration through dike removal.

East Bay Wetland, Echo Creek Sub-basin

Wetland integrity: 0.43

This 65-acre site was bordered by the Cooston Channel of the Coos Bay estuary on the western edge (no dike) and uplands with a county road along the north and eastern side. Wetland alterations have occurred at the southern tip of the site including diking off of a previously-contiguous wetland (northern tip of Demers Flat site).

East Bay wetland with large wood, looking north along the Cooston Channel, August, 2008.

Residential development was encroaching along the northwest edge, road along the upland edge, and clear-cuts in upland drainage. The most notable features of the site were the un-diked edge with the estuary, and the large wood scattered on the surface and accumulating at the north and eastern edges. There were two major channels entering the site from the north (very wide channel) and south ends of the delimited site. These tidal channels joined in the middle at a very small juncture.

Species Percent in Vegetation Transects, East Bay	
32	*Carex lyngbyei*
1	*Cuscuta salina*
9	*Deschampsia caespitosa*
32	*Distichlis spicata*
2	*Festuca rubra*
1	*Grindelia stricta*
1	*Jaumea carnosa*
14	*Salicornia virginica*
10	*Triglochin maritimum*

Nine plant species were recorded in the vegetation transects. *Carex lyngbyei* (lyngby sedge) and *Distichlis spicata* (saltgrass) were both present, composing 32% each. *Salicornia virginica* (pickleweed 14%), *Triglochin maritimum* (arrow grass 10%) and *Deschampsia caespitosa* (tufted hairgrass 9%) composed most of the remaining plant population and all others recorded were present at one or two percent each.

Bickett Wetland, Coalbank Slough Sub-basin

Wetland integrity: 0.43

This 37.0-acre site was bounded by uplands on the southeast and a dike that borders the majority of the site along Coalbank Slough. The dike was breached near the downstream end of the site forming the mouth of the main internal tidal channel (see photo).

Mouth of main channel into the Bickett wetland adjacent to a Coos Bay industrial area. May, 2008.

Characteristic tidal channeling was observed throughout the site, as well as pannes. Very little wood was observed on the marsh surface or in the channels, a likely result of the surrounding dike with only one breach. A gravel road on the upland side of the marsh is set back from the site edge by more than 100 feet along most of its length, and industrial and commercial land uses are directly across the Coalbank Slough channel.

Eight plant species were recorded in vegetation transects. Vegetation was heavily dominated by *Carex lyngbyei* (lyngby sedge 72%) with *Agrostis stolonifere* (creeping bentgrass 19%) showing significant presence within the transects. All other plant species were less than 5% each.

Species Percent in Vegetation Transects, Bickett	
19	*Agrostis stolonifera (A. alba)*
1	*Argentina egedii*
1	*Atriplex patula*
72	*Carex lyngbyei*
1	*Deschampsia caespitosa*
4	*Hordeum brachyantherum*
1	*Juncus balticus*
3	*Triglochin maritimum*

Hong Wetland, Isthmus Slough Sub-basin

Wetland integrity: 0.43

This 25.2-acre site had a dike along the outer edge bordering Isthmus Slough. The southern boundary, and channel mouth, of this site were vague and hard to define as the marsh surface gradually became sub-tidal. This boundary was approximately directly west from the largest divot in the eastern upland border (see aerial) - this was where significant (>20% in quad) vegetation began that loosely defined the channel measurement. (This site assessment boundary suggested by P. Adamus.) The western boundary was a dike with a very wide, upstream breach, and the eastern side was bounded by uplands. The northern end of the site was connected to a smaller wetland through a breached dike.

Hong wetland from county road, dike and Isthmus slough in background, September, 2008.

This site was diked and drained pre-1939. The dike is assumed to have been breached >10 years ago. The mucky soil was relatively more compact (observation only), possibly due to historic livestock use combined with bark accumulation from nearby log rafts. The outer dike seemed largely composed of large wood debris. Driftwood edge existed along the majority of the perimeter – although less wood volume than the East Bay site. There were pilings within the site along some of the channel areas, and there was a large electrical line structure on the site (south of assessment boundary), that could potentially influence future management actions.

Species Percent in Vegetation Transects, Hong	
1	*Atriplex patula*
17	*Carex lyngbyei*
10	*Distichlis spicata*
19	*Eleocharis parvula*
4	*Jaumea carnosa*
1	*Lilaeopsis occidentalis*
23	*Salicornia virginica*
1	*Spergularia salina (marina)*
26	*Triglochin maritimum*

Nine plant species were recorded in the vegetation transects. This site showed more distribution of species than many of the other sites with five species recorded in amounts between 15 – 30%. *Triglochin maritimum* (arrow grass) was the most abundant at 26%.

Demers North (Flat), Echo Creek Sub-basin

Wetland integrity: 0.35

This site 26.3-acres site was historically connected to the East Bay, Brunschmid, and Demers Marsh sites and lies in the center of them. It was bordered by a county road and uplands along the eastern and northeastern edge, a breached dike on the western edge with the Cooston Channel, and dikes on the north and south tips.

Demers Flat wetland near southeast corner, August, 2008.

The most notable features of the site were the extensive dikes, the pedestal soil formations, and the relative lack of large, leafy vegetation. Six plant species were recorded in the transects; dominated by *Eleocharis parvula* (dwarf spikerush 57%), *Carex lyngbyei* (lyngby sedge 16%), and *Salicornia virginica* (pickleweed 12%).

On the other side of the road was the Brunchmid wetland restoration project which filled in a freshwater ditch just after this assessment. This may change the freshwater input previously coming in through a culvert near the southeast corner of this site. Both Demers sites are currently being considered for a dike removal and wetland enhancement project.

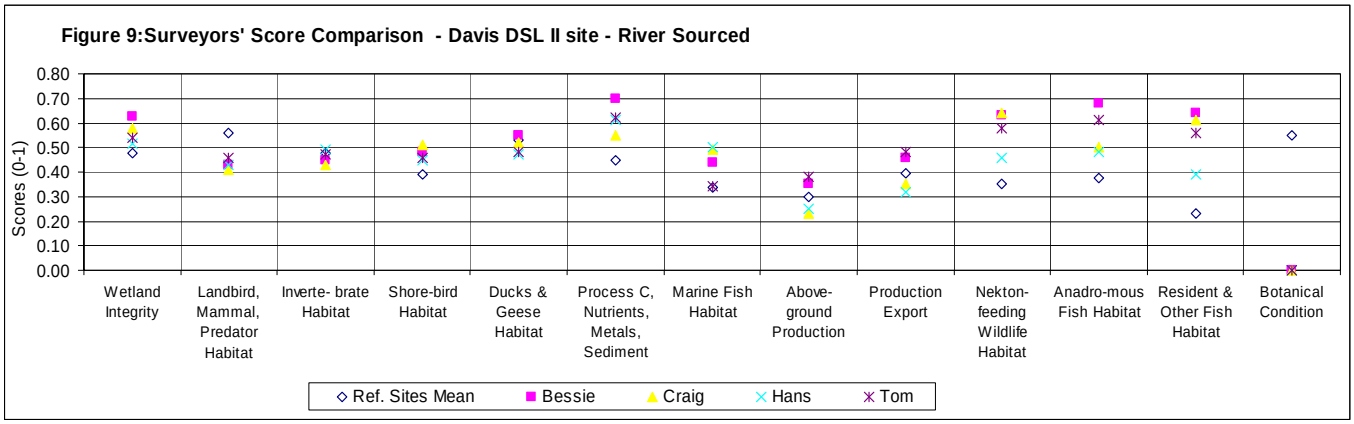
Species Percent in Vegetation Transects, Demers Flat	
16	*Carex lyngbyei*
4	*Cotula coronopifolia*
57	*Eleocharis parvula*
12	*Salicornia virginica*
10	*Spergularia salina (marina)*
1	*Triglochin maritimum*

Surveyor Comparison

A group of local wetland advisers was convened during the early project period to learn about the methods. Attending advisors included two employees of South Slough National Estuarine Research Reserve/Department of State Lands, one from the Coos Bay North Bend Water Board, one from the Curry Soil and Water Conservation District. A meeting was held in August, 2008, during the HGM assessment period. Attendees concluded that a field test and mini-training of the methods on a familiar site would be useful.

The project manager took three South Slough National Estuarine Research Reserve/ Department of State Lands employees to the Davis DSL II site, provided an instructive review of the methods, data sheets and discussed some additional field survey recommendations based on her experience to that point. The individuals conducted the HGM RAM independently, but at the same time, at the somewhat-familiar wetland site producing the score results shown in Figure 6, below.

Surveyor's scores varied but were generally similar in trend. Exceptions include the wider range of resulting scores for the functions of *Resident and other Fish Habitat*, *Anadromous Fish Habitat*, and *Nekton Feeding Wildlife Habitat*. Standard deviation of surveyor's scores, on a scale of 0 to 1, ranged from 0 to 0.112 and averaged 0.057 or 5.7%.



CONCLUSIONS

The Estuary Assessment results, overall, show that 50% of the assessed wetlands (1790 acres) are ranked for high restoration priority. Most of the high priority rankings, 41%, are located in the Lower Catching Slough sub-basin. The Lower Catching area's land use is predominantly agricultural, managed for pasture, and is less densely populated with relatively larger land holdings per owner. These combined characteristics are promising for developing potential restoration projects given outreach education to landowners there.

A possible wetland restoration and highly-visible demonstration project, at the border between Lower and Upper Catching sub-basins, is now being scoped with partners. Owned by the well-known Messerle family and adjacent to the rural community of Sumner, the project will have outstanding demonstration value. The project will exemplify a typical scenario of marginal, lowland pasture becoming too costly to continue managing for that purpose, i.e., maintenance of ditches, dikes, tide gates, and the associated permit processes. The project will likely entail removal of a tide gate and dikes, channel re-meandering, diking to protect neighboring property from tidal inundation, wetland and riparian planting and outreach components.

Conservation priority ranked wetlands composed only 12%, 479 acres, of all assessed wetlands and most are located along Upper and Lower Isthmus Slough. This rank category also has the highest amount of stormwater potential, 32%. All reaches of Isthmus Slough have high traffic, i.e., US hwy 101 and hwy 42, on one side, and Lower Isthmus Slough has a high concentration of industrial land use bordering the slough in many places. These conservation wetlands serve an especially important service as buffers between sources of polluted stormwater runoff and Isthmus Slough, which has been identified by the Oregon Department of Environmental Quality as a non-point source control priority waterway in the western Oregon region (RFP Oregon 319 Non-point Source Implementation Grants Fiscal Year 2010).

These assessment tools, results and potential implications of this project will be used on an on-going basis in upcoming outreach and assessment programs of the CoosWA and its partners. Two new programs, the Coos Stormwater Solutions outreach education program (DEQ funded) and the Partnership for Coastal Watersheds (CICEET funded) will both be working with advisors and landowners to identify ways to improve watershed conditions through the conservation, restoration and enhancement of tidal wetlands.

Literature Cited

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

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

Coos Watershed Association. 2006. Coos Bay Lowland Assessment and Restoration Plan. March, 2006. Charleston, OR: Coos Watershed Association

Coos Watershed Association. 2008. Catching Slough, Daniel's Creek and Heads of Tide Sub-basin Assessment and Restoration Opportunities. Charleston, OR: Coos Watershed Association

Costanza et.al. 1997. The value of the world's ecosystem services and natural capital. Nature 387:253-260.

DLCD (Department of Land Conservation & Development). 1997. Estuary Management Units for Coos Bay Estuary Management Plan. SMMS Metadata Report.

EPA. 2000. HGM & Bio-assessment Development in Oregon. epa.gov/owow/wetlands/bawwg/case/or.html.

Hoffnagle et.al. 1976. A Comparative Study of Salt Marshes in the Coos Bay Estuary. Nat. Science Foundation Student Originated Study.

Miller & Sadro. 2003. Residence Time and Seasonal Movements of Juvenile Coho Salmon. American Fisheries Society.

Oregon Department of Fish and Wildlife (ODFW). 2005. http://oregonstate.edu/Dept/ODFW/spawn/pdf%20files/coho/AnnualEstESU1990-2004.pdf. Accessed on February 9, 2006.

Shaffer, L.J.. 1999. How successful has wetland mitigation been? An examination of wetland compensatory mitigation success in the Coos Watershed, Oregon. U. of O. Master of Science Thesis.
Zedler, J.. 2001. Handbook for Restoring Tidal Wetlands. CRC Marine Science Series.

APPENDIX A

Estuary Assessment Notes:

EPB layer not aligned w HGM layer therefore some EPB designations for HGM polygons are incorrect.

NWI classifications were ignored where only a tiny portion of the NWI class intersected the HGM polygon, i.e., < 5%.

No Local Wetland Inventory map was available.

A large part of the project area is not covered by the ONHP GLO 2008 historic vegetation database, the uncovered area includes the Catching Sough sub-basin and the upper Noble Creek area.

No ONHP GLO 2008 'swamps' were identified for the project area.

Only characteristically meandering channels were considered tidally 'active' or 'remnant' channels in historic photo interpretation, but may have had tidal action in channelized streams.

The upper tip of Davis Slough (near Belloni's Ranch) is not on the HGM or NWI layers, but has tidally influenced soils and is obviously a wetland currently and in the 1939 aerial photos. This wetland was not included in the assessment.

Historical aerial photos did not have sufficient resolution to determine dominance of spruce over other conifers. The 2005 CIR photos were used and spruce was considered historically dominant only if the trees appeared large and old and more than a few sparse trees were inside the polygon area. Spruce dominance was considered a secondary tidal indicator.
All wetland polygons (excluding roads, dikes and developed areas) were determined tidal or formerly tidal wetland, and none were determined to have never been tidal. This may have been skewed by a step in the methods that identified all polygons above a dike or tide gate to have 'questionable' tidal influence and therefore kept their formerly-tidal status.

The Bickett wetland on Coalbank Slough has a breached dike, but the dike was not identified as a separate polygon on the HGM layer and is therefore not identified in the assessment as a dike.

Many potential tidal indicators were not evaluated in this assessment, see Brophy 2007. These include presence of spoils, excavation, brackish vegetation, channel armoring, logging and driftwood removal, noxious weeds.

Apart from deleting developed areas of HGM polygons, HGM polygons were not edited.

Several wetlands missing from the HGM layer were included in the assessment by supplementing with the NWI layer. This supplement amounted to 125 acres.

Dams were considered dikes.

Roads and dikes themselves were not considered for stormwater potential status.