Appendix E

Sub-Basin Graphics: Landscape Classes, Landscape Functions, Stressors, pocket estuary table, and drift cell graphic plus analysis

The following pages within Appendix E include five separate pieces (four graphics and one table) for each of the 11 sub-basins. For example, the first sub-basin listed, South Georgia Straits, contains five figures labeled as E-1.1 through E-1.5. The four graphics are a series of GIS maps for each of the sub-basins discussed throughout the chapter, and the single table presents information from our pocket estuary analysis. For three of the four graphics, two sub-basins are represented on each map with the following attributes:

1. Landscape classes: Natal estuaries, bays, beaches, and marine water. In addition, "other" estuaries are depicted by a fish symbol on the first figure in each sub-basin. These estuaries were identified where Chinook use/distribution have been documented (e.g., those areas other than the natal estuaries).
2. Landscape functions: Particularly, pocket estuary function within 5, 10 and >10 miles buffers from natal deltas, plus land use cover types.
3. Stressors: Including shoreline alteration (armoring) with drift cell overlay, sewage outfalls, and 303 d listing parameters.

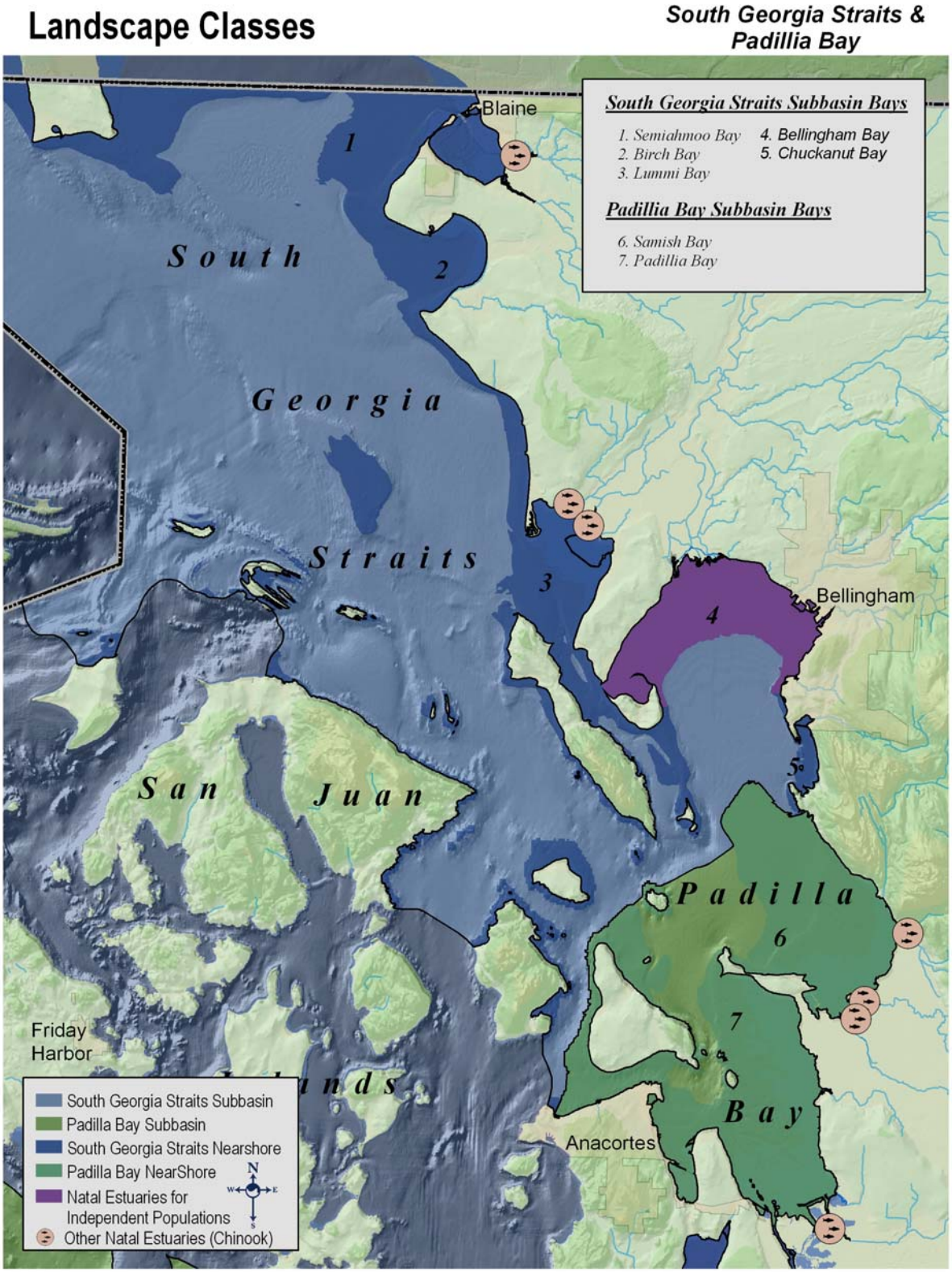


Figure E-1.1: South Georgia Strait and Padilla/Samish Landscape Classes

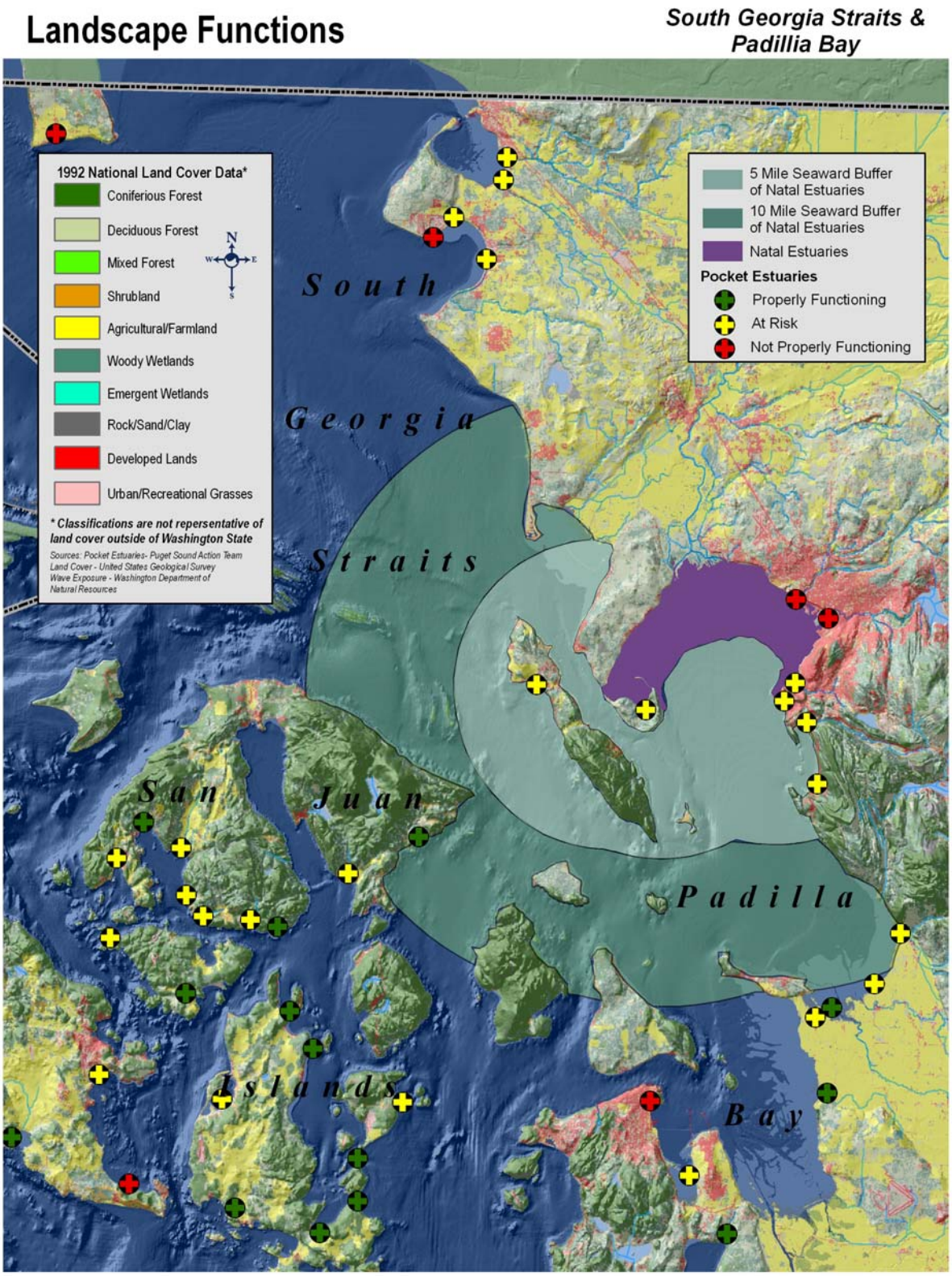


Figure E-1.2: Landscape Functions for the South Georgia Straits and Padilla/Samish Bay sub-basins.

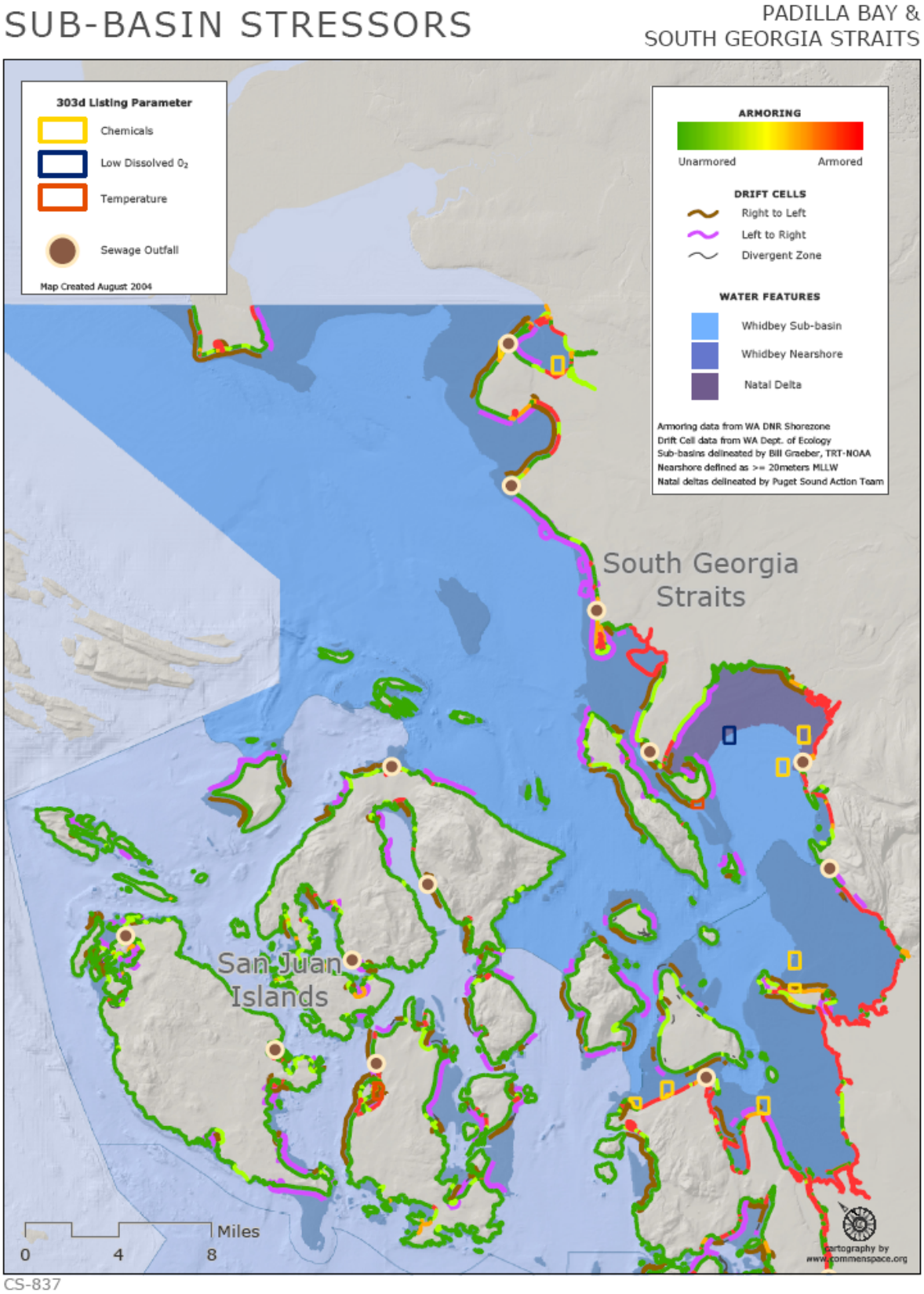


Figure E-1.3: Stressors for the South Georgia Straits and Padilla/Samish Bay Sub-Basins.

Pocket Estuary Identifier	Latitude	Longitude	Photo ID #	Freshwater (Y/N)	Likely Chinook Functions				Shoreline Dev.	Urbanization	Diking/Filling	Susceptibility to spills and discharges	Aquaculture related substrate alterations	Vulnerability to Sea Level Rise	Final Chinook Function Score
					Feeding	Osmoreg.	Refuge								
GS1 - Chuckanut Bay	48.671	122.489	010524-145352a	Y	x	x	x		x		x	x		x	AR
GS2 - Chuckanut Creek	48.701	122.498	010524-145130	Y	x	x	x		x	x	x	x		x	AR
GS3 - Post Point	48.711	122.515	010524-144834	N			x		x		x	x		x	AR
GS4 - Padden Creek	48.72	122.507	010524-144650	Y	x	x	x		x	x	x	x		x	AR
GS5 - Whatcom Creek	48.752	122.484	010524-144426	Y	x	x	x		x	x	x	x		x	NPF
GS6 - Squalicum Creek	48.761	122.508	010524-144056	Y	x	x	x		x	x	x	x		x	NPF
GS7 - Portage Island	48.705	122.617	010524-132032	Y	x	x	x				x				AR
GS8 - Legoe Bay	48.716	122.698	010524-125010	Y	x	x	x		x		x			x	AR
GS9 - Terrell Creek	48.923	122.744	010524-121144	Y	x	x	x		x	x	x	x		x	AR
GS10 - Cottonwood	48.943	122.769	010524-121044	Y	x	x	x		x		x	x		x	AR
GS11 - Birch Bay	48.933	122.784	010524-120826	N			x		x	x	x	x		x	NPF
GS12 - California Creek	48.962	122.733	010524-120004	Y	x	x	x			x		x			AR
GS13 - Dakota Creek	48.973	122.731	010524-115458	Y	x	x	x		x	x		x			AR
GS14 - Point Roberts	48.978	123.066	010524-113516	Y					x	x	x	x		x	NPF

Figure E-1.4: South Georgia Straits sub-basin pocket estuary locations, likely Chinook functions, and observed stressors.

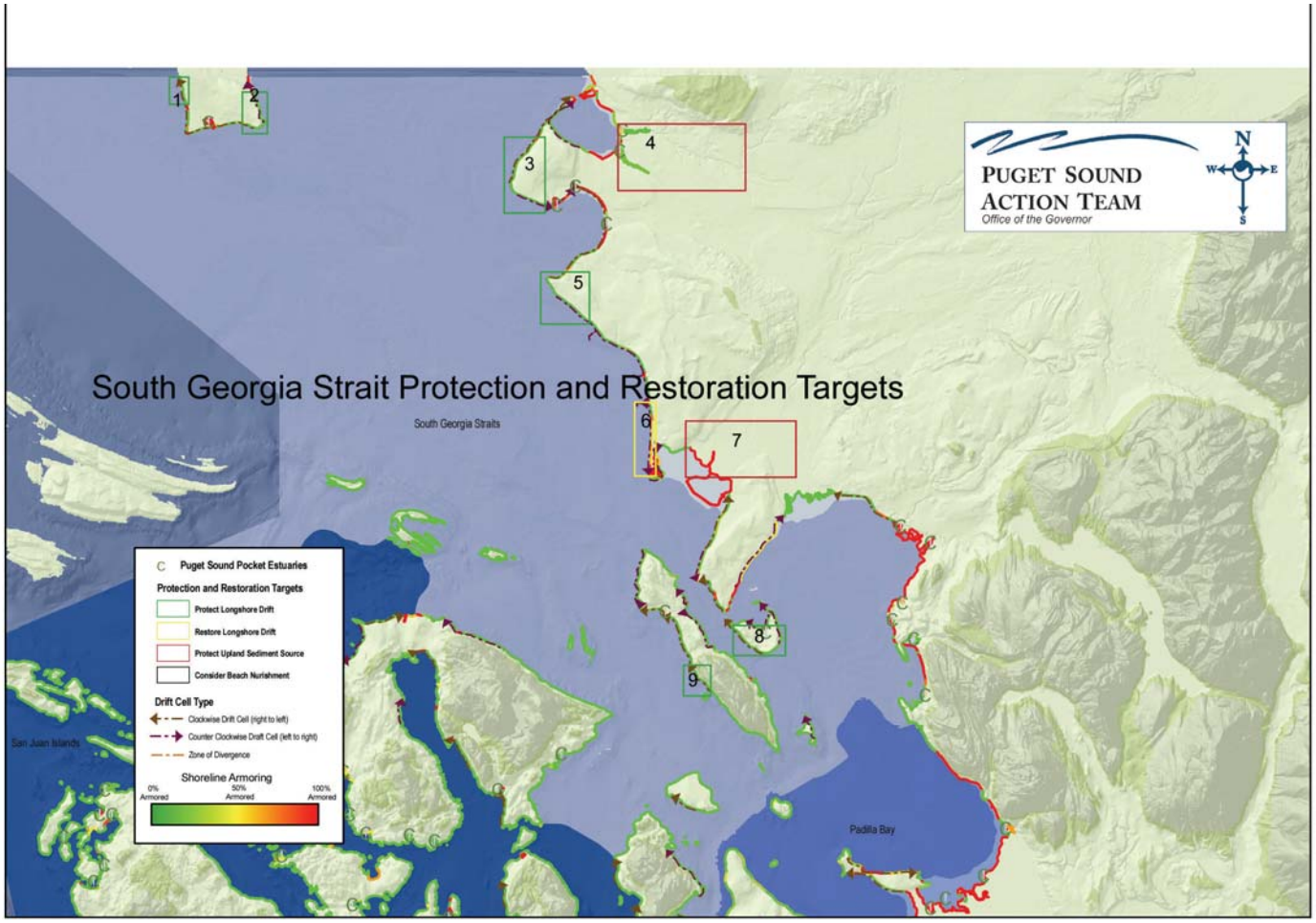


Figure E-1.5: South Georgia Straits sub-basin analysis of drift cells and shoreline armoring

SOUTH GEORGIA STRAIT SUB-BASIN

Box 1 – The general direction of littoral drift in Point Roberts is from right to left along the shoreline from the southeast corner of the peninsula to the Canadian border. The entire southwest corner of the peninsula is a large depositional landform. While shoreline development occurs within much of this drift cell, the beach within box 1 becomes considerably less armored and so any erosion that may occur within box 1 should distribute sediments northward.

Box 2 – This box inscribes a divergence zone where the drift cell described in box 1 starts moving to the left and the drift cell that continues northward along the eastern shoreline of Point Roberts continues northward into Boundary Bay. Box 2 can be considered the "feeder bluff" for both box 1 and box 2 drift cells, therefore all depositional features within those boxes are dependent on that sediment source.

Box 3 – This box encompasses all of Birch Point, which is the "feeder" source for Semiahmoo Spit. Semiahomoo Spit is the barrier beach for Drayton Harbor, an embayment that contains several miles of low gradient shoreline and two embedded pocket estuaries.

Box 4 – This box inscribes upland sediment sources for pocket estuaries in Drayton Harbor. Long term protection of these sediment sources through appropriate riparian buffer regulations and stewardship should protect pocket estuary function and maintain a source of deltaic sediments that contribute to the unique shape and character of Drayton Harbor.

The complex structure of Drayton Harbor is a result of deltaic processes bringing sediment and freshwater into South Georgia Strait and those sediments and freshwaters being confined behind a system of spits maintained by the erosion and deposition of the Birch Point drift cell.

Box 5 – The Cherry Point "feeder" bluff supplies sediment north to Birch Bay and further south toward the refineries and Sandy Point and into Lummi Bay. This process should be protected through critical areas and appropriate shoreline management designations as well as stewardship efforts.

Box 6 - Most of the shoreline development and armoring seems to have taken place on the depositional sections of the Cherry Point drift cell. In addition to protecting the Cherry Point area as a source of sediment, education about drift cell functions should be offered to residents further south so that landowners can make informed decisions about real and perceived erosion risk. It may be possible to engage the community in smaller scale restoration efforts like removing bulkheads that are deemed to be unnecessary.

Box 7 – Much of the shallow shelf structure of Lummi Bay is due to historic deltaic processes. These processes no longer occur because of the disconnection of the Lummi delta from the Nooksack River. The long term erosion of the shallow shelf structure

between the historic Lummi delta and Sandy Point could potentially contribute to the erosion of the sand spit.

Box 8 – This feeder bluff provides the sediment source for two diverging drift cells that define the shape of Portage Island including the long spits which define the border of Portage Bay.

Box 9 – While much of southern Lummi Island is a rocky coastline, this feeder bluff supplies a long continuous drift cell on the western shoreline.

Other South Georgia Sub-basin Shorelines – Other shorelines within South Georgia Basin are generally in the transport and depositional sections of drift cells whose sediment source is recommended for protection above. Within these sections, limited development practicing shoreline best management practices will likely have little effect on sediment transport patterns. However, strong education programs, Critical Areas Ordinance and Shoreline Management implementation should be employed.

Pocket Estuary Identifier	Latitude	Longitude	Photo ID #	Freshwater (Y/N)	Likely Chinook Functions			Shoreline Development	Urbanization	Diking and Filling	Susceptibility to spills and discharges	Aquaculture related substrate alterations	Vulnerability to Sea Level Rise	Final Chinook Function Score		
					Feeding	Osmoreg.	Refuge									
PDS1 - Anacortes	48.514	122.606	010525-132322	N			x	x	x	x	x			NPF	PF = Property Functioning	
PDS2 - Fidalgo Bay	48.478	122.576	010525-131936	Y	x	x	x	x	x	x	x		x	AR	NPF=Not Properly Functioning	
PDS3 - Joe Leary Slough	48.52	122.476	010525-124104	Y	x	x	x	x			x			PF	AR=At Risk	
PDS4 - Samish Island	48.557	122.486	010525-123050	Y	x	x	x			x	x		x	AR		
PDS5 - Samish River	48.562	122.474	010525-121516	Y	x	x	x			x				PF		
PDS6 - Edison Slough	48.574	122.443	010525-122404	Y	x	x	x	x	x	x	x			AR		
PDS7 - Colony Creek	48.599	122.425	010525-122252	Y	x	x	x			x	x		x	AR		

Figure E-2.4: Padilla/Samish sub-basin pocket estuary locations, likely Chinook functions, and observed stressors.

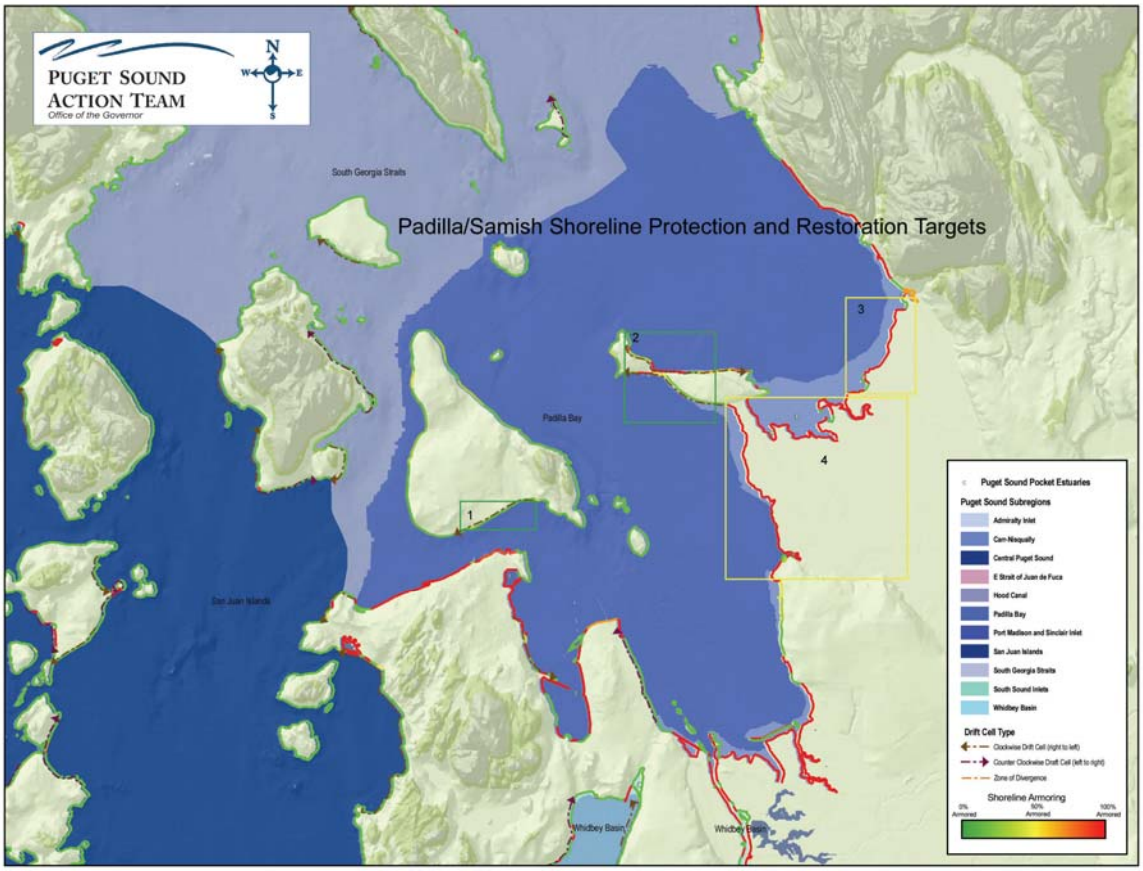


Figure 2.5: Padilla/Samish sub-basin analysis of drift cells and shoreline armoring

Padilla/Samish

Box 1 - Much of the Guemes Island shoreline is either rocky or no appreciable net shore drift has been documented. The island is also fairly sparsely populated. The drift cell within box 1, however, continues from Deadman Bay to Kelly's Point and consists of a high feeder bluff exposed to considerable fetch to the south. The depositional processes of this drift cell appear to have isolated a historic pocket estuary near Kelly's Point so that it is no longer connected to Guemes channel. These semi-isolated wetland features are rare in Puget Sound and are extremely valuable for migratory birds. During high tides and heavy surf, they may temporarily join with the larger body of water and then close again after the tides have receded. They would be expected to provide the same functions as other pocket estuaries during the time they are open. It is unknown what functions these types of wetlands play in regard to salmon VSPs over time.

Box 2 –Box 2 inscribes two feeder bluffs and their associated drift cells traveling in opposite directions. The northern feeder bluff, though small in size, supplies sediment to a long stretch of shoreline on the north shoreline of Samish Island. The South feeder bluff supplies sediment to the entire south shoreline. Together, the interaction of these two drift cells fused the rocky western part of Samish Island with the sandier eastern part to form its unique current shape. The narrow isthmus that connects the two sides of the island depends on a healthy longshore sediment transport process.

Boxes 3 and 4 – The seaward levees separating the historic northern portions of the Skagit delta from Padilla and Samish bays should be considered for removal under a comprehensive Skagit delta restoration plan. Removing these levees along with limited diversion of water and sediments from the Skagit River and its tributaries would likely restart deltaic processes.

Other shorelines within the Samish/Padilla Sub-basin – Most of the Samish/Padilla sub-basin is extremely shallow and dominated by historic deltaic sediments of the Skagit River that have interacted with various offshore rocky islands. The role of longshore sediment transport is therefore greatly reduced but still important in shaping some of the unique features of this sub-basin. Existing development including the City of Anacortes, March Point refineries and agricultural levees are expected to persist into the future. The Burlington Northern railroad is a dominant feature along the Chuckanut Mountain shoreline, which because of its highly erodible nature, may have been more of a factor in determining shoreline sediment drift process in the past than it does currently, especially north into the South Georgia Strait sub-basin.

Figure E-3.1: San Juan Islands and Eastern Strait of Juan de Fuca Landscape Classes

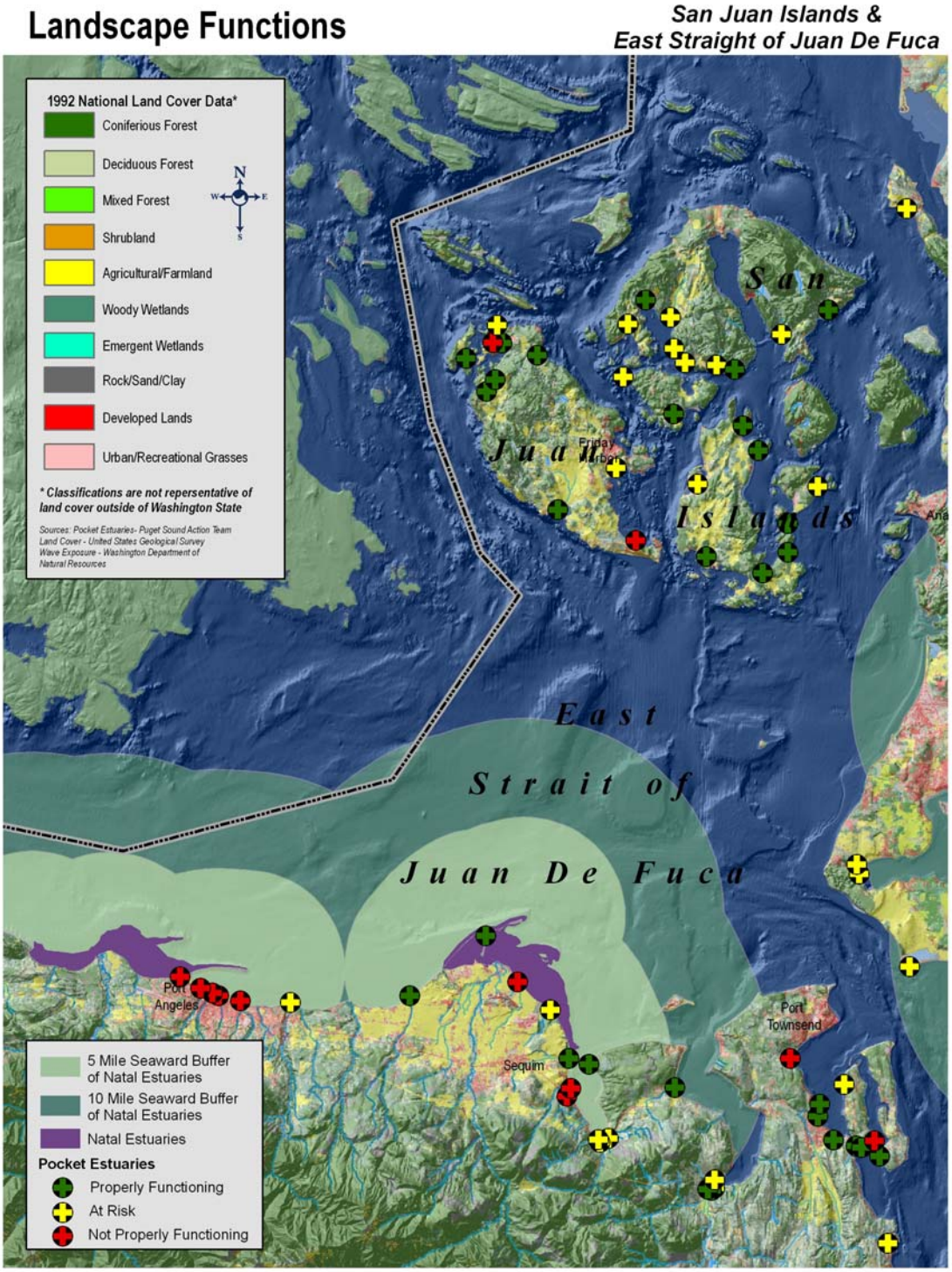


Figure E-3.2. Landscape Functions for the San Juan Islands and Eastern Strait of Juan de Fuca Sub-Basins.

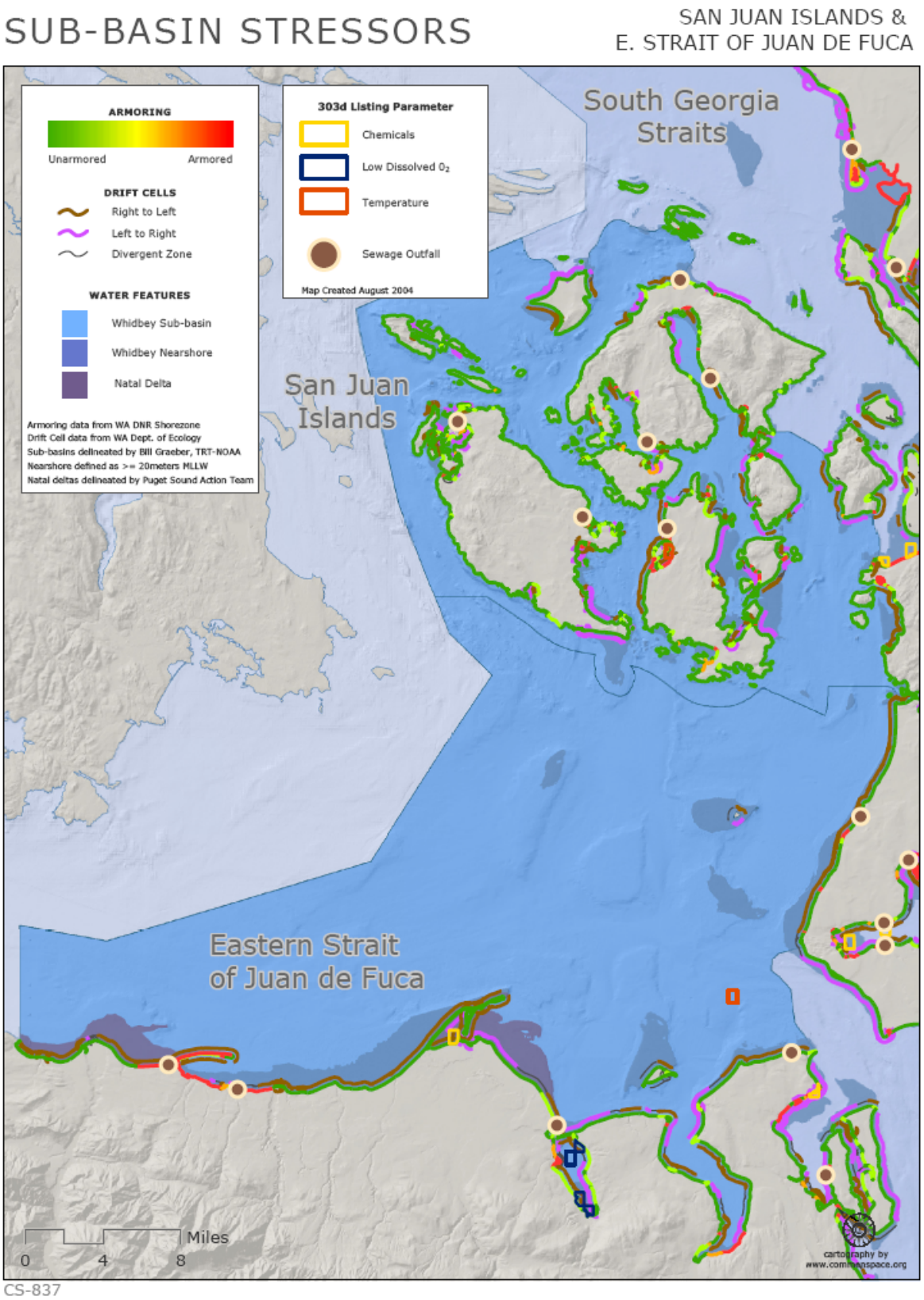


Figure E-3.3 Stressors for the San Juan Islands and Eastern Strait of Juan de Fuca SubBasins.

Figure E-3.4 Eastern Strait of Juan de Fuca sub-basin pocket estuary locations, likely Chinook functions, and observed stressors

Pocket Estuary Identifier	Latitude	Longitude	Photo ID #	Freshwater (Y/N)	Likely Chinook Functions			Shoreline Development	Urbanization	Diking and Filling	Susceptibility to spills and discharges	Aquaculture related substrate alterations	Vulnerability to Sea Level Rise	Final Chinook Function Score		
					Feeding	Osmoreg.	Refuge									
ES1 - Fairmount	47.992	122.879	010522-131518	Y	x	x	x						x	AR	PF = Property Functioning	
ES2 - Snow Creek	47.99	122.882	010522-131528	Y	x	x	x			x	x		x	PF	NPF=Not Properly Functioni	
ES3 - Salmon Creek	47.991	122.886	010522-131530	Y	x	x	x	x		x	x		x	PF	AR=At Risk	
ES4 - Maynard	47.998	122.879	010522-131700	N	x		x	x	x	x	x		x	AR		
ES5 - Eagle Creek	48.065	122.926	010522-132206	Y	x	x	x							PF		
ES6 - Paradise Cove	48.08	123.021	0205311218_050	N	x		x	x						PF		
ES7 - Blyn	48.026	122.997	0205311221_075	N	x		x	x		x	x		x	AR		
ES8 - JimmyComeLately	48.023	123.006	0205311222_079	Y	x	x	x	x	x	x	x			AR		
ES9 - Dean Creek	48.025	123.008	0205311222_080	Y	x	x		x	x	x	x		x	AR		
ES10	48.056	123.044	0205311223_099	Y	x	x		x	x	x	x			NPF		
ES11 - Johnson Creek	48.062	123.04	0205311224_103	Y	x	x		x	x	x	x		x	NPF		
ES12 - Bell Creek Lagoon	48.084	123.043	0205311234_123	Y	x	x	x		x				x	PF		
ES13 - Glenn Creek	48.119	123.065	0205311237_138	Y	x	x	x		x					AR		
ES14 - Cassalery Creek	48.139	123.102	0205311238_147	Y	x	x		x	x	x	x		x	NPF		
ES15 - Dungeness Spit	48.172	123.139	0205311246_185	N	x		x						x	PF		
ES16 - Siebert Creek	48.126	123.22	0205311259_218	Y	x	x	x							PF		
ES17 - Morse Creek	48.118	123.351	0205311309_249	Y	x	x	x	x	x				x	AR		
ES18 - White/Ennis	48.118	123.406	0205311311_262	Y	x	x		x	x	x	x		x	NPF		
ES19 - Peabody Creek	48.121	123.43	0205311312_270	Y	x			x	x	x	x		x	NPF		
ES20 - Valley Creek	48.123	123.437	0205311312_272	Y				x	x	x	x		x	NPF		
ES21 - Tumwater Creek	48.126	123.45	0205311312_276	N				x	x	x	x		x	NPF		
ES22 - Ediz Lagoon	48.134	123.473	0205311320_312	N	x		x	x	x	x	x		x	NPF		

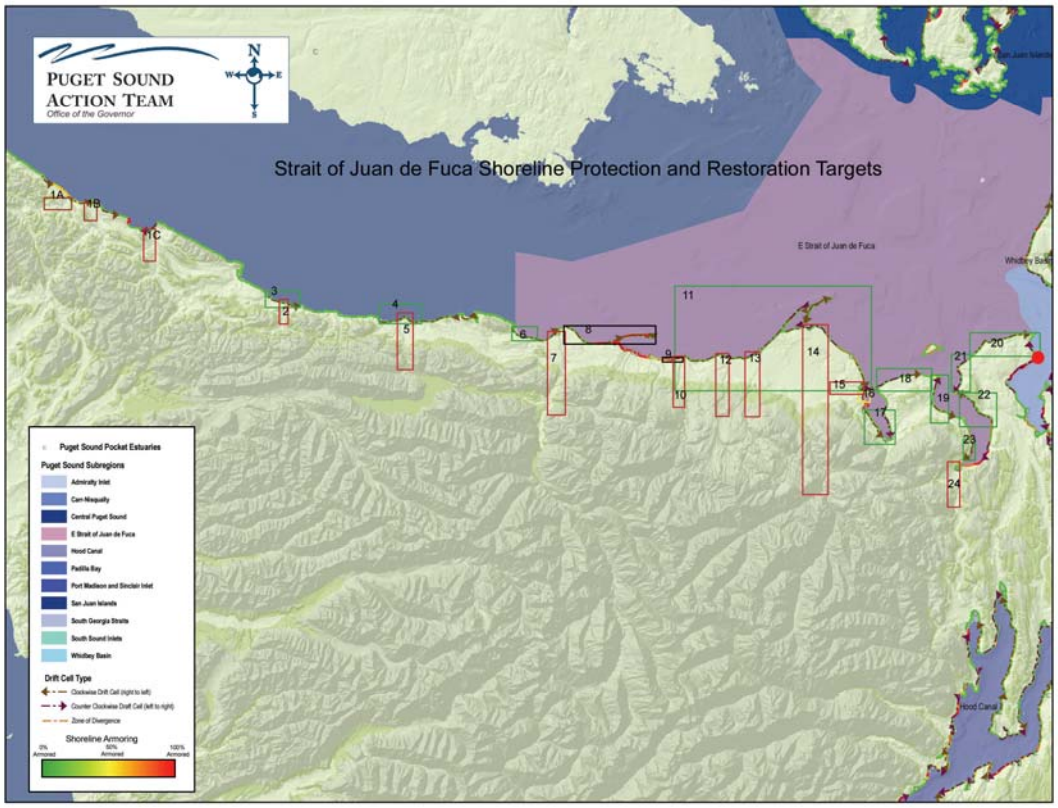


Figure E-3.5 Eastern Strait of Juan de Fuca sub-basin analysis of drift cells and shoreline armoring

Strait of Juan de Fuca

Boxes 1A,B and C – Sandy beaches on the outer Strait of Juan de Fuca appear to be "pocket" beaches between otherwise rocky headlands. As such, the longshore component of sediment transport is less important than maintaining the source of upland sediments from the Sekiu, Hoko and Clallam rivers.

Boxes 2 and 3 – The long drift cell that extends eastward from the mouth of Jim Creek distributes sediment from the adjacent sandy bluff as well as sediment coming downstream from Deep Creek supporting a number of depositional features. To maintain this unique structure will require protecting both upland sediment sources from the creek and long-term sediment delivery from the eroding bluff.

Boxes 4 and 5 – This drift cell starts on the bluffs near Murdock creek and extends eastward to Tongue Point. Much of the sediment that is transported comes from the Lyre River and smaller streams within the drift cell.

Boxes 6 and 7 – The shorelines of western Freshwater Bay are somewhat protected by a rocky headland. This drift cell interacts with the considerable historic Elwha River delta.

It is expected that river sediments will once again be deposited onto this delta and into the drift cell as a result of dam removal commencing in 2007.

Box 8 – The high sandy bluffs east of the Elwha River historically built the extensive depositional structure of Ediz Hook along with river sediments. In recent years, armoring of the bluff base east of Dry Creek has increased effectively removing those bluff sediments from the drift cell. Ediz Hook continues to erode and is now also protected by extensive armoring. This unique drift cell may need to be studied to understand the relative contribution of bluff and river sediments over time in maintaining Ediz Hook structure. New river sediments coming down from the Elwha are expected to move along the shoreline but it is uncertain whether the armoring of the transport and depositional sections of this drift cell will preclude settlement of these sediments onto the beach and the hook. At the very least, aggressive protection of the function of bluffs from the River mouth to Dry Creek is recommended.

Boxes 9-14 – The unique structure of Dungeness Spit and Dungeness Bay is the result of a complex interaction of deltaic sediment input from the Dungeness River interacting with bluff sediments on all shorelines East of Port Angeles to the base of the spit. The strong longshore drift eastward from Port Angeles prevents any significant deposition of sediments until they reach the spit. Morse Creek, Siebert Creek, McDonald Creek and other small drainages may contribute sediment to the system in lesser degrees or during seasonal floods and so that process should also be protected. Beaches in Box 9 are currently heavily armored, most likely the result of the perception of increased wave action beyond the “shadow effect” of Ediz Hook. However, it’s quite possible sediments from Box 9 bluffs would also contribute to the Dungeness Spit and should be considered for beach nourishment or some “softer” method of shoreline treatment.

Boxes 15, 16, 17 and 18 – Longshore drift processes within these drift cells define the complex depositional structures within Sequim Bay. Upland sediment sources from Box 15 historically interacted with the depositional end of the large drift cell (Box 11) described above containing Dungeness Spit and sediments traveling westward from the drift cell in box 18 and northward in box 16. Some restoration of armored shorelines in Box 16 should be considered to maintain the structure of the pocket estuary. Drift cells traveling southeasterly within Box 17 aid in the formation of extensive mudflats at the mouth of Jimmycomelately Creek, Dean Creek and other drainages at the head of Sequim Bay.

Boxes 19-22 – These largely unarmored shorelines within and near Discovery Bay support a number of depositional features at the terminal ends of their drift cells. In many cases the convergence of neighboring drift cells forms the point bar feature. These features are often associated with a wide intertidal and shallow subtidal shelf creating an extensive area within the photic zone. This is important here because the waters of outer Discovery Bay and the Eastern Strait are otherwise quite deep.

Boxes 23 and 24 – The structure of the Salmon and Snow Creek estuary is as a result of interactions between the southwesterly bluff sediment transport from box 23 and deltaic sedimentation from Box 24.

Figure E-4.4 San Juan Islands sub-basin pocket estuary locations, likely Chinook functions, and observed stressors

Pocket Estuary Identifier	Latitude	Longitude	Photo ID #	Freshwater (Y/N)	Likely Chinook Functions			Shoreline Development	Urbanization	Diking and Filling	Susceptibility to spills and discharges	Aquaculture related substrate alterations	Vulnerability to Sea Level Rise	Final Chinook Function Score		
					Feeding	Osmoreg.	Refuge									
SJ1 - False Bay	48.487	123.075	0206121423_1	Y	x	x	x							PF	PF = Property Functining	
SJ2 - Mitchell Bay	48.572	123.158	0206121413_0	N	x		x	x					x	PF	NPF=Not Properly Functioning	
SJ3 - Westcott Bay 1	48.581	123.149	0206121408_0	Y	x	x	x							PF	AR=At Risk	
SJ4 - Westcott Bay 2	48.608	123.143	0206121405_0	Y	x	x	x							PF		
SJ5 - Open Bay	48.596	123.182	0209091132_0	Y	x	x	x							PF		
SJ6 - Roche Harbor	48.608	123.153	0206121401_9	Y	x	x	x	x	x		x		x	NPF		
SJ7 - Davison Head	48.621	123.149	0206121350_9	N	x		x	x					x	AR		
SJ8 - Rocky Bay	48.6	123.103	0206121452_9	Y	x	x	x							PF		
SJ9 - North Bay	48.519	123.012	0206121438_8	N	x		x	x		x	x		x	AR		
SJ10 - American Camp	48.462	123.983	0206121433_8	N			x							NPF		
SJ11 - Davis Bay	48.456	122.909	0206131136_0	Y	x	x	x							PF		
SJ12 - Mud Bay	48.445	122.846	0206131229_2	N	x									PF		
SJ13 - Fortress Island	48.461	122.819	0206131202_1	N	x		x						x	PF		
SJ14 - Spencer Spit	48.535	122.855	0206131237_3	Y	x	x	x						x	PF		
SJ15 - Shoal Bay	48.553	122.873	0206131300_4	N	x		x	x						PF		
SJ16 - Fisherman Bay	48.509	122.921	0209091116_0	N	x		x	x			x		x	AR		
SJ17 - Squaw Bay	48.56	122.95	0206131322_9	Y	x	x	x	x						PF		
SJ18 - Wasp	48.586	123.007	0206131313_9	N	x		x	x						AR		
SJ19 - Harney1	48.598	122.939	0206121310_3	Y	x	x	x	x			x		x	AR		
SJ20 -Harney2	48.597	122.904	0206121312_3	N	x		x	x						AR		
SJ21 - Foster Pt.	48.594	122.884	0206121314_3	Y	x	x	x							PF		
SJ22 - Cascade Creek	48.621	122.833	0206121330_4	Y	x	x	x	x					x	AR		
SJ23 - Doe Bay	48.64	122.782	0206121339_9	Y	x	x	x							PF		
SJ24 - Deer Harbor	48.625	123.004	0206121258_2	Y	x	x	x	x		x	x		x	AR		
SJ25 - Massacre Bay	48.643	122.985	0206121304_3	Y	x	x	x							PF		
SJ26 - White Beach Bay	48.631	122.957	0206121307_3	Y	x	x	x	x		x	x		x	AR		
SJ27 - West Sound	48.608	122.952	0206121309_3	Y	x	x	x	x					x	AR		
SJ28 - Decatur 1	48.482	122.82	0206131209_1	N	x		x							PF		
SJ29 - Decatur 2	48.51	122.788	0206131214_2	N	x		x	x		x			x	AR		

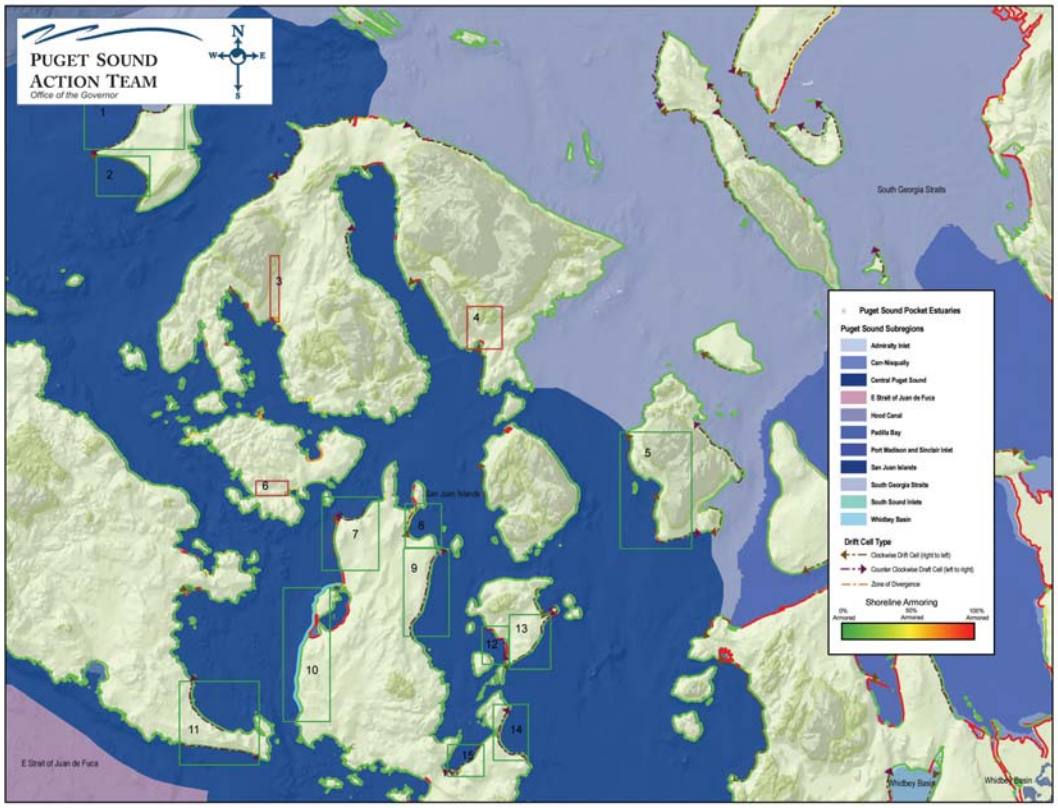


Figure E-4.5 San Juan Islands sub-basin analysis of drift cells and shoreline armoring

San Juan Islands

Boxes 1 and 2 – These 2 boxes inscribe the only two active drift cells on Waldron Island. The soft sediments on the west side of the island are shaped by prevailing seasonal winds from the north and south that create the long depositional point Sandy Point.

Boxes 3, 4 and 6 – These boxes inscribe upland sediment sources for important pocket beaches and estuaries on Orcas and Shaw Islands. Most other pocket estuaries appear to be the result of tidal currents rather than freshwater outflow.

Box 5 – The entire western shoreline of Cypress Island should continue to be protected from armoring as it is one of the largest stretches of soft sediment shoreline in the San Juan Islands

Box 7 – The two converging drift cells within this box support a large depositional point and associated broad subtidal shelf on the northwest corner of Lopez Island.

Boxes 8 and 9 – The two converging drift cells along this shoreline support the large depositional Tombolo and lagoon feature at Spencer Spit State Park.

Box 10 – This long drift cell on the west side of Lopez Island supports the large and complex spit separating Fishermen's Bay from Griffin Bay in Lopez Village.

Box 11 – The Two drift cells running in opposite directions on the southern tip of San Juan Island respond to the strong tidal currents within Griffin Bay and Haro Strait. These shorelines are almost completely inside the San Juan National Historical Park and are expected to remain protected from degradation. The Griffin Bay drift cell contains several small lagoons that appear to be the result of frequent overwash.

Boxes 12 – 15 – Interactions between these four drift cells and the complex rocky shoreline and small islets between Decatur and Lopez Islands create a variety of shallow water habitats including sandy beaches, tombolos, spits and lagoons.

Other San Juan shorelines – The limited amount of fine grain sediments that can be moved by longshore drift and create depositional features means that forage fish spawning potential is also limited. The few places where such grain sizes exist for surf smelt and sand lance spawning particularly should be protected from further degradation.

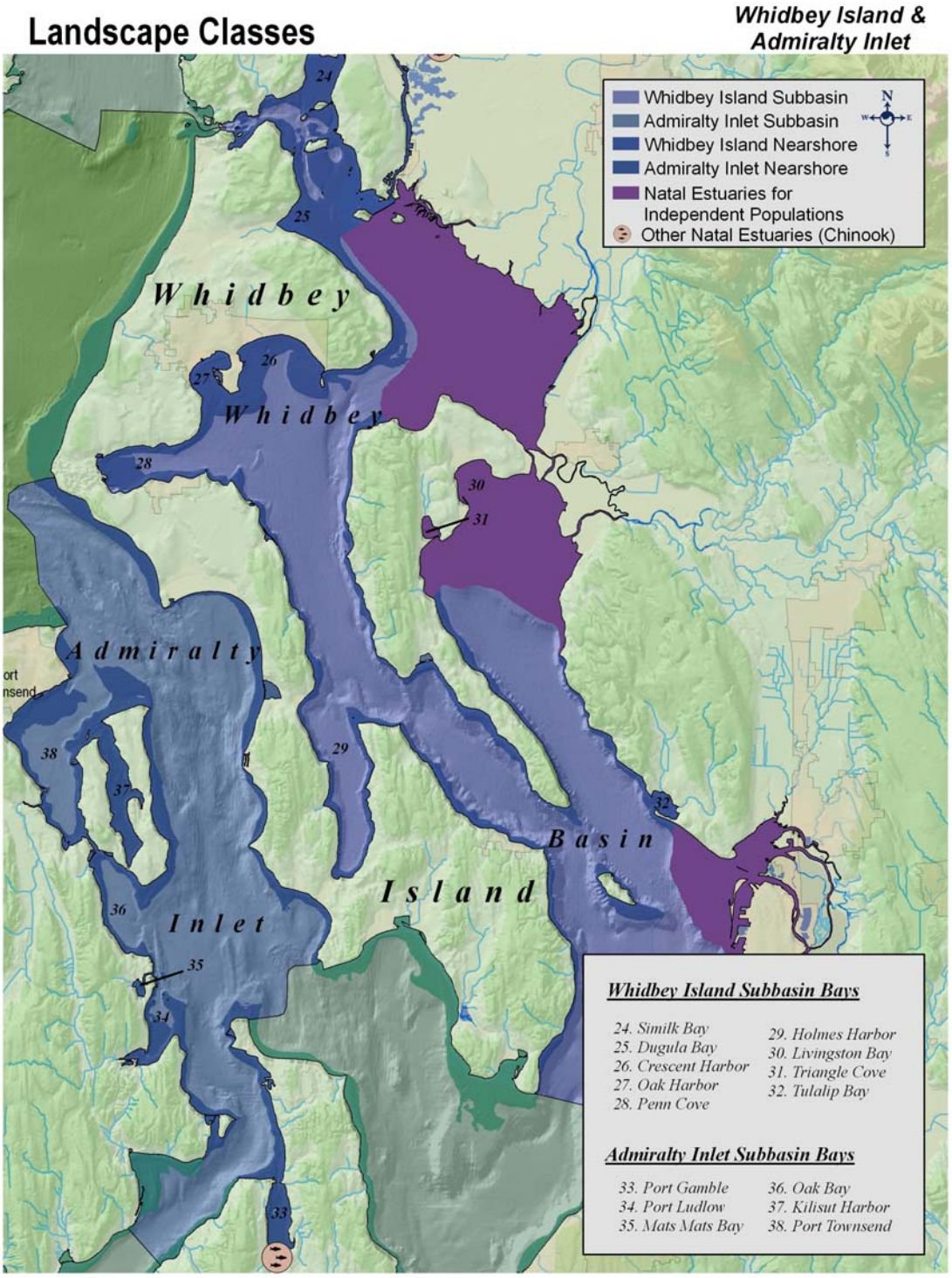


Figure E-5.1 Admiralty Inlet and Whidbey Sub-basin Landscape Classes

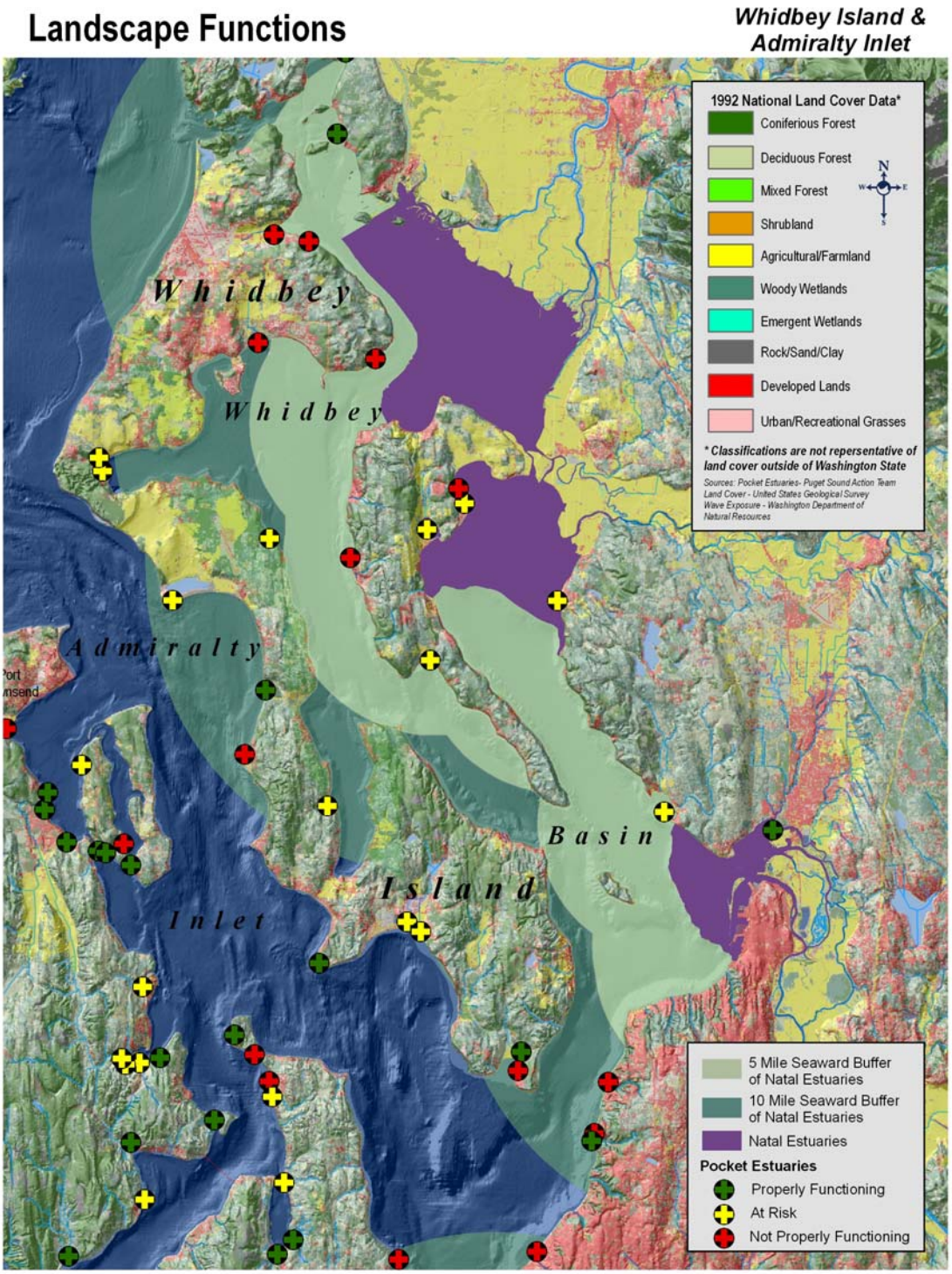


Figure E-5.2 Admiralty Inlet and Whidbey sub-basin landscape functions

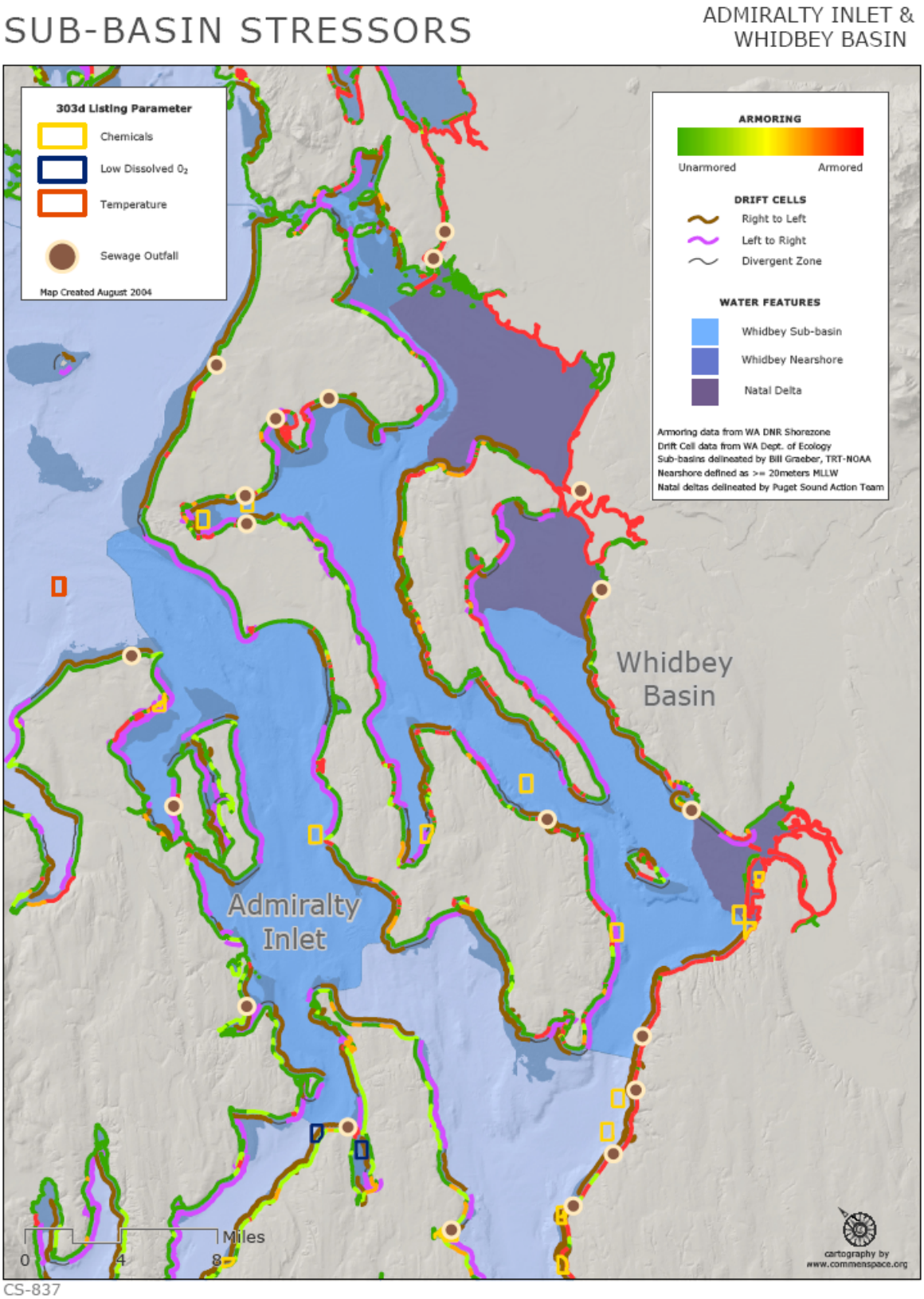


Figure E-5.3 Admiralty Inlet and Whidbey Sub-basins stressors

Figure E-5.4 Admiralty Inlet Sub-basin pocket estuary locations, likely Chinook functions, and observed stressors

Pocket Estuary Identifier	Latitude	Longitude	Photo ID #	Freshwater (Y/N)	Likely Chinook Functions			Shoreline Development	Urbanization	Diking and Filling	Susceptibility to spills and discharges	Aquaculture related substrate alterations	Vulnerability to Sea Level Rise	Final Chinook Function Score			
					Feeding	Osmoreg.	Refuge										
AI1- Keystone	48.113	122.597	010411-131906	N	x		x	x		x	x			AR	PF = Property Functioning		
AI2 - Hancock Lake	48.079	122.612	010411-132042	N			x							PF	NPF=Not Properly Functioning		
AI3 - Lagoon Point	47.97	122.549	010411-132706	N	x		x	x	x	x	x		x	NPF	AR=At Risk		
AI4 - Double Bluff	47.931	122.614	010426-142724	N	x		x							PF			
AI5 - Foulweather Bluff	47.921	122.598	010426-142816	Y										PF			
AI6 - Foulweather Lagoon	47.907	122.586	010426-142944	N			x							NPF*			
AI7 - Loon Bay	47.899	122.583	010426-143238	Y	x	x	x	x	x	x	x			NPF			
AI8 -	47.854	122.572	010426-143440	N	x		x	x		x			x	AR			
AI9 - Point Julia	47.824	122.564	010426-143618	Y	x	x	x	x		x	x		x	AR			
AI10 - Port Gamble 1	47.816	122.576	010426-143906	Y	x	x	x	x						PF			
AI11 - Port Gamble 2	47.843	122.681	010522-114016	Y	x	x	x			x	x			PF			
AI12 - South Point	47.873	122.693	010522-114218	Y	x	x	x	x	x	x	x		x	AR			
AI13 - Shine	47.886	122.628	010522-114844	N	x		x	x		x	x			PF			
AI14 - Bywater Bay	47.918	122.672	010522-115732	N	x		x							PF			
AI15 - Port Ludlow 1	47.915	122.688	010522-115744	Y	x	x	x	x					x	PF			
AI16 - Port Ludlow 2	47.914	122.699	010522-115810	Y	x	x	x	x	x	x	x		x	AR			
AI17 - Port Ludlow 3	47.917	122.702	010522-120304	Y	x	x	x	x	x		x		x	AR			
AI18 - Port Ludlow 4	47.955	122.687	010522-120920	Y	x	x	x		x		x		x	AR			
AI19 - MatsMats Bay	48.026	122.725	010522-121648	N	x		x	x			x		x	AR			
AI20 - Oak Bay 1	48.025	122.719	010522-121816	N	x		x			x				PF			
AI21 - Oak Bay 2	48.019	122.699	010522-123502	N	x		x							PF			
AI22 - Scow Bay 1	48.03	122.705	010522-123628	Y						x				PF			
AI23 - Scow Bay 2	48.046	122.112	010522-123722	N	x		x			x				NPF			
AI24 - Kilisut	48.071	122.74	010522-124154	Y	x	x	x							PF			
AI25 - Walan Point	48.03	122.75	010522-124826	Y	x	x	x			x	x		x	AR			
AI26 - Hadlock	48.047	122.768	010522-125014	Y	x	x	x			x			x	PF			
AI27 - Chimacum Creek	48.056	122.766	010522-125248	N	x		x		x		x			PF			
AI28 - Kala Point	48.089	122.8	010522-125612	N									x	PF			
AI29 - Glen Cove								x		x	x			NPF			

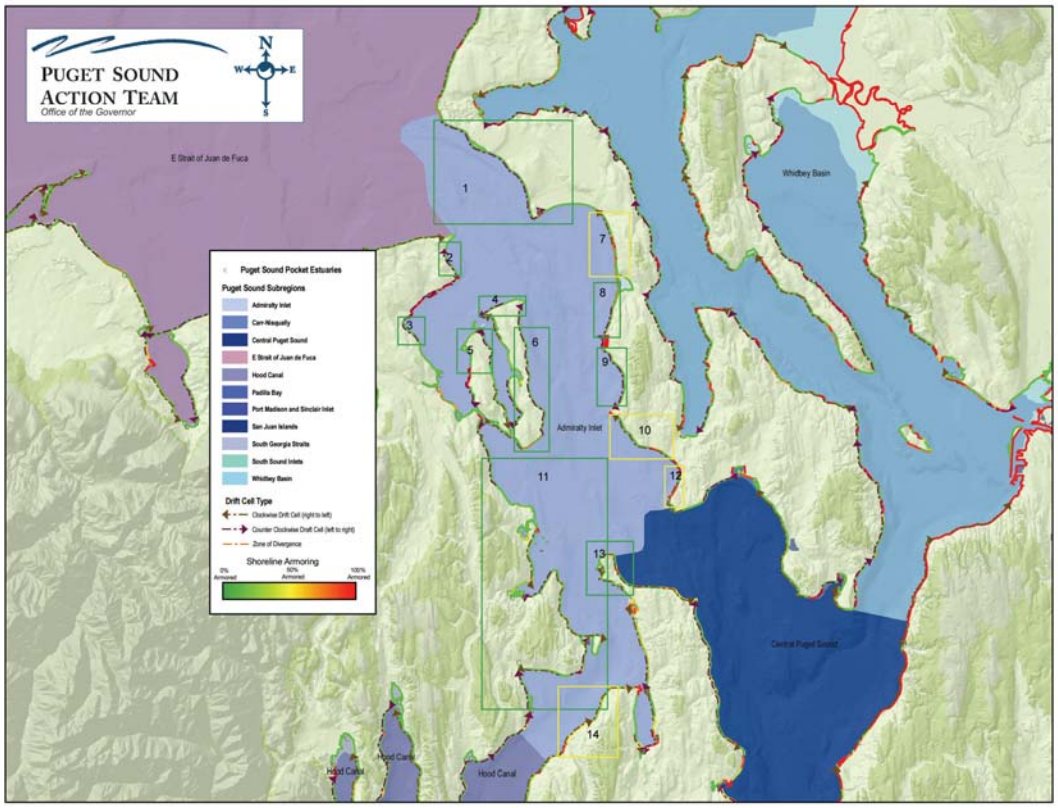


Figure E-5.5 Admiralty Inlet sub-basin analysis of drift cells and shoreline armoring

Admiralty Inlet

Box 1 - This large drift cell transports large amounts of sediment southward along East Whidbey Island due to its exposure to strong ocean swells and westerly winds from the Strait of Juan de Fuca. The erosion of the bluffs also supports an extensive shallow subtidal shelf just offshore.

Box 2 – While this is a short drift cell, it is important in maintaining the shallow shelf and point bar at Fort Worden State Park.

Box 3 – This short drift cell diverges to the north and south and supports spit structures separating pocket estuaries in Port Townsend Bay.

Boxes 4, 5 and 6 – These drift cells interact with tidal currents at the opening of Kilisut Harbor to create a series of spits and shallow sub-tidal shelves.

Boxes 7 and 8 – In the vicinity of Hancock Lake, one drift cell continues northward toward the keystone ferry landing supporting the spit structure that separates Crocket lake from Admiralty inlet and the main road to the ferry. The level of armoring is a concern because of the short distance this drift cell covers and restoration should be considered here. Southward of Hancock Lake, the drift cell supports a depositional feature, which was once a pocket estuary but is now a highly modified residential development with dredged navigation channels. Protecting this drift cell could prevent future coastal flooding of that development.

Boxes 9, 10 and 12 – This shoreline consists of two small convergent drift cells which support a large depositional point on which many houses are built. Like box 8 above, the continued function of these drift cells may lessen the risk of coastal flooding in this community. Sediments from bluffs in boxes 10 and 12 also likely support the wide shallow sub-tidal shelf just offshore of this beach.

Box 11 – This largely intact shoreline has low levels of shoreline development, a complex pattern of nearshore drift and an unusual concentration of pocket estuaries for this part of Puget Sound. It is also the first Admiralty Inlet shoreline adjacent to the entrance to Hood Canal so it likely supports a number of migrating populations of Chinook, Bull Trout and Hood Canal Summer Chum salmon.

Box 13 – This shoreline's unique shape is due to the interaction of strong tidal currents entering Hood Canal and Admiralty Inlet along with significant northward littoral drift along the shoreline. The depositional features include Foulweather Bluff lagoon, an unique brackish pond important for migratory birds as well as an extensive intertidal marsh.

Box 14 – This drift cell should be considered for restoration. At present, the source of sediment moving northward is likely from small streams. However, an extensive intertidal and shallow subtidal shelf structure exists at the mouth of Port Gamble, which may have historically been built from a combination of longshore sediment drift and tidal currents.

Figure E-6.4 Whidbey Sub-basin pocket estuary locations, likely Chinook functions, and observed stressors

Pocket Estuary Identifier	Latitude	Longitude	Photo ID #	Freshwater (Y/N)	Likely Chinook Functions			Shoreline Development	Urbanization	Diking and Filling	Susceptibility to spills and discharges	Aquaculture related substrate alterations	Vulnerability to Sea Level Rise	Final Chinook Function Score		
					Feeding	Osmoreg.	Refuge									
WH1 - Similik	48.45	122.547	010411-122140	Y	x	x	x						x	PF	PF = Property Functining	
WH2 - Tosi Point	48.407	122.552	010525-144838	Y	x	x	x							PF	NPF=Not Properly Functioning	
WH3 - Onamak Pt.	48.184	122.533	010512-122326	N				x		x				NPF	AR=At Risk	
WH4 - Elger Bay	48.131	122.468	010512-122744	Y	x	x	x	x		x				AR		
WH5 - Triangle Cove	48.2	122.473	010512-120322	Y	x	x	x	x		x	x	x	x	AR		
WH6 - Livingston 1	48.214	122.444	010512-120736	Y	x		x	x		x			x	AR		
WH7 - Livingston2	48.222	122.449	010512-120754	N										NPF		
WH8 - Warm Beach	48.164	122.369	000924-115638	Y	x	x	x	x	x	x	x		x	AR		
WH9 - Tulalip Bay	48.054	122.281	000924-120518	Y	x	x	x	x	x		x		x	AR		
WH10 - Honeymoon Bay	48.053	122.546	010411-105158	N			x	x		x			x	AR		
WH11 - Race Lagoon	48.193	122.597	010411-110140	N			x	x		x	x		x	AR		
WH12 - Penn Cove 1	48.226	122.73	010411-113426	N			X	x		x			x	AR		
WH 13 - Penn Cove 2	48.233	122.733	010411-113438	N			x	x		x			x	AR		
WH14 - Crescent Harbor	48.296	122.61	010411-114848	Y				x		x	x		x	NPF		
WH15 - Strawberry Marina	48.289	122.517	010411-115358	N				x	x	x	x		x	NPF		
WH16	48.35	122.572	010411-115850	N				x	x	x	x		x	NPF		
WH17 - Dugualla Bay	48.353	122.6	010411-115938	Y		x		x		x	x		x	NPF		

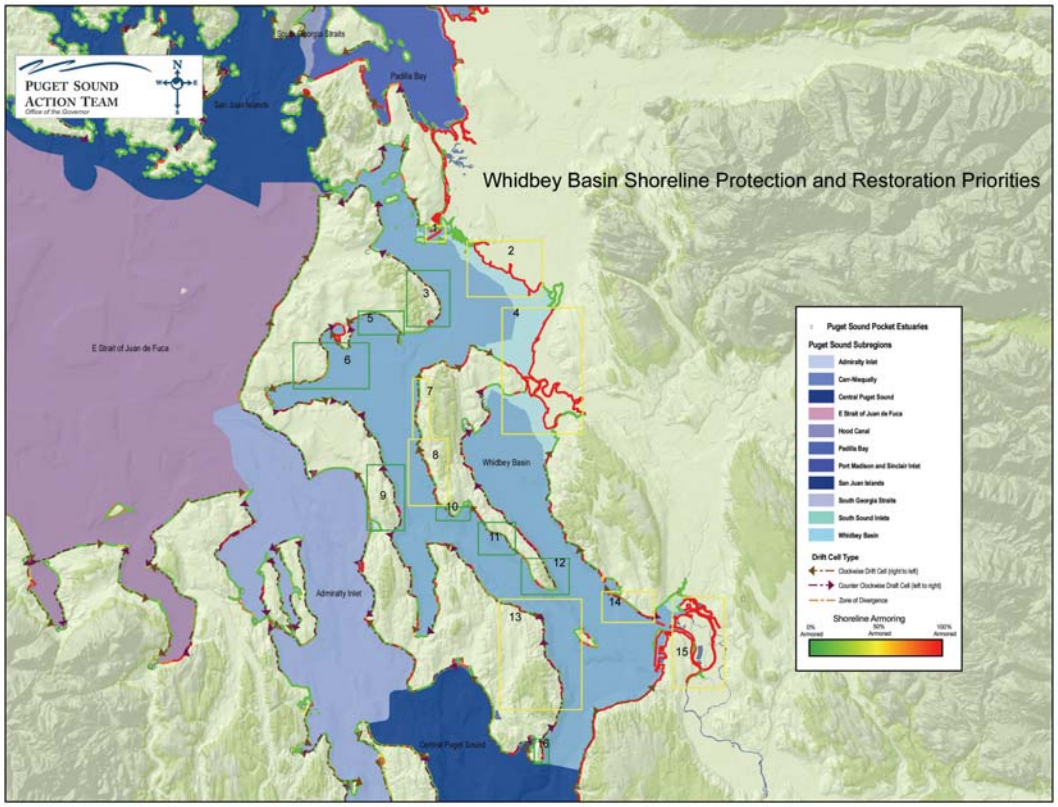


Figure E-6.5 Whidbey Sub-basin analysis of drift cells and shoreline armoring

Whidbey Basin

Box 1 – The Corps of Engineers dike along the entrance to Swinomish channel is likely interfering with natural deltaic and longshore sediment transport processes as well as tidal circulation in this region with unknown effects on salmon VSPs. Evaluation of that structure in the context of both watershed scale and sub-basin scale ecosystem restoration planning should continue to address possible salinity and other physical barriers to salmon migration, especially any barrier for Skagit river fish to rear in Padilla and Samish Bays.

Boxes 2 and 4– Existing agricultural dikes on the seaward edge of the Skagit and Stillaguamish deltas likely inhibit further delta formation into Skagit Bay and Port Susan. Deltaic processes historically dominated much of the Whidbey Basin's eastern shoreline. In light of the massive scale of direct juvenile rearing habitat loss within the historic delta itself and continued productive agricultural land use, the importance of restoration of deltaic processes to create "neo-deltas" in Skagit Bay should be considered. This may include both strategic dike removal and water diversions along historic or new distributary channels.

Box 3 – This bluff serves as a feeder source for long, continuous drift cells to the north toward Deception Pass. The depositional area of the first and largest of these cells interacted historically with the deltaic processes of Dugualla Bay. Since the construction of the road on top of that depositional feature, the longshore processes alone maintain that structure presently.

Box 5 - This bluff serves as a feeder source for a continuous drift cell, which protects the City of Oak Harbor sewage treatment plant and several extensive pocket estuaries. Interruption of sediment transport processes within this cell could lead to erosion of the marsh in which the sewage treatment plant lagoons are located as well as a marsh on the west side of Maylor Point.

Box 6 – Blowers bluff is the sediment source for a drift cell that creates a large intertidal shelf within Oak Harbor to the north and a drift cell into Penn Cove to the west where the longshore sediment transport processes interact with deltaic processes from two small pocket estuaries.

Boxes 7, 8 and 10 – Boxes 7 and 8 act essentially as one long drift cell on the west shoreline of Camano Island. Much of the existing functions of this drift cell could be maintained with limited restoration of drift functions along some of the armored portions. However, the feeder source for this drift cell is located within box 10, located entirely within Camano Island State Park.

Box 9 – This is the feeder source (North bluff/Pratt bluff) for a drift cell that travels north along the eastern shoreline of Whidbey Island and another that travels south toward Dines Point, the northern boundary of Holmes harbor. The northern drift cell interacts with stream mouths to form two pocket estuaries. The southern drift cell supplies a low broad intertidal shelf that historically interacted with deltaic sediments. The depositional section of this southern drift cell now contains a number of low-lying houses that could be at risk of flooding if sediment transport were interrupted.

Boxes 11 and 12 – The southern Camano Island shoreline is a high bluff feeder source for an extensive drift cell that travels north to Elger Bay on the west Camano shoreline and northward toward Port Susan on the eastern Camano shoreline. The limited amount of armoring present on this shoreline does not occur at a scale that is like to interrupt sediment transport processes.

Box 13 – This large drift cell starts at the southern tip of Whidbey Island and continues northward along the eastern shoreline to Sandy Point. While much of the drift cell is unarmored, many waterfront property owners have built bulkheads seaward of the mean high water line and several have built cross-shore structures specifically designed to interrupt longshore sediment transport processes. This shoreline should be investigated for alternative shoreline treatments that would provide protection for upland properties without interrupting the drift cell. Aggressive education of waterfront property owners and bulkhead contractors should be considered in order to improve shoreline

management practices if and when bulkheads need to be replaced. Island County should implement critical areas ordinances and shoreline management that acknowledges the natural littoral drift processes in this cell.

Box 14 and 15– The shoreline within box 14 is the divergence of two drift cells, one traveling north to form the spit separating Tulalip Bay from Possession Sound and the other traveling south toward the mouth of the Snohomish River. The northern drift cell appears to have a low level of armoring currently and should be protected in its natural state to continue that function. However, there is a great deal of armoring throughout the southern drift cell. It is expected that the shoreline adjacent to a large river delta would be extremely dynamic over time. Construction projects that maintain the river mouth for navigation have probably added to that instability. The leveed islands inside the Snohomish delta should be considered for restoration of tidal influence, but the interaction between deltaic sediments reaching Possession sound and the southern drift cell within box 14 should be considered in conjunction with such restoration. It is likely that juvenile salmon migrating from the Snohomish River would heavily use this shoreline.

Other Whidbey Basin shorelines – There are many smaller drift cells that travel both north and south along the Whidbey Basin shoreline. The feeder sections of those drift cells may be extremely small because of the sheer volume of the high bluffs. The southern facing feeder bluffs are particularly active because of long fetches exposed to the main basin of Puget Sound. As development pressure continues along already armored shorelines, it will be important to integrate protection and restoration strategies that take into effect the complex interactions between the many freshwater outflow sources and long, continuous drift cells. The more interior portions of the Whidbey Basin such as Holmes Harbor, Penn Cove and Livingston Bay may be susceptible to eutrophication, so, the impacts of sewage and septic nutrient inputs should also be considered in relation to the net drift of nearshore waters and total oceanographic residence time.

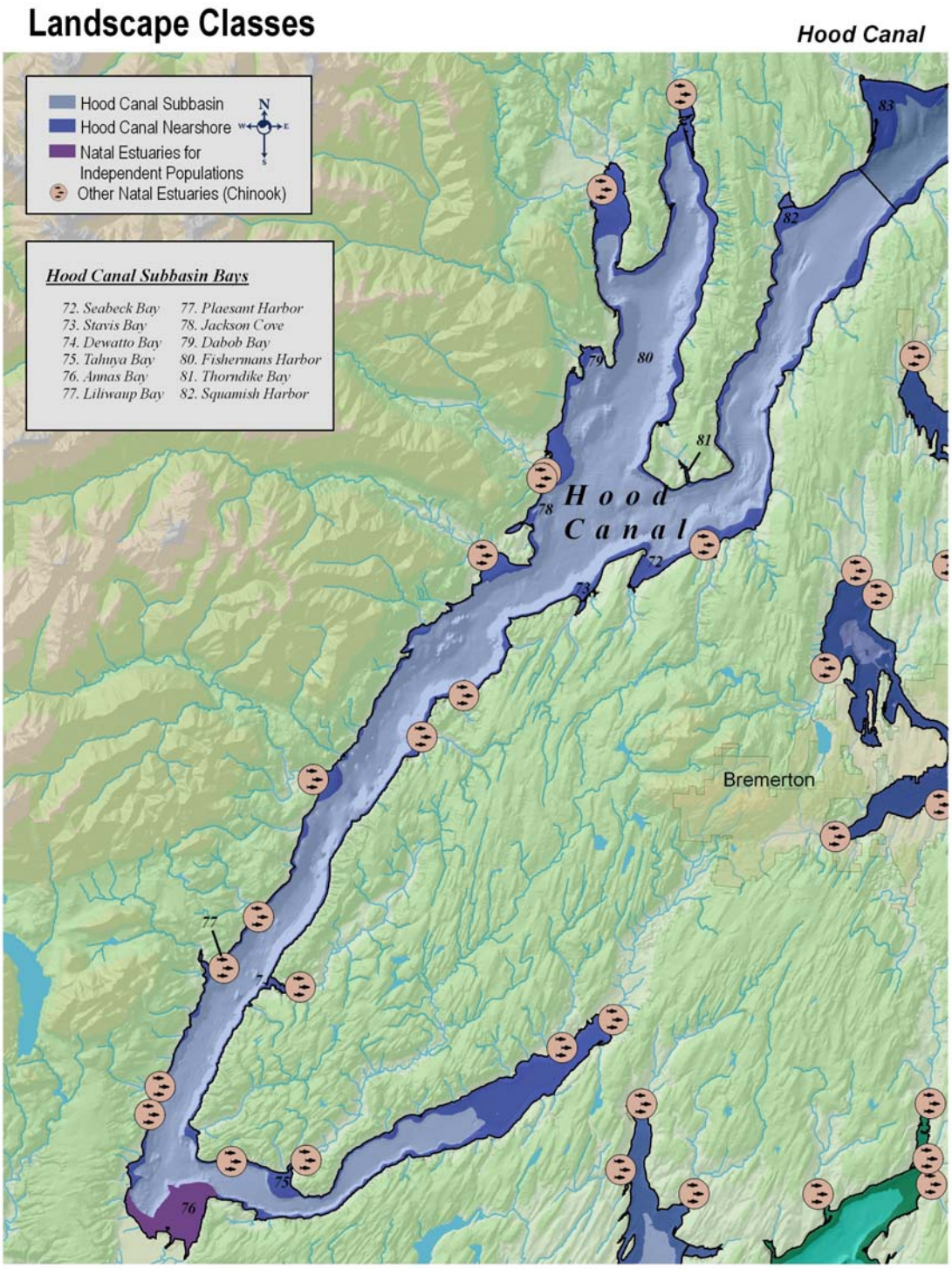


Figure E-7.1 Hood Canal Sub-basin landscape Classes

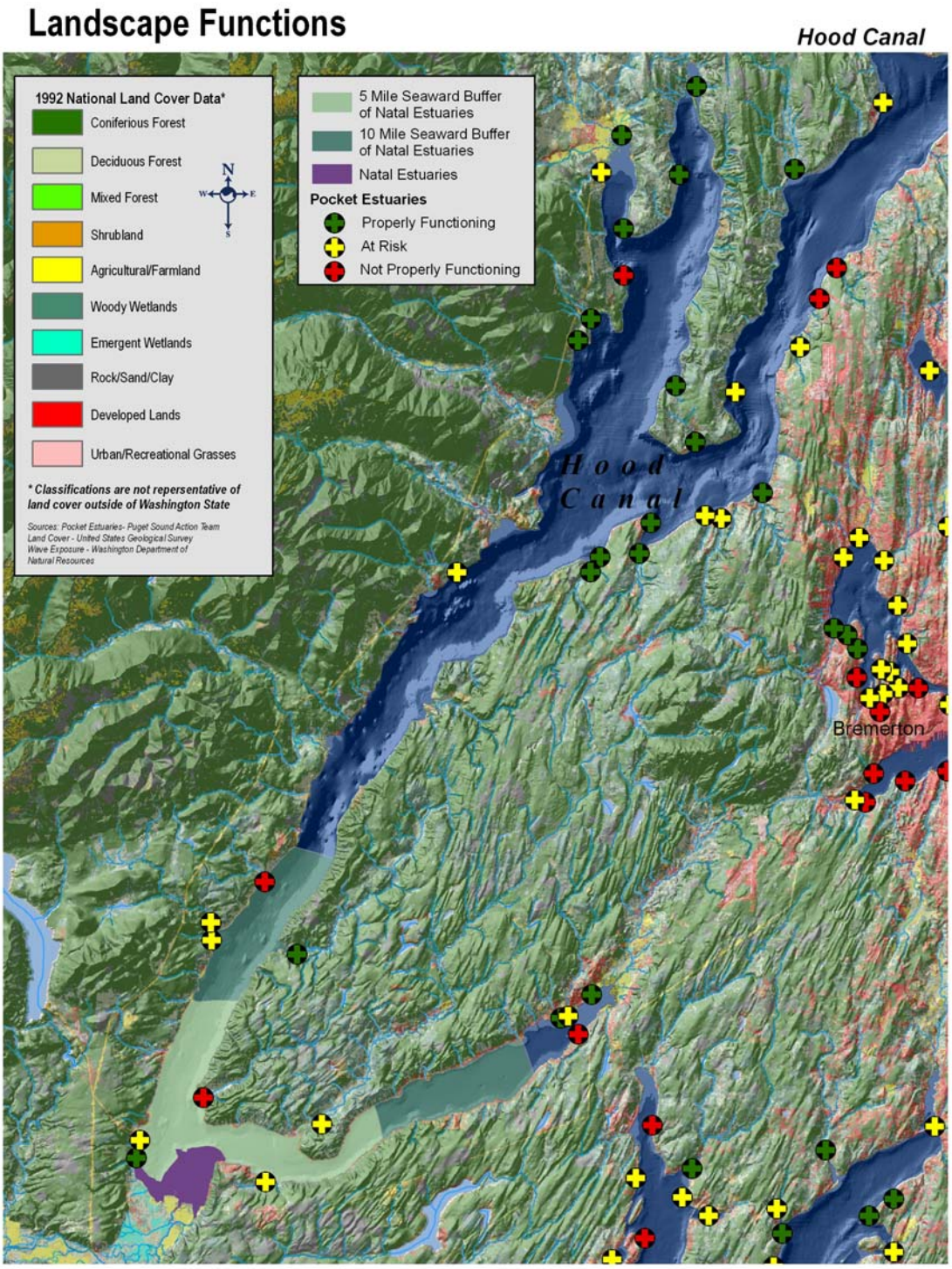


Figure E-7.2 Hood Canal Sub-basin Landscape Functions

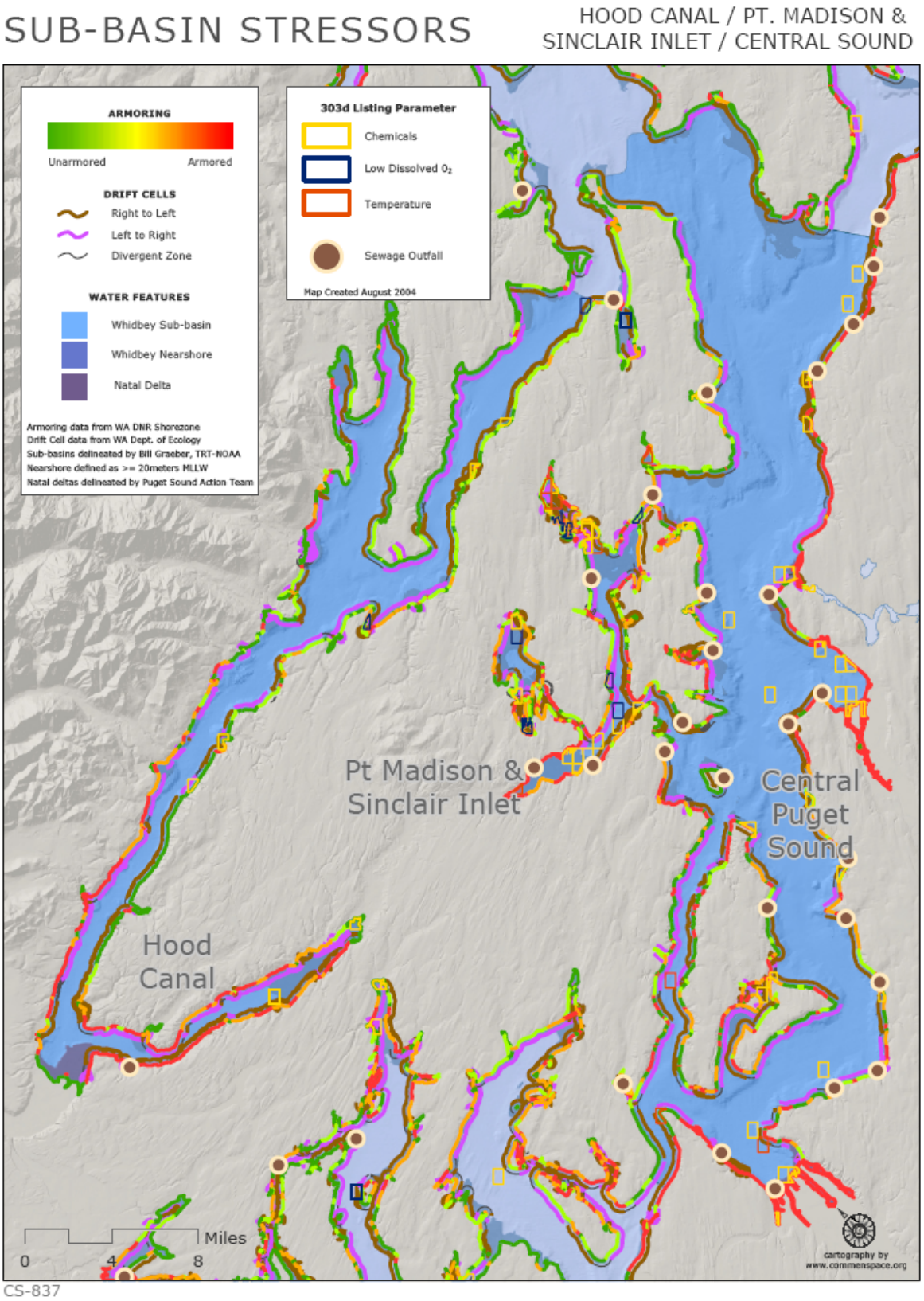
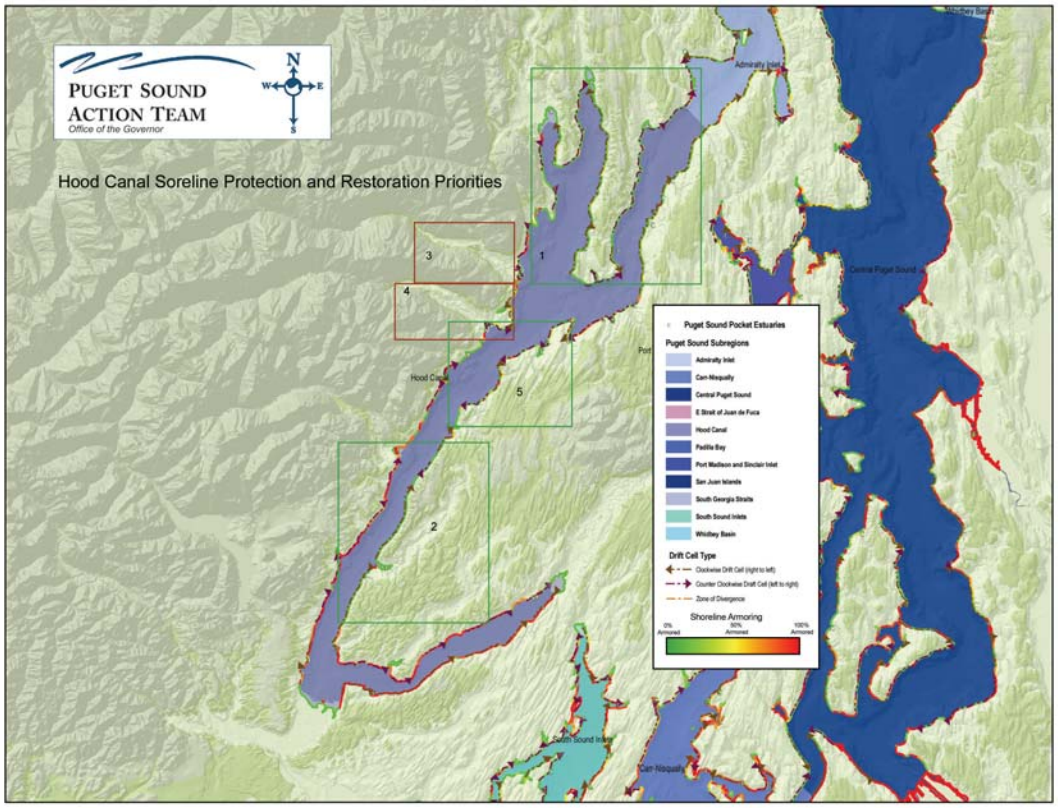


Figure E-7.3 Hood Canal, Port Madison/Sinclair and Main Basin Stressors

Figure E-7.4 Hood Canal Sub-basin pocket estuary locations, likely Chinook functions, and observed stressors

Pocket Estuary Identifier	Latitude	Longitude	Photo ID #	Freshwater (Y/N)	Likely Chinook Functions			Shoreline Development	Urbanization	Diking and Filling	Susceptibility to spills and discharges	Aquaculture related substrate alterations	Vulnerability to Sea Level Rise	Final Chinook Function Score			
					Feeding	Osmoreg.	Refuge										
HC1 - Vinland	47.768	122.709	010426-144648	Y	x	x				x	x		x	NPF	PF = Property Functioning		
HC2-Hood Canal 1	47.754	122.72	010426-144744	Y				x		x	x			NPF	NPF=Not Properly Functioning		
HC3-Bangor	47.732	122.732	010426-122.732	N	x		x			x				AR	AR=At Risk		
HC4-Anderson	47.666	122.754	010426-145152	Y	x	x	x	x						PF			
HC5-Big Beef Harbor	47.654	122.781	010426-145346	Y	x	x	x	x		x	x			AR			
HC6-Little Beef	47.655	122.792	010426-145514	Y	x	x	x	x		x				AR			
HC7-Seabeck	47.637	122.835	010426-150048	Y	x	x	x	x						PF			
HC8-Misery Pt.	47.651	122.828	010426-150154	N			x							PF			
HC9-Maple Beach	47.635	122.861	010426-150342	N	x		x							PF			
HC10-Stavis Bay	47.628	122.867	010426-150500	Y	x	x	x							PF			
HC11-Dewatto	47.452	123.054	010626-144608	Y	x	x	x							PF			
HC12-Rendsland	47.386	123.113	010626-145110	Y	x	x		x	x	x	x	x		NPF			
HC13-Tahuya	47.376	123.034	010626-145508	Y	x	x	x	x						AR			
HC14-Belfair	47.427	122.878	010626-150356	N	x		x							PF			
HC15-Belfair2	47.428	122.873	010626-150422	N	x		x	x		x				AR			
HC16-Lynch Cove	47.438	122.858	010626-150500	Y	x	x	x							PF			
HC17-Devereaux	47.42	122.866	010626-151446	N			x	x	x	x				NPF			
HC18-Union	47.349	123.07	010626-152122a	Y	x	x	x	x	x				x	AR			
HC19-Potlatch	47.358	123.156	010522-100410	Y	x	x								PF			
HC20-Minerva	47.366	123.154	010522-100432	y	x	x	x	x	x		x		x	AR			
HC21-Lilliwaup1	47.457	123.111	010522-100912	Y	x	x	x	x					x	AR			
HC22-Lilliwaup2	47.465	123.112	010522-101014	Y	x	x	x	x		x				AR			
HC23-Eagle Creek	47.484	123.077	010522-101254	Y	x	x	x	x		x		x	x	NPF			
HC24-Hamma Hamma	47.548	123.037	010522-102046	Y	x	x	x	x		x		x	x	AR			
HC25-McDonald Creek	47.626	122.956	010522-102724	Y	x	x	x	x		x				AR			
HC26-Duckabush	47.649	122.927	010522-103002	Y	x	x	x	x		x				AR			
HC27-Dosewallips	47.691	122.888	010522-104044	Y	x	x		x	x	x		x		NPF			
HC28-Cove Park	47.732	122.88	010522-104408	N	x		x							PF			
HC29-Jackson Cove	47.742	122.872	010522-104602	Y	x	x	x							PF			
HC30-Whitney Point	47.762	122.851	010522-105316	N	x		x	x	x	x	x			NPF			
HC31-Quilcene Bay1	47.808	122.868	010522-105528	N	x		x			x				AR			
HC32-Quilcene Bay2	47.825	122.855	010522-105658	Y	x	x	x			x				PF			
HC33-Fishermans Point	47.783	122.852	010522-110436	N			x							PF			
HC34-Broad Spit	47.808	122.816	010522-110726	N	x		x							PF			
HC35-Tarboo Bay	47.848	122.806	010522-111224	Y	x	x	x							PF			
HC36-Zelatched Point	47.713	122.814	010522-112104a	Y	x	x	x							PF			
HC37-Fisherman Harbor	47.688	122.8	010522-112340	Y	x	x	x				x			PF			
HC38-Go-onna Dr.	47.711	122.774	010522-112740	N			x	x						AR			
HC39-Thorndike Bay	47.812	122.739	010522-113400	Y	x	x	x					x		PF			

Figure E-7.5 Hood Canal Sub-basin analysis of drift cells and shoreline armoring



Hood Canal

Box 1 – Toandos and Bolton Peninsulas – This large area contains many shorelines that are currently experiencing very low levels of upland and shoreline development. There are several publicly owned beaches managed by DNR along these peninsulas. The generally south to north drift cells deliver sediments necessary to support a wide, sandy intertidal shelf along most of the transport sections of the cell. This shelf becomes even more extensive where interactions with deltaic sediments in Quilcene, Tarboo and Thorndike Bays produce extensive mudflats and marsh structures. Large sections of the west Kitsap peninsula within box 1 are protected from further development by the Navy Bangor sub base. Quilcene and Dabob Bays are heavily used for shellfish aquaculture so maintaining water quality by limiting shoreline development would also benefit that industry. Quilcene and Dabob Bays also experience long water residence times and are therefore susceptible to eutrophication.

Box 2 – Eastern Hood Canal shoreline from Dewatto to Holly – This section of Hood Canal shoreline has experienced little shoreline residential development because of its relative remoteness. Unlike shorelines in box 1, the littoral drift process do not appear to interact substantially with deltaic sediments. Rather many of the stream channels are

deeply incised into the uplands. Marsh and mudflat structure seem to occur well inland of the immediate shoreline in Dewatto Bay.

Boxes 3 and 4 – The intertidal structure along this section of the Hood Canal shoreline is dominated by the deltaic influences of the Duckabush and the Dosewallips Rivers as they interact with the otherwise steep, rocky shoreline of this area. Protecting the delivery of upland sediment sources from these two large rivers will be important to maintaining the functions of the nearshore in this area.

Box 5 – Anderson Cove to Seabeck – The level of development, direction of net shore drift and the influence of deltaic sediments is highly variable along this stretch of shoreline. The existing habitat structure in the nearshore reflects this complexity. At the largest scales (drift cell), protection of existing functions could be achieved by protecting the area from further development. Where bulkheads have been built along the shoreline within this box, common practice has been to place the bulkhead quite a bit seaward of Mean High Water. Education programs for residents and bulkhead contractors working in this area may be needed to prevent further degradation and to reverse this trend over time as bulkheads are replaced.

Other Hood Canal Shorelines - The Southern and Western shorelines of Hood Canal are heavily developed with structures in the intertidal zone, little remaining riparian vegetation and documented problems with septic and other pollution sources. It is likely that under GMA, continued development and redevelopment pressure will occur within these areas over the next decades. Considerable attention is being given to these shorelines to address water quality, especially as it relates to chronic low dissolved oxygen levels which may affect salmon VSPs. These shorelines are also heavily infested with Pacific oysters from years of shellfish aquaculture. Some of the soft sediment transport dynamics that may have been active in the past may no longer occur because of the stabilizing effect oysters and their shells have had on the shoreline. Significant restoration may need to take place to address the dissolved oxygen issue and broader ecosystem recovery goals. However, because of the complex ownership patterns of these shorelines and their current level of development, it is likely restoration within these areas will occur at the site scale.

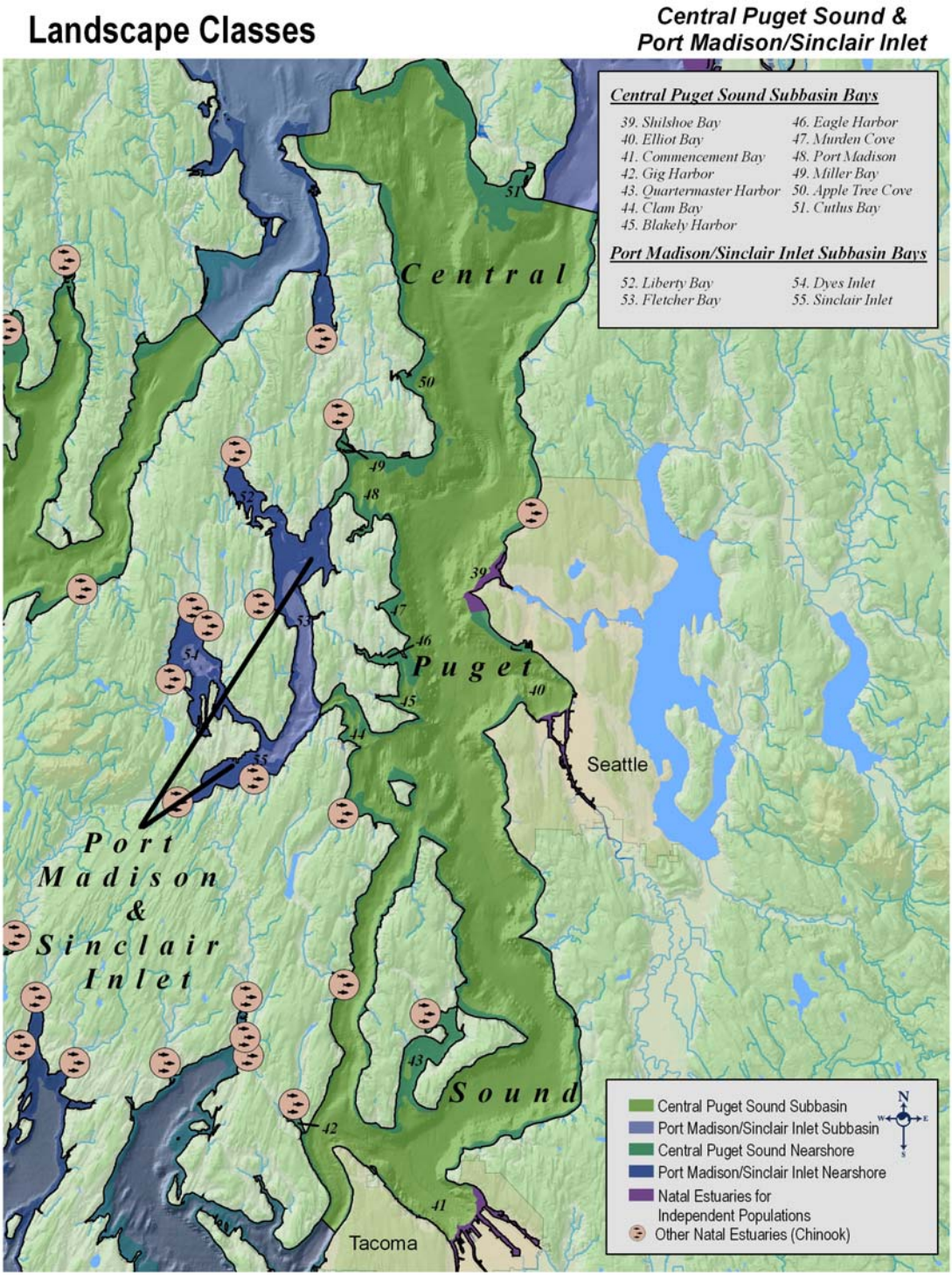


Figure E-8.1 Port Madison/Sinclair and Main Basin Landscape Classes

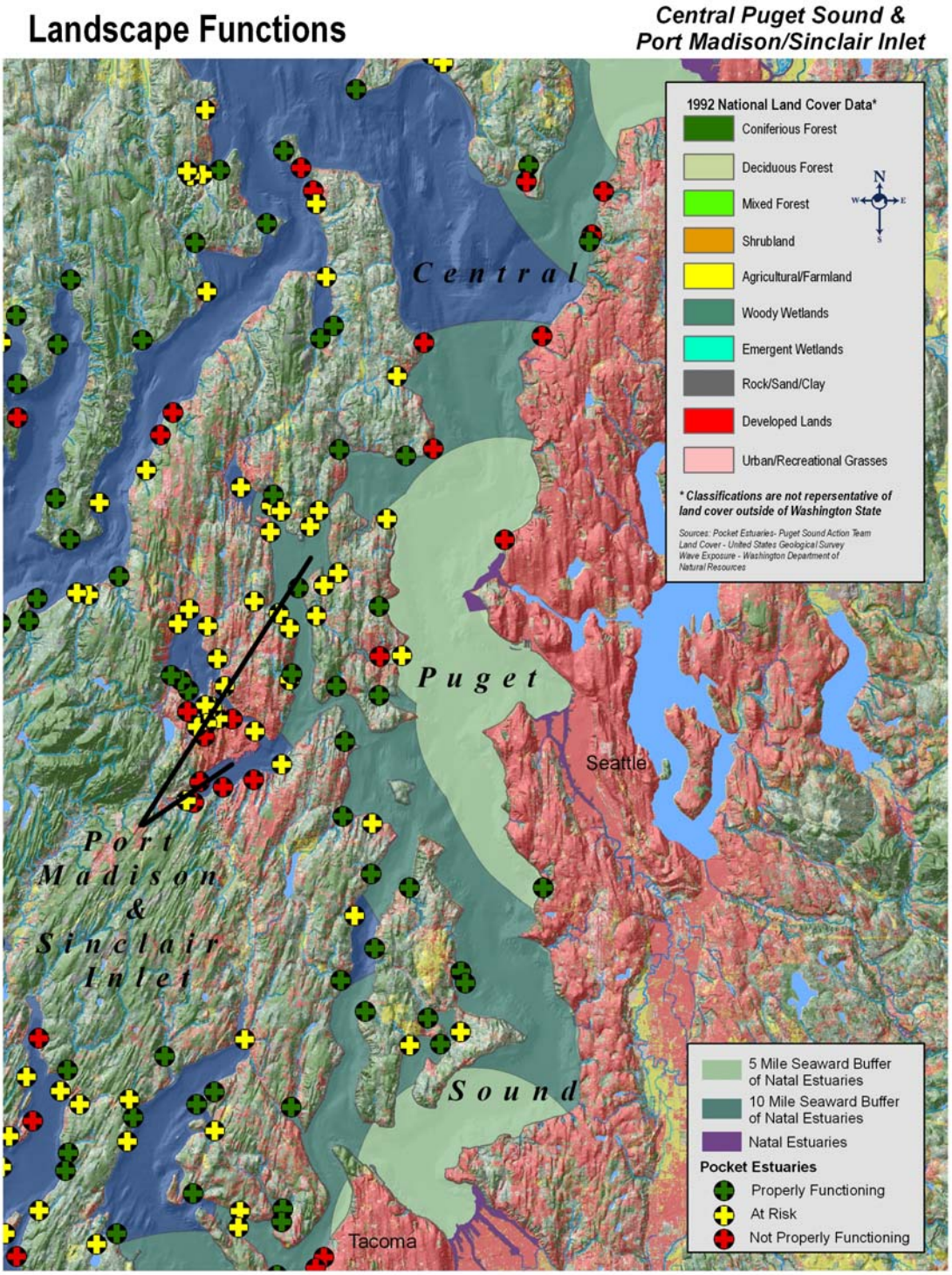


Figure E-8.2 Port Madison/Sinclair and Main Basin Landscape Functions

Figure E-8.4 Central Puget Sound (Main Basin) pocket estuary locations, likely Chinook functions, and observed stressors

Pocket Estuary Identifier	Latitude	Longitude	Photo ID #	Freshwater (Y/N)	Likely Chinook Functions			Shoreline Development	Urbanization	Diking and Filling	Susceptibility to spills and discharges	Aquaculture related substrate alterations	Vulnerability to Sea Level Rise	Final Chinook Function Score			
					Feeding	Osmoreg.	Refuge										
CPS1-Big Gulch	47.911	122.32	000925-123204	Y	x	x		x		x	?		x	NPF	PF = Property Functining		
CPS2-Picnic Pt. Park1	47.884	122.33	000925-123324	N			x	x	x	x			x	NPF	NPF=Not Properly Functioning		
CPS3-Picnic Pt. Park2	47.88	122.332	000925-123336	Y	x	x	x	x	x					PF	AR=At Risk		
CPS4-Shell Creek	47.821	122.373	000925-123642	Y	x	x	x	x						NPF			
CPS5-Meadow Point	47.695	122.403	000925-124406	N				x		x				NPF			
CPS6-Seahurst	47.481	122.36	000925-132924	Y	x	x								PF			
CPS7-Gig Harbor	47.342	122.584	000817-145448	Y	x	x	x		x					PF			
CPS8-Olalla	47.421	122.542	000923-104424	Y	x	x	x			x				PF/AR			
CPS9-Fragaria	47.461	122.531	000923-104856	Y	x	x	x	x	x					AR			
CPS10-Driftwood Cove	47.487	122.517	000923-105022	Y	x	x	x							PF			
CPS11-Harper	47.518	122.517	000923-105344	Y	x	x	x	x		x	x			AR			
CPS12-Curley Crekk	47.522	122.544	000923-105624	Y	x	x	x							PF			
CPS13-Little Clam Bay	47.568	122.544	000923-110542	N	x		x					x (look like		PF			
CPS14-Lynwood Center	47.602	122.553	000926-114912	Y	x	x	x			x				PF			
CPS15-Blakely Harbor	47.597	122.514	000926-115536	Y	x	x	x							PF			
CPS16-Winslow	47.621	122.514	000926-120338	N	x			x	x	x	x		x	NPF			
CPS17-Wing Point	47.622	122.494	000926-120420	N			x							AR			
CPS18-Murden Cove	47.652	122.516	000926-120712	Y	x	x	x							PF			
CPS19-Point Monroe	47.706	122.511	000926-121224	N(?)	x	x(?)	x	x	x		x(recreational bo			AR			
CPS20-Miller Bay1	47.748	122.556	000924-104606	Y	x	x			x					PF			
CPS21-Indianola	47.745	122.495	000924-105348	Y	x	x	x							PF			
CPS22-Point Jefferson	47.75	122.47	000924-105954	N	x		x							NPF(?)			
CPS23-Appletree Cove	47.794	122.505	000924-110222	Y	x	x	x		x					AR/PF			
CPS24-Apple Cove Point	47.815	122.481	000924-110516	N	x		x		x	x				NPF			
CPS25-Deer Lagoon	47.993	122.481	010411-132956	N	x		x	x		x			x	AR			
CPS26-Sunlight Beach	47.988	122.47	010411-133152	N	x		x			x				AR			
CPS27-Cultus Bay1	47.926	122.389	010411-133902	Y	x	x	x			x			x	PF/NPF			
CPS28-Cultus Bay2	47.916	122.391	010411-134040	N			x	x	x	x	x(recreational bo			NPF			
CPS29-Klahanie	47.428	122.433	000923-103134	N			x							PF			
CPS30-Point Heyer	47.421	122.429	000923-103056	N	x		x							PF			
CPS31-Quartermaster1	47.391	122.432	000923-101454	Y	x	x	x			x				AR			
CPS32-Judd Creek	47.399	122.462	000923-101022	Y	x	x	x							PF			
CPS33-Burton	47.383	122.45	000923-100750	N	x		x							PF			
CPS34-Magnolia	47.382	122.478	000923-100508	Y	x	x	x		x					AR			
CPS35-Lisabeula	47.402	122.519	000925-135600	Y	x	x								PF			
CPS36-Sunset Beach	47.441	122.512	000925-135414	N(?)	x		x							PF			
CPS37-Shingle Mill Cr.	47.479	122.482	000925-135120	Y	x	x								PF			

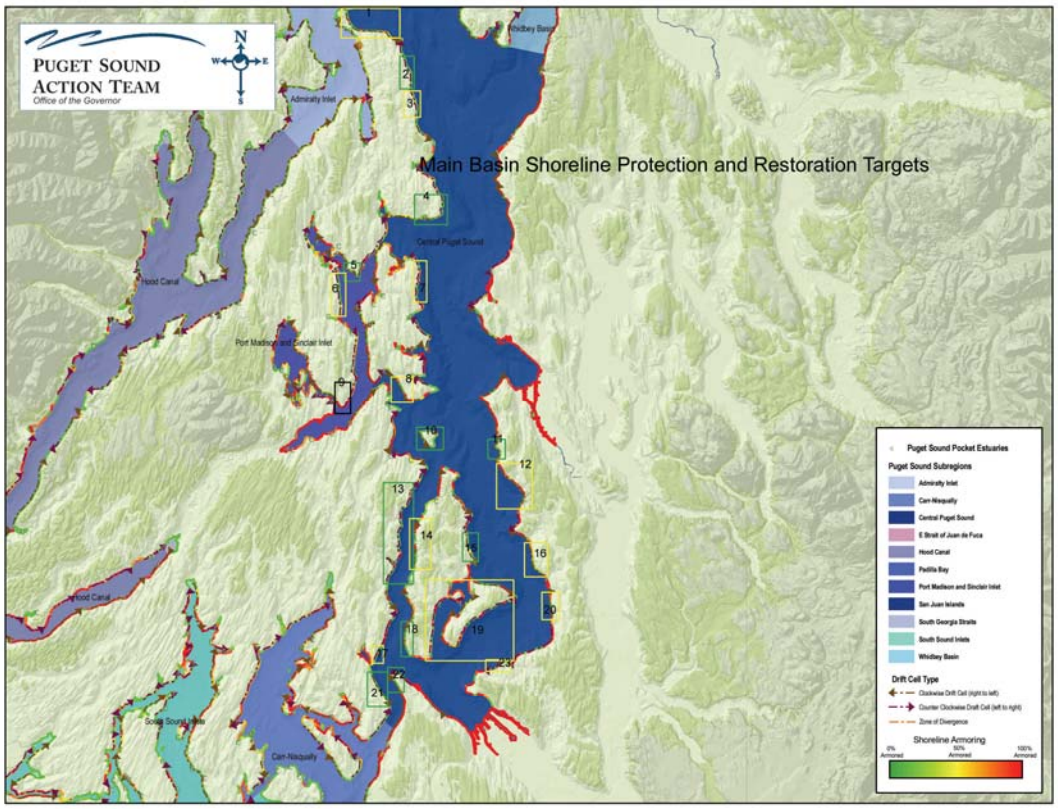


Figure E-8.5 Central Puget Sound (Main Basin) and Port Madison/Sinclair analysis of drift cells and shoreline armoring

Main Basin

Boxes 1,2 and 3 – Two long, convergent drift cell carry sediments southward from Foulweather Bluff on Admiralty Inlet and northward along the Hansville shoreline to the depositional feature, Point No Point. The southern drift cell is constrained by a number of cross-shore structures such as marine railways, boat launches and piers in the feeder section (box 3) but becomes much less armored in the transport and depositional sections to the north (box 2). The northern drift cell (box 1) is similarly constrained as box 3. Restoration should be considered in boxes 1 and 3 along with the protection of box 2 to maintain the structure and improve the function of this shoreline as it is critical for the outmigration of many populations of Chinook from within Puget Sound and may also be used by outmigrating Hood Canal summer chum as well.

Box 4 – This box contains the feeder sections of two divergent drift cells in a relatively unarmored state. These drift cells supply sediments to shorelines with broad subtidal shelves and numerous depositional features. In fact, the longshore transport processes

seem to have cut off access to several historic pocket estuaries to the north toward Carpenter Creek but appear to continue to be in equilibrium with deltaic processes of the two properly functioning pocket estuaries to the west of the feeder bluff. It will be important to understand the role of the northward drift cell if undertaking any pocket estuary restoration south of Kingston.

Boxes 5 and 6 – These two northward moving drift cells flank the mouth of Liberty Bay and continue to provide sediment which along with deltaic sediments from several small stream mouths shapes much of the shoreline. While the bluffs in box 5 are currently being protected within the Port Madison Indian Reservation, some restoration of drift cell function should be considered in the feeder section of box 6 which supports a broad intertidal and subtidal shelf and a long depositional spit adjacent to the Keyport Naval installation.

Box 7 - Much of this northeastern shoreline of Bainbridge Island consists of one large northward moving drift cell that carries both deltaic and bluff sediments northward from Murden Cove, deposits a broad shelf at Skiff Point and terminates in a spit at Port Madison. The central part of this drift cell contains a moderate amount of riprap armoring and some small scale fills into intertidal zone. Restoration of this relatively small area could restore function to a large section of shoreline as the rest of the drift cell seems to be functioning quite well.

Box 8 – This long drift cell starts at the southernmost tip of Bainbridge Island and continues northward along Rich Passage to Lynnewood Center. It contains unique geologically uplifted features along the Seattle fault, a state park shoreline and moderate amounts of coastal development. This drift cell has been embroiled in the controversy over perceived erosion threats from ferry wakes. Much of the drift cell is unarmored so restoration should be considered taking into account the constraints mentioned above.

Box 9 – The shoreline inscribed by Box 9 is the location of a historic divergence zone of two very long drift cells both traveling northward. The drift cell along the eastern shoreline of the Kitsap Peninsula interacts with four pocket estuaries, including Illahee State Park and is probably extended in length by strong tidal currents through Port Orchard. Both drift cells suffer from extensive residential development where cross-shore structures and fill are commonplace. Beach nourishment should be considered within box 9 to add sediment back into these extensive drift cells and rebuild some of the historic function of these shorelines for larger life history types of salmon that migrate from other parts of Puget Sound through this area.

Box 10 – All shorelines of Blake Island should continue to be protected. There is an extensive shallow shelf on the north and east sides of the island likely created by long term exposure of island bluffs to the open water fetch of waves in central Puget Sound.

Boxes 11 and 12 – Protection within box 10 and restoration within box 12 will support the feeder functions of one of the longest drift cells in central Puget Sound. This drift cell

continues northward from just north of Three Tree Point to Alki Beach and contains a variety of bluff and low bank features including some extensive shallow shelves. Recent bulkhead removal at Seahurst Park in Burien should act as an anchor project for further restoration opportunities within this drift cell. There are quite a few high bank properties with no immediate waterfront development, yet the properties still contain riprap or other armoring. Extensive shoreline residential education and landowner incentives should take place within this drift cell to maximize the restoration potential.

Boxes 13 and 14 – These shorelines within Colvos Passage support a large number of pocket estuaries due to the interaction of small streams and strong tidal currents. Most development seems to have occurred on small depositional features within the drift cells and doesn't appear to be limiting overall drift cell function within box 13. Box 14 shorelines should be considered for restoration where some residential properties appear to have filled into the intertidal zone.

Box 15 – This southward drift cell is largely unarmored and supports a large depositional feature at Point Heier, which contains a pocket estuary.

Box 16 – This drift cell contains the sediment source for Three Tree Point. Natural geologic features left over from the glaciers interact with sediment transport in the vicinity of Three Tree Point to create a broad sub-tidal shelf. Limited restoration should be considered to improve the functions of this drift cell.

Box 17 – While much of this long drift cell on the southeast Pierce County shoreline near Gig Harbor is armored due to residential development, the armoring is largely in the transport and depositional sections of the cell. The "feeder" section is considerably less armored and can continue to provide function to the entire drift cell if no further armoring occurs and limited restoration is considered. Tidal currents are strong here because of the proximity of this shoreline to the Tacoma Narrows.

Box 18 – The southwest tip of Vashon Island contains the feeder section for a long drift cell continuing northward into Colvos Passage. It is largely unarmored and should be protected to prevent further perceived erosion risk in the transport and depositional sections of the cell.

Box 19 – The complex shorelines of Maury Island and Quartermaster Harbor are some of the most important forage fish spawning beaches within central Puget Sound. Three large drift cells move northward along both shorelines at the opening of Quartermaster Harbor and the southeastern shoreline of Maury Island. There are numerous pocket estuaries within inner Quartermaster Harbor, which create a shallow subtidal shelf when interacting with the northward drift. Restoration of all shorelines within box 19 should be considered due to the importance of the forage fish resource to all life history stages of Chinook salmon.

Box 20 – This relatively unarmored shoreline should be considered for protection and restoration of its drift cell functions. It is one of the longest stretches of unarmored

shoreline in this part of the sound and supports a broad subtidal shelf northward toward Des Moines. The Saltwater State Park is contained within this drift cell and could become an anchor demonstration project for restoration by bulkhead removal for this entire drift cell, much like Seahurst Park to the north. Aggressive homeowner education and incentive programs should also be considered to restore function to this drift cell.

Boxes 21 and 22 – This unarmored shoreline is directly adjacent to Commencement Bay and the Puyallup estuary. It is expected that shorelines within Point Defiance Park will remain protected. However, the large southward drift cell within box 21 should be protected from armoring by bluff property owners. The steepness of the bluffs and the active tidal currents along the Narrows suggest Pierce County's critical areas ordinance will play a large role in protecting drift cell function. Continued homeowner education on bluff stewardship should be targeted to this area.

Box 23 – This short, divergent drift cell is largely unarmored because of the presence of Dash Point State Park. This shoreline is directly adjacent to Commencement Bay where Puyallup and White River Chinook stocks enter Puget Sound and the shoreline likely supports a number of small Chinook life history types because of that proximity. The deltaic sediments from the park and erosion of adjacent bluffs creates a broad intertidal and subtidal shelf that continues north to Dumas Bay where Joe Creek adds additional sediment to the shelf. There are a small number of houses at the base of the bluff which appear to be at risk of landslides. Pierce County should prepare long range plans to reduce that risk and at the same time restore drift cell function to this important shoreline.

Pocket Estuary Identifier	Latitude	Longitude	Photo ID #	Freshwater (Y/N)	Likely Chinook Functions			Shoreline Development	Urbanization	Diking and Filling	Susceptibility to spills and discharges	Aquaculture related substrate alterations	Vulnerability to Sea Level Rise	Final Chinook Function Score			
					Feeding	Osmoreg.	Refuge										
PM1 - Liberty Bay	47.723	122.645	000924-103900	Y	x	x	x	x	x	x	x		x	AR	PF = Property Functining		
PM2 - Lemolo 1	47.712	122.617	000926-124714	Y	x	x	x	x		x			x	AR	NPF=Not Properly Functioning		
PM3 - Lemolo 2	47.719	122.615	000926-124720	Y	x	x	x			x				PF	AR=At Risk		
PM4 - Lemolo 3	47.709	122.608	000926-124822	N	x		x	x		x			x	AR			
PM5 - Sandy Hook	47.7	122.581	000924-104322	Y	x	x	x	x		x			x	AR			
PM6 - Manzanita Bay 1	47.672	122.554	000926-122508	Y	x	x	x	x	x				x	AR			
PM7 - Manzanita Bay 2	47.664	122.567	000926-122650	Y	x	x	x	x		x			x	AR			
PM8 - Battle Point	47.662	122.59	000926-122938	N	x		x	x		x			x	PF			
PM9 - Agate	47.71	122.573	000924-104344	N	x		x	x					x	AR			
PM10 - Fletcher Bay	47.645	122.573	000926-123056	Y	x	x	x	x		x	x		x	AR			
PM11 - Retsil	47.553	122.601	010512-125532	Y	x	x	x	x	x	x	x		x	AR			
PM12 - Blackjack Creek	47.543	122.626	010512-125624	Y	x	x	x	x	x	x	x		x	NPF			
PM13 - Ross Creek	47.538	122.654	010512-125930	Y	x	x	x	x		x	x		x	NPF			
PM14 - Anderson Creek	47.528	122.68	010512-130238	Y	x	x	x	x	x	x	x		x	NPF			
PM15 - Gorst	47.529	122.687	010512-130332	Y	x	x	x	x	x	x	x		x	AR			
PM16 - Sinclair	47.541	122.675	000924-101136	Y		x		x	x	x	x		x	NPF			
PM17 - Narrows	47.573	122.626	000924-101420	N	x		x	x	x	x	x		x	AR			
PM18 - Port Washington	47.58	122.647	000926-112116	N			x	x	x	x	x		x	NPF			
PM19 - Phinney Bay 1	47.58	122.66	000926-112314	Y	x	x	x	x		x	x		x	AR			
PM20 - Phinney Bay 2	47.587	122.666	000926-112332	N	x		x	x	x	x	x		x	AR			
PM21 - Mud Bay	47.588	122.672	000926-112638	N	x		x	x		x	x		x	AR			
PM22 - Oyster Bay 1	47.577	122.67	000926-131026	N	x		x	x		x	x		x	AR			
PM23 - Oyster Bay 2	47.569	122.672	000926-112936	Y	x	x	x	x	x	x	x		x	NPF			
PM24 - Ostrich Bay 1	47.575	122.679	000926-113156	Y	x	x	x	x		x			x	AR			
PM25 - Ostrich Bay 2	47.584	122.688	000926-113238	N	x		x	x	x	x	x		x	NPF			
PM26 - Erland Point	47.597	122.688	000926-113430	N	x		x	x						PF			
PM27 - Chico Bay	47.603	122.695	000926-113620	N	x		x	x					x	PF			
PM28 - Chico Creek	47.606	122.704	000926-113748	Y	x	x	x		x		x		x	PF			
PM29 - Newberry	47.638	122.699	000926-114004	Y	x	x		x	x	x	x		x	AR			
PM30 - Silverdale	47.647	122.689	000926-114226	Y	x	x	x	x	x	x	x		x	AR			
PM31 - Barker Creek	47.637	122.672	000926-125626	Y	x	x	x	x		x	x		x	AR			
PM32 - Tracyton	47.617	122.662	000926-125746	Y	x	x	x	x		x			x	AR			
PM33 - Bass Point	47.6	122.655	000926-125838	Y	x	x	x	x		x			x	AR			
PM34 - Illahee SP	47.605	122.596	000924-102052	Y	x	x		x		x			x	AR			
PM35 - Illahee	47.609	122.594	000924-102106	Y	x	x	x		x					PF			
PM36 - Gilberton	47.637	122.597	000924-102254	Y	x	x	x	x					x	AR			
PM37 - Burke Bay	47.646	122.607	000924-102432	Y	x	x		x			x		x	AR			
PM38 - Crouch Creek	47.653	122.63	000924-102524	Y	x	x	x			x	x		x	AR			
PM39 - Keyport	47.696	122.617	000924-102822	Y	x	x	x	x	x	x	x		x	AR			

Figure E-9.4 Port Madison/Sinclair Sub-basin pocket estuary locations, likely Chinook functions, and observed stressors

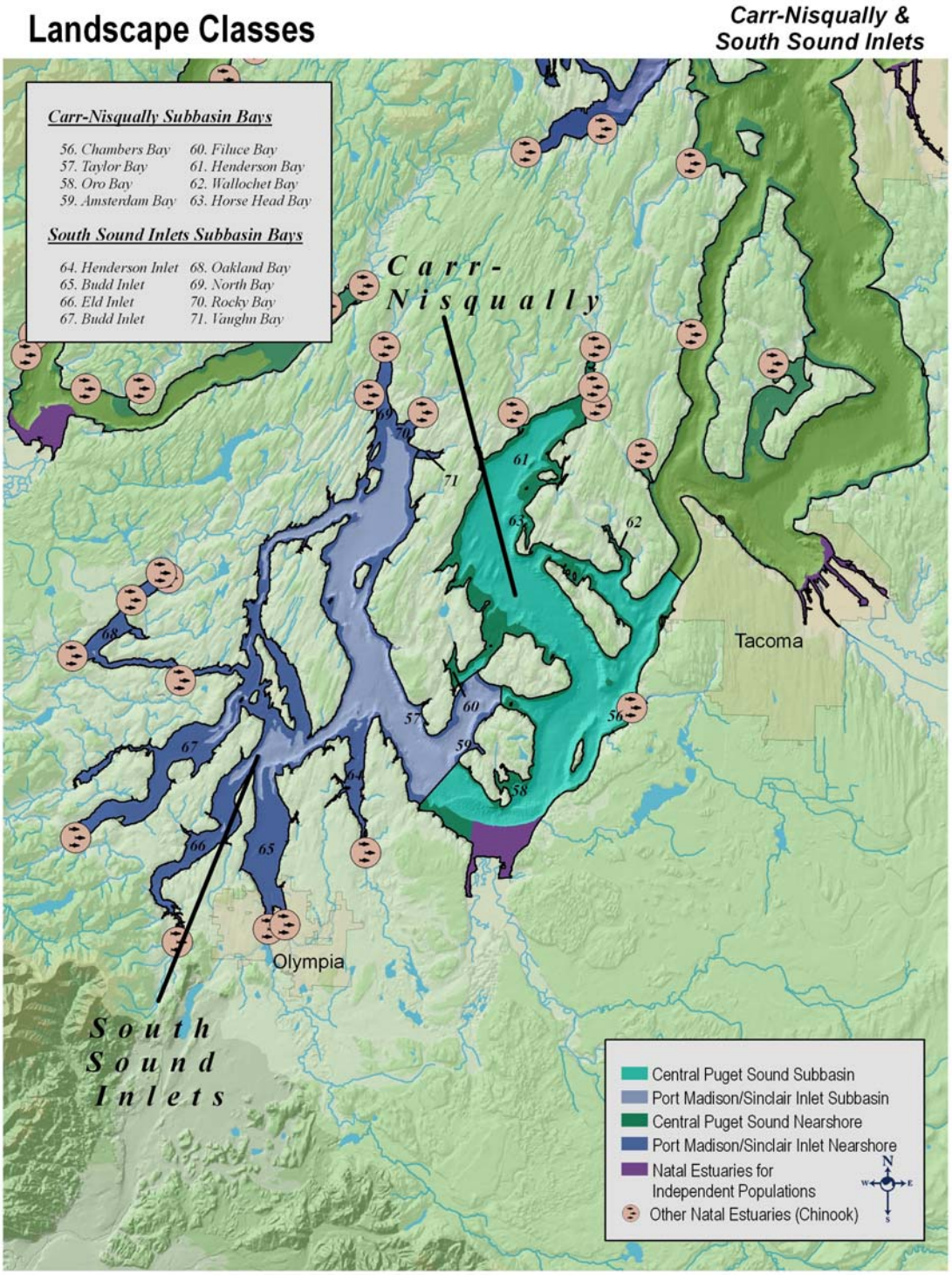


Figure E-10.1 Carr-Nisqually and South Sound Sub-basin Landscape Classes

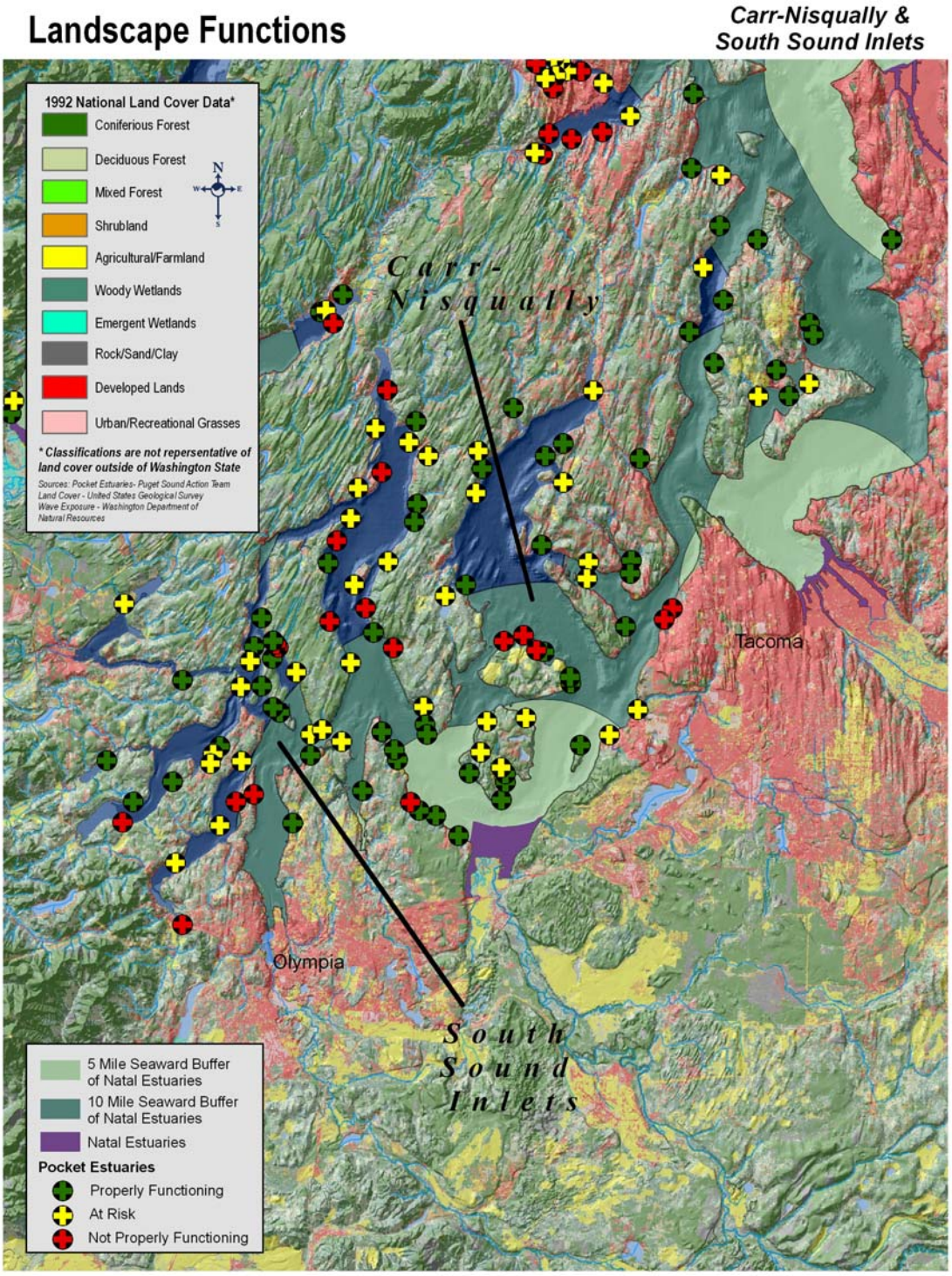


Figure E-10.2 Carr-Nisqually and South Sound Sub-basins Landscape Functions

Figure E-10.4 Carr-Nisqually Sub-basin pocket estuary locations, likely Chinook functions, and observed stressors

Pocket Estuary Identifier	Latitude	Longitude	Photo ID #	Freshwater (Y/N)	Likely Chinook Functions			Shoreline Development	Urbanization	Diking and Filling	Susceptibility to spills and discharges	Aquaculture related substrate alterations	Vulnerability to Sea Level Rise	Final Chinook Function Score			
					Feeding	Osmoreg.	Refuge										
CN1-Titlow	47.25	122.551	000817-155018	N				x		x				NPF	PF = Property Functining		
CN2-Days Island	47.243	122.558	000817-155218	N	x		x	x	x	x	x		x	NPF	NPF=Not Properly Functioning		
CN3-Chambers Creek	47.187	122.58	000817-155538	Y	x	x	x	x		x	x			AR	AR=At Risk		
CN4-Steilacoom	47.171	122.605	000817-155822	Y	x	x	x		x	x				AR			
CN5-Ketron Is.	47.164	122.631	000923-122112	N	x		x							PF			
CN6-Beachcrest	47.106	122.739	000802-125642	N(?)	x		x							PF			
CN7-Big Slough	47.118	122.76	000802-125730	N	x		x							PF			
CN8-Carson Bay	47.145	122.731	000923-115300	N	x		x							PF			
CN9-Thompson Cove	47.129	122.701	000923-115436	N	x		x							PF/AR			
CN10-Oro Bay	47.14	122.698	000923-115958	N(?)	x		x							PF			
CN11-East Oro1	47.145	122.698	000923-120042	N	x									PF			
CN12-East Oro2	47.149	122.702	000923-120128	N	x		x			x				AR			
CN13-Johnson Landing	47.18	122.681	000923-120540	Y (?)	x	x	x							AR			
CN14-Hyde Point1	47.202	122.641	000923-113950	N	x		x							PF			
CN15-Hyde Point2	47.206	122.642	000923-114002	N	x		x							PF			
CN16-Still Harbor	47.221	122.666	000923-114550	N	x		x							PF			
CN17-McNeil Island1	47.222	122.673	000923-114616	N	x			x		x				NPF			
CN18-McNeil Island2	47.231	122.685	000923-114710	N(?)	x		x			x				NPF			
CN19-McNeil Island3	47.227	122.703	000923-114818	N				x		x				NPF			
CN20-Penrose Point	47.261	122.739	000803-145250	N			x							PF			
CN21-Mayo Cove	47.254	122.757	000803-145352	Y	x	x	x		x		x(recreational			AR			
CN22-Sunshine Beach	47.318	122.732	000803-150128	N			x							AR			
CN23-Thompson Spit	47.333	122.727	000803-150212	Y	x	x	x							PF			
CN24-Glencove	47.344	122.731	000803-150308	Y	x	x	x	x		x				AR			
CN25-Sunrise Beach	47.371	122.7	000803-150634	Y	x	x	x	x						PF/AR			
CN26-Burley Lagoon	47.383	122.628	000803-151138	Y	x	x	x	x	x	x	x	x(appear		AR/NPF			
CN27-Henderson Bay	47.35	122.654	000803-152216	Y(?)	x	x	x							PF			
CN28-Allen Point	47.342	122.67	000803-152344	N	x		x	x						PF/NPF			
CN29-Rosedale	47.326	122.653	000803-152740	Y	x	x	x	x	x					AR			
CN30-Arletta	47.287	122.671	000817-144004	Y	x	x	x							PF			
CN31-Sunny Bay	47.277	122.628	000817-144104	Y	x	x	x		x					AR			
CN32-Wollochet1	47.279	122.589	000817-144526	Y	x	x	x							PF			
CN33-Wollochet2	47.271	122.59	000817-144542	Y(?)	x	x			x					PF/AR			
CN34-Hope	47.238	122.593	000923-112936	Y(?)	x	x	x	x	x					PF			
CN35-Ketners Point	47.267	122.629	000923-122956	N			x							AR			

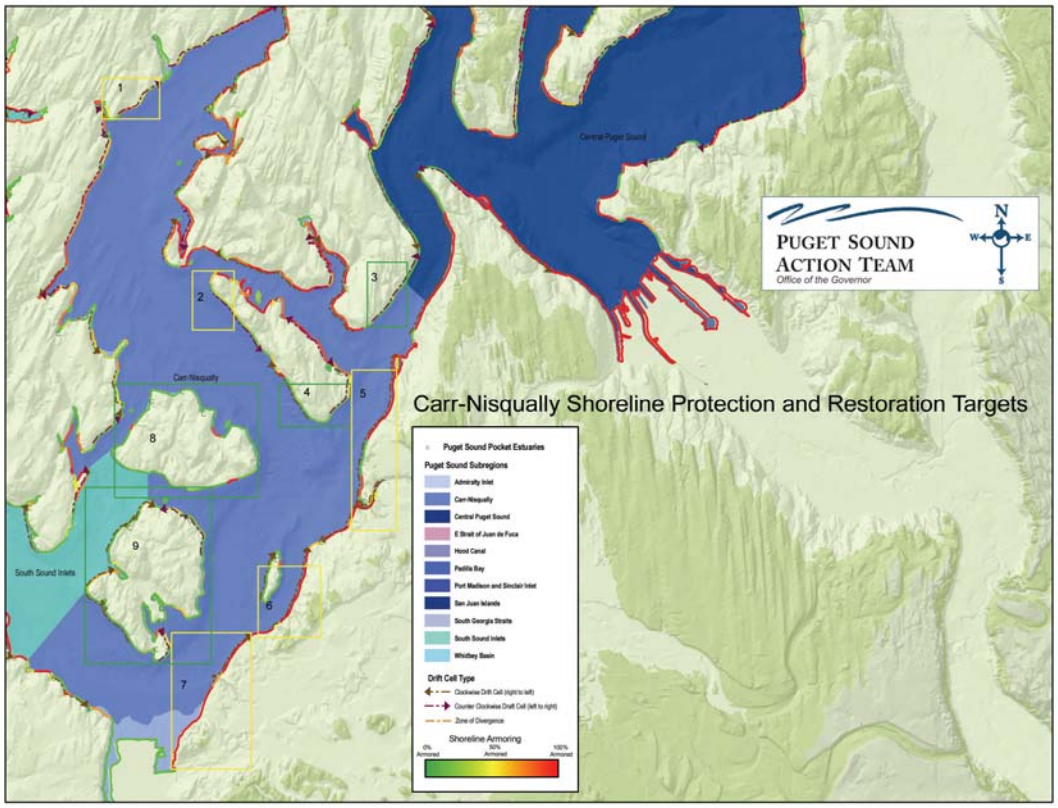


Figure E-10.5 Carr-Nisqually Sub-basin analysis of drift cells and shoreline armoring

Carr-Nisqually

Box 1 – This small divergent drift cell contains large feeder bluffs terminating in two separate depositional spits forming the mouths of pocket esturies. There is a small amount of armoring along residential sections that should be considered for restoration and education on shoreline stewardship.

Box 2 - This southward moving drift cell at the north end of Fox Island, while containing moderate amounts of residential development, is disrupted primarily by the Navy pier. Restoration of sediment transport processes through pier redesign should be considered.

Box 3 – This high bluff along Tacoma Narrows supplies sediments northward into the main basin of Puget Sound and is currently unarmored. Like the converging continuing south from Gig Harbor, continued protection of shoreline functions may require an aggressive education campaign among shoreline property owners and protection of its critical areas functions by Pierce County.

Box 4 – This is the feeder source for two diverging drift cells on the south side of Fox Island that, along with the drift cell described in box 2, supply sediment to a large portion of the island's shorelines.

Boxes 5, 6 and 7 – This shoreline, composed of two long northward drift cells (boxes 6 and 7) and a southward drift cell that includes the Chambers Creek area (box 5), is dominated by a single armoring feature, the Burlington Northern Railroad Line. The importance of this shoreline to fish migrating northward from the Nisqually suggests efforts should be persued to restore some of the natural sediment transport functions through a number of means including beach nourisnment, bypassing of sediment that falls onto the tracks during landslides and creating additional opening where historic pocket estuaries would have delivered deltaic sediments to that shoreline.

Boxes 8 and 9 – Due to the proximity of Anderson Island and McNeil Island to the Nisqually delta and their current unarmored state, every effort should be taken to continue a high level of protection from degradation to these shorelines. These two islands have numerous pocket estuaries and shallow, low gradient shorelines, which support Chinook functions from the Nisqually population and other parts of the sound. Pierce County should aggressively control additional shoreline armoring of waterfront properties on Anderson Island and continue advertising incentives like the Public Benefit Rating System to prospective waterfront property owners.

Pocket Estuary Identifier	Latitude	Longitude	Photo ID #	Freshwater (Y/N)	Likely Chinook Functions			Shoreline Development	Urbanization	Diking and Filling	Susceptibility to spills and discharges	Aquaculture related substrate alterations	Vulnerability to Sea Level Rise	Final Chinook Function Score			
					Feeding	Osmoreg.	Refuge										
SS1-Tolmie	47.121	122.775	000802-125756	Y	x	x	x							PF	PF = Property Functining		
SS2-Dogfish Bight	47.126	122.783	000802-125818	N(?)				x		x				NPF	NPF=Not Properly Functioning		
SS3-Puget	47.152	122.796	000802-130102	Y	x	x	x							PF	AR=At Risk		
SS4-N. Reach1	47.158	122.799	000802-130130	N	x		x							PF			
SS5-Johnson Point	47.169	122.811	000802-130334	N	x		x	x						PF			
SS6-Henderson Inlet1	47.132	122.827	000802-130842	N	x		x	x	x					PF			
SS7-Dickenson Point	47.162	122.847	010512-142734	N	x		x	x	x					AR			
SS8-Dana Passage1	47.153	122.875	010512-143154	N	x		x							PF			
SS9-Gulf Harbor	47.111	122.889	000803-122112	N	x		x							PF			
SS10-Countryside Beach	47.128	122.925	000803-123820	N(?)					x	x				NPF			
SS11-Eld Inlet1	47.123	122.941	000803-124214	N			x	x		x				NPF			
SS12-Mud Bay	47.046	122.986	000803-125154	N	x		x	x	x	x	x		x	NPF			
SS13-Eld Inlet2	47.084	122.994	000803-130056	Y	x	x	x							AR			
SS14-Flapjack Point	47.108	122.955	000803-130438	N	x		x	x						AR			
SS15-Sanderson Harbor	47.148	122.937	000803-130814	N	x		x	x		x				AR			
SS16-Totten Inlet1	47.157	122.957	000803-131558	N	x		x					x		PF/AR			
SS17-Totten Inlet2	47.152	122.963	000803-131622	Y	x	x	x	x				x		AR			
SS18-Totten Inlet3	47.146	122.965	000803-131634	N	x		x	x				x		AR			
SS19-Totten Inlet4	47.134	122.999	000803-132346	Y	x	x	x	x				x		PF			
SS20-Burns Point	47.108	123.043	000803-132654	N			x	x	x	x		x	x	NPF			
SS21-Snodgrass Creek	47.121	123.034	000803-133628	Y	x	x	x							PF			
SS22-Little Skookum	47.146	123.059	000803-134540	N	x		x	x						PF			
SS23-Arcadia	47.194	122.94	010512-145842	Y	x	x	x	x				x		AR			
SS24-Mill Creek	47.197	122.993	010512-150144	Y	x	x	x							PF			
SS25-Bay Shore	47.243	123.048	010512-151344	Y	x	x	x	x		x	x			AR			
SS26-Squaxin1	47.219	122.929	010512-144410	N			x							PF			
SS27-Squaxin2	47.212	122.912	010512-144242	Y		x	x							PF			
SS28-Squaxin3	47.179	122.904	010512-144804	N	x		x							PF			
SS29-Squaxin4	47.182	122.91	010512-144758	N	x		x							PF			
SS30-Squaxin5	47.195	122.921	010512-144542	N	x		x							PF			
SS31-Cape Cod	47.21	122.932	010512-153520	N			x	x						AR			
SS32-Stadium	47.319	122.839	010512-155426	N	x		x	x	x					AR			
SS33-Stretch Is.1	47.329	122.818	010626-160406	N			x	x		x				NPF			
SS34-North Bay1	47.356	122.825	010512-155752	Y	x	x	x	x						AR			
SS35-Victor	47.38	122.815	010512-160638	N			x	x		x				NPF			
SS36-Rocky Bay	47.361	122.788	000803-140230	Y	x	x	x			x				PF			
SS37-Sunshine Beach	47.348	122.794	000803-140458	N	x		x	x						AR			
SS38-Vaughn Bay	47.34	122.776	000803-140742	Y	x	x	x	x	x		x			AR			
SS39-Dutcher Cove	47.31	122.785	000803-141022	Y	x	x	x	x						PF			
SS40-Case Inlet1	47.299	122.787	000803-141438	Y	x	x	x							PF			
SS41-Herron	47.274	122.81	000803-141548	Y	x	x	x	x						AR			
SS42-Herron Island	47.259	122.84	000803-141722	N			x	x		x				AR			
SS43-Tiedman	47.245	122.829	000803-142134	Y(?)				x		x				NPF			
SS44-Case Inlet2	47.23	122.821	000803-142220	Y	x	x	x							PF			
SS45-Whitman Cove	47.221	122.803	000803-142358	N(?)				x		x		x(?)		NPF			
SS46-Taylor Bay	47.185	122.774	000803-142748	Y(?)	x	x	x	x						AR			
SS47-Case Inlet3	47.174	122.772	000803-142820	Y	x	x	x							PF			
SS48-Devils Head	47.168	122.77	000803-142838	N	x		x							PF			
SS49-Lovass	47.177	122.716	000923-120724	N	x		x	x						AR			
SS50-Amsterdam Bay	47.158	122.721	000923-121326	Y	x	x	x	x			x			AR			
SS51-Brisco Point	47.166	122.875	010626-154920	N	x		x	x						AR			
SS52-Harstene1	47.204	122.89	010626-154748	N			x	x						AR			
SS53-Harstene2	47.219	122.907	010626-161918	N						x				NPF			
SS54-Harstene3	47.221	122.909	010626-161914	N			x	x		x				NPF			
SS55-Harstene4	47.223	122.912	010626-161904	Y	x	x								PF			
SS56-Harstene5	47.237	122.923	010626-161810	N	x							x		PF			
SS57-Dougall Point	47.3	122.845	010626-160230	N	x		x	x		x				AR			
SS58-Harstene6	47.286	122.857	010626-160140	Y				x		?				NPF			
SS59-Fudge Point	47.272	122.864	010626-155930	Y	x	x	x					x		PF			
SS60-Ballow	47.236	122.861	010626-155444	Y				x		x				NPF			
SS61-Harstene7	47.211	122.841	010626-155320	N			x							AR			
SS62-Harstene8	47.169	122.865	010626-155040	Y(?)	x		x	x	x	x				AR			

Figure E-11.4 South Sound sub-basin pocket estuary locations, likely Chinook functions, and observed stressors

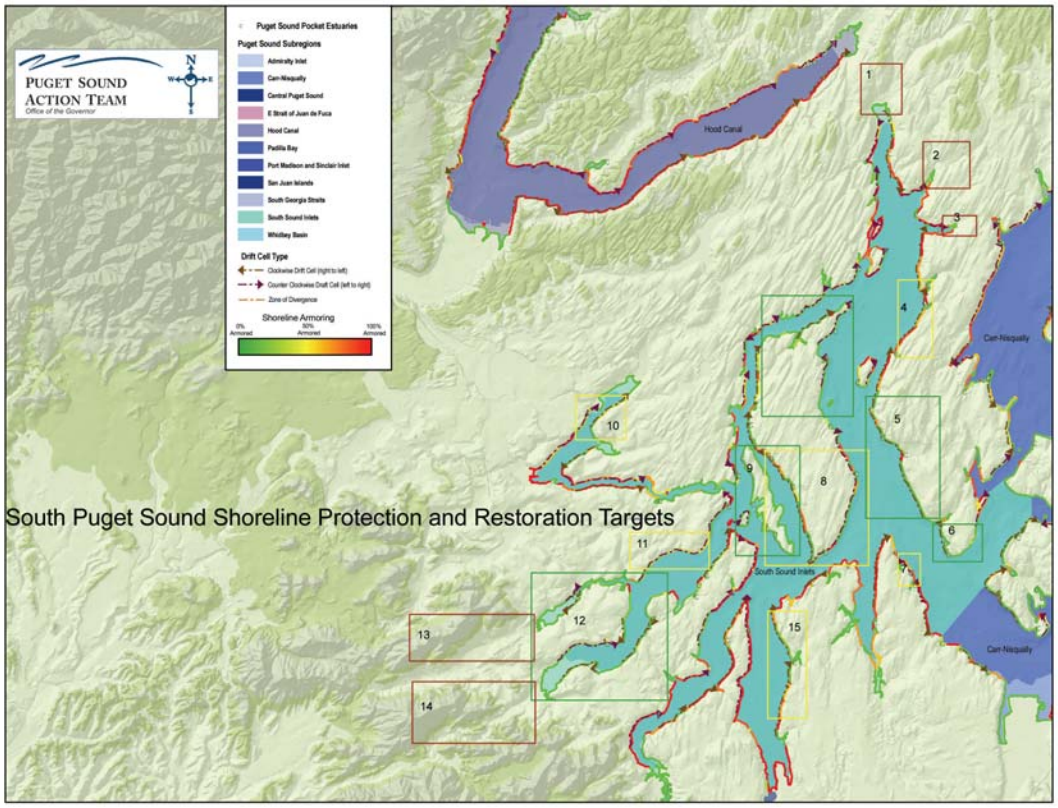


Figure E-11.5 South Sound sub-basin analysis of drift cells and shoreline armoring
South Sound

Boxes 1, 2, 3, and 4 – The upland sediment sources from Coulter Creek, Rocky Creek and other drainages interact with the longshore sediment transport in the upper reaches of Case Inlet to create a substantial shallow shelf and intricate structure of pocket estuaries. The small divergent drift cell in box 4 should be considered for protection through aggressive landowner education and regulatory protection from Pierce County because of its importance in maintaining the broad intertidal shelf of this shoreline.

Boxes 5 and 6 – The entire western key peninsula shoreline and the southernmost feeder bluff (box 6) currently maintain function for nearshore sediment delivery and the protection of 6 important pocket estuaries within 5-10 miles of the Nisqually delta and should therefore be targeted for protection.

Box 7 – This small drift divergence area feeds a number of important shorelines along this otherwise heavily armored residential area. Together with the large number of pocket estuaries and their associated deltaic sediments, this shoreline provides important habitats for fish migrating from the Nisqually and other part of Puget Sound. Aggressive

landowner education and strong regulatory presence from Thurston County will be needed to protect the remaining functions of this shoreline.

Box 8 – This feeder section supplies two divergent drift cells that support the shorelines of southern Hartstene Island. The green box outlining northern Hartstene Island also suggests a protection priority. The Hartstene Island shorelines contain a number of pocket estuaries and a broad intertidal and subtidal shelf.

Box 9 – Like Hartstene Island above, Squaxin Island is virtually uninhabited and the shorelines unarmored. Strong commitments from the Squaxin Island Tribe suggest these shoreline will remain protected.

Box 10 – The two northeasterward drift cells in Oakland Bay assist in the retention of fine deltaic sediments entering the bay from John's Creek, Cranberry Creek and Deer Creek. Mason County should aggressively protect natural sediment transport functions through their ciritcal areas ordinance and shoreline master program as well as support Public Benefit Rating System for protection of shoreline properties within box 10.

Box 11 – The northern shoreline of Totten Inlet consists of one large drift cell that travels northeasterly from Skookum Inlet to Hammersly Inlet. There are a number of cross-shore structures, presumably from shellfish aquaculture operations, visible from aerial photographs, which may impede the natural transport of sediment along that shoreline. The effects of such structures should be studied before any recommendations are considered.

Box 12, 13 and 14 – Both Oyster Bay and Skookum Inlet shorelines appear to be functioning quite well and have littoral drift processes that are likely due to strong tidal action rather than wind driven waves. Efforts of the commercial and recreational shellfish growers to protect water quality in these inlets has resulted in undeveloped local watersheds (boxes 13 and 14) as well as undeveloped shorelines (box 12).