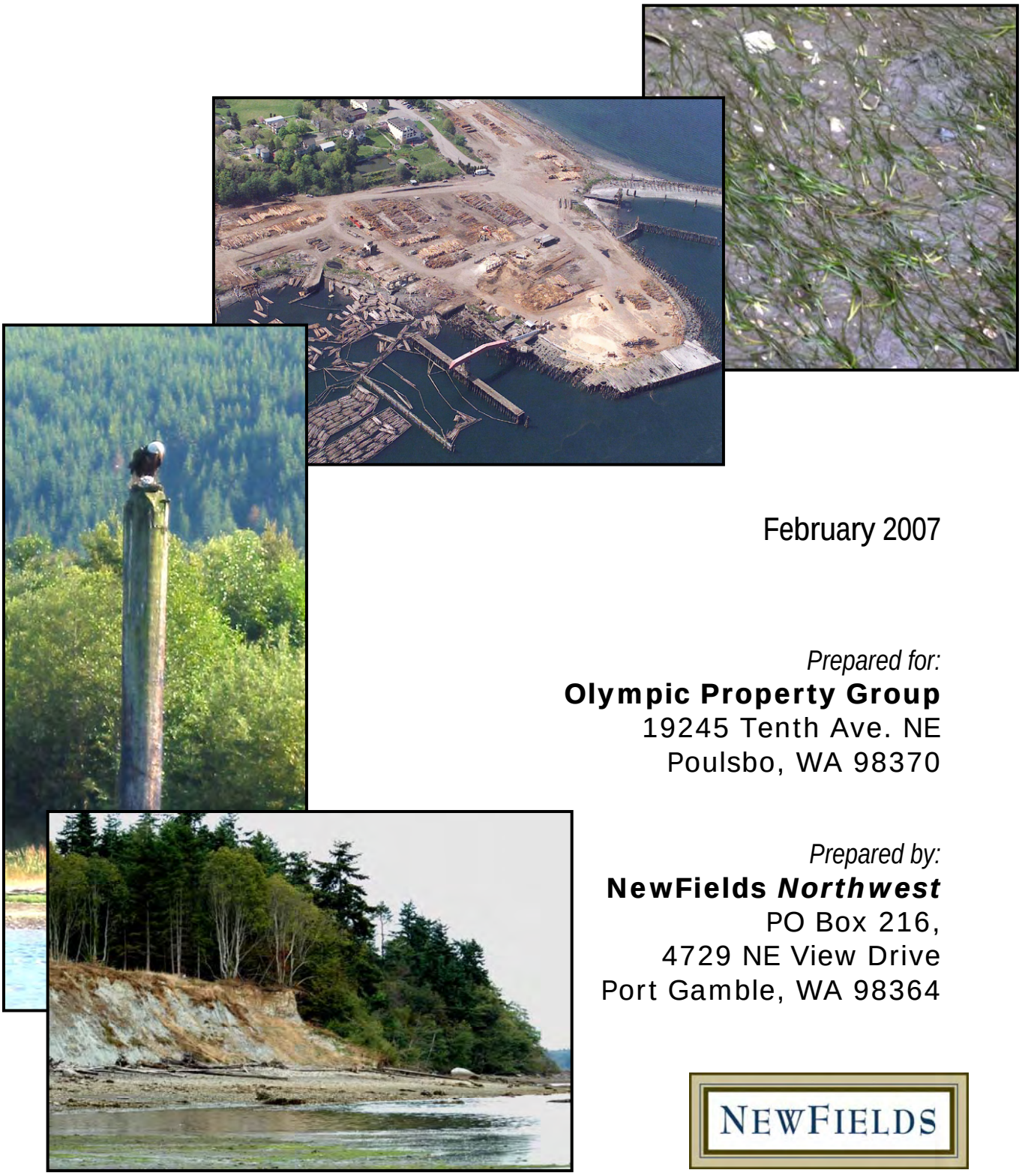
Port Gamble Baseline Investigations: Marine Natural Resources



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NEWFIELDS

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Executive Summary

The Olympic Property Group (OPG) is anticipating future growth in Port Gamble, Washington. As part of the planning process for this development, OPG has requested NewFields Northwest, LLC (formerly Weston) to evaluate the existing marine resources in the Port Gamble area and assess what constraints or opportunities might exist as a result of these marine resources. This report presents the results of a review of existing data from State, Tribal, and private sources, as well as from reconnaissance surveys in the nearshore and subtidal area of the OPG property.

There are several classes of priority habitat that exist in the nearshore areas of Port Gamble. These include steep banks, emergent marsh, inter-tidal and subtidal eelgrass beds, and hardened reef structures. In addition, there are a number of important marine species that occur throughout the area, including commercially important finfish and shellfish species.

Eelgrass beds are considered critical habitat for a number of fish and invertebrate species, including juvenile salmonids. There are significant subtidal eelgrass beds along the northern shoreline of the OPG property. Subtidal eelgrass is less common in Port Gamble Bay. There are however, extensive intertidal eelgrass beds on OPG shorelines in Port Gamble Bay. Both types of eelgrass are protected habitat and may influence near-shore or in-water construction. There are significant eelgrass restoration and mitigation opportunities, particularly in conjunction with the ongoing cleanup of woody debris and sediment. Areas which have historically been known eelgrass beds may provide the best opportunities.

The waters north of Teekalet Bluff represent migratory waters for both adult and juvenile salmon from streams in the north and from southern Hood Canal. Of particular concern are the federally listed Hood Canal Summer Chum salmon stocks. Salmonids that frequent Port Gamble Bay waters include the Northeast Hood Canal Summer and Fall Chum, Hood Canal Coho, Hood Canal Summer/Fall Chinook, Pink Salmon, and Coastal Cutthroat Trout. Of these species, only Hood Canal Coho and Hood Canal Cutthroat Trout are known to currently access and spawn in streams that empty into Port Gamble Bay or Hood Canal from OPG property. The entire shoreline on the Port Gamble Bay and along the area north of Teekalet Bluff falls is considered a Class I Conservation Area, which requires a Habitat Management Plan for all areas within 200 ft. of the shoreline. In addition, there are buffers along salmon-bearing streams. These setbacks may also apply to stream mouths, if the setback is greater than the nearshore limit.

Forage fish (herring, surf smelt, and sand lance) spawn in Port Gamble Bay and along the Hood Canal shoreline. Port Gamble Bay has the second largest herring spawning population in the State. Herring spawn on vertical structure, such as eelgrass, kelp, rocks, and man-made structures. Herring spawning substrate is considered critical habitat and is protected. All forage fish spawning grounds are protected by in-water construction closure periods that prevent any construction below the ordinary high water line forage fish are spawning. In addition, there are limits to man-made structures that might destroy forage fish spawning substrate. Much of the available herring spawning substrate on OPG property are man-made structures and most of these structures are constructed of material treated with potentially harmful creosote. As a potential mitigation action, alternative construction materials may be used to maintain spawning substrate, while improving the health of the stock.

A number of other fish species occur in the area, including rockfish, lingcod, and flat fish. There are no special protections for these species, with the exception of the eelgrass beds.

Shellfish that occur in the area include geoduck, clams, oysters, Dungeness crab, and shrimp. While there are no special protections required for these species, there may be some opportunities for aquaculture of geoduck or intertidal clams. In addition, OPG currently operates a sewage treatment facility that terminates in a commercial geoduck bed. OPG pays $40,000 per year to the Washington Department of Natural Resources to compensate for lost geoduck resource. Outfall redesign, alternative placement, and changes to treatment may all contribute to reduce or remove this annual expense.

There are a number of man-made structures in Port Gamble Bay, including docks, piers, and pilings. Many of these are aging, creosote structures. Removal or replacement of these structures represents significant mitigation opportunities for future development. Additional surveys of habitat and fish and shellfish in the immediate vicinity of the industrial site will help to define what limitations and opportunities may exist there.

Extensive development of the upland site could potentially impact the marine and nearshore resources of the site. Particular consideration should be given to eelgrass beds, salmon streams and stream mouths, forage fish habitat, shellfish beds, and water quality. There are a number of considerations and development alternatives that can not only minimize these impacts, but potentially improve habitat for protected species. In addition, OPG can provide for recreational opportunities by creating pathways and wildlife viewing platforms. Additional surveys will be required to better understand the distribution of eelgrass throughout the area, the utilization by key species, such as salmonids and herring, and the best opportunities for habitat mitigation.

Report Purpose and Need

The Olympic Property Group (OPG) is planning for future growth in Port Gamble, Washington. This property is bordered to the north and east by marine and nearshore areas. The purpose of this marine resources assessment is to inventory the existing marine habitats and resources in and near the OPG property, to provide an indication of what regulatory constraints may exist, and to highlight unique opportunities that may exist for mitigation and for creating a livable community, integrated with the surrounding environment.

Background

Future growth in Port Gamble, Washington is currently in the planning stages. A Master Plan is required before development within the township and forested areas to the south can occur. As part of the development of this master plan, OPG and Pyramid Engineering have requested that NewFields provide a baseline assessment of the nearshore and marine areas bordering the OPG property. An understanding of these natural resources and sensitive areas throughout the site will assist the expansion design, assure that natural resources are protected, and help manage any necessary mitigation with the ultimate goal that the evolving Port Gamble community is harmonious with its natural resources.

This report represents an initial effort to assess the natural resources in the marine areas surrounding the OPG property and to understand any constraints or opportunities that these natural resources might represent for future development. Marine resources were evaluated for the western portion of Port Gamble Bay and the waters of Hood Canal bordering the north shore of the Port Gamble Township.

This initial review was be based largely on existing data that has been developed by a variety of local, State, Tribal, and Federal agencies, as well as private interests. The bulk of the data came from the following sources:

Kitsap County
Washington Department of Ecology (DOE)
Washington Department of Natural Resources (DNR)
Washington Department of Fish and Wildlife (WDFW)
Washington Department of Health (DOH)
US Fish and Wildlife Service (USFWS)
National Oceanographic and Atmospheric Administration (NOAA) Fisheries
Point No Point Treaty Council (PNPTC)
Field Surveys conducted by NewFields Northwest LLC
Washington Administrative Code (WAC)

When the Kitsap County Critical Areas Ordinance is referenced, this refers to the revised CAO as published in the Staff Version available in October, 2005. Kitsap County does not anticipate significant changes from that red-line, Staff Version.

Generally there were multiple data sets for each natural resource that was evaluated. Data sources were available either as raw data, published reports, or a data layers in a geographical information system (GIS). All data were put into GIS layers using ArcGIS 9.1, and then exported into Canvas for final formatting.

Port Gamble Bay is located in Kitsap County and is within the State of Washington Water Resources Inventory (WRIA) Area 15 West. The waters of Port Gamble Bay and northern Hood Canal are within Tidal Reference Area 13 and WDFW Fish and Shellfish Management Area 9. Each of these area designations has associated management requirements for marine and nearshore resources. These will be discussed in the sections below.

Some data have been collected directly by NewFields in support of this evaluation. SCUBA transect surveys were conducted both in Port Gamble Bay and along the northern shoreline bordering Hood Canal following WDFW transect survey protocols for eelgrass and herring spawning substrate. These surveys were conducted along shore-perpendicular transects, with all observations being made at 20' intervals to a depth of -20 ft. mean lower-low water. Eelgrass shoot density was recorded for three, replicate 0.25 m^2 quadrats at each station. In addition, observations were recorded for substrate type, herring spawning substrate (as percent cover), as well as presence absence of geoduck, subtidal clams, Dungeness crab and other crab species. In addition to the SCUBA surveys, beach walks were conducted at low tide to record substrate type, beach profile, topography, intertidal eelgrass, oyster presence/absence, and occurrence of shore birds, fish, vegetation, important stream, bank types, and man-made structures. GPS readings were made periodically along the beach walk to allow for geo-referencing of the observations.

To evaluate intertidal shellfish resources, shore-perpendicular transects from the upper intertidal to -1-ft. MLLW were conducted every 1,000 ft. along the Port Gamble Bay and Hood Canal shorelines. At 40-ft. intervals on each transect all clams occurring within a 1-ft. by 1 ft. area were identified and enumerated. This was then translated into density estimates.

This report is presented as a series of maps with supporting text. A discussion of constraints and opportunities that each resource presents is included. A summary of overall constraints and opportunities is also presented with a brief discussion regarding considerations for future development and its impact on the marine environment and associated resources. Unless otherwise noted in the text, data sources are cited on the corresponding maps. It is important to note that elevations, either above or below sea level are expressed relative to mean lower low water (MLLW). This is an average sea level of the lower-low tides that occur over a period of time.

Physical Setting

The OPG property is bordered on the north by Hood Canal and on the east by Port Gamble Bay. Nearly all of the backshore on the property, with the exception of the industrial township, is vegetated steep slope or high bank **(Map 1)**. Portions of this high bank along Teekalet Bluff are considered unstable and likely feed the sandy beaches on the northern shores of the property. The bluffs along the western portion of Port Gamble Bay are considered to have "intermediate" stability. Nearshore drift is minimal along the northwestern portion of the bay and material deposited from the bluffs likely remains in the area. There is little high marsh habitat on the property boundaries, with only a small pocket of emergent marsh occurring at the western margin of the industrial site (**Map 2**).

Three creeks feed directly into the Port Gamble Bay from the upland portions of the OPG property. In each case, the beach area broadens into a small delta, a likely result of sediment deposits from the creeks. The most pronounced delta occurs at the mouth of Ladine-DeCouteau Creek. The nearshore drift in the middle and southern portions of the western shore of Port Gamble Bay is southerly, and these creeks may feed the fine sand/mud beaches to the south of Ladine-DeCouteau Creek.

Machias Creek empties directly into Hood Canal along the northern shore of the OPG property. There is a small weir that presumably changes some of the natural flow from Machias Creek. However, the lower portion of the creek is channelized and the small weir may actually serve to reduce some of the increased energy from the channel. There is also some evidence of sediment deposition and deltaic formation at the mouth of Machias Creek. Nearshore drift is easterly from the creek mouth, presumably feeding the beach between the mouth and the industrial portion of the site. A more thorough discussion of sediment movement will be provided in the geotechnical report by Zipper Zeman Inc.

The beach profile along Port Gamble Bay is fairly uniform. The upper intertidal beach that abuts the steep back-beach is gravel and coarse sand **(Map 2)**. From the mouth of Ladine-DeCouteau Creek to the north, the upper intertidal substrate is very coarse sand, large cobble, and boulders. To the south, large cobble and boulder is less common, presumably due to the lack of exposed steep cliff. The upper intertidal band is generally 10 to 30 feet wide and represents that portion approximately greater than 6 ft. MLLW.

In Port Gamble Bay, the upper intertidal is steeper than the very gradual middle and lower intertidal flats. The dominant substrate in the mid to lower intertidal (-2 ft. MLLW to +3 to +5 MLLW) is fine sand and mud. The muddier portions of the intertidal beach are generally limited to small "pocket" coves. Broad intertidal flats occur along the western shore of Port Gamble Bay and are comprised of fine to medium sand. There is likely a "hardpan" clay layer underneath the surface sediment throughout Port Gamble Bay. The sediment depth at which this very hard layer occurs is unknown.

Subtidal substrates within Port Gamble Bay are fine and medium sand, with pockets of finer silt or mud. There is little hard intertidal or subtidal substrate inside the bay, with

isolated boulders occurring primarily in the northwestern portion of the bay. Much of the subtidal bay is very gradual and shallow **(Map 3)**. There is a dredged channel at the entrance of the Bay. This is presumed to be sandy substrate.

The northern shoreline bordering Hood Canal is defined by steep, vegetated cliffs, with sand beach extending from the toe of the cliff. Both the intertidal and subtidal substrate is comprised of medium to coarse sand.

The industrial portion of the site at the western side of the entrance to Port Gamble Bay represents the majority of the hard substrate and structure on OPG property. The entire site is protected by hardened shoreline (rip-rap), which is bordered by subtidal substrate of medium to coarse sand on the Hood Canal shore and finer sand and mud along the Port Gamble Bay shore.

Marine Resources, Constraints and Opportunities

Plants

There are two critical habitats that are defined by the plant species that occur there: emergent marsh and eelgrass beds. These are important habitat for protected fish species and their prey.

Emergent Marsh

Emergent marsh is found just above mean high tide and is defined by several salt-tolerant plants (**Map 2**). There is one established emergent marsh area on OPG property, 100 linear ft immediately west of the industrial site. Plant species found here are Dune grass (*Elymus* sp.) and saltweed (*Atriplex patula*). Emergent marsh protects shoreline from erosion, stabilizing soft banks. This area is considered important nearshore habitat and may receive similar protection as riparian habitat during the shoreline development review process.

Eelgrass (*Zostera marina* and *Zostera japonica*)

Both intertidal and subtidal eelgrasses occur along the shorelines of the OPG property **(Map 4)**. Along the northern shoreline, the subtidal eelgrass beds (Common eelgrass or *Z. marina*) are moderately dense, with periodic gaps. Subtidal eelgrass depths range from -2 to -5 ft MLLW. Beyond -5 ft MLLW to approximately -10 ft. MLLW, the eelgrass distribution becomes patchier, ending at approximately -10 ft. MLLW (Weston 2004). Intertidal eelgrass (Dwarf eelgrass or *Z. japonica*) is defined by very short and stout shoots and occurs in a band between 0 ft. MLLW and +2 ft. MLLW and is patchy along the northern shoreline. It is important to note that for those places (light green dots) where eelgrass is "present", this is based on boat surveys which have "raked" the bottom and does not distinguish between attached and drift eelgrass. These observations should be verified by targeted eelgrass surveys.

Eelgrass surveys conducted in Port Gamble Bay for this evaluation found little subtidal *Z. marina*, with only isolated groups of 4 or 5 plants. This is also reflected in the WDFW herring spawning surveys, which also evaluated marine algae and eelgrass presence/absence (WDFW 2005). However, the WDFW surveys also show a gradual decrease in subtidal eelgrass in recent years, indicating that there may be some potential for eelgrass recovery in the future. Eelgrass beds provide important habitat and nursery ground for salmonids, rockfish, lingcod, crab, shrimp, and many other marine species.

Intertidal dwarf eelgrass (*Z. japonica*) is quite common in Port Gamble Bay, occurring on the sand flats from the mouth of Ladine-DeCouteau Creek and south; not as a continuous bed, but with dense patches occurring very high in the intertidal zone (+2 to +4 MLLW) (Weston 2005). *Z. japonica* is an introduced species, but serves some of the same habitat functions as the native "common" eelgrass. They provide habitat for a variety of invertebrates, which during higher tides serve as prey for salmonids and other predatory

fish. However, *Z. japonica* in the upper intertidal may not be effective herring spawning substrate or juvenile rockfish rearing habitat, especially when it occurs very high on the intertidal.

Constraints and Opportunities: Eelgrass is listed as "*Critical Habitat*" due to the ESA listing of Hood Canal Summer chum salmon. It is also considered "*Essential Fish Habitat*" under the Magnuson-Stevens Fishery Conservation and Management Act which requires NOAA Fisheries to identify essential fish habitat for federally managed marine fish, and federal agencies must consult with NOAA Fisheries about actions that could damage that habitat. Eelgrass beds are a priority habitat in Washington State, which manages this habitat with a "no-net-loss" philosophy. Eelgrass is protected under WAC 220-110-250 (Saltwater habitats of special concern) and may affect bulkhead and bank protection projects (WAC 220-110-280), docks and over-water construction, boat ramp and marina construction (WAC 220-110-270 to 330). Construction in eelgrass beds is discouraged and generally not allowed without some mitigation measures. According to Randi Thurston at WDFW, *Z. japonica* falls within these "eelgrass" protections; however, the State may not consider *Z. japonica* mitigation at a similar level to that required for *Z. marina*.

The fundamental difference between the intertidal and subtidal eelgrass is tidal elevation. Because *Z. japonica* occurs so high on the intertidal, it cannot provide the same kind of habitat as *Z. marina*, especially at low tide. It is presumed that mitigation opportunities would be greater for subtidal eelgrass, in part due to its high habitat value. The technology of eelgrass transplanting is also more developed for subtidal eelgrass. Because intertidal eelgrass is more exposed to wave action and drying during low tides, successful transplantation is less likely.

The difference in elevation creates different constraints for construction. In-water construction that does not impact the intertidal zone will not affect intertidal eelgrass and would not require mitigation. This would also be true of structures that are elevated above the intertidal surface (such as elevated walkways), provided that there is not significant shading of eelgrass. Conversely, construction that might impact the upper intertidal area would not affect subtidal eelgrass or require mitigation for *Z. marina*. For mitigation purposes, it is doubtful that these species would be interchangeable. However, because of the greater habitat value of the subtidal *Z. marina*, mitigation of *Z. japonica* loss with *Z. marina* may be possible.

Fish

Salmonids

Port Gamble Bay and the waters north of Teekalet Bluff represent migratory waters for both adult and juvenile salmon from streams in the north and southern Hood Canal. Of particular concern are the federally listed Hood Canal Summer Chum salmon stocks. Salmonids that frequent Port Gamble Bay waters include the Northeast Hood Canal Summer and Fall Chum, Hood Canal Coho, Hood Canal Summer/Fall Chinook, Pink Salmon, and Coastal Cutthroat Trout. Of these species, only Hood Canal Coho and Hood Canal Cutthroat Trout are known to currently access and spawn in streams that empty into Port Gamble Bay or Hood Canal from OPG property (*Ladine-DeCouteau Creek* and *Machias Creek*; **Map 5**). A Port Gamble S'Klallam tribal biologist has suggested that a Northeast Hood Canal fall chum stock occasionally makes use of lower stream reaches on OPG property. However, these occurrences are not well documented. All other species spawn in streams that empty into the southern and eastern portions of the Bay. This occurrence data is based on WDFW Priority Habitat Species data published in 2005 and is not based on actual observations collected during the reconnaissance surveys. There are some discrepancies between the state database and tribal data regarding a resident spawning population of pink or Chinook salmon in Gamble Creek (Ted Labbe, Port Gamble S'Klallam Tribe). It is likely that the returning salmon are strays and not a self-producing stock. Such discrepancies should be addressed in any Biological Evaluations, Habitat Management Plans, and Habitat Conservation Plans required by the County or NOAA Fisheries. There are partial blockages in both Ladine-DeCouteau Creek (culvert) and Machias Creek limiting access; however these are not necessarily total blockages and it is not unreasonable to believe that these are active streams. The extent to which the culverts under SR104 and the weir at Machias Creek block access, as well as the extent of fish utilization of the creeks and creek mouths should be determined during salmon migration.

There are also fish pens located in the eastern portion of Port Gamble Bay. These are owned and operated by the Port Gamble S'Klallam Tribe.

***Constraints and Opportunities**:* In 1999, Hood Canal Summer Chum salmon were listed as a Threatened species under the Federal endangered species act. This prevents any activities that could result in a take of Hood Canal summer chum and requires a Section 7 consultation with NOAA Fisheries. This listing also provides for the protection of critical habitat and any biological features that are critical to the survival of summer chum salmon. If during the Section 7 consultation there is a significant concern, a habitat conservation plan is prepared. This process may not be necessary for smaller projects. For most projects, a Biological Evaluation is prepared. This document describes the planned activity and the potential impacts, or lack thereof, to adult and juvenile salmon.

Based on the Kitsap County Critical Areas Ordinance Section KCC 19.300.310 4, waters that are named as chum or Puget Sound Chinook habitat are classified as Class I Wildlife

Conservation Areas. The entire shoreline on the Port Gamble Bay and along the area north of Teekalet Bluff falls into this classification. Class I Areas require a Habitat Management Plan for all areas within 200 ft of the shoreline. Further limitations to protect salmonid habitat and migratory pathways include limitations to the construction of over-water structures and bulkheads, set backs from the nearshore and salmon-bearing stream of 35 to 50 ft in the urban portion of the site and 50 to 70 ft in the Urban Conservancy area along the western shoreline of Gamble Bay. Stream buffers include those areas around the mouth of creeks.

There are some opportunities for salmon habitat mitigation at the mouths of both Ladine-DeCouteau Creek and Machias Creek. The mouth of Ladine-Decouteau Creek has a culvert which could be modified to facilitate fish passage. Likewise, the weir at the mouth of Machias creek could be modified or removed to facilitate fish passage. As stated above, further evaluation of the salmonids using these streams and the extent to which these structures block fish passage should be evaluated during the salmon migrations. Fish passage further up stream will be evaluated by GeoEngineers.

There are fish pens in Port Gamble Bay and this may represent an opportunity in Port Gamble Bay. However, fish pens are contentious in Washington State and would be problematic in Port Gamble Bay, an embayment that is shallow and has relative poor circulation.

Environmental Windows: For the protection of migrating Hood Canal chum (juvenile salmonids) no work below the ordinary high water line should occur between February 15th and July 14th.

Herring (*Clupea heringus pallasi*)

The Port Gamble Herring stock represents the second largest herring spawning population in the state of Washington with a 25-year mean spawning biomass of population of over 2,000 tons (WDFW 2004; Washington State Herring Stock Status Report). Herring spawn annually between the months of January and March. Based on herring spawning surveys, spawning intensity is higher along Point Julia and along the north shore of Teekalet Bluff **(Maps 6a and 6b)**. Map 6a indicates all stations that have been checked for herring spawn (between 2001 and 2005) and Map 6b indicates those stations where spawn was actually observed. While herring spawn has been documented along the entire shoreline of Port Gamble Bay; WDFW spawning surveys indicate that spawning intensity drops off west of the Port Gamble Township and south of the industrial site (provided by Kurt Stick WDFW La Conner). The industrial site was not surveyed as part of WDFW annual assessments; there is no data for spawn in that area.

Herring spawn in calm and protected waters, attaching their eggs to vertical structure, such as eelgrass, kelp, red algae, subtidal reefs, and man-made structures. Their spawning habit attracts them to areas with docks, piers, rip-rap, and pilings. In the Port Gamble area, eelgrass, red algae (*Gracilaria* sp.), submerged rocks and pilings represent the available spawning substrate **(Map 7)**. The dock and pier structures likely represent a

significant portion of the available spawning substrate at the mouth of Port Gamble Bay; however this has not been documented, as WDFW's surveys typically do not include the industrial site. There is little natural herring spawning substrate in the inner bay south of the industrial site and north of the OPG property line, with little subtidal eelgrass or *Gracilaria* sp. present. Intertidal eelgrass (*Z. japonica*) is common in the high intertidal, (-1 ft. MLLW to +4 MLLW), and generally occurs above the spawning depth range for herring (0 ft MLLW to -10 ft MLLW). There is continuous eelgrass and fairly dense *Gracilaria* along the Hood Canal shore, from the industrial site to the western OPG boundary.

***Constraints and Opportunities*:** Documented herring spawning grounds are protected from habitat loss by the Washington Administrative Code Hydraulic Code Rules. In practical terms, this can require mitigation or design requirements, such that there is no net loss of eelgrass or *Gracilaria*. Impacts from new construction on eelgrass and *Gracilaria* can be offset by the removal of historic impediments to their growth, such as over-water structures or pilings that will then allow for their reestablishment.

Recent studies indicate that direct contact of herring embryos with creosote may result in decreased developmental success of those eggs (Gardiner, personal communication; Paisano and Dinnel 2005[1]; Vines et al. 2000[2]). Although the dock and pier structures may provide important spawning substrate for herring, they may actually negatively affect the population. A replacement of aging structures with newer, best-management-practices materials would remove the impacts of creosote, while continuing to provide structure for herring spawning. This may result in no-net-loss of spawning substrate.

Herring spawning surveys at the industrial site would provide needed information to document the relative importance of the structures there on the herring population in Port Gamble Bay.

Environmental Windows: In addition, there are fish windows that prevent in-water construction during the spawning period. For the protection of herring spawning areas in Port Gamble, no work below the ordinary high water line may occur between January 15th and April 14th.

[1] Paisano, L. and P. Dinnel. 2005. Comparative toxicity to creosote in pacific herring, topsmelt, and sea urchin. M.S. Thesis. Department of Biology, Western Washington University, Spring 2005. [1]

[2] Vines, C.A., T. Robbins, F.J. Griffin, G.N. Cherr. 2000. The effects of diffusible creosote-derived compounds on development in Pacific herring (*Clupea pallasi*). Aquat Toxicol. 2000 Dec; 51(2):225-39.

Sand Lance (*Ammodytes hexapterus*)

Sand lance, or candlefish, are an important forage fish species that spawn on the intertidal zone of the Puget Sound shoreline at high tide. Sand lance deposit eggs on a rather broad range of beach surface substrates, from soft, pure fine sand beaches to beaches armored with gravel up to 3 cm in diameter, although most spawning appears to occur on the finer grained substrates. Spawning occurs at tidal elevations ranging from +5 feet to about the mean higher high water line. After deposition, sand lance eggs may be scattered over a wider range of the intertidal zone by wave action. The incubation period is about four weeks.

There are documented sand lance spawning areas along the north portion of Teekalet Bluff, and along the western shores of Port Gamble Bay (**Map 8;** Pentilla et al. 2001).

Constraints and Opportunities: Local spawning populations are vulnerable to shoreline development. Construction of bulkheads and other shoreline armoring can bury the upper intertidal zone. Bulkheads and other armoring may also damage spawning habitat by causing increased erosion and interruption of sediment transport.

The spawning habitat of sand lance is considered a "marine habitat of special concern" in the Washington Administrative Code (WAC) Hydraulic Code Rules. All proposed shoreline construction activities are reviewed by state agencies for impacts to the spawning habitat of sand lance and other species. In cases where no satisfactory redesign or mitigation is possible, a Hydraulic Permit may be denied.

Permit applicants may be required to produce resource/habitat surveys before construction, redesign projects to reduce impacts, follow restrictions on seasonal timing of in-water work, provide mitigation for impacts of permitted work, or consider alternatives to bulkheads and other hard shoreline armoring structures.

Environmental Windows: For the protection of sand lance spawning areas in Port Gamble, no work below the ordinary high water line is allowed between October 15th and March 1st. During this time period, a project proponent may request a consultation from WDFW to determine whether there has been recent spawning activity. If there is no evidence of recent spawning activity, a 7-day construction period may be allowed.

Surf smelt (*Hypomesus pretious*)

Surf smelt spawn in the upper intertidal zones of mixed sand and gravel beaches, generally within a few feet of the high tide line. There are few documented spawning beaches on OPG shorelines; however, they have been documented in other portions of Port Gamble Bay **(Map 9;** Pentilla et al. 2001). The Port Gamble Bay area has only had one surf smelt spawning area survey in 1996, and this may underrepresent the spawning activity in the area. In the past, WDFW has managed this area using a cautionary approach, and environmental windows for the Tidal Area have applied to OPG shorelines.

Constraints and Opportunities: Local spawning populations are vulnerable to shoreline development. Construction of bulkheads and other shoreline armoring can bury the upper intertidal zone. Bulkheads and other armoring may also damage spawning habitat by causing increased erosion and interruption of sediment transport. Even on lightly armored beaches, wave action along the base of the structures may scour away fine-grained sediments. Armoring on long stretches of shoreline and conversion of natural streams to drainage culverts may remove sources of beach sediments to long shore drift systems. Beach substrate may gradually coarsen; eliminating essential surf smelt spawning substrate.

All known surf smelt spawning sites have been given enhanced "no net loss" protection in the application of Washington Administrative Code (WAC) "Hydraulic Code Rules." Permit applicants may be required to produce resource/habitat surveys before construction, redesign projects to reduce impacts, follow restrictions on seasonal timing of in-water work, provide mitigation for impacts of permitted work, or consider alternatives to bulkheads and other hard shoreline armoring structures.

Environmental Windows: In Port Gamble, no work is allowed below the ordinary high water line from October 15th to January 31st. During this time period, a project proponent may request a consultation from WDFW to determine whether there has been recent spawning activity. If there is no evidence of recent spawning activity, a 7-day construction period may be allowed.

Bottomfish/Groundfish

There are a number of groundfish species that occur in Port Gamble Bay, including flatfish, sculpin, dog fish, greenling and perch. There are three species that are of particular interest and are considered by Washington Department of Fish and Wildlife as Species of Special Concern: Lingcod, Rockfish, and Rock Sole.

Lingcod (*Opihodon elongates*)

Lingcod are a common groundfish species that live in and around natural and man-made structure, such as rocks and docks (Pacunski and Palsson 1998). Lingcod spawn in rocky crevices in shallow areas with strong water motion. Juveniles feed in benthic vegetated habitats. The first and second year class lingcod occupy open, sand flat habitats prior to moving to rocky reefs. Adults have a small home range, generally less than 50 m. There is a substantial lack of subtidal structure in Port Gamble Bay, primarily being limited to the jetty and dock areas at the mouth of the bay and several submerged rocks just northwest of the entrance. Lingcod are known to occupy the rocky reef along the inside of the jetty **(Map 10)**.

Constraints and Opportunities: Lingcod settlement and nursery areas are protected under WAC 220-110-250 (Saltwater habitats of special concern) and may affect bulkhead and bank protection WAC 220-110-280, docks and over-water construction, boat ramp and marina construction (WAC 220-110-270 to 330).

Rockfish (*Sebastes* spp.)

The most common rockfish species that occur in Hood Canal are the Copper rockfish and Quillback rockfish (Pacunski and Palsson 1998). Rockfish require three different habitat types depending on life stage. Of particular interest, juvenile rockfish require nearshore vegetated habitat, in particular eelgrass, kelp, and under-story kelps, as well as rock reefs. Adult rock fish species typically orient to structure, both natural and man-made. Their home range is small, generally less than 50 m. There is a substantial lack of subtidal structure in Port Gamble Bay, primarily being limited to the jetty and dock areas at the mouth of the Bay and several submerged rocks just northwest of the entrance. Subtidal eelgrass beds are primarily located along the north shore of Teekalet Bluff. Although there is no specific data regarding rockfish in Port Gamble Bay, it is presumed that either Copper or Quillback rockfish are present.

Constraints and Opportunities*:* Puget Sound Copper and Quillback rockfish populations have shown declining stocks in the late 1990s; however, it is unclear whether that decline extends to Hood Canal. Rockfish are considered a special species of concern by WDFW. Rockfish settlement and nursery areas are protected under WAC 220-110-250 (Saltwater habitats of special concern) and may affect bulkhead and bank protection WAC 220-110-280, docks and over-water construction, boat ramp and marina construction (WAC 220-110-270 to 330).

Rock Sole (*Lepidopsetta bilineata*)

Rock sole are a popular recreational flatfish species. Adults generally use sandy or muddy bottoms, but will at times occupy smooth rocky outcrops. Juvenile rock sole will reside around reef structure, including docks and pilings. There is no specific data indicating the location or extent of rock sole in Port Gamble Bay; however, juveniles are presumed to occupy the dock and reef structures at the mouth of the bay.

***Constraints and Opportunities**:* Rock sole are among 13 species listed to be in decline (Palsson et al. 1997). Rock sole spawning beds occur in the upper to mid intertidal and as such are protected under WAC 220-110-250 (Saltwater Habitats of Special Concern) and may affect bulkhead and bank protection WAC 220-110-280, docks and over-water construction, boat ramp and marina construction (WAC 220-110-270 to 330).

Shellfish

Geoduck (*Panopea abrupta*)

Geoduck are a large (over two pounds each), commercially important bivalve clam species. Geoduck distribution ranges from the lower intertidal to beyond -300 ft MLLW and they are found in most substrates, although growth and densities are highest in soft substrates (fine sand and silt). They are not generally found in muddy waters and in gravel and cobble bottom their commercial values is substantially decreased.

In waters deeper than -18 ft MLLW, geoduck are surveyed by the Northwest Treaty Tribes, DNR, and DOE. There are geoduck tracts to the north of the Port Gamble Township and at the head of Port Gamble Bay **(Map 11)**. It is likely that these tracts extend shoreward to the shallow subtidal zone. Reconnaissance SCUBA surveys conducted by NewFields (Weston 2005) did not find geoduck in the shallow subtidal zone in the middle of Port Gamble Bay, however, they were observed along the shoreline north of Teekalet Bluff (Weston 2004).

Constraints and Opportunities:

Geoduck Harvest and Aquaculture: There are two geoduck fisheries in the State of Washington. The sub tidal fishery includes geoduck below -18 ft MLLW to a depth of -70 ft MLLW. Because of their value as a marine resource, geoduck harvest is closely regulated by the Tribes and DNR. The State subtidal fishery is conducted by DNR and is administered to fishers as individual boat quotas. There is little access to this fishery.

The intertidal fishery is just developing in Washington and is open to lease holders of intertidal lands and operations are becoming more common as the aquaculture technology has developed. Intertidal geoduck for aquaculture is generally planted no higher than +3 ft MLLW and to a depth as low as practical (generally -3 ft MLLW). Because grow out requires protective tubes and maintenance, subtidal fisheries that require divers are at the time impractical, although some inroads have been made into the subtidal fishery.

Culture of the geoduck has been under development for more than twenty years in Puget Sound, Washington and there are now hatcheries and farms producing a significant amount of market product. Geoduck have a five to seven year culture cycle from planting to harvest, requiring a significant level of planning, management and investment capital. Seed (minimum size = 10 mm) are generally purchased from suppliers and transferred to grow-out beds, which can be either low-intertidal or sub-tidal beds. Geoduck seed that is planted must be protected from predators, such as crabs and starfish, since the geoduck will take some time to bury in the substrate.

In Puget Sound, seed geoduck are planted directly into PVC tubes in the spring. The tubes may be 12-16 inches long and 4-6 inches in diameter. The tubes are pushed into the sand substrate and covered with a protective mesh. The mesh is removed after the first year. Geoduck prefer the low inter-tidal environment. Ideally they should be planted no higher than the +3 ft MLLW level and as low as is practical to access them. They can be

planted as high as +6 feet tide level but growth and survival will be lower. Based on bathymetry data and the depth distribution and substrate preference of geoduck, the western portion of Port Gamble Bay represents approximately 50 acres of potential geoduck aquaculture **(Map 12)**. If there is significant "hardpan" clay that is within 3 ft of the sediment surface, aquaculture opportunities would be more limited.

Geoduck Closure Area: Currently, the Port Gamble sewage outfall terminates within a state-certified geoduck bed (State geoduck Tract #20050). This tract is bisected by the "Sewage-Treatment Plant" closure zone, and as a result prohibits the harvest of an area of 37.8 acres (Pyramid Engineering 2005). Based on a tract density of 0.45 geoduck/ft^2 and a biomass of 1.5 lbs/geoduck (WDFW 2005), this closure area represents approximately 741,348 geoduck or 11,120,021 lbs of geoduck. If the tract were fished down to 20%, this closure area would represent approximately $53.4 million of geoduck resource. OPG pays $40,000 per year to compensate DNR for this lost resource. Additionally, the closure zone extends to the shoreline, preventing harvest of intertidal clams **(Map 11)**.

The original closure area was calculated by Mr. Frank Merriweather of the Washington State Department of Health (DOH). Based on the configuration of the outfall and the volume of discharge, the closure area was determined to be 390 yards in radius from the center of the pipe. This determination was also based on the confidence that DOH has in the reliability of the existing treatment system (Merriweather, personal communication). The outfall has a single pipe with no diffuser, discharging 1150 ft from shore in 15 ft of water. The lack of a diffuser and discharge to a shallow depth prevents any substantial dilution. The addition of a diffuser and an extension of the outfall into deeper water would likely reduce the size of the closure zone. In addition, upgrades to the treatment system could also reduce the size of the closure area. However, Mr. Merriweather cautioned that the original area calculation was based on a population at the time of Mill closure and that significant increases in discharge volume could offset changes in the outfall configuration and location.

In planning for future development, relocation of the outfall and upgrading the system may serve to limit or remove the closure areas and will likely be required to minimize Port Gamble's impact on Hood Canal water quality – an emerging issue in Washington State. Any proposed marinas require a mandatory closure zone for shellfish harvest in the surrounding area. The size of this closure zone is dependent upon marina design and physical conditions at the site. Marina design should incorporate best management practices (such as pump out stations, shore-side facilities, limited or no temporary moorage, and required dye-tabs in vessel holding tanks) to minimize the size of the mandatory closure zone.

Intertidal Clams

There are several species of intertidal clams, most of which are recreationally and/or commercially important species. Neither WDFW nor the Tribes have conducted intertidal clam surveys of the western shore of Port Gamble Bay or the northern shore of Teekalet Bluff. NewFields conducted reconnaissance intertidal clam transects along the shorelines owned by OPG in October 2005 **(Map 13)**. Shore-perpendicular transects from the upper intertidal to -1 ft MLLW were conducted every 1,000 ft along the Port Gamble Bay and Hood Canal shorelines. At 40 ft intervals on each transect all clams occurring within a 1 ft by 1 ft area were identified and enumerated. This was then translated into density estimates.

Intertidal clams that were observed during the transect surveys were Manila (also called Japanese Littleneck) and Native Littleneck clams, Butter clams, Horse clams, Cockles, *Macoma* clams, and the invasive Varnish clam. Manila and Native Littleneck clams are commercially important species. The Manila clam is an aquaculture species and can be effectively seeded and grown on natural beach substrate.

Constraints and Opportunities: There are no direct limitations to upland or nearshore development to protect clam resources; however, there are a number of initiatives to decrease shellfish bed closures due to fecal coliform contamination. Reduction in the sewage treatment area would decrease the area of closed beds in Hood Canal; however, growth in sewage volumes without improved treatment would likely increase closed beds. This is a consideration for the sewage treatment plant as the town population increases. Recreational, Tribal, and commercial harvest opportunities would be considered an attraction to the area for future residential development. The Port Gamble S'Klallam tribe currently conducts a subsistence fishery on some OPG beaches.

Manila clams (*Tapes phillipinarum*)

Manila clams typically occur between 3 and 6 ft above MLLW. They prefer substrate that is 50-80% sand, particularly gravel, sand, mud, shell combined. For rapid growth, they require consistent plankton sources throughout the year.

Clam aquaculture is a possibility in Port Gamble; however, it is important to use the current distribution of clams as a cue to how aquaculture projects would fare. Based on intertidal surveys, the "clam band" for Manila clams is fairly narrow in Port Gamble Bay, restricted to an approximately 20 ft band in the upper intertidal. Substrate was definitely more favorable in the north portions of the bay. The environmental conditions (temperature, salinity, plankton) are favorable for moderate growth.

Clam aquaculture is quite labor intensive and requires permits from Washington Department of Health, Washington Department of Fish and Wildlife, Washington Department of Natural Resources, County Planning Department, State Environmental Policy Act – Environmental Impact Statement, US Army Corp of Engineers and the treaty Tribes. The Tribes are allowed 50% of the naturally occurring clams, but are not entitled to a share of the clams resulting from commercial improvements.

Native Littleneck (*Prototheca staminea*) and Butter clams (*Saxidomas giganteus*)

Native littleneck clams and butter clams are typically found in the lower intertidal and upper subtidal beaches. They prefer muddy sand to coarse sand or gravel substrate. Neither species are cultured in Washington State, but are a popular recreational fishery. Recreational clam harvest may be a tourist activity that can be encouraged; however, clam densities are moderate and may not support a substantial fishery.

Oysters

Pacific Oysters (*Crassostrea gigas*)

Pacific oysters are a large, commercially important shellfish resource that is found on the upper and middle intertidal (-1 to +3 ft MLLW). Oysters were present on the western shore of Port Gamble Bay with the highest densities found in the northwestern portion of the bay **(Map 14)**. Beaches here were almost completely covered with oysters. In the southwestern portion of the Bay, oysters occur in dense clumps on the muddier substrates.

Pacific oysters are cultured in Washington State. Culture options include bottom, stake, rack, raft, and longline culture. Oysters can be cultured from the nearshore to about -12 ft MLLW depending on culture method, but culture is most productive in the intertidal around 0 MLLW. In Port Gamble Bay, there are substantial eelgrass beds in the upper intertidal and this may pose a problem when harvesting bottom cultures. Oyster culture would likely be successful in Port Gamble Bay given the dense natural beds that occur on the western shores.

Olympia Oysters (*Ostrea lurida*)

Olympia oysters, once the only oyster species in Puget Sound and Hood Canal, are no longer common. There are an increasing number of recovery efforts in Puget Sound. While there may be Olympia oyster on the OPG shorelines, their population is likely low. No information regarding population size or distribution in Port Gamble Bay was found.

Other Invertebrates

Dungeness Crab and Shrimp

Dungeness crab are an important commercial and recreational crab species in Puget Sounds and Hood Canal. Embayments, like Port Gamble Bay, are critical rearing and mating habitat, as well as an important part of the normal home range. Adult and juvenile Dungeness crab are common throughout Port Gamble Bay and along the northern shoreline of the Township. There are no specific limitations to development as a result of the crab population in the bay.

Hood Canal Shrimp

Pandalid shrimp are present in Port Gamble Bay and the eelgrass beds along the northern shore. Spot shrimp (*Pandalus platyceros*) use Puget Sound embayments, such as Port Gamble Bay as rearing grounds and as such are typically closed to large fisheries. Coon stripe shrimp (*P. hypsinotus*) and the Dock shrimp (*P. danae*) have been observed in Port Gamble Bay. While these species represent commercially or recreationally important species, there are no specific limitations as a result of their presence.

Marine Mammals

Harbor seals (*Phoca vitulina richardsi*)

Harbor seals are common in Port Gamble Bay. There are two documented haul out locations within the bay **(Map 15)**. However, both of these haul outs were on log rafts on the western portion of the Bay. In each case, the observed number of seals was greater than 100 (Gardiner 2005, personal observation; WDFW 2000). Log rafts are typically still present in the Bay, but their location varies. It is unclear whether the removal of the log rafts would result in the seals using the neighboring beaches as haul out locations, or whether they would leave the Bay.

The Harbor seal population in Washington State is not considered as a depleted or strategic stock (NMFS 2003) and as such does not have any specific protection beyond the restriction of "takes" or harassment under the Marine Mammal Protection Act. While there is likely to be some consideration by WDFW for the protection of seal haul outs, it is doubtful that this would extend to the log rafts.

OPG may choose to create seal haul out structures as a "recreational opportunity" or possibly as mitigation for other impacts. However, this should be considered with care as it can become a nuisance or liability in the long term (i.e., long-term maintenance of habitat).

Birds

There is one Bald Eagle nesting site in the township of Port Gamble, as well as two nest sites near Teekalet bluff, west of Machias Creek. In addition, there are four other nests on or near the west side of Gamble Bay (Randi Thurston WDFW). Bald eagles have been protected under the Endangered Species Act (ESA) which protected them from takes or substantial impacts to their habitat. As of July 2007, the Bald Eagle has been removed from the endangered species list; however it continues to be protected by the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act. It is worth noting that previous in-water activities conducted by OPG required a Section 7 consultation. The conclusion of this consultation was a determination of non-significance. While it is not anticipated that nearshore activities would be affected by the presence of eagles, there may be some limitations on impacts of noise during nesting season and certain flyways protected. Nest locations and limitations due to their presence are included in the upland evaluation for the site (GeoEngineers 2005).

Marbled murrelets are also protected under ESA; however, there are no documented nests in the Port Gamble area.

Other birds of concern include osprey, Great Blue herons, loons, cormorants, grebes, scoters and rhinoceros auklets. Birds are an important link in the aquatic food chain as they feed on marine fish and invertebrate species and as such receive some protection during the shoreline review process. Great Blue heron rookeries are found in high, nearshore trees. Rookeries are protected from development, with buffers surrounding nests. There are two Osprey nests at the eastern portion of town. The presence of nests and protective buffers are included in the upland evaluation. Nearshore and marine birds are protected under the Migratory Bird Act, which is primarily prevents the killing or possession of birds and their eggs. Most of these bird species are present during the environmental windows for fish and would be protected from in-water construction by these windows (Randi Thurston WDFW).

Man-Made Structures

There are three dominant forms of man-made structure in Port Gamble Bay, creosoted and non-creosoted pilings, over-water structures (docks and piers), and rip-rap **(Map 16)**. These structures both provide habitat and impact habitat.

Pilings in the marine environment can impact marine habitat by displacing aquatic plants, increasing sedimentation, and, if creosoted, becoming a source of contamination. There is increasing evidence that, although pilings create structure for spawning herring, the chemicals used to preserve the pilings can result in larval deformities or egg mortalities. Very dense groups of pilings trap sediment and prevent light from reaching the bottom affecting marine plants and altering animal behavior. Pilings can also create habitat, providing structure some attaching organisms, like mussels. In addition, pilings provide important roosts for marine birds, including bald eagles, osprey, great blue herons, and cormorants.

There over 100 pilings in Port Gamble Bay south and west of the industrial site. These pilings were used to tie rafted logs that were being transited by water. Most are single pilings, although there are some grouped pilings (dolphins) as well. If creosoted, the amount of creosote appears to be generally low. In locations with older pilings with weathered creosote, the contamination in sediment surrounding the pilings is generally low and limited to the areas close to the pilings. In the industrial site there are several locations with areas of very dense pilings that once supported dock structures that are now abandoned. These pilings are more limited in terms of habitat value and likely trap more sediment and have elevated contaminant concentrations surrounding them.

Over-water structures are structures that are suspended over the water and serve to shade the habitat below. This shading effect can reduce the health of eelgrass beds by preventing photosynthesis and can interrupt fish migrations along shore. Removal and limitation of over-water structures has recently become a priority for WDFW and DNR. There are three notable dock structures along the western shore of Port Gamble Bay. Approximately 1.3 miles south of the industrial site is an abandoned dock that represents approximately 4,100 square feet of over-water surface. At the end of the industrial site, there is an abandoned dock structure that represents 31,000 sq ft. of over-water surface. In addition, there are several smaller abandoned or degraded dock structures.

Rip-rap is considered “hardened shoreline” that creates an unmovable and reflective surface and displaces natural shoreline that is used by forage fish. Wave energy is reflected from the rip-rap and translated laterally, serving to erode shorelines and create unstable substrate. The industrial portion of the OPG property is surrounded by rip-rap, with approximately 21,000 ft. of hardened shoreline.

***Constraints and Opportunities*:** Since these structures already exist, it is doubtful that they create any limitations to development. However, there will likely be limitations on their modification. Permitting for new construction will likely require modification of

some of these structures. These structures do, however, represent a substantial opportunity for OPG. There are several efforts in Puget Sound to remove creosoted pilings from marine environments, to reduce the amount of "hardened" shoreline, and to reduce the area of over-water structure in potential eelgrass habitat. There are substantial funding sources that might be available through DNR, USEPA Brownfields, and NOAA Restoration Center for piling removal and eelgrass habitat restoration. Perhaps most important, these structures offer opportunities for on-site mitigation for new construction.

Shading will also be a concern for new over-water structures; however, there are a number of technology alternatives that allow for construction without significantly impacting light transmission to the habitat below. These best management practices (BMPs) have been developed and are in use by the Washington Department of Transportation and have been developed in part by NewFields scientists. The BMPs employ structures that allow light through and reflect light downward to the areas below.

Water Quality

Port Gamble Bay is considered Excellent (Class A) waters in the State of Washington; whereas North Hood Canal is considered Extraordinary (Class AA waters; among the cleanest waters in the State). These Washington Department of Ecology designations are based on projected use of a particular water body and are not based on the water quality that exists at a particular time in the Bay. Reclassification of water bodies is not easily accomplished and has potential implications on future use.

Extraordinary waters are considered pristine. Excellent waters allow for some decrease in beneficial uses but must allow for the harvest of fish and shellfish without having adverse affects on human health. As defined in Chapter 173-201 WAC, Class A waters also have criteria for bacterial counts, dissolved oxygen, temperature, pH, and turbidity (water clarity).

DOH monitors water quality in marine waters in Port Gamble Bay, as well as in stream throughout the watershed. Stations at the mouth of Martha John Creek and the mouth of Port Gamble Bay exceeded fecal coliform standards, while the station at the mouth of Ladine-DeCouteau Creek was acceptable. Failure to meet Excellent standards for the bay is largely due to failing septic systems in Gamblewood residential development. While the existing impacts to water quality in Port Gamble Bay are not necessarily due to current OPG activities, this does highlight the fragile nature of Port Gamble Bay water quality and the potential for impacts from development. At this time there are no 303d listed waters in the Port Gamble area. There are efforts to resolve the failing septic systems at Gamblewood Village and area farmers have agreed to implement best management practices to resolve fecal coliform issues.

Recent concerns regarding low dissolved oxygen (D.O.) in Hood Canal has resulted in the implementation of the Hood Canal Dissolved Oxygen Program (HCDOP). This program combines policy and science to monitor and analyze the cause of low D.O. in Hood Canal and to suggest potential corrective actions. The area identified to have problems associated with low dissolved oxygen is in the southern and middle portions of Hood Canal. Port Gamble Bay empties into the area of Hood Canal north of a prominent "sill", or underwater wall that limits water exchange between Hood Canal north and south of the Hood Canal Bridge. Thus, the impacts of Port Gamble Bay waters have on Hood Canal are limited. However, any new sources of nutrient and organic material discharges, especially from large changes in population will likely be evaluated by the regulatory agencies with this issue in mind.

It will be important for OPG to monitor water quality in its creeks and in the Bay as it develops the OPG town site. This will allow OPG to evaluate how its activities might be affecting water quality in the streams, the Bay, and Hood Canal. It will also allow OPG to respond to any claims that it may be impacting water quality in the area. In addition,

OPG should consider that spills may occur during marina and sewage treatment operations, and fines for clean-up costs can be considerable.

The deposition of wood debris as a by product of lumber mill operations is of growing concern for state agencies and the scientific community. The State Department of Ecology considers woody debris a "deleterious material" which has the potential to impact ecological communities. During past mill operations in Port Gamble, wood waste accumulated in dense layers on the bottom, potentially altering bottom habitat. In addition to prohibiting nutrient gradients, decaying material may reduce the availability of dissolved oxygen. The mill at Port Gamble ceased operations in 1995, however the effect of historic deposition continues to be of potential concern.

Pope and Talbot Inc. is currently engaged in a voluntary clean up, in association with the State Department of Ecology to remove wood waste from the Mill site. As part of the voluntary clean up, the area has been surveyed for wood waste and those areas deemed unsuitable habitat by the State are being dredged and capped. It is anticipated that this action should address water quality issues related to wood waste and that future development by OPG would not require further clean up actions.

Potential influences of Upland and Nearshore Development

As OPG begins to develop the upland areas of the Port Gamble property, there are potential influences on the marine and nearshore environment to consider. The nature and scope of these influences can be limited, or turned into opportunities, depending upon the type of development. Those constraints and opportunities are based on the types of habitat in each area. The basic environmental habitat types adjacent to the property include:

1. Sandy beach environment facing Hood Canal to the West of the Property;
2. High intertidal eelgrass patches (*Zostera japonica*);
3. A small area of emergent marsh (approximately 100 ft. long);
4. Subtidal eelgrass beds that extend from this sandy beach environment to depths of approximately -15 ft MLLW;
5. Deeper water habitats in finer grained sediment extending from these eelgrass habitats and which contain *Gracilaria* sp. and commercially harvested geoduck;
6. Riprap and filled shoreline along the entire industrial portion of the site;
7. Pilings and dock structures along the industrial portion of the site;
8. Dredged channel environment at the entrance into Port Gamble Bay;
9. Fine grained sand and muddy inter and subtidal habitats along the western shore of Port Gamble Bay, with areas of clam and oyster communities;
10. Extensive intertidal eelgrass beds in high intertidal areas;
11. Pilings and an abandoned dock on the eastern edge of this small embayment; and,
12. Fine grained sand and muddy subtidal substrate with patch subtidal eelgrass and sparse *Gracilaria* sp.

The physical conditions that maintain these various habitat types include alongshore transport of sediment, storm surge and wind waves along the shoreline, and the quiescent water and depositional areas inside of Port Gamble Harbor and adjacent to pilings.

The types of shoreline modifications that can directly or indirectly alter or impact these environments include those that change the amount and location of sedimentation, those that alter the levels of contaminants entering habitats, and those that cause direct disturbance from human use. Specific upland influences include point (i.e. waste-water treatment plants) and non-point source pollution (i.e. stormwater runoff), impervious surface, hardened shorelines and breakwaters, noise, and increased intertidal visits. Nearshore development that could potentially affect nearshore environments would include marinas, boat ramps, boardwalks, and other structures potentially built over water or in-water.

Point Source Pollution: Point source pollution is wastewater that enters a receiving water body from a single point. A good example of this is the Port Gamble Wastewater treatment plant (WWTP). As OPG begins to develop the town site and increase population, the impact of the sewage outfall will increase. Movement of the sewage outfall and improvements to both the outfall and the WWTP will limit impacts and perhaps decrease fees associated with lost geoduck resource. Modifying the sewage treatment system to include a Living System (green-house based system similar to Orion Arks International system created by Dr. John Todd) would limit or eliminate the need for the existing discharge system and reduce or eliminate impacts to shellfish resources. The costs to develop a system of this type would be based upon increased population size. The long term cost savings for upgrades and repairs of the existing system needs to be examined. Additional benefits would include reduction or elimination in the biological oxygen demand of these materials which are likely to be more closely controlled in order to improve conditions in Hood Canal.

Industrial development of the site may also produce new point-source discharges. These discharges would be regulated through the National Pollution Discharge Elimination System and DOE. However, it is worth noting that Port Gamble Bay is quite shallow and circulation in Port Gamble Bay is limited. This is likely to magnify effects of any discharges directly into the Bay.

Non-point Source Pollution: Non-point source pollution includes contaminants to the marine waters that come from more generalize sources, such as stormwater run-off. Stormwater collects nutrients, oil and grease, metals, yard and garden chemicals from paved areas, yards, and pastures, carrying them untreated into receiving waters, such as Hood Canal and Port Gamble Bay. Significant deforestation and increased impervious surface area can result in increased soil erosion, erosion of ravines, bluff failures, and increased suspended sediment in the Bay. Increased suspended sediment affects essential fish habitat and can increase the biological oxygen demand in the bay, reducing dissolved oxygen concentrations. Run-off from residential areas is often enriched with fertilizers and insecticides from lawns and gardens. Once in the Bay or Canal, these chemicals act as they do on land, they fertilize phytoplankton growth and kill marine invertebrates that feed on phytoplankton. The result in decreased water clarity and, when the algae die, decreased dissolved oxygen concentrations. These are both causes of the current problems occurring in Hood Canal.

Under the Clean Water Act, the State of Washington now (as of 2005) requires Phase II Stormwater Permits for less densely populated cities and construction projects (less than one acre). Low impact development can effectively limit stormwater run-off. Low-impact development includes limiting impervious surface, preserving native vegetation, and managing stormwater close to the source. Bioswales, greenbelts with plantings, native plants and soils, and rainwater retention and reuse can all limit stormwater.

Construction on the industrial site behind the rip-rap wall would need to provide collection areas for storm water (change in the pervious portion of site) and collection and treatment of contaminants and sediment that would be washed from the various activities employed on the site. These collection and treatment systems could be simply swales designed to handle peak flows. The swales can also be designed to provide habitat and opportunities for people to view wildlife associated with the swales.

In-water Construction: In water construction includes marina development, dock and boat ramp construction, and breakwater installation. In-water construction may affect marine resources on the Port Gamble site. The industrial site is the most likely location for such construction. This area includes essential fish habitat for salmon, herring, sand lance, surf smelt, rockfish and lingcod. Regulatory limitations on the scope of in-water construction will be based on direct impacts to these marine resources, as well as impacts to eelgrass, herring spawning substrate, and shorelines used by sand lance and surf smelt. The timing of in-water construction will be limited by fish closure windows for surf smelt, sand lance, juvenile salmon, and herring spawning activity. A summary of closures in the Port Gamble area are presented in **Table 1**.

Table 1. Environmental Windows Indicating Closure Periods

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept
Salmonids Hood Canal chum (juv)												
Herring												
Sand Lance												
Surf Smelt												

Additional hardened shoreline and the construction of new breakwaters could dramatically alter the areas of sediment deposition and erosion. This not only affects nearshore habitat, but can result in the support of man-made structures resulting in structural failures. Any new shoreline hardening should consider "soft" structures and take into consideration the implications of altering alongshore flow.

Opening up of the blind, protected area behind the jetty by leaving a small opening at the base would help circulation and flush fine-grained sediment from this area of accumulation. Secondarily, this area could be turned into a marina after removal of pilings that are now dispersed throughout the industrial site. Removal of pilings could be considered a mitigation step for a marina or development on other areas of the property.

Many of the impacts of new construction may be offset by mitigation. Removal of unused pilings and dock structures will likely allow for the development of certain areas. Some of this mitigation can also be considered as restoration and as such may be eligible for certain funding sources. Early coordination with local, State and Federal agencies will increase the possibilities and cooperation in moving these projects forward. Possible funding sources may include DNR, EPA Brownfields, and NOAA Office of Restoration.

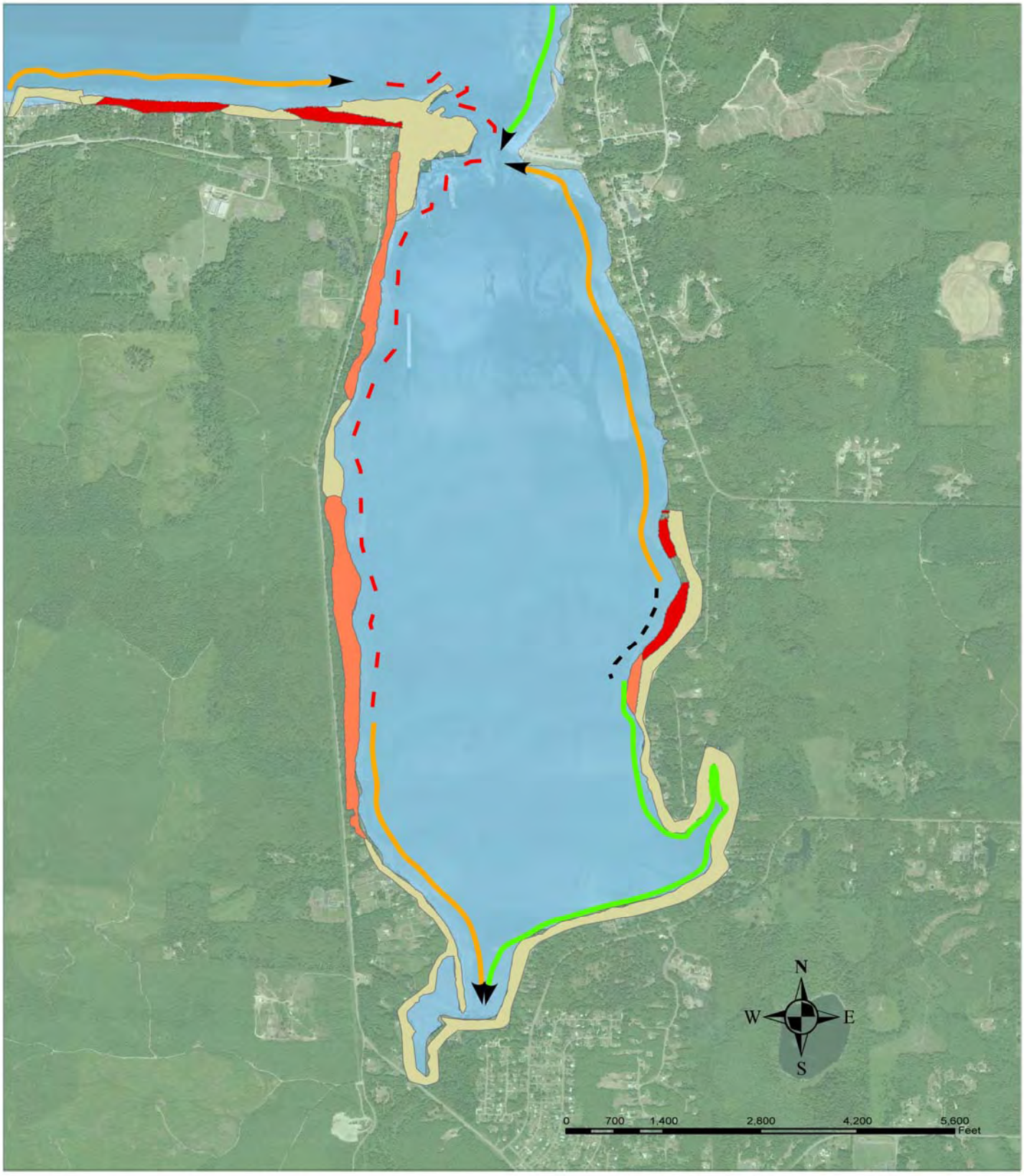
Dredging for in-water construction requires a Nationwide dredging permit. The sediment that is proposed for dredging will need to be evaluated for chemical contamination and possibly biological effects, depending upon the disposal option that is being considered. Much of the costs associated with dredging are related to disposal. However, there may be options for beneficial use of dredged material on site, resulting in substantial cost savings.

Shoreline Visits: To minimize trampling impacts in the intertidal environment designated trails can be developed. Interpretive trails that not only provide shoreline access but highlight different environmental types will act as an attraction, an educational opportunity, and protect the shoreline from trampling. Installation of viewing platforms on both the beach sites and along the bluffs will allow for wildlife viewing opportunities and may mitigate for any lost shoreline access from construction.

There are some funding sources that support nearshore trails and access points. DNR operates the Aquatic Lands Enhancement Account (ALEA) grant program specifically for this purpose.

SEPA Review of Future Development: All nearshore and in-water construction requires review under the State Environmental Protection Act (SEPA). SEPA review includes a number of regulatory agencies, including the US Army Corps of Engineers, WDOE, WDNR, WDFW, and Kitsap County. There may be other agency review required, such as Section 7 consultations with NOAA Fisheries. This is generally determined during the initial SEPA review. In addition, it is likely that a Habitat Management Plan will be required. Although the need for this document may be determined during the SEPA review, it would be prudent to initiate this process prior to SEPA submittal.

The SEPA review will require a detailed understanding of the habitats and habitat utilization of the marine and nearshore areas of the site and how they may be impacted. Likely areas that may be a concern for the SEPA review would be critical habitats (eelgrass, emergent marsh, rocky reef, herring and forage fish spawning substrate) and species of concern (salmonids, herring, forage fish, rockfish, rock sole, bald eagles), as well as other resources species, particularly oysters, clams, and geoduck. In order to determine the nature and extent of impacts from future development, additional information regarding the distribution and health of these habitats and species populations, as well as more specific information regarding the development plans for Port Gamble is required.



Bluffs and Nearshore Drift

- Right to Left
- No Appreciable Drift
- Left to Right
- Divergence Zone

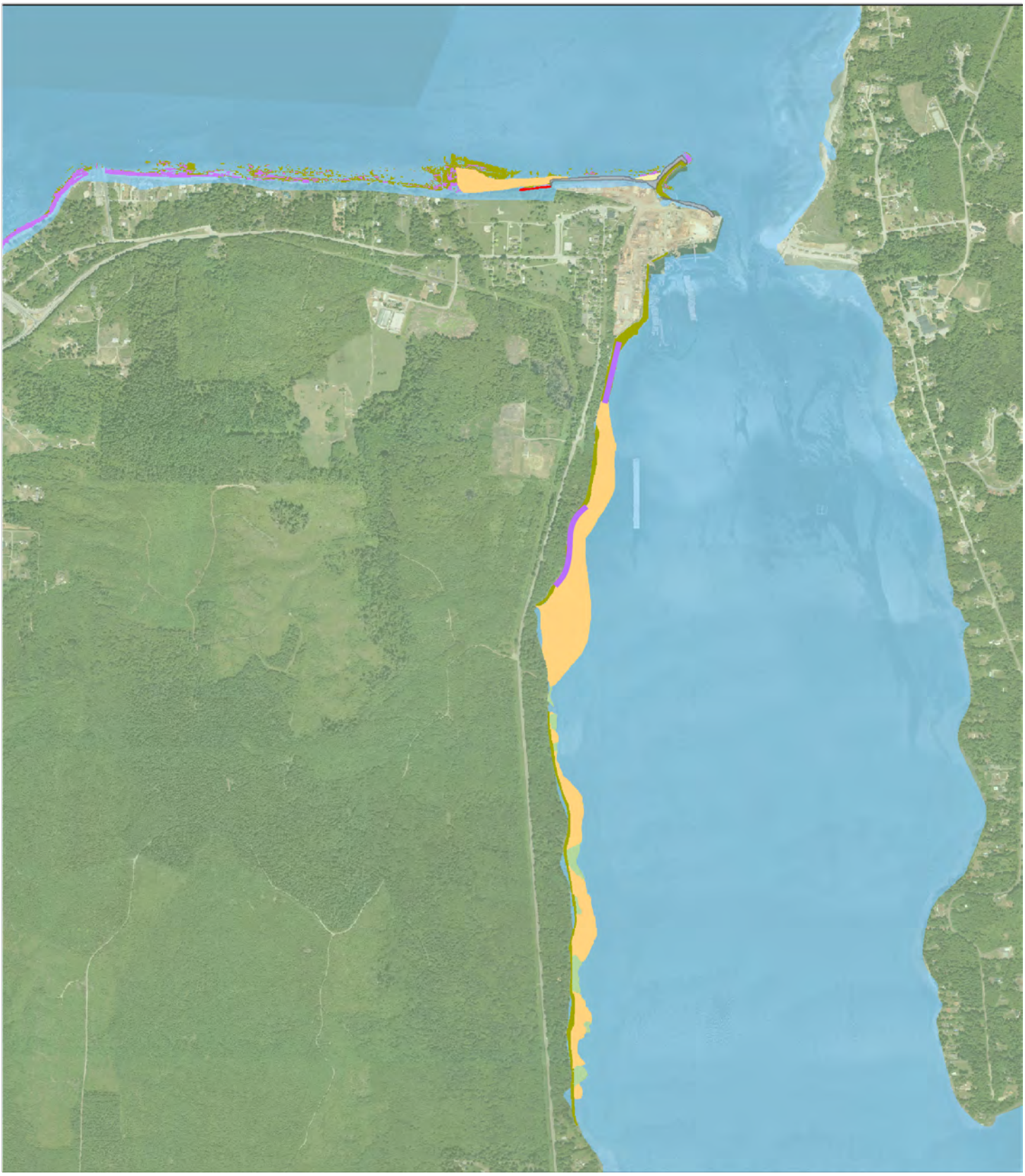
- Modified
- Stable slope
- Intermediate slope
- Unstable slope

- Land
- Water

WESTON SOLUTIONS

Map 1

Map Datum: NAD 1983
Map Coordinate System: Washington State Plane N FIPS 4601
Map Projection: Lambert Conical
Base Map Data: DIAS Imagery; DNR
Attribute Data: WDOE
Created by: Ryan Ericson
Date Created: October 2005



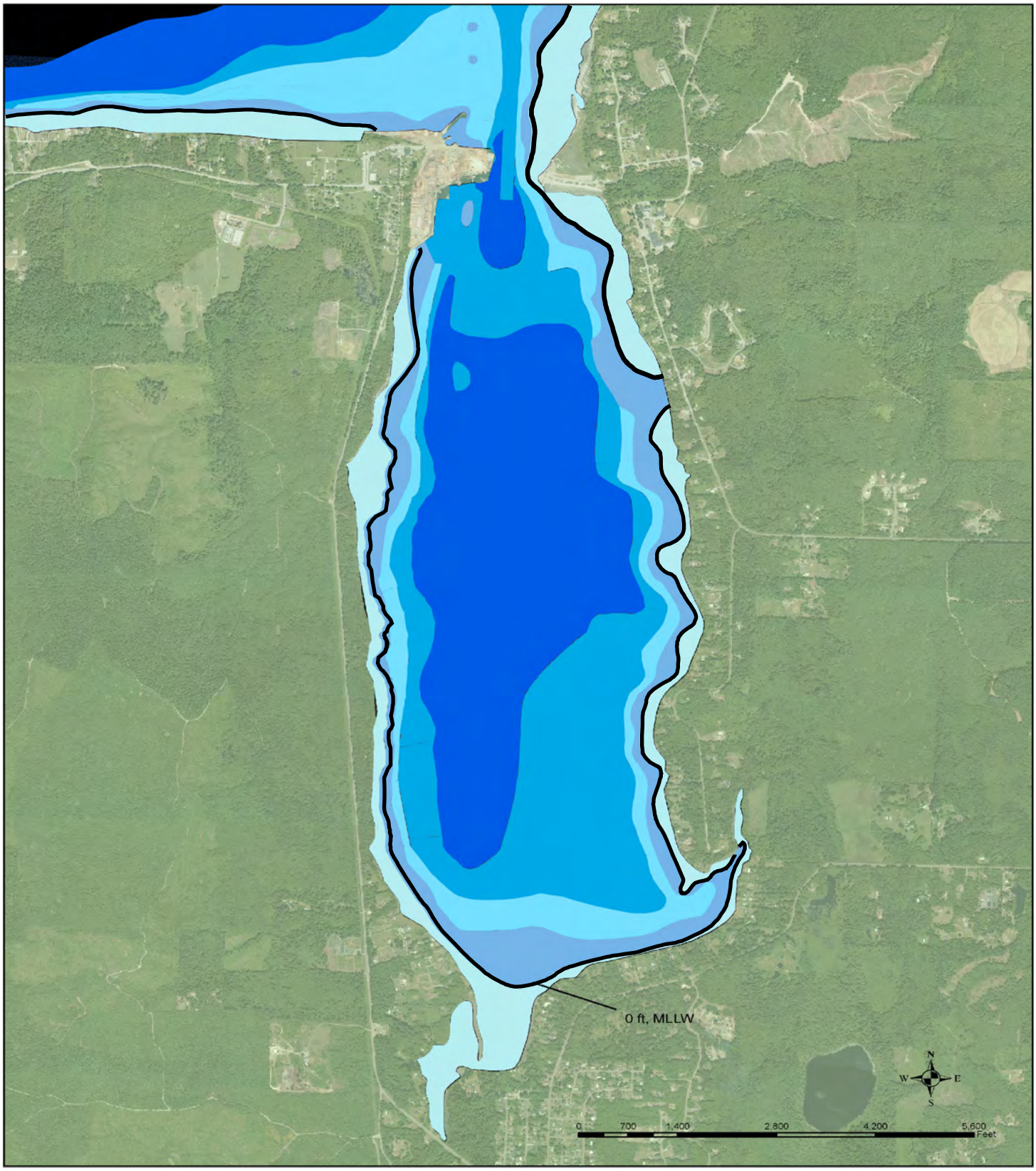
Substrate

- Med-Coarse Sand
- Emergent Marsh
- Mud/Fine Sand
- Sand
- Gravel / Cobble
- Sand/Gravel
- RipRap

WESTON SOLUTIONS

Map 2

Map Datum: NAD 1983
Map Coordinate System: Washington State Plane N FIPS 4601
Map Projection: Lambert Conical
Base Map Data: DIAS Imagery; DNR
Attribute Data: WDFW, PNPTC, Weston
Created by: Ryan Ericson
Date Created: October 2005



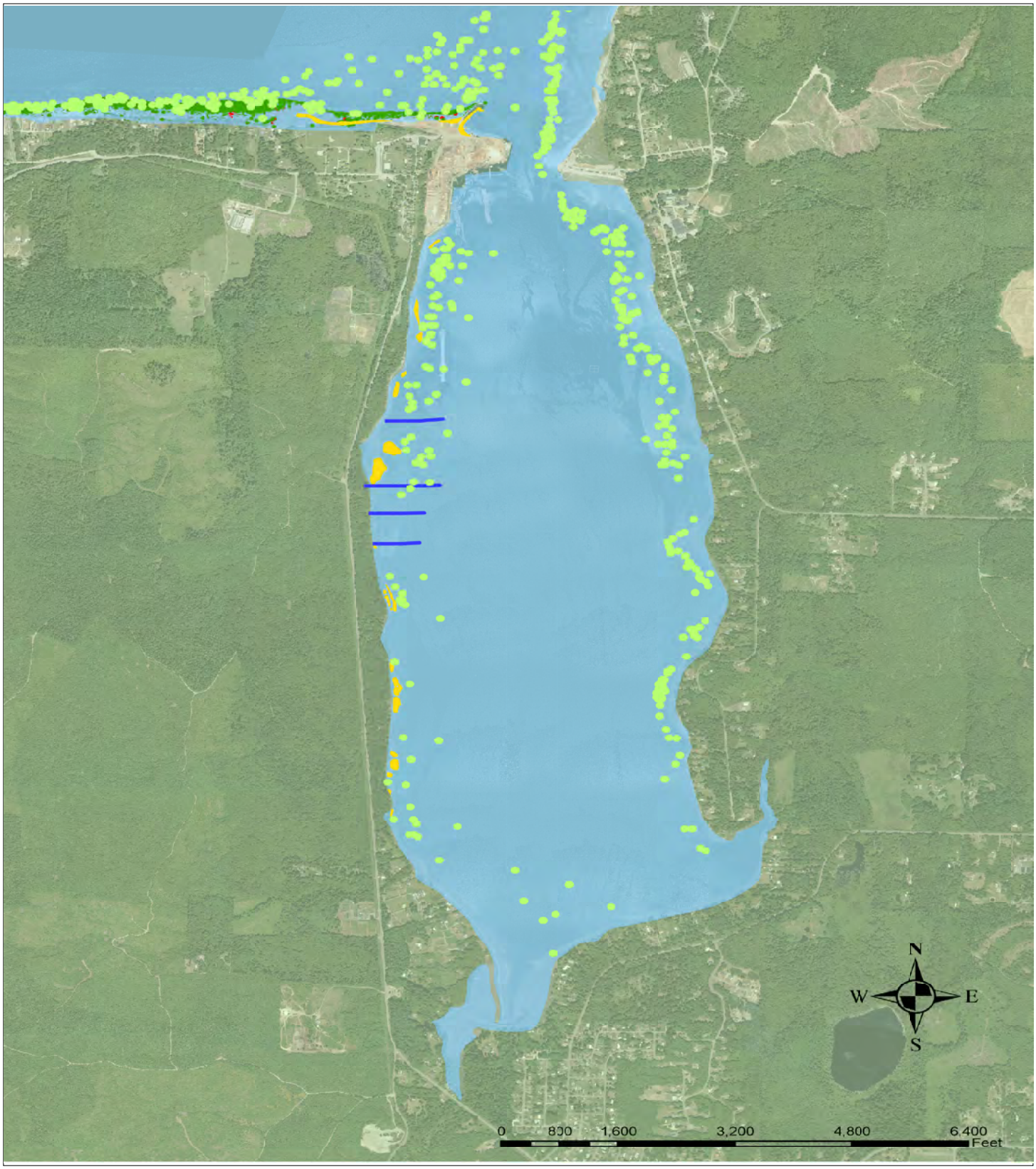
Bathymetery (Ft)

-2.7 - -0.0	16.2 - 27.2
0.0 - 5.4	27.2 - 91.0
5.4 - 16.2	

WESTON SOLUTIONS

Map 3

Map Datum: NAD 1983
Map Coordinate System: Washington State Plane N FIPS 4601
Map Projection: Lambert Conical
Base Map Data: DIAS Imagery; DNR
Attribute Data: NOAA Chart 18477
Created by: Ryan Ericson
Date Created: October 2005



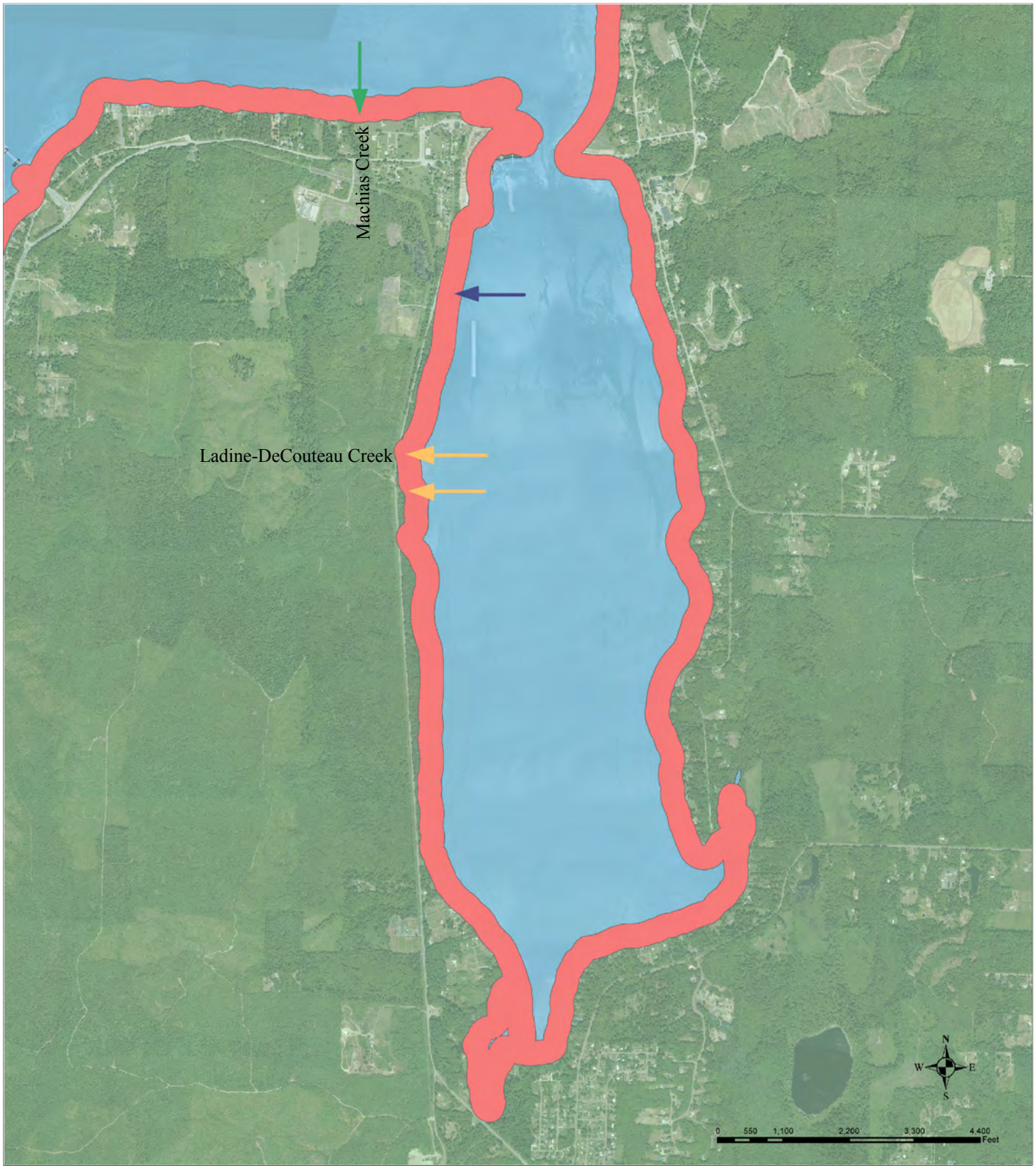
Eelgrass Distribution, 2001-2005

- *Z. japonica*
- Dense *Z. marina*
- Sparse *Z. marina*
- Present
- Dive Survey

WESTON SOLUTIONS

Map 4

Map Datum: NAD 1983
Map Coordinate System: Washington State Plane N FIPS 4601
Map Projection: Lambert Conical
Base Map Data: DIAS Imagery; DNR
Attribute Data: WDFW, PNPT
Created by: Ryan Ericson
Date Created: October 2005



Salmon Habitat Protection Zones

- Class 1 Wildlife Conservation Area
- Salmon Bearing Creek / Partial Obstruction
- Salmon Bearing Creek
- Non-Salmon Bearing Stream
- Land
- Water

WESTON SOLUTIONS

Map 5

Map Datum: NAD 1983
Map Coordinate System: Washington State Plane N FIPS 4601
Map Projection: Lambert Conical
Base Map Data: DIAS Imagery; DNR
Attribute Data: WDFW
Created by: Ryan Ericson
Date Created: October 2005

Herring Spawn Stations, 2001 - 2005

Stations

WESTON SOLUTIONS

Map 6a

Map Datum: NAD 1983
Map Coordinate System: Washington State Plane N FIPS 4601
Map Projection: Lambert Conical
Base Map Data: DIAS Imagery; DNR
Attribute Data: WDFW
Created by: Ryan Ericson
Date Created: October 2005

Herring Spawning Intensity

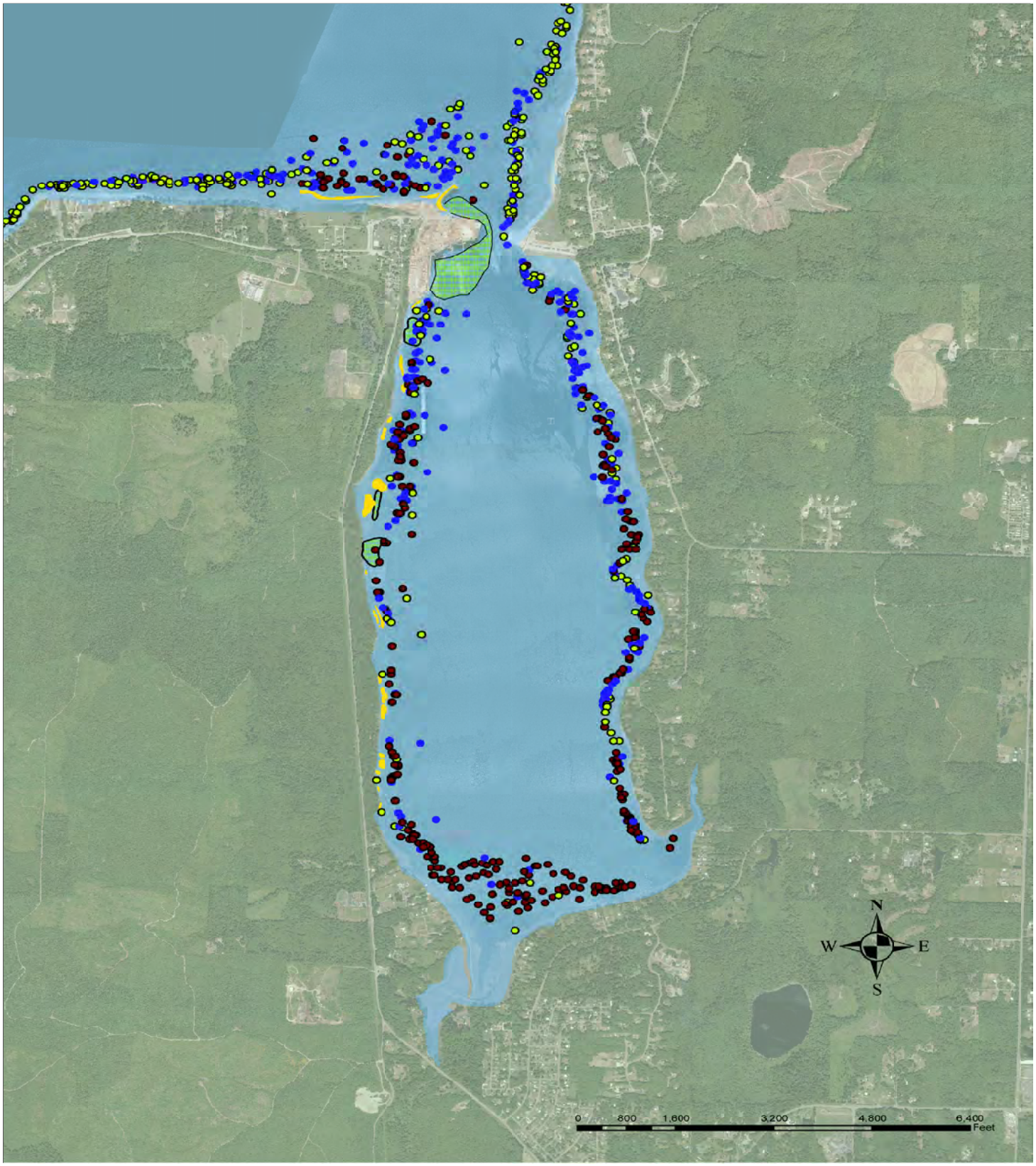
- Trace / Low
- Low / Medium
- Medium
- High

No data

WESTON SOLUTIONS

Map 6b

Map Datum: NAD 1983
Map Coordinate System: Washington State Plane N FIPS 4601
Map Projection: Lambert Conical
Base Map Data: DIAS Imagery; DNR
Attribute Data: WDFW
Created by: Ryan Ericson
Date Created: October 2005



Herring Substrate, 2001-2005

- Eelgrass
- Eelgrass/Gracilaria
- Gracilaria
- Intertidal Eelgrass
- Man-Made Spawning Substrate

WESTON SOLUTIONS

Map 7

Map Datum: NAD 1983
Map Coordinate System: Washington State Plane N FIPS 4601
Map Projection: Lambert Conical
Base Map Data: DIAS Imagery; DNR
Attribute Data: WDFW, Weston
Created by: Ryan Ericson
Date Created: October 2005

Sand Lance Spawning Beaches

Documented Spawning Sites

WESTON SOLUTIONS

Map 8

Map Datum: NAD 1983
Map Coordinate System: Washington State Plane N FIPS 4601
Map Projection: Lambert Conical
Base Map Data: DIAS Imagery; DNR
Attribute Data: WDFW
Created by: Ryan Ericson
Date Created: October 2005

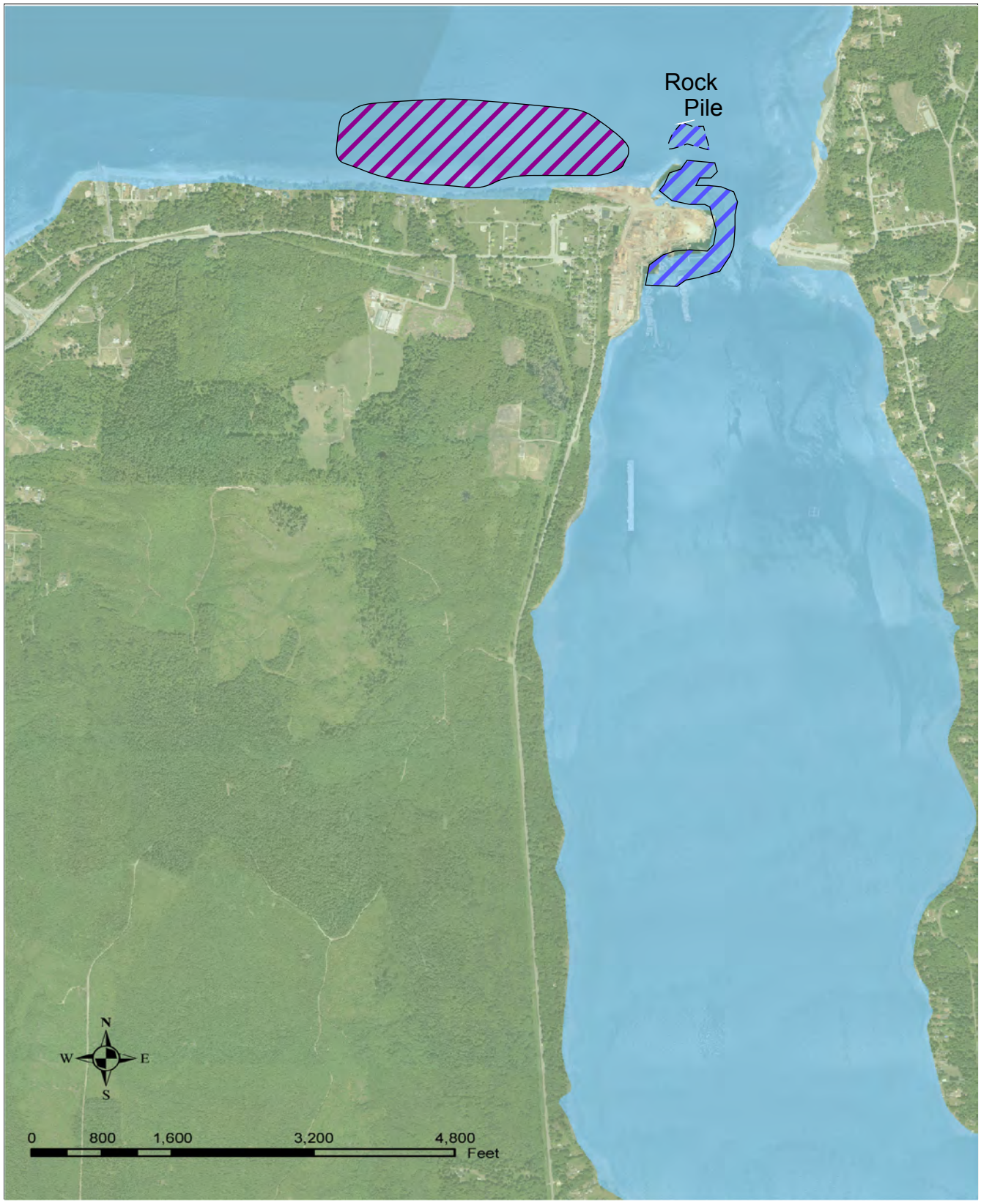
Surf Smelt Spawning Beaches

Spawning Sites

WESTON SOLUTIONS

Map 9

Map Datum: NAD 1983
Map Coordinate System: Washington State Plane N FIPS 4601
Map Projection: Lambert Conical
Base Map Data: DIAS Imagery; DNR
Attribute Data: WDFW
Created by: Ryan Ericson
Date Created: October 2005



Rocky Habitat

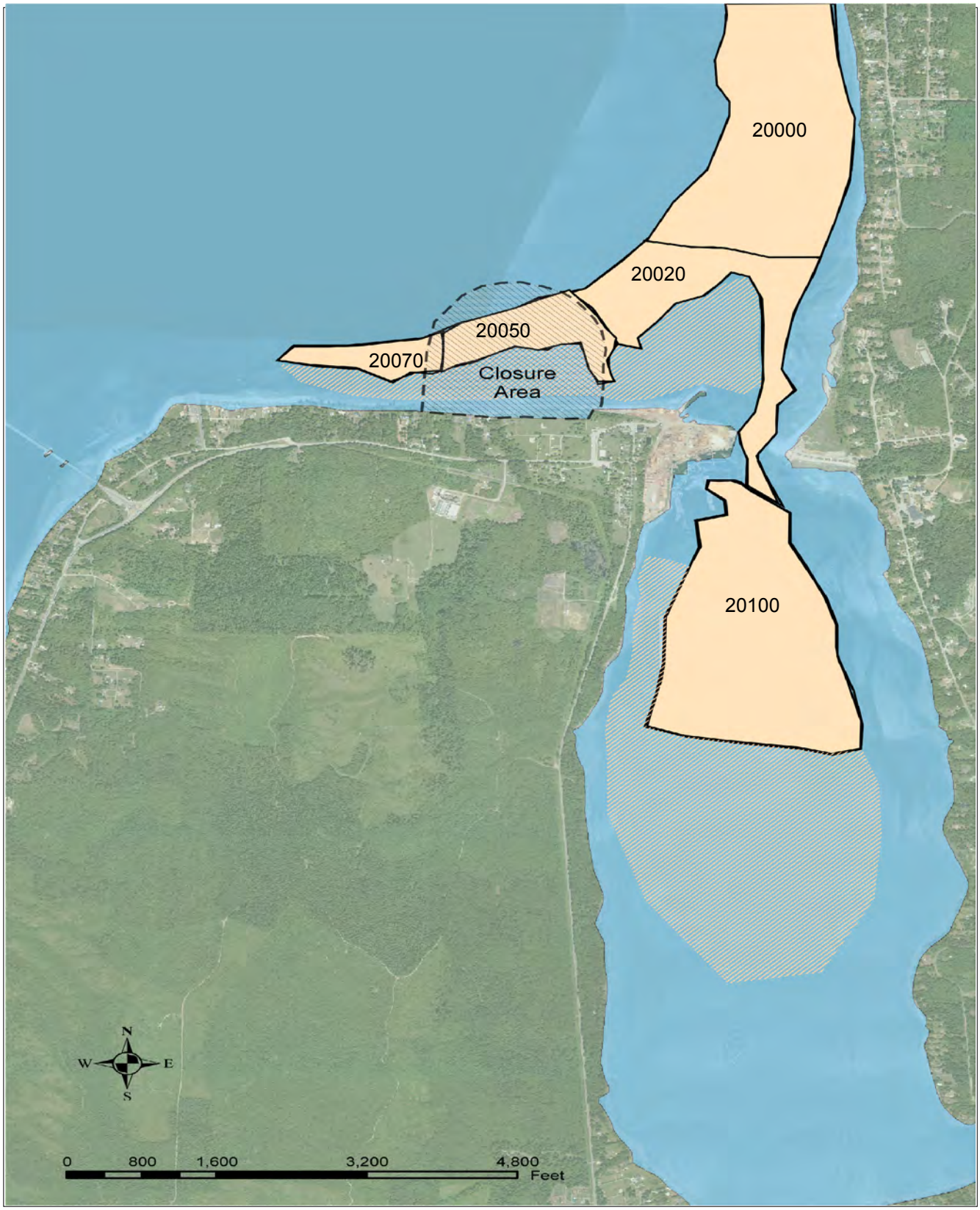
Adult Rockfish

Juvenile Rockfish

WESTON SOLUTIONS

Map 10

Map Datum: NAD 1983
Map Coordinate System: Washington State Plane N FIPS 4601
Map Projection: Lambert Conical
Base Map Data: DIAS Imagery; DNR
Attribute Data: WDFW
Created by: Ryan Ericson
Date Created: October 2005



Geoduck Bed Distribution

Commercial Geoduck Bed

Presumed Geoduck Bed

WESTON SOLUTIONS

Map 11

Map Datum: NAD 1983
Map Coordinate System: Washington State Plane N FIPS 4601
Map Projection: Lambert Conical
Base Map Data: DIAS Imagery; DNR
Attribute Data: WDOE, Pyramid Engineering
Created by: Ryan Ericson
Date Created: October 2005

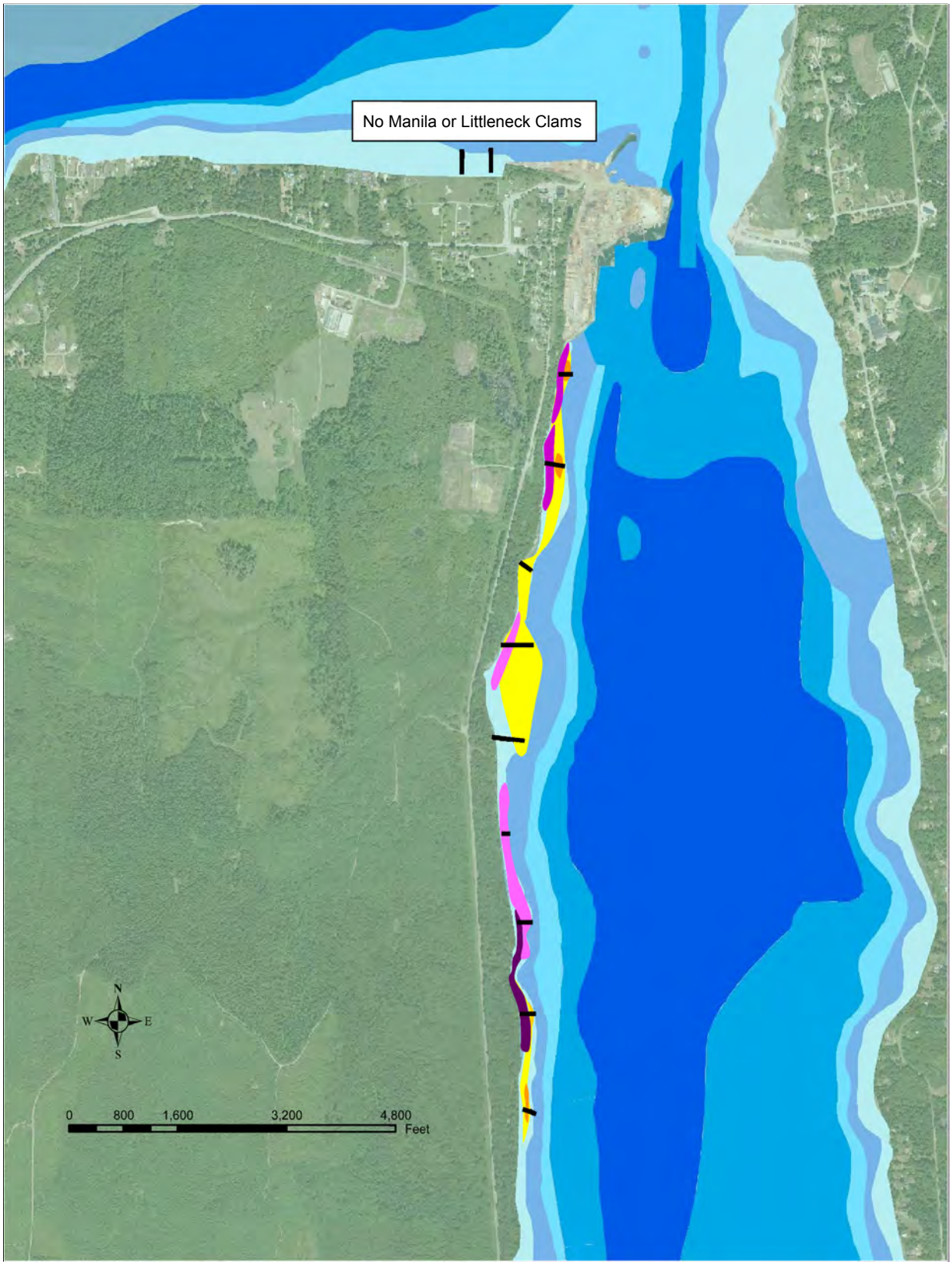
Potential Geoduck Aquaculture

Potential Geoduck Beds

WESTON SOLUTIONS

Map 12

Map Datum: NAD 1983
Map Coordinate System: Washington State Plane N FIPS 4601
Map Projection: Lambert Conical
Base Map Data: DIAS Imagery; DNR
Attribute Data: Weston
Created by: Ryan Ericson
Date Created: October 2005



Clam Distribution

Japanese Littleneck (m^2)

- 0 - 10
- 11 - 20
- 21 - 30
- 31+

Native Littleneck (m^2)

- 0 - 10
- 11 - 20

WESTON SOLUTIONS

Map 13

Map Datum: NAD 1983
Map Coordinate System: Washington State Plane N FIPS 4601
Map Projection: Lambert Conical
Base Map Data: DIAS Imagery; DNR
Attribute Data: Weston
Created by: Ryan Ericson
Date Created: October 2005

Oyster Distribution

Dense Oyster Area

WESTON SOLUTIONS

Map 14

Map Datum: NAD 1983
Map Coordinate System: Washington State Plane N FIPS 4601
Map Projection: Lambert Conical
Base Map Data: DIAS Imagery; DNR
Attribute Data: Weston
Created by: Ryan Ericson
Date Created: October 2005

Marine Mammal Haul Out Sites

Group Size

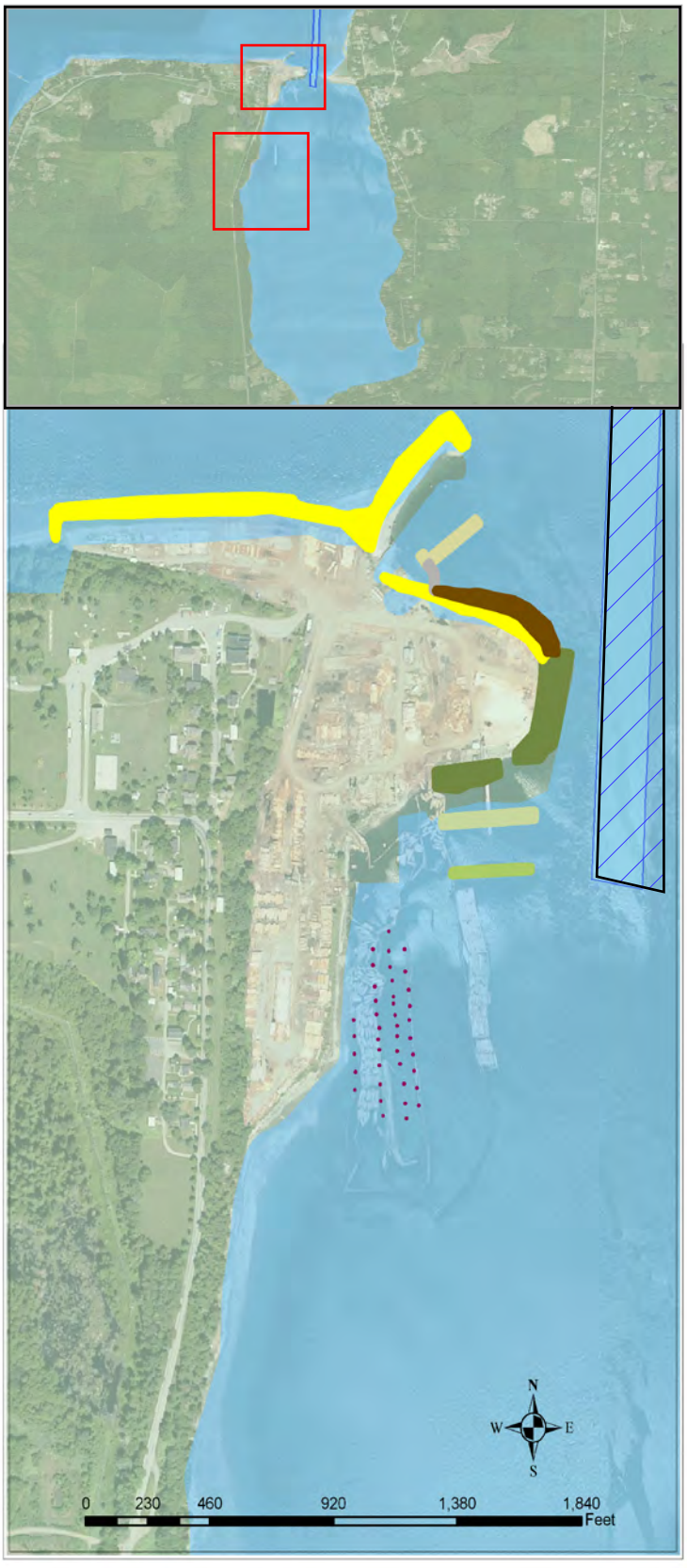
Less than 100

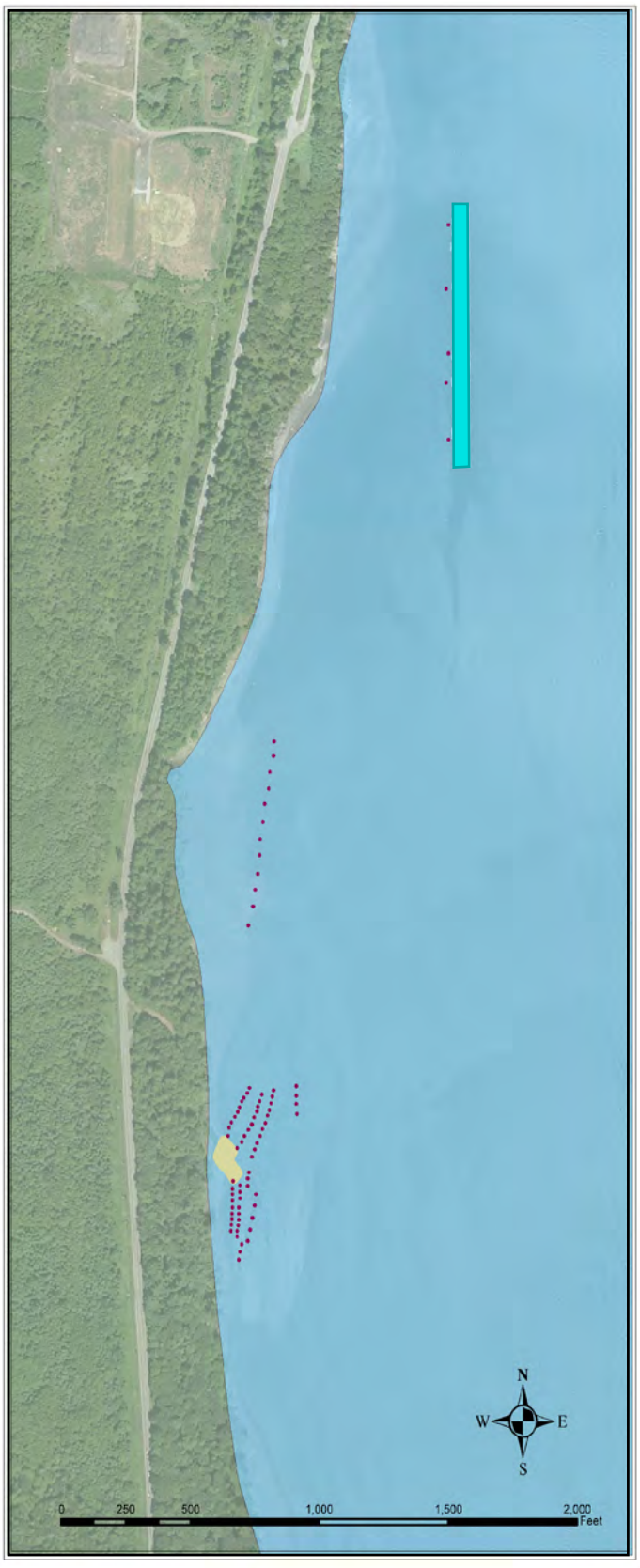
Greater than 500

WESTON SOLUTIONS

Map 15

Map Datum: NAD 1983
Map Coordinate System: Washington State Plane N FIPS 4601
Map Projection: Lambert Conical
Base Map Data: DIAS Imagery; DNR
Attribute Data: WDFW
Created by: Ryan Ericson
Date Created: October 2005





Piers and Wharfs

- Breakwater (wood)
- Pier
- Dense Piling Group
- Gangway
- Pilings
- RipRap
- Wharf
- Dredge Area
- Floating Bridge Span

WESTON SOLUTIONS

Map 16

Map Datum: NAD 1983
Map Coordinate System: Washington State Plane N FIPS 4601
Map Projection: Lambert Conical
Base Map Data: DIAS Imagery; DNR
Attribute Data: Weston
Created by: Ryan Ericson
Date Created: October 2005