

San Juan County Best Available Science for Critical Areas

March 2008 Draft



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ACRONYMNS and ABBREVIATIONS

BAS – Best Available Science
 BMP's – Best Management Practices
 CAO Critical areas ordinance
 CARA – Critical Aquifer Recharge Area
 CD&P – San Juan County Community Development and Planning Department
 CTED – Washington State Department of Community Trade and Economic Development
 dbh – diameter at breast height
 DNR – Washington Department of Natural Resources
 Ecology – Washington State Department of Ecology
 EPA - U.S. Environmental Protection Agency
 ESU - Evolutionarily Significant Unit
 FWHCA -Fish and Wildlife Habitat Conservation Area
 GMA – Washington State Growth Management Act
 H&CS - San Juan County Health and Community Services Department
 LID – Low Impact Development
 LWD Large Woody Debris
 mg/l – milligrams per liter
 MLLW – Mean Lower Low Water
 MSA – Marine Stewardship Area
 NRCA – Natural Resources Conservation Area
 NPDES - National Pollution Discharge Elimination System
 OHWM – Ordinary High Water Mark
 OSS - on-site sewage system
 ppm – part per million
 RCW - Revised Code of Washington
 SJCC - San Juan County Code
 UIC – Underground Injection Control
 UGA – Urban Growth Area
 USACE - United States Army Corps of Engineers
 USFWS - U.S. Fish and Wildlife Service
 WAC - Washington Administrative Code
 WDFW - Washington Department of Fish and Wildlife
 WDNR – Washington Department of Natural Resources
 WNHP – Department of Natural Resources Natural Heritage Program

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CHAPTER 1

INTRODUCTION AND BACKGROUND

INTRODUCTION

In 1990 the Washington State Legislature adopted the Growth Management Act (GMA). This statute mandates that local jurisdictions adopt policies or regulations that protect the ecological functions and human values of Critical Areas. Critical Areas include Critical Aquifer Recharge Areas (CARAs), Frequently Flooded Areas, Geologically Hazardous Areas, Wetlands, and Fish and Wildlife Habitat Conservation Areas. Local governments are not required to protect the functions and values of all Critical Areas, but are required to achieve “no net loss” of the functions and values. Local governments are also required to develop regulations that reduce the risks associated with geologically hazardous and frequently flooded areas.

In 1995, the Washington State legislature amended the GMA to require that local governments consider the Best Available Science (BAS) in designating and protecting Critical Areas (RCW § 36.70A.172(1)). In 2000 the State Office of Community Trade and Economic Development (CTED) adopted procedural criteria to implement these changes and provided guidance for identifying BAS¹. According to this guidance, BAS means current scientific information derived from research, monitoring, inventory, survey, modeling, assessment, synthesis, and expert opinion that is:

- Logical and reasonable
- Based on quantitative analysis
- Peer reviewed
- Used in the appropriate context
- Based on accepted methods
- Well referenced

COORDINATION WITH SHORELINE MASTER PROGRAM

Although Critical Areas in shorelines are initially to be identified and protected under the GMA in other sections of County Code, those protections are to be transferred to the County’s Shoreline Master Program when it is updated in accordance with Ecology’s current shoreline guidelines. In the mean time, management of Critical Areas within the shoreline must be consistent with current shoreline management policies and requirements. These include:

- a) When part of a Critical Area lies within the County’s shoreline jurisdiction and part lies without, the entire Critical Area and its buffers must be protected under one or both sections of County Code (Ecology/CTED, 2004).
- b) The shoreline guidelines define critical saltwater habitats to include all kelp beds, eelgrass beds, spawning and holding areas for forage fish, such as herring, smelt and sand lance, subsistence, commercial and recreational shellfish beds, mudflats, intertidal habitats with vascular plants, and areas with which priority species have a primary association. These areas must be protected as Critical Areas.

¹ Washington Administrative Code (WAC) 365-195-900 through 925

c) Shoreline critical freshwater habitats include those portions of streams, rivers, wetlands, and lakes, their associated channel migration zones, and flood plains that lie within the shoreline jurisdiction. [WAC 173-26-221(2)(c)(iii)(A) and (iv)(A)]. These areas must also be protected as Critical Areas.

d) The objectives of shoreline management provisions for critical areas “shall be the protection of existing ecological functions and ecosystem-wide processes and restoration of degraded ecological functions and ecosystem-wide processes” [173-26-221(2)(B)(iv)].

e) To comply with the new shoreline guidelines, future residential development must be located and designed to avoid the need for shoreline armoring, and stabilization measures for existing homes should not be allowed unless there is “conclusive evidence, documented by a geo-technical analysis, that the structure is in danger from shoreline erosion caused by tidal action, currents, or waves.” [WAC 173-26-231 (3)(a)(iii)]. Stabilization measures for existing homes should not be allowed unless all the conditions below apply:

- The erosion is not being caused by upland conditions, such as the loss of vegetation and drainage.
- Nonstructural measures, such as placing the development further from the shoreline, planting vegetation, or installing on-site drainage improvements, are not feasible or not sufficient.
- The need to protect primary structures from damage due to erosion is demonstrated through a geotechnical report. The damage must be caused by natural processes, such as tidal action, currents, and waves.
- The erosion control structure will not result in a net loss of shoreline ecological functions.

f) When the Shoreline Master Program is updated, County policies and regulations must identify and address cumulative impacts of all new shoreline development. New development in shoreline areas will either avoid new impacts or provide mitigation sufficient to achieve “no net loss of shoreline ecological functions”. “To comply with the general obligation to assure no net loss of shoreline ecological function, the *process* of developing the policies and regulations of a shoreline master program requires *assessment* of how proposed policies and regulations cause and avoid such cumulative impacts.” (emphasis added) [WAC 173-26-201(3)(d)(iii)]

g) When the Shoreline Master Program is updated the County must identify ecologically degraded shorelines and develop and implement a plan to restore and achieve overall improvements in shoreline ecological functions (WAC 173.26.186(8)(c) and WAC 173-26-201 (2)(f)). (“Ecological functions” is defined as the role played by the physical, chemical, and biological processes that create and maintain shoreline environments that make up the shoreline’s natural ecosystem).

This document includes summaries of the science related to Critical Areas in San Juan County, evaluations of existing programs and regulations, management options the County might employ to better protect these areas and relevant citations of Growth Management Hearings Board and Court decisions. This information will be used in selecting actions, including regulatory changes that are suitable for San Juan County. At a minimum, the County must integrate Critical Area protections into zoning regulations, clearing and grading provisions, stormwater management requirements, subdivisions regulations, and eventually the Shoreline Master Program.

This report was prepared by staff and reviewed by technical experts including those from federal, state, tribal and local agencies. Comments will also be solicited from the public and from the County’s advisory committees including the Critical Areas Ordinance Citizen Review Committee, Water Resources Committee, and Marine Resources Committee.

COUNTY SETTING

San Juan County is located in the northwestern portion of Washington State between the mainland of Washington and Vancouver Island, Canada. The County consists of 428 islands (those exposed at high tide) that are part of the San Juan archipelago, with a total land area of 172 square miles and a total of 408 miles of shoreline, more than any other county in the nation. The islands that make up the County range in size from 36,432 acres to considerably less than one acre. Many of the smaller islands are uninhabitable or are in public ownership; fewer than fifty are potentially available for private development. Only the four largest islands are served by the Washington State Ferry System: Orcas (36,432 acres), San Juan Island (35,448 acres), Lopez (18,847 acres), and Shaw (4,937 acres). The topography of individual islands varies. Orcas Island has the greatest relief, with land-surface altitudes ranging from sea level to 2,407 feet with seven peaks higher than 1,000 feet above sea level. Water catchment areas on the islands are small, streams are primarily intermittent and the freshwater habitat is conducive to limited spawning of salmonids. The freshwater-seawater interface however, supports an abundant environment for young, migrating salmon (SJ County, 2004)

According to the Washington State Office of Financial Management, San Juan County's year-round population is just under 16,000 making it thirty-second overall out of the 39 counties in the State. The population density in the County is approximately 89 people per square mile, 10th among Washington counties. The County is experiencing rapid growth, with a population increase of 40% between 1990 and 2000, ranking number 2 in the State. These numbers do not account for increases in non-resident and summer transient populations which peak in July and August. The summer population is generally three to four times the winter resident population. County population is expected to grow at 2.2 – 2.4% per year through 2015.

Most of the County is rural in nature, with 75% of the population living outside the “urban” areas of Friday Harbor, Eastsound and Lopez Village. The Town of Friday Harbor on San Juan Island is the only incorporated municipality, with a population of 2,220. Rural residential development is concentrated along the shoreline in small subdivisions, villages, hamlets and resorts including Rosario and Roche Harbor Resorts, Orcas Village, Doe Bay, Olga, Deer Harbor, Westsound, and North Rosario.

The economy of San Juan County is driven by residential and commercial construction, particularly the construction of summer homes. Regardless of whether business owners have a personal interest in environmental protection, many of their livelihoods depend on the health of the area's ecosystems, benefiting and even relying on the high quality of the environment to succeed. Demographically the islands amount to one large resort, with many residents who do not depend on the economy of the islands for their sustenance; investment income makes up 46% of the total income, while wage and salary is only 27%. Excluding government, average pay in all the top employment sectors is quite low. Many of those who work for a living do so in low wage occupations with no readily apparent wage premium for working in what is clearly a high cost county. (Barney and Worth, 2007).

The lack of affordable housing in the County is a significant problem. Between 2001 and 2006 the median home price rose 165% compared to 61% in the rest of Washington State. The affordability index is 37 (22 for first time buyers) which is the lowest in the State. 100 is the level at which a typical family can buy a median priced home (San Juan County, 2007). A 2003 survey by the Community Land Trust Alliance of the San Juan Islands found that 18% of respondents did not anticipate being able to find market price housing that would meet their needs and that they could afford. Based on this survey, 111 households in the very low, low, and moderate income households are seeking affordable housing now, an additional 114 will be looking within the next two years, and another 168 will be in need of housing in the next 2-5 years (CLTA, 2003). According to the Town of Friday Harbor's 2002 housing report they also need 189 units of affordable housing.

In recent years, the County has struggled to deal with the rapid pace of growth, the requirements of the Growth Management Act (GMA), and community expectations for services. Revenue is subject to voter imposed limitations and the situation is exacerbated by high staff turnover and chronic staff shortages due in part to the high cost of housing. Past planning efforts have identified actions needed to better protect critical areas, but without adequate staff and funding many of these recommendations were never implemented. Because the County is not in compliance with GMA, they are not eligible for State grants from the Centennial Clean Water and Public Works Trust funds, and the funds that are available are often earmarked for remediation of degraded areas, rather than protection of good habitat such as that found in San Juan County. Even when the County is eligible for grants, they have difficulty competing with the larger, more sophisticated jurisdictions. This report will include more detailed evaluations of the regulations and programs that apply to each of the five critical areas, but County resources and the capacity to act are factors that must be considered if effective protection mechanisms are to be developed.

History

The San Juan and Gulf islands have been seasonally occupied by Central Coast Salish tribes from approximately 5000 years ago through the eighteenth century. The Songhees, Saanich, Lummi, and Samish all had winter villages in the southern Gulf and San Juan islands, as well as many permanent structures for other seasons (SJ County, 2000, from Suttles 1990). The seasonal and local availability of fish had a great impact on population movements and settlement patterns of local Indian tribes. During summer months, populations commonly disbanded and dispersed to locations where food was available. Small units of people left their winter villages and migrated to optimal fishing and plant gathering areas, where they resided in temporary lodges. It is thought that Native Americans influenced native grasslands and oak woodlands through the use of fire (San Juan County, 2000 from Agee and Dunwiddie 1984). The population of native peoples of the San Juan islands declined by over 80 percent within 100 years of the arrival of Europeans in 1774, due to the introduction of disease and the subsequent political removal of these peoples to mainland reservations.

European settlement of the islands began in 1850, when the Hudson's Bay Company established a fish-salting station at Salmon Banks on the southern tip of San Juan Island. Bellevue Farm was established in 1853 as an agricultural station with over 4000 head of livestock. By the time American troops arrived on southern San Juan Island in 1859, native grasslands were already disturbed by the extensive grazing activities. Until 1872, the San Juan Islands were claimed both by the United States and Great Britain. Military forces from both countries jointly occupied the islands until October 1872, when the San Juans became a part of the United States. Within 20 years settlers had spread to Lopez, Shaw, Orcas, Decatur, and Blakely islands, raising sheep, cattle, and poultry on small subsistence farms. Sheep farming was the most important livestock industry on the islands. Vegetables and fruits were also grown for markets on the mainland.

Extensive logging at the beginning of the 20th century removed all old growth and valuable timber on most of the islands. Establishment of the local lime industry also consumed great amounts of wood to run kilns, as well as young trees to make barrels for the lime. The lime company at Roche Harbor continued to operate until 1956. Quarrying activities for sandstone used for streets in Seattle were extensive on Waldron, Sucia, and Stuart Islands. Fishing was a major industry in the islands, with canneries located at Friday Harbor and Deer Harbor. The collapse of the herring fishery, as well as the virtual shutdown of commercial salmon fishing due to population declines, brought an end to the natural resource based economy that supported the island population in the past.

Climate

The maritime climate of San Juan County is typified by cool, dry summers and mild, moderately wet winters. The islands are located in a rain shadow on the leeward side of the Olympic Mountains resulting in much less precipitation than other parts of western Washington. Precipitation at sea level increases from south to north as the rain shadow influence dissipates. In the southern part of the

County, precipitation at low to moderate altitudes ranges from about 26 inches to about 35 inches, and is about 48 inches at the highest land surface altitudes on Orcas Island. Snowfall is not a significant factor in the San Juan Islands. (USGS, 2002)

The maritime air surrounding the islands moderates the climate. Summers are relatively short, cool and dry, and winters are mild and moderately dry when compared to other portions of the Puget Sound. The average high temperature in summer is 65° F, and the average low in winter is 40° F, though there may be cold periods when arctic air funnels down the Fraser River Valley from Canada.

On a global scale, scientists have widely and conclusively determined that global warming is occurring, and that it is contributing to a significant increase in sea level due to thermal expansion of ocean waters and melting of glaciers and ice fields (NWF, 2007). In the Puget Sound, the sinking of tectonic plates, combined with rising sea levels is expected to result in from 1 to 5 inches of sea level rise per decade (Ecology, 2006). Global climate change and the associated rise in sea level may affect critical areas by exacerbating seawater intrusion into groundwater, encroaching on shoreline development and changing shoreline habitat.

Geology

Geologically the San Juans are a kind of separate world, related to surrounding regions but sufficiently apart from mainland Washington and Vancouver Island so that it has its own stratigraphic section and formation names (Bates). Bedrock geology dominates the landscape, and surface elevations range from sea level to 2,407 feet at the summit of Mt. Constitution on Orcas Island. Two distinct types of geologic landforms occur in the San Juans. The first consists of bedrock domes thinly covered with late Quaternary (glacial) sediments commonly found on San Juan, Shaw, and Cypress Islands (which is in Skagit County). The second type, found on Lopez, Waldron, and Decatur, is composed of bedrock buried beneath sediments more than 300 feet thick in places. However, neither formation is exclusive to any single island. Portions of Orcas, Lopez, and Waldron have surface exposures of bedrock, and parts of Orcas and San Juan have thick glacial deposits. (White 1994)

Prior to glaciation, this region of the coastline was augmented by small micro-continents traveling eastward on the Juan de Fuca plate. As these landmasses impacted the main N. American continent, they were squished, squeezed and "accreted" onto the coastline. The resulting structural geology is a complex combination of overlapping thrust faults along tectonic lenses and plates (SJ County, 2000, from Brandon et al 1988). These thrust systems include Paleozoic volcanic arc rocks, Mesozoic pillow basalts, limestones, cherts, high-pressure metamorphics and clastics.

Repeated glaciations during the last ice age shaped the bedrock and developed the rugged landscape of the islands. The region was scoured by a blanket of ice as much as a mile thick which carved out marine channels, creating the scenic beauty for which San Juan County is world renowned. As the glaciers advanced from north to south they created numerous bays and waterways including San Juan Channel, West Sound, East Sound and Lopez Sound. Higher elevations of bedrock were carved, scraped, and rounded. When the glaciers began melting the resulting debris was left behind, blanketing low-lying areas with unconsolidated glacial deposits of clay, silt, sand, gravel, and boulders.

In the San Juans, glacial and interglacial deposits are relatively thin when compared to other areas in Puget Sound where this type of deposition may be several thousand feet thick. Contour maps of sediment thickness generated from county well logs by White (1994) show most of the San Juans to have less than 20 feet of sediment cover. This thickness, compared to the Quaternary sediment layers in other parts of the Puget Lowland, is miniscule, and reflects the role that the bedrock elevations played in the glacial history of the islands. Glacial sediment distribution in the County varies greatly, with large pockets scattered at random in low-lying areas and little or no sediment found

elsewhere. The two largest concentrations of sediment are located on Lopez and Orcas, where sections extend below sea level.

Hydrology

The islands are composed of varying thicknesses of glacial deposits that overlie, to varying extents, a complex of metamorphosed sedimentary and volcanic bedrock. (Russell, 1975; Brandon et al, 1988). Most streams are intermittent and are usually dry between June and late October or November. The glacial deposits, when saturated, generally yield large quantities of water to wells; the bedrock generally yields only small quantities, usually sufficient only for single family domestic use. Most of the bedrock is nonporous and water occurs primarily in joints and fractures. Because most areas are not overlain by sufficient thicknesses of glacial deposits, most wells produce water from bedrock. (USGS, 2002) About 80 % of Lopez Island is overlain by saturated glacial deposits with thicknesses of as much as 250 feet. About 40% of San Juan Island is overlain by glacial deposits, but only as thin, discontinuous sheets, with thicknesses generally less than 30 feet. Although much of the glacial deposits on San Juan Island is not saturated, the extreme southern part is overlain by relatively thick, saturated glacial deposits, as much as 100 feet thick. About 15 % of Orcas Island (many small areas) is overlain by glacial deposits with thicknesses of as much as 300 feet at the northern end and in the central part, west of East Sound. Less than 10% of Shaw Island (only one small area) is overlain by glacial deposits.

Most wells in the county obtain water from bedrock aquifers which are less productive and which, due to the geologic complexity mentioned above, are less predictable consisting of interconnected fractures and fracture zones (see Figure 2-8). Due to the structural complexity and accretionary nature of the bedrock, there are no pathways along which groundwater could travel from the mainland. Generally, groundwater flows outward from the centers of the islands toward the shorelines. Because of a high ratio of shoreline length to land area in the San Juans there is an appreciable flow of groundwater seaward.

The final melting of the glaciers supercharged the area with groundwater, filling all available underground spaces. Today however, all of the "resupply" or "recharge" comes from rainfall; San Juan County has no rivers and no snow pack to replenish groundwater supplies. Actual infiltration of precipitation into groundwater is determined by several factors including the volume and timing of the water at the surface, infiltration capacity of the soil, the condition, type and amount of vegetative cover, porosity of the underlying geology, and aquifer characteristics (such as storage capacity), and topography.

Groundwater recharge was estimated using a daily near-surface water-balance Deep Percolation Model, resulting in the following average recharge rates for the four largest islands: Lopez Island 2.49 inches per year; San Juan Island 1.99 inches per year; Orcas Island 1.46 inches per year; and Shaw Island 1.44 inches per year (USGS, 2002). Other estimates using a chloride mass-balance method resulted in an average recharge value on Lopez Island of only .63 inches per year, with a range of .29 to 1.95 inches per year. Sources of chloride in the groundwater other than from the atmosphere may however, have caused these estimates to be less than the actual recharge.

Surface runoff is another component of the hydrologic system. Prior to land development, the amount of runoff varies depending on amount of precipitation, slope gradient, depth and type of soil, and the type and condition of vegetation, with forested areas providing the least runoff. Surface runoff estimates for an undeveloped landscape indicate that annual runoff at sea level varies from a low of 3 inches in the southern parts of the County, to a high of over 13 inches on Mount Constitution. Runoff occurs chiefly from December through March when soils are saturated and rainfall is heaviest. Runoff

estimates developed using a runoff modeling program² indicate that 28 percent of average annual precipitation becomes runoff, though this amount varies from 11 to 45 percent (SJ County, 2000, from Russell 1975). This differs from naturally vegetated areas where only 10-15% of rainwater becomes runoff (Preisler, 2007).

As part of its recharge analysis, USGS gauged several streams from October 1996 through September 1998. During that time stream flow volumes equaled approximately 25 % of precipitation volumes on Orcas and San Juan Islands, and 13 % on Shaw and Lopez Islands. Drainage basins overlain by glacial deposits have less stream flow and are dryer for longer periods because greater quantities of water can percolate into the soil and groundwater, and because the soils stay moist for longer periods of time, more water is lost to evapotranspiration (USGS, 2002). The San Juan Island's False Bay watershed has the greatest volume of runoff for any basin in the county with 3,154 acre-feet per year. The next largest volume of runoff is for the Crow Valley basin, with 2,276 acre-feet. The largest drainage on Lopez drains to Davis Bay with a volume of 743 acre-feet (EES 1990 from SJ County, 2000).

Evaporation and transpiration, or evapotranspiration, is the process by which water is cycled back to the atmosphere from surface water, soil and plant surfaces. In the San Juan Islands, evapotranspiration is the most significant process resulting in loss of fresh water. It is estimated that 42 to 49 percent of annual precipitation is lost to evapotranspiration, though individual basins vary depending on land cover and topography (EES, 1990 from SJ County, 2000). Dietrich reported that 67 percent of annual precipitation at Olga returns to the atmosphere through this process (Dietrich, 1975 from SJ County, 2000), but in the Trout Lake watershed, which is steep and forested, losses due to evapotranspiration are estimated at 26 percent of annual precipitation (Town of Friday Harbor, 1999, from SJ County, 2000). Evapotranspiration is greatest during the summer months when precipitation is minimal and plants are actively respiring. In an average year in the San Juans, evapotranspiration is greater than precipitation from mid-April through September, causing water to be depleted from the soil.

Soils

Material deposited or accumulated through geologic forces is modified by climate, vegetation and other living organisms resulting in the formation of soil. The soil is then further modified by topography and the length of time the parent material has been in place. Soil is composed of varying sizes of mineral particles, organic matter and multiple species of living organisms, with biological, chemical and physical properties that are in a constant state of flux.

Many processes take place in soil. It acts as a filter to protect the quality of water. The permeability of soil influences the infiltration of rainfall and the quantity of surface water runoff. The regulation of water flow through soil affects the movement of soluble materials, such as pesticides, fertilizers and toxic materials. Soil is a physical, chemical and biological environment in which water, nutrients, and heat are exchanged between plants and animals. Soil surveys classify soils by the limiting factors that restrict the ability of the soils to fully perform the processes listed above.

There are three principal limiting factors that occur in the soils of San Juan County (USDA, 1962). 57 percent of the soils in San Juan County are limited by the shallowness of the rooting zone, stones in the soil profile and low moisture-holding capacity in the root zone. Many of the soils in this limitation class are less than 30 inches deep and sit atop a cemented glacial till layer (hardpan) that restricts the

² U.S. Army Corps of Engineers SSARR Watershed Model, Water Resource Assessment Technical Report, Economic and Engineering Services Inc, (EES), San Juan County Comprehensive Water Plan.

downward flow of water. The soils that are deeper than 30 inches are located above coarse layers of sand and gravel that tend to allow water to drain through the soil very rapidly.

Excessive water is the dominant hazard or limitation affecting the use of 23 percent of the soils in the San Juan soil survey. This hazard/limitation includes poor soil drainage, soil wetness and a high water table. Finally, susceptibility to erosion is the dominant hazard or limiting factor in 19 percent of the soils in the County. The majority of the soils and soil complexes in this classification have slopes in excess of 30 percent and are mapped as rock areas or soil and rock complexes.

Soil erosion is a natural process that can be affected by human action. Removal of the protective vegetative cover exposes the soil to the impacts of rainfall. This impact clogs the air spaces in the soil making it less permeable, increasing runoff, and causing individual soil particles to break loose and be carried down slope. The thinness and relatively high clay content of San Juan County soils make them particularly susceptible to compaction such as when heavy equipment or farm animals are placed on wet soils. These processes cause a loss in soil nutrients, making plant growth more difficult, and soils that move off site can negatively affect streams, wetlands and marine habitats.

Land Cover

Land cover is an important feature of the natural and built environment, directly influencing the infiltration of precipitation, base stream flows, erosion potential and wildlife habitat. Forests are the dominant type of land cover in the San Juan Islands and in 2001 they covered approximately 61% of the landscape, slightly less than the 62% land cover present in 1991 (Ecology, Coastal Zone Atlas). These areas consist primarily of Douglas fir, pine, Western hemlock, and Western red cedar, with some areas of Big-leaf maple and Red alder. The remaining land cover is grassland used for hay or pasture; scrub/shrub plant communities such as willow, Nootka rose, bitter cherry, and ocean spray; rock outcrops; and beaches.

Stormwater Runoff

Forests provide the greatest infiltration and recharge to groundwater and produce the least runoff. Tree canopies intercept rainfall, allowing some of it to evaporate prior to reaching the ground surface. Low growing vegetation, logs and organic debris absorb the energy of falling raindrops, and protect the soil from erosion. Runoff is trapped in the myriad of depressions in the uneven forest floor where it soaks into the organic duff and then flows along the root systems to be absorbed and assimilated by trees and other vegetation. Excess groundwater travels below the ground surface, eventually reaching drainageways, wetlands and the shoreline where it helps to maintain base flows during the dry summer months (Horner, 2007).

Replacing forest with pasture, non-native vegetation, lawn, driveways and structures reduces infiltration and increases runoff. Driveways and cutoff trenches (e.g. curtain drains) also intercept shallow, laterally moving groundwater converting it to surface water. Runoff that is directed to ditches, pipes and other conveyances flows through the watershed more quickly than it did prior to development, increasing peak flows and creating more frequent runoff events which erode drainageways and streams; alter the delivery of nutrients and organic matter; create temperature pulses; change benthic geomorphology; and flood lowlands. In conjunction with residential development, landowners in the County often construct dams and ponds, which further modify runoff patterns and increase the temperature of the water. Because of these hydrologic changes, the complexity of the habitat decreases, the composition of the biotic community shifts toward species that are tolerant to disturbance (Preisler, 2007), downstream wetlands and shallow embayments can be filled with deposited sediment, and streams, wetlands and shoreline seeps can dry up during the hot summer months.

Studies conducted in the Puget Sound found a precipitous decline in the biotic integrity of streams when the imperviousness of a watershed exceeds 5% (Horner, 2007). A 2003 study of three

watersheds found that streams with the highest biological indices are only found in areas with no or extremely low urban development, very high forest retention and minimal human intrusion into riparian zones. Biological responses to urbanization in combination with loss of natural cover do not exhibit thresholds of watershed change that can be absorbed with little decline in health. Rather, the decline in biological health of streams starts in the earliest stages of land conversion to human occupation (WMI, 2003):

Increasing surface runoff also increases the quantity of pollutants which are swept into the water during storms. Removal of riparian vegetation destroys a natural filter and as a result, runoff, sediment and nutrients which used to be trapped by vegetation, flow unimpeded into the water. Developing an area also exposes more pollutants to stormwater. Fertilizer, pesticides, deicing salt, anti-freeze, oil, toxic residue from automobile exhaust, and heavy metals are deposited on surfaces washed by runoff. Zinc, which is present on galvanized surfaces and which is used to deter the growth of moss, and nickel, cadmium and copper (from the wear of brakes, tires and auto parts) are of particular concern because of their toxicity to aquatic plants and animals. Studies conducted around the country have found that residential and commercial development significantly and permanently increase pollutant loads to water bodies (EPA, 1983).

Following are general watershed management recommendations for reducing the impact of residential and commercial land development (WMI, 2003):

1. Base watershed management on specific objectives tied to desired biological outcomes.
2. If the objective is to preserve an existing high level of biological integrity, very broadly preserve watershed and riparian native vegetation and soil cover through outright purchase, conservation easements, transfer of development rights etc.
3. If the objective is to prevent further degradation when partially developed areas urbanize further, maximize the protection of existing native vegetation and soil cover in areas closest to the stream, especially in the nearest riparian band. In the uplands, develop in locations already missing characteristic native vegetation. As much as possible, preserve existing native cover and limit conversion to impervious surfaces.
4. Fully serve newly developing and redeveloping areas with stormwater quantity and quality control facilities sited, designed, and operated at state-of-the-art levels and attempt to retrofit these facilities in existing developments.
5. Where riparian areas have been degraded by encroachment, crossings, or loss of mature, native vegetation, give high priority to restoring them to extensive, unbroken, well-vegetated zones.

Nearshore and Coastal Ecosystems

Coastal ecosystems are some of the most productive and diverse ecosystems in the world. Over 80% of the 13,200 known species of marine fish are coastal or spend at least part of their life cycle within a coastal ecosystem. Estuaries, sea grass beds, marshes and other nearshore ecosystems serve as filters and food sources for the rest of the marine environment including the deep ocean (Preisler, 2007; Belfiore, 2003).

Different combinations of marine processes create conditions for different types of marine habitat, and within those habitat types, different community compositions. Factors that affect marine habitats include depth, salinity, substrate, wave/current energy, oxygen, pH, light, turbidity, sediment, temperature, nutrients, organic matter, and the topography of the shoreline. For example, although

kelp and sea grass can inhabit the same depths, they have very different water energy, light and substrate requirements. Since sea grasses are rooted, sea plants, they require a sandy substrate, very clear water for photosynthesis, and low wave action. In contrast, giant kelp are macro algae. Lacking true roots they anchor themselves to rocks and boulders with thick, root like cords called holdfasts. They can tolerate less light than sea grass because they are able to use more of the visible light spectrum in photosynthesis, however, they need more wave action or currents to bring in nutrients (Preisler, 2007).

The greatest number of species in marine environments are small, secondary place holders who rely on the presence of foundation species to create the environmental conditions in which they can live. Foundation species modify environmental conditions, resource availability and species interactions by changing flow velocity and turbulence, creating refuges, entraining nutrients and larvae, stabilizing substrates, increasing sedimentation and providing shade which reduces physiological stress. The following table identifies the major nearshore habitat types and the associated foundation species (from Preisler, 2007).

Habitat	Location	Foundation Species	Depth (m)	Wave/Current Energy	Sediment Size	Facilitation Mechanisms
Rocky Intertidal	moderate-open coastlines		through splash zone	varies from very strong to low	large	
Kelp Forest	moderate -open coastlines	Giant kelps + understory kelps	3-28 below MLLW, low intertidal to upper subtidal	moderate-strong	cobbles and larger	2,3,5,6
Beaches	steeper than mudflats		MLLW to upper end of swash zone	moderate-strong	varies	1,2,3,4,5,6
Salt Marsh	river deltas, estuaries, protected and semi-protected bays, places where sediment supply is relatively high	Marsh grasses	MHHW and above, high intertidal to supratidal	low	fine-gravel	2,4
Flats/Soft sediments	river deltas, protected and semi protected coves and bays, often near sediment sources	polychaete worms, various other bioturbators, sediment stabilizers, and irrigators	1-2 above MLLW to below MLLW, intertidal to shallow subtidal	low	mud-sand	2,3,5,6
Sea grass Bed	protected and semi protected bays	Sea grasses	+1m to '-5m relative to MLLW in Puget sound, lower intertidal-shallow subtidal	low-moderate	sand	1,2,3,5,6
Aquatic Reef	river deltas, estuaries, protected and semi-protected bays	reef oysters	2-10m to 30m, predominantly subtidal, but intertidal-subtidal	moderate	firm mud, sand, gravel, shell or rock	1,2,3,5
Marine riparian zone	upland	none	soil	shade, insects as food source, woody debris, buffer		4,6

1= general habitat creation and/or attachment site

- 2=refuge from predation
- 3=physiological stress reduction
- 4=physiological stress reduction
- 5=enhancement of propagule supply or retention
- 6=increased food supply

As with streams and wetlands, human activities also affect coastal ecosystems - directly through physical modification and disturbance of shoreline and nearshore habitat, and indirectly through changes to the water. For example, eelgrass beds are sensitive to changes in the clarity of water, oxygen levels, temperature (it prefers 10-15°C), salinity (5-32 ppm), and nutrients. Too much sediment or nutrients in the water can cause excessive growth of floating and attached algae, causing a reduction in the light available to the eelgrass (CTP, 2006). Though Low Impact Development (LID) techniques have been developed for protecting freshwater systems, there appear to be no guidelines for how to apply LID to coastal areas (Preisler, 2007). Stormwater from ditches and pipes outfall into marine systems, concentrating flows and inputs. Though marine systems need some sediment, sediment from urban runoff tends to contain adsorbed toxins, and to be made up of fine clay or silt which smothers benthic organisms. Metals in particular are highly toxic to phytoplankton and other marine organisms, and they do not degrade over time. Both zinc and cadmium tend to be in a highly available, dissolved form. Pesticides are also a problem, entering runoff from lawns, gardens and agricultural lands. They too are water soluble, mobile and are highly toxic to marine organisms (Levinton, 2001). Other contaminants of concern include Polycyclic Aromatic Hydrocarbons (PAHs) which are in fuel, oil, asphalt abrasion dust and deposits from automobile exhaust; and Polychlorinated Biphenyls (PCBs) which are extremely toxic, extremely stable, and which were released extensively into coastal waters (Levinton, 2001).

The effects of toxins on the marine environment are most pronounced at the outfall site, and fall off with distance as the stormwater mixes with seawater. Dilution and mixing however depend on the interaction of longshore transport, cross shore transport, longitudinal dispersion, and turbulent diffusion, all of which depend on local wave conditions. One cannot assume that runoff, and the suspended and dissolved contaminants it contains, will quickly disperse once it is discharged, nor can one assume that placing outfalls in areas of low habitat quality will not adversely impact habitat elsewhere - it depends on how nearshore transport processes move the runoff and sediment (Grant, 2005; Preisler, 2007).

The effect of a toxin in the marine environment also varies based on a number of factors including a) whether it is introduced as a large pulse or at a low level over time, b) how quickly the toxin breaks down in saltwater, c) whether the toxin bioaccumulates and travels up the food chain, and d) how the toxin affects particular organisms. Toxin impacts are further complicated because they rarely appear alone within a system. Marine systems are usually dealing with a combination of toxins, organic enrichment, elevated nutrients and other stressors (temperature, lack of nutrients or food, changes in salinity) which make impacts hard to predict (Fleeger et al, 2003; Heugens et al., 2001).

In embayments with little circulation, where the less dense fresh water floats on top the seawater, increasing stormwater flows increases the thickness of the freshwater layer, enhances stratification and potentially reduces the oxygen in deeper areas. Estuaries and wetlands are particularly sensitive to changes in the timing and volume of freshwater inputs since plant community composition is determined by sedimentation, water level, flood tolerance and salinity gradients. Where shoreline wetlands filter incoming runoff, increased and more frequent flows may not allow water to infiltrate, and may cause wetlands to export, rather than trap nutrients (Lee et al., (2006).

As in upland streams and wetlands, subsurface flows are an important source of fresh water to marine environments. Groundwater naturally flows into the nearshore via subsurface seeps, contributing 17-20% of the total water flow into some estuaries (Johannes, 1980). Unlike stormwater from developed

areas, these inputs of freshwater flow in slowly over time and do not cause rapid and repeated changes to the temperature and water chemistry.

Actions that can be taken to lessen impacts to the marine environment include using appropriate BMPs to minimize hydrologic changes; reducing the land devoted to pollution generating activities; and reducing the use of pollution generating materials (e.g. replacing zinc and asphalt on roofs with other materials or with green roofs, using organic fertilizers, and planting or retaining native vegetation particularly trees) (Preisler, 2007).

Naturally Occurring Water Contaminants

Several ongoing (and yet to be completed) studies have found relatively high levels of arsenic and cadmium in groundwater, surface water, marine waters and shellfish in San Juan County. This could be naturally occurring from local bedrock, but additional information is needed. Researchers from Kwaht, the Huxley College of the Environment (Western Washington University), the University of Washington, USGS and the Pacific Shellfish Institute are currently involved in these studies.

Anadromous (migratory) Fish

Most streams in San Juan County are small and many do not support anadromous or resident salmonids. Cascade Creek on Orcas Island is an exception, where the presence of salmon and trout have been documented over the past 50 years. Much of the Cascade Creek watershed is located within Moran State Park, and Cascade Creek has a series of waterfalls between its source at Mountain Lake and its outlet at Buck Bay. While there is very good habitat in many of the reaches between the cascades, in most areas there is very limited opportunity for fish to move upstream more than a few hundred yards. Despite this limitation, brook and cutthroat trout seem to be surviving and breeding in the short reaches and salmon return and spawn in the limited anadromous reach downstream. Lower Cascade Creek is inhabited by sea-run cutthroat trout, eastern brook trout, and Coho, Chum and Chinook salmon. Though some of these runs are planted, natural spawning also occurs. Whether or not the runs are natural, they are public resources and are protected.

Storage in Mountain Lake is almost entirely managed to keep Cascade Lake full, provide for the Olga and Rosario water rights, and provide recreation in Mountain Lake itself. At times no flow at all is present immediately below the Rosario diversion, but between the lower dam and the falls some level of base flow provides water to the creek. The absence of flow in some areas does not preclude the presence of fish where there is water (Boessow, 2005 & 2007; Pacheco, 2005; Schuller, 1992; Olga Water, 2007).

An ongoing assessment of streams and salmonids is being conducted by the Wild Fish Conservancy, KWIAHT and WDFW. Since 2004 they have examined the main reaches of 11 streams on Orcas Island, 7 on San Juan, and 6 on Lopez and found that a total of 31 streams in San Juan County are potentially fish bearing. Thus far *Oncorhynchus* species (Coho, Chum, Chinook, sea-run coastal cutthroat) have been identified in 8 streams on Orcas and San Juan islands, and additional salmon habitat has been identified which is inaccessible due to anthropogenic (human built) features including perched, inadequate or failed culverts under roads and driveways; runoff from residential property; reduced summer base flow; the loss of stream flow due to the construction of private dams, ponds and pond weirs; and changes in stream channel alignment associated with agricultural activities (Barsh, 2007).

EXISTING PROGRAMS ASSOCIATED WITH PROTECTION OF CRITICAL AREAS

The following section describes the array of organizations and programs that have a hand in protecting critical areas, through funding, study, education, incentives and regulation. Though the focus of this effort is on the evaluation and enhancement of County programs and regulations, an

awareness of the activities of other organizations is important to ensure that County efforts do not duplicate those of other organizations, and that public monies are used in the most cost effective manner possible.

LOCAL AGENCIES

San Juan County Community Development and Planning Department (CD&P). CD&P is responsible for long range planning, including compliance with the Growth Management Act, and for ensuring compliance with building and development codes including stormwater controls, the County's adopted Shoreline Master Program, and requirements for Critical Areas. Services are funded through permit and application fees and general fund revenue.

San Juan County Health & Community Services (H&CS). H&CS is responsible for insuring safe drinking water, proper treatment and disposal of sewage, and proper handling and disposal of solid waste. Activities include but are not limited to; review and oversight of Group B water systems, review of individual well construction, water resource planning, assessing and mitigating potential seawater intrusion, permitting and inspecting on-site sewage treatment & disposal systems, overseeing on-site sewage system repairs, ensuring proper operation and maintenance of on-site sewage systems, and permitting and inspecting solid waste handling facilities. Services are funded through permit and application fees.

San Juan County Water Resource Management Committee. This is a citizen advisory committee appointed by the County Council to advise San Juan County and the State Department of Ecology regarding water resource issues. The committee developed the San Juan County Water Resource Management Plan, oversaw the development the Lopez Village Abbreviated Coordinated Water System Plan and the East Orcas Water Supply Report, and provided technical review and input on the aquifer susceptibility analysis. The committee was also instrumental in revising San Juan County Code 8.06 to include provisions to address water resource issues on subdivisions and requirements for seawater intrusion protection. The committee work is funded by a Department of Ecology grant.

Lead Entity for Salmon Recovery. This is a local, watershed based organization devoted to recovery of sustainable salmon populations to support the needs of the local ecosystem, wildlife, and people in San Juan County. The San Juan County Lead Entity develops and maintains the local salmon recovery plan and a 3 year work plan of projects and programmatic activities. The Lead Entity solicits, develops, prioritizes, and submits habitat protection and restoration projects for funding to the Salmon Recovery Funding Board (SRFB) and other funding sources. They consist of a coordinator, a committee of local technical personnel, and a committee of local citizens. The local technical experts assist in development of salmon recovery strategies, and identification and prioritization of projects. The local citizen committee is responsible for developing the final prioritized project list and submitting it to funders for final consideration. The local strategy emphasizes protection and the Lead Entity is currently focused on assessment of data gaps in order to improve prioritization of protection and restoration projects.

Marine Resources Committee (MRC). The MRC is a citizen advisory committee appointed by the County Council to advise them on all matters pertaining to the marine environment. The MRC recently completed a Marine Stewardship Area (MSA) plan (Evans and Kennedy 2007), covering the entire county, which was adopted by the County Council in July 2007. . The MRC is funded through Federal Coastal Zone Management monies administered by Ecology and the Northwest Straits Commission, a variety of foundation and government grants for special projects, and direct county appropriations. The MRC's current work includes implementing the six highest priority strategies in the MSA plan through public education and outreach, working with county governmental processes, and coordinating with federal, state, tribal, and other marine managers. Some aspects of the MSA

plan pertain directly to the update of the county CAO, and the MRC is actively participating in the CAO update.

San Juan County Public Works Department. The Public Works Department responsibilities include maintaining public roads, issuing approach permits for driveways entering public roads, and operating solid waste facilities on the islands. The County Stormwater Utility which was established to correct existing water quality and runoff problems is managed under this department. The Utility is funded by fees that apply to all developed property. On behalf of CD&P the Public Works engineering staff also review private development plans for conformance with the Western Washington Stormwater Management Manual, a service that is funded through plan review fees. This Department also provides Geographic Information System (GIS) analysis and mapping support to several County departments including CD&P.

As part of ongoing efforts to reduce and encourage proper disposal of chemical wastes to minimize contamination of ground and surface water, the County Solid Waste Division organizes and subsidizes (with assistance from state grant funding) hazardous waste collection days once a year on San Juan, Lopez and Orcas Islands. Residents of other islands and island businesses are invited to participate in any of these collections. More than 350 tons of hazardous waste has been collected since 1989 when the project began. In addition used motor oil, antifreeze and vehicle batteries from homes and businesses are recycled through the project.

San Juan County Land Bank. The Land Bank was established to preserve in perpetuity areas in the County that have environmental, agricultural, aesthetic, cultural, scientific, historic, scenic or low-intensity recreational value and to protect existing and future sources of potable water. Their primary source of funding is a one percent real estate excise tax paid by purchasers of property in the County. The Land Bank currently owns 2,880 acres of land and oversees 1,878 acres with conservation easements. A map of conservation properties including those owned by the Land Bank are included at Figure 1-1 at the end of this chapter.

San Juan County Conservation District.

This is a local organization committed to protecting and enhancing the natural resources of San Juan County ecosystems. They are dedicated to providing natural resources education, information, and technical assistance free of charge to citizens of, and organizations, in San Juan County. Services offered by the Conservation District include:

- Sustainable Farm and Forest Resource Planning
- Sustainable Building and Land Use Practices
- Water Quality and Watershed Assessment
- Native Plant Use and Wildlife Habitat Preservation
- Natural Resources Education Workshops
- Climate Change Impacts Information

San Juan County Agricultural Resources Committee. This committee was formed by the County Commissioners in 2005 to achieve the protection and restoration of agricultural resources. The seventeen person advisory committee makes recommendations to the County Council on agricultural issues. Priority issues addressed by the ARC are farm marketing, farmland preservation and farm regulation.

San Juan County Noxious Weed Board (through the SJ County/ WSU Extension Office). This organization operates through the County Extension Office. Their mission is to focus on education, prevention, technical assistance and control of noxious weeds through voluntary compliance with RCW 17.10 and WAC 16-750. The program strives to detect and remove early infestations, provides

weed identification workshops and publications, and offers technical assistance on weed identification and methods of control.

WASHINGTON STATE PROGRAMS

Department of Health. The State Department of Health manages pollutants in water, shellfish and fish if they impact human health. It deals with pathogens in shellfish, drinking water, & toxin levels in fish.

Department of Community, Trade & Economic Development (CTED). CTED provides technical and financial resources to help local governments comply with the Growth Management Act, including the requirement to adopt local ordinances to protect Critical Areas.

Department of Ecology.

Underground Injection Control Program. This program protects groundwater quality by regulating the disposal of fluids into the subsurface. Most injection wells are used to manage storm water (i.e., drywells) and sanitary waste (large on-site systems), return water to the ground, and help clean up contaminated sites. The potential for groundwater contamination from injection wells depends upon well construction and location; the volume and quality of the fluids injected; and the hydrogeologic setting. The UIC Program, authorized by the Safe Drinking Water Act, is administered under Title 40 Code of Federal Regulations (CFR) part 144. State regulation Chapter 173-218 WAC (Underground Injection Control Program) is used to administer the program.

Non-point Discharge Elimination System (NPDES) Program. The Dept. of Ecology manages the NPDES program in Washington. Permits are required for construction sites involving more than one acre of disturbed area. Ecology also regulates stormwater discharges from industrial facilities, gravel mines and boat yards, requiring a plan to identify, prevent, and control the contamination of stormwater discharges.

Shoreline and Environmental Assistance Program. This program administers the Shoreline Management Act, which creates a partnership between local government and Ecology through the local shoreline master program (SMP). Local government has the primary responsibility for required planning and the administering of regulatory requirements. Although Ecology acts primarily in supportive and review capacity, it is required to approve local SMP amendments and some types of shoreline permits. Ecology also has authority to enforce the local SMP if necessary, but does not have the staff to take an active role in most cases. Currently, Critical Areas within shoreline jurisdiction are protected to some degree directly or indirectly by the local SMP. Recent state legislation requires that any comprehensive amendment of a SMP assume full protection of Critical Areas within shoreline jurisdiction. San Juan County is not required to update its SMP until 2012.

Water Rights. Ecology regulates ground and surface water withdrawals through water rights, although ground water withdrawals that are less than 5,000 gallons per day are generally exempt from the water-right permitting process (including water used for stock, single or group domestic purposes, industrial uses, or watering a lawn or non-commercial garden not larger than one-half acre).

Washington Coastal Zone Atlas

The Washington Coastal Zone Atlas provides maps of habitat, geologic, hydrologic features, the location of shoreline modification, as well as aerial and satellite photographs and information on land

cover in 1991, 1996 and 2001. These maps can be viewed at http://www.ecy.wa.gov/programs/sea/sma/atlas_home.html.

Washington State Department of Natural Resources (DNR) is responsible for resource protection and land management, such as state Forest Practices rules that guide logging and road building. Other responsibilities include aquatic lands management and providing scientific information to the public about geologic hazards such as landslides, earthquakes, and volcanoes. DNR's Aquatic Lands Program manages State owned aquatic lands including issuing use agreements for marinas, docks, boat ramps, bridges, and bedlands, and their Natural Heritage Program provides listings and data on rare and endangered plant communities.

Washington Department of Fish and Wildlife (WDFW) manages about 150 species of fish and shellfish ranging from clams to salmon. WDFW jointly co-manages many of these species with Native American tribes. WDFW also administers grants to the Lead Entities to protect and restore salmon habitat. Following are sources of information on fish and wildlife in Washington:

- WDFW Priority Habitats and Species Program. This is a very important database that is used by many local jurisdictions to determine the status of species and habitats in Washington state. Management recommendations for certain species of mammals, birds, and habitat types can be accessed at the following web link, however information contained in the list is not updated in a timely manner (i.e., monthly or in some areas, yearly). <http://wdfw.wa.gov/hab/phspage.htm>
- Puget Sound Ambient Monitoring Program. Again, funding is always an issue with this program. <http://wdfw.wa.gov/fish/psamp/>
- Puget Sound Nearshore Project (Cooperative project) <http://www.pugetsoundnearshore.org/>
- Aquatic Lands Enhancement Account, <http://wdfw.wa.gov/volunter/vol-7.htm>
- Landowner Incentive Program, <http://wdfw.wa.gov/lands/lip/>
- Regional Fisheries Enhancement Groups, <http://www.wdfw.wa.gov/volunter/index.htm>
- WDFW Aquatic Habitat Guidelines, <http://wdfw.wa.gov/hab/ahg/>
- WDFW Habitat Conservation Plans. These papers are not available to the public yet, but will be soon. <http://wdfw.wa.gov/hcp/index.html>
- Hydraulic Project Approval, <http://wdfw.wa.gov/hab/hpapage.htm>
- Bald Eagle Protection Plans, <http://wdfw.wa.gov/wlm/diversty/soc/baldeagle/>
- Backyard Wildlife Sanctuary Program, <http://wdfw.wa.gov/wlm/backyard/>
- Technical Applications Division, <http://wdfw.wa.gov/hab/tapps/index.htm>
- Salmon and Steelhead Habitat Inventory and Assessment Program, <http://wdfw.wa.gov/hab/sshiap/>
- Washington's Conservation Strategy and Wildlife Action Plan, <http://wdfw.wa.gov/wlm/cwcs/>

- NatureMapping, <http://wdfw.wa.gov/outreach/education/naturmap.htm>

Puget Sound Nearshore Partnership White Papers

White papers produced by the Puget Sound Nearshore Partnership can be found at: http://www.pugetsoundnearshore.org/technical_reports.htm.

RCW 90.44, 90.48 & 90.54; WAC 173-100 & 200. These chapters of Washington law and Administrative Code establish guidelines, criteria, and procedures for the designation and protection of ground water management areas and sets forth a process for the development of ground water management programs for those areas.

WAC 173-160. This Chapter contains the well drilling regulations, which include requirements to locate water wells minimum distances from potential contamination sources such as feedlots and landfills.

FEDERAL PROGRAMS

The U.S. Fish & Wildlife Service. This is the principal Federal agency assigned to the protection, conservation and enhancement of fish, wildlife, and their habitats. The Service manages a national network of National Wildlife Refuges and is the primary agency administering the Federal Endangered Species Act. There are 83 established National Wildlife Refuges in the San Juans to protect seabird colonies and marine mammal haul out sites. Most are closed to the public to avoid disturbing wildlife.

National Oceanic and Atmospheric Administration (NOAA). NOAA administers the National Coastal Zone Management Program and the National Estuarine Research Reserve System. Under the Coastal Zone Management Program NOAA provides funds to help with marine and shoreline planning and protection. In Washington these funds are managed by the Washington Dept. of Ecology Shorelines & Environmental Assistance Program. Estuarine reserves serve as field laboratories to provide a greater understanding of estuaries and how humans impact them. The Padilla Bay Estuarine Research Reserve is a part of the National Estuarine Research Reserve System.

NOAA Fisheries administers the Endangered Species Act (ESA) as it applies to marine species. ESA forbids Federal Agencies from authorizing, funding or carrying out actions which may jeopardize the continued existence of endangered or threatened species, and forbids the taking (i.e. harming, harassing, or killing) of animals without a permit. Once a species is listed as threatened or endangered, the ESA requires that critical habitat be designated and protected, including areas necessary to recover the species. Chinook salmon, Hood Canal chum, bulltrout, and steelhead are listed as threatened under ESA in WA State. The Southern resident killer whales are listed and NOAA has recently created a draft recovery plan for them.

PROGRAMS ADMINISTERED BY NON-GOVERNMENTAL ORGANIZATIONS OR PARTNERSHIPS

San Juan Initiative. The San Juan Initiative ensures effective stewardship policies and practices by evaluating the volunteer, education, and regulatory programs addressing our natural resources in an ecosystem-based brand of management. Led by a broad constituency of volunteer community leaders, the San Juan Initiative is a pilot project for the entire Puget Sound

KWIAHT (Center for the Historical Ecology of the Salish Sea). KWIAHT's charter mission is to provide science for better stewardship in the San Juan Archipelago, with research projects that focus on critical data gaps. Current projects include identifying salmonid-bearing streams, monitoring salmonid populations, and identifying limiting factors and threats to salmon; mapping the structural

hydrology and geochemistry of wetlands in urbanizing areas; mapping and experimenting with the management of rare and ethno botanically significant plant species in upland and wetland habitats; and studying the County's remaining sphagnum bogs.

Friends of the San Juans. Established in 1979 to support implementation of land use planning in San Juan County, Friends of the San Juans is a membership based, nonprofit organization with a mission to “protect the land, water, sea and livability of the San Juan Islands through science, education, policy, law and citizen action”. Friends’ works collaboratively with local, state and federal individuals and agencies to ensure the latest science is applied to land use decisions. Friends has completed numerous county-wide habitat assessments in the nearshore, including distribution maps of eelgrass, forage fish spawning beaches and bull kelp. In addition to habitat mapping, Friends’ also conducts environmental analysis, restoration and education programs for a wide range of audiences including private landowners, teachers, contractors, land managers and realtors. Friends’ policy and public interest law work covers marine, nearshore, freshwater, and upland resources. Friends’ staff serve on multiple county committees, including the Marine Resources Committee, the Water Resources Committee, the Salmon Recovery Technical Advisory Group and the Science and Policy Advisory Committees for the San Juan Initiative.

SeaDoc Society. The SeaDoc Society funds and conducts scientific research and provides the findings to managers and policy makers. They do not manage areas, but have provided data to groups such as the US Fish and Wildlife Service and the Marine Resources Committee. Information on SeaDoc Society projects and research is available at <http://www.vetmed.ucdavis.edu/whc/seadoc/index.html>.

The Nature Conservancy. The Nature Conservancy (TNC) owns six preserves in the San Juans: Yellow Island, Sentinel Island, Goose Island, Deadman Island plus the Cowlitz Bay Preserve and Bitte Baer Preserve, both on Waldron Island.

Yellow Island is part of the Yellow and Low Island Marine Protected Area (MPA). The Nature Conservancy has taken an active role in managing this MPA. Working with WDFW enforcement agents, the fishing regulations are strictly enforced making this area arguably the most protected waters in the San Juans. TNC has also taken the lead in determining the health of the ecosystem in this MPA. In 2004 Dr. Megan Dethier’s class from Friday Harbor Labs (FHL), surveyed the intertidal area around Yellow re-monitoring the area surveyed by the first stewards on Yellow (1980). In 2006 TNC began financing a three year baseline study of the subtidal ecosystem in the MPA, with Dr. Dethier as principal investigator. In 2007, portions of the subtidal adjacent to Jones Island were added to the survey and act as a control to which the MPA may be compared. This study measures the health of the rockfish and lingcod populations, marine invertebrates including sea urchins and sea cucumbers, plus subtidal vegetation including eelgrass and algae in the MPA and the control area. The Yellow and Low Island MPA is home to nesting black oystercatchers and over 100 harbor seals. Sentinel, Goose and Deadman islands are not as actively managed as Yellow Island. All three, however, provide habitat for species listed in the Marine Resources Committee’s (MRC) new Marine Stewardship Area (MSA) plan. Seabirds and marine mammals are two of the targets of the MSA plan. Sentinel Island has one of the many bald eagle nests in San Juan County plus a small colony of nesting pigeon guillemots. Black oystercatchers forage in the intertidal and nest on nearby Sentinel Rocks. Goose Island is home to nesting double-crested and pelagic cormorants as well as four breeding pairs of black oystercatchers. Hundreds of glaucous-winged gulls nest on Goose Island and it is a major haulout for harbor seals. Deadman Island also has nesting oystercatchers as well as being a seal haulout. Deadman is being considered as a possible site for the reintroduction of *Castilleja levisecta* (golden paintbrush), a Federally Threatened species.

The preserves on Waldron protect two very different types of habitat. The Cowlitz Bay preserve protects more than 250 acres, including wetlands and over 4000 feet of beach front. The Bitte Baer

Preserve on Point Disney is being actively managed to restore a Garry oak savannah plant community – one of the vegetational communities of statewide significance located in the San Juans. DNR has withdrawn the tidelands surrounding all TNC preserves from commercial/private leasing, giving further protection to these properties.

In addition to the site specific information noted above, WDFW and TNC co-led the production of the Georgia Straits-Puget Trough Ecoregional Assessment. This assessment identifies critically important terrestrial, freshwater, and marine areas based on the presence of Threatened & Endangered species and exemplary plant communities and faunal assemblages. The plan and accompanying maps delineate areas in San Juan County and elsewhere that are of high ecological importance. Ecoregional assessments in hard copy or on C.D. may be consulted by those interested in better understanding the location of ecologically important lands and nearshore marine habitats within specific geographical areas. (View C.D.'s on TNC's website at Nature.org.)

TNC also assisted the San Juan County Marine Resources Committee in developing an action plan for the County designated Marine Stewardship Area. Adapting a conservation planning process developed by The Nature Conservancy, and with the help of many partner organizations, stakeholders, managers, and local citizens, the MRC identified over 35 priority strategies under the Marine Stewardship Area plan. These strategies were presented to citizens throughout the county and other key stakeholder groups through a series of presentations and public meetings on all the ferry serviced islands. In July 2007 the County Council unanimously endorsed the MSA action plan.

San Juan Preservation Trust. The San Juan Preservation Trust focuses on preserving land in the San Juan Archipelago including the islands of San Juan, Skagit and Whatcom counties. The Preservation Trust works to protect open space, forest, agricultural lands, special habitats, wetlands and shorelines. They accomplish these goals primarily through the voluntary donation of conservation easements, but in special cases will purchase preserve lands or easements. In the negotiation of easements, the Preservation Trust seeks to maximize the ecological value of the land while still maintaining the needs of the landowner.