PugetSoundPartnership

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DISCUSSION PAPER

HABITAT AND LAND USE

July 11, 2008

Puget Sound Partnership

Introduction to the Topic Forum Discussion Papers

As part of the development of the 2020 Action Agenda, six topic forum discussion papers were prepared to provoke and inspire enduring community conversation and critical thinking about the specific problems facing Puget Sound, and the strategies and actions needed to overcome the threats we face. The information from the topic forums was used to help answer two of the four questions of the Action Agenda: a) What is the status of Puget Sound's health and what are the biggest threats to it?; and b) What actions should be taken that will move use from where we are today to a healthy Puget Sound by 2020?

The papers represent the first effort in the region to comprehensively synthesize and document what we know about the Sound's problems, solutions that work, our current approach to solving problems, and what approaches we need to continue, add, or change. These papers address broad science and policy questions, providing an overview of each topic that looks at the Puget Sound ecosystem, from the crest of the Cascades to the Strait of Juan de Fuca, and documenting the basis of our conclusions and recommendations. They were fundamental to establishing strong connections between science and policy as we developed the 2020 Action Agenda.

For five of the topics (human health, land use and habitat, species and biodiversity, water quality, and freshwater quantity), the Partnership commissioned small groups of science and policy experts to prepare a draft discussion paper as a starting point. The papers are organized to logically step through three initial questions (two are science and one is policy) that build to a rational conclusion (the fourth question) about the strategies and actions that we will need to continue, add, or change as a region. The design is intentional so that 1) our policies are based on science and 2) scientists and policy experts talk to one another. The intent of papers is to focus on identifying problems and solutions, rather than specific details about implementation.

The authors were instructed to review available information and prepare a brief overview of the key issues pertaining to each topic. The draft papers were produced in March 2008, reviewed by a broad audience, and discussed at individual topic forums held in April and May 2008. More than 500 people attended the topic forums, and dozens more provided comments online. During the review period, more than 1,200 pages of public comment were received from 229 people or entities. The Partnership, in conjunction with the papers' authors, reviewed and considered all of the comments as we prepared these revised discussion papers. Summarized comments and responses are included as appendices to the papers.

Following this public process, the Partnership Science Panel conducted a peer review of the five papers focused only on the science questions. The peer review addressed: 1) Do the conclusions in the paper have strong analytical support, and what is the nature of that support (e.g., multiple lines of evidence

are offered; empirical data, analyses, or model results are available; documentation of rationale underpinning key points is clear)?, 2) What are key uncertainties or gaps in understanding, and how might these be addressed in future work?, and 3) Given reviewer assessment and characterization of the certainty in the paper's content, what guidance can be offered for how this information can be fruitfully used as part of the scientific basis of the Partnership's work? The general conclusion of the Science Panel and reviewers was that the topic forum papers were a good start at synthesizing information, particularly given the time available and length of the papers. In general, future improvements could include: more thorough discussion and inclusion of some topics (particularly climate change); inclusion of more recent and pertinent peer-reviewed literature and less use of gray literature; consistency and clarification of terms; and more treatment of terrestrial ecosystems. The schedule for developing the Action Agenda in late 2008 did not allow time for revisions to topic form papers following peer review. However, the peer review summaries were evaluated by Partnership staff when considering what portions of the topic forum papers to incorporate into the Action Agenda. The Science Panel concluded that the topic forum process was useful and a version of the process should be conducted in the future.

A sixth paper on human well-being/quality of life was also prepared as a complement to the other five. This interdisciplinary topic is a very new area of work for the Puget Sound region. The paper presents a summary of the human dimensions and quality of life considerations associated with Puget Sound ecosystem recovery as articulated by the Partnership's work products developed in support of completing the 2008 Action Agenda. The human well-being paper also provides an initial human dimensions framework for moving forward.

The discussion papers are intended to be both comprehensive and brief, providing a synthesis of existing, readily available information and an initial list of recommendations for moving forward to achieve the Partnership's six main goals. Work to refine topic forum papers and to integrate the products from the respective topic forums within an ecosystem management framework will be an ongoing effort of the Partnership. In reading the discussion papers, several concepts should be considered:

- **The discussion papers provide an overview of the topic**, summarizing and synthesizing existing documentation. These papers are intended to provide a framework for future management strategies, but are not intended to address in detail all available data on the topic.
- **The Partnership identifies priority actions that are based on science.** People concerned with the future of the Puget Sound ecosystem express a wide range of opinion about the Sound's problems and suggest literally hundreds of ideas for how to solve them. This was evidenced by the broad range of opinions expressed during the topic forum process. Our continuing goal is to find reasonable consensus on the general nature and magnitude of the documented threats to Puget Sound, so that we have a better chance of prioritizing durable and effective solutions.
- **The papers mainly focus on the Sound as a whole.** We know that there are variations in information availability, type and extent of threats, and workable solutions in different parts of our region. The action area profiles in the Action Agenda help highlight local issues.

- **The discussion papers were used to develop cross-topic priorities for the Action Agenda.** A number of key themes emerged from the topic forum process and helped define priorities for management strategies and specific actions.
- **The recommendations to the Partnership in the papers represent the conclusion of the authors based on their expertise and comments received. The recommendations were considered by the Partnership, but should not be interpreted as a Partnership endorsement.** This was an intentional design of the topic forum process.
- **The papers intentionally do not focus on the need for more education/outreach, new funding strategies including creative incentives, and a coordinated monitoring and adaptive management program.** The Partnership knows that these three aspects are critical to long-term success and is using other processes to address them. That work is more fully explained in the Action Agenda. By addressing the system-wide needs, we will be able to more effectively focus the education/outreach, funding, and adaptive management and monitoring strategies.

The Partnership greatly appreciates the level of interest and participation that reviewers showed by attending topic forums and providing thorough, thoughtful comments. The comments that we received have greatly expanded and deepened the overall level of discussion, and moved our knowledge forward on these topics. We are committed to continuing this level of engagement.

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FINAL DISCUSSION PAPER

LAND USE/HABITAT PROTECTION AND RESTORATION IN PUGET SOUND

Science Question 1 (S1): What is the current documented knowledge about threats to ecosystem processes and resulting habitat as a result of land use practices in Puget Sound?

"Habitat" is the biological and physical conditions of an area that support a particular species or species assemblage (Ruckelshaus and McClure 2007). Examples of Puget Sound habitats include high-elevation glaciers, alpine meadows, mid-elevation mixed forests of fir, hemlock, alder and maple, river floodplains, freshwater wetlands, riparian forests, estuarine and tidal marshes, mudflats, eelgrass meadows, and sand and gravel beaches (Kruckeberg 1991; Williams et al. 2001; Ruckelshaus and McClure 2007). Habitats occur within ecosystems, or discrete areas of any size that contain interacting biotic and abiotic elements, and which interact with their surrounding areas (Grimm et al. 2000). Ecosystems and habitats are formed and maintained by the interaction of physical, chemical and biological processes (i.e., ecosystem processes) occurring throughout their watersheds (Spence et al. 1996; Dale et al. 2000; NRC 2001; Roni et al. 2002; Stanley 2005; Simenstad et al. 2006). Specific habitats in Puget Sound can be grouped based on the following general ecosystem types: freshwater, estuarine, marine, and terrestrial.

Ecosystem processes deliver, move, and transform water, sediment, nutrients, pathogens, light, and wood and other organic matter. These processes are responsible for creating and maintaining the habitats that we see and for the functions that habitats provide (Figure S1-1; Naiman and Bilby 1998; Hobbie 2000; Benda 2004; Simenstad et al. 2006; King County 2007; see Appendix S1-1 for more information about processes). These processes exist in a dynamic state and constantly respond to controlling factors such as precipitation or to episodic disturbance events like landslides, fires, seismic events, droughts, and flooding (NRC 1996). These processes can operate at different spatial scales (e.g., regional/large-scale, local/landscape-scale, or finite/small-scale) and exert influence at different time intervals (e.g., daily versus once a century or much longer) and at different levels of magnitude (e.g., bankfull river flows versus 100-year storm event). Native plant, wildlife, and fish species are adapted to and ultimately benefit from the frequency and magnitude of disturbances in their habitats (Reice et al. 1990).

Ecosystem processes form the basis for understanding how habitats are formed and maintained, and for examining the influence that people have on ecosystems. This memorandum provides a brief summary of threats and ecosystem conditions in the Puget Sound watershed, based on readily available existing information. The paper focuses on aquatic aspects of the Puget Sound watershed; further analyses will need to expand on the terrestrial components of the ecosystem. Also, habitat and land use are intertwined. It is important to acknowledge that ecosystem processes are also at the basis of water quality, biodiversity, water quantity, and human health/ and well-being conditions. However, this memorandum will primarily focus on land use and habitat conditions.

Major Stressors on Ecosystem Processes and Habitats

Ecosystem function is produced by biophysical drivers, which in turn direct processes and patterns (Figure S1-1, lower half). Human activities also affect ecosystem function, and those activities flow from social and economic drivers (Figure S1-1, top half). Together, the ecological and socioeconomic drivers form the basis of ecosystems and habitats, including those within Puget Sound.

Human activities can also affect ecosystem processes and threaten the integrity of habitat structures and functions. In this paper, alterations or "threats" [1] are human activities that modify ecosystems, either through eliminating or reducing the ability of a process to occur (e.g., by cutting off beach feeding sediment sources), or through direct alteration of habitat (e.g., dredging). Alterations include such activities as shoreline armoring, removing vegetation, constructing roads and buildings, and harvesting timber. Alterations can affect processes at different scales of space and time.

Table S1-1 lists major threats to Puget Sound ecosystem processes for freshwater, estuarine, and marine, and terrestrial environments and resulting impacts on ecosystem processes. Appendix S1-1 provides more detailed information about ecosystem processes.

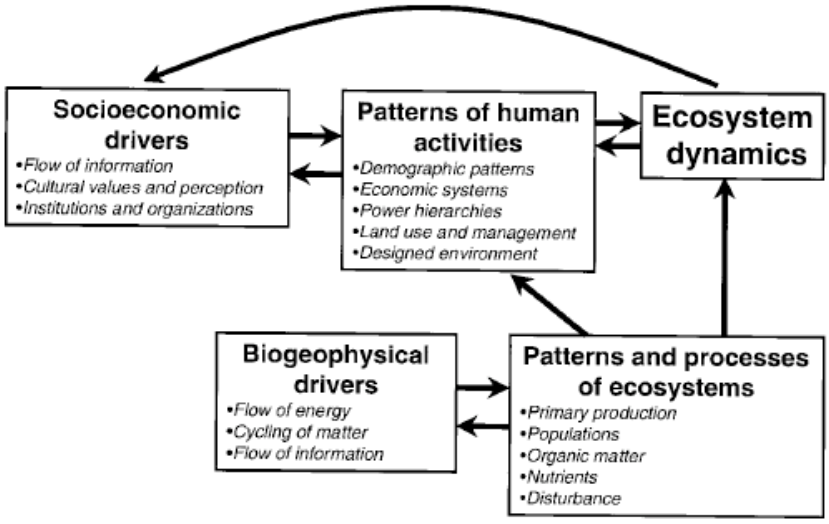

Figure S1-1: Ecosystems and their habitats are shaped by both biophysical drivers and socioeconomic drivers. Biophysical drivers direct ecosystem processed and patterns, and in turn affect ecosystem dynamics. Human activities also affect ecosystem dynamics, and vice versa. Understanding both the biophysical and human sides of ecosystem dynamics is needed to recover Puget Sound habitats. Figure from Grimm et al. 2000. Ecosystem processes are responsible for creating and maintaining habitat structures and the resulting functions. Drivers are natural phenomena that disturb ecosystems and drive long-term maintenance of habitat structures and their functions. Threats are human-driven disturbances to ecosystems that have cascading effects. Adapted from King County 2007.

[1] In this document, "threats" are human activities that disturb ecosystems. It is synonymous with "stressors," a term that is often used in scientific literature.

Table S1-1: Major threats to habitats in freshwater, estuary, marine, and terrestrial ecosystems and their resulting impacts on ecosystem processes.		
Threat	**Ecosystems**	**Process Impact**
In-water		
Overwater structures (docks, piers, buildings, houseboats)	Marine, estuaries, and freshwater (lakes typically)	Light delivery: shading of the sea floor reduces primary productivity Hydrology/Wave energy: redirects/deflects wave energy and currents with influence on sediment and sea floor slopes
Marinas	Marine, estuaries, and freshwater (lakes typically)	Hydraulics: redirects/deflects wave energy with influence on sediment and sea floor slopes Light delivery: shading reduces primary productivity Nutrients: adds nutrients and toxics
Dredging, channel straightening	Marine, estuaries, and freshwater (rivers usually)	Sediment dynamics: reduces sediment supply, changes sediment sizes and slope/depth characteristics, reduces river-floodplain dynamics;
Jetties, breakwaters, log booms and rafts	Marine, freshwater (lakes, reservoirs typically)	Hydraulics: redirect and reduce wave energy and current patterns, at river mouths can also tidal prisms and flushing characteristics Sediment dynamics: alters depth and availability of substrates, obstruct littoral drift and longshore sediment transport with resulting bathymetry and beach formation changes
Groins	Marine (usually)	Sediment dynamics: intercept littoral drift, reduce sediment movement
Boat wakes and prop wash	Marine, estuaries, freshwater (lakes and rivers)	Hydraulics: increases wave energy, focused scouring Sediment dynamics: boat wakes can alter shoreline erosion patterns and change beach profiles, prop wash can scour sediments changing substrate sizes and depths
Culverts	Estuaries, Freshwater (rivers and streams)	Hydraulics: reduces stream channel widths, focuses stream flow, increases upstream water levels, can scour stream bed downstream Sediment: can impede sediment transport Wood: reduces wood movement, can reduce supply as wood is removed for maintenance Light delivery: shades stream Nutrients: reduces upstream movement of marine derived nutrients

Table S1-1: Major threats to habitats in freshwater, estuary, marine, and terrestrial ecosystems and their resulting impacts on ecosystem processes.		
Threat	**Ecosystems**	**Process Impact**
Dams	Freshwater (rivers and streams)	Hydrology: alters timing and magnitude of flows and flooding, creates inundation zone upstream Sediment: traps sediment on upstream side, decreases or eliminates downstream sediment delivery Wood: decreases or eliminates downstream wood delivery, decreases wood recruitment upstream
Aquaculture (e.g., shellfish farming, fish pens, trout ponds)	Marine and estuaries primarily	Depends on type and management practices. Impacts can include increased nutrient loading and pollution (net pens), changes to physical beach structure, and food web and species assemblage impacts.
At the water's edge		
Armoring (bulkheads, revetments, seawalls)	Marine, estuaries, and freshwater	Hydrology: increases wave energy at shoreline Sediment dynamics: restricts sediment recruitment, increases beach erosion, increases steepness of beach profile, prevents backshore, larger homogeneous substrate Wood: reduces delivery/accumulation of wood and detritus Nutrients: reduces natural nutrient inputs through removal of native riparian and intertidal vegetation Light delivery: increases light delivery and temperature due to removal of riparian vegetation
River levees	Rivers	Hydrology: focuses stream flow, increases localized velocities, restricts floodplain access Sediment dynamics: reduces sediment storage and recruitment, alters substrate sizes Wood: reduces wood storage and recruitment Nutrients: reduces natural nutrient inputs through removal of native riparian vegetation Light delivery: increases light delivery and temperature due to removal of riparian vegetation
Fill/dikes	Estuaries primarily, marine, freshwater (including wetlands)	Hydrology: reduces water storage, in estuary and marine areas alters tidal prism and inundation patterns, reduce river-floodplain dynamics Sediment dynamics: increases fine sediment delivery downstream Nutrients: reduces biofiltration Nutrients: reduces natural nutrient inputs through removal of native riparian vegetation Light delivery: increases light delivery and temperature due to removal of riparian vegetation

Table S1-1: Major threats to habitats in freshwater, estuary, marine, and terrestrial ecosystems and their resulting impacts on ecosystem processes.		
Threat	**Ecosystems**	**Process Impact**
Native vegetation removal, ornamental landscaping	Marine, estuaries, freshwater	Hydrology: reduces infiltration and evapotranspiration Light: reduces shading allowing for increased temperatures of water or sediments Sediment dynamics: increased sediment loading if bank become unstable Wood: Reduces wood recruitment Nutrients: reduces biofiltration, increases toxic loadings and reduces natural nutrient inputs
Boat launches and rails	Marine, estuaries, lakes, rivers	Hydrology: increases wave energy at shoreline Sediment dynamics: restricts sediment recruitment Wood: reduces delivery/accumulation of wood and detritus
Away from the water		
TTmber harvest	Terrestrial	Hydrology: alters timing of snow melt, reduces groundwater recharge, increases in surface runoff and stream peak flows, reduces evapotranspiration Light delivery: increases stream temperatures and reduces dissolved oxygen levels Sediment delivery: increase surface erosion/sediment delivery to streams and wetlands, increased mass wasting Wood: reduces wood and woody debris for aquatic areas Terrestrial species habitat fragmentation and loss
Agriculture/Grazing	Terrestrial	Hydrology: reduces infiltration, alters water patterns and timing with ditching and irrigation Sediment dynamics: increases surface erosion, livestock can increase sediment loading through stream bank trampling Nutrients: increase in nitrogen loading, often toxics as well, can have downstream effects that reach waters of Puget Sound Terrestrial species habitat fragmentation and loss
Depressional wetland fill	Terrestrial	Hydrology: reduced surface storage Nutrients: reduced removal of nutrient through denitrification, adsorption and biofiltration, increase in downstream nitrogen delivery Wetland and terrestrial species habitat loss

Impervious surfaces, urbanization (roads, parking lots, buildings)	Terrestrial	Hydrology: reduced infiltration and water storage from vegetation removal and soil compaction, increased surface runoff and peak flows in streams from impervious areas and constructed drainage systems, reduced groundwater and summer low flows. Sediment dynamics: Increase in fine sediments from ground-disturbing activities, peak flows promote bank erosion and can promote stream channel incision and disconnection from the floodplain. Nutrients: Increase from fertilizers and other sources in addition to an increase in toxic loading Terrestrial species habitat fragmentation and loss.
Mineral and Gravel Mining	Terrestrial	Hydrology: reduced infiltration and water storage from vegetation removal and soil compaction, increased surface runoff and peak flows in streams from impervious areas and constructed drainage systems, dewatering can cause reduced groundwater and summer low flows. Sediment dynamics: Increase in fine sediments from ground-disturbing activities, peak flows promote bank erosion and can promote stream channel incision and disconnection from the floodplain. Nutrients: Uncontrolled stormwater runoff can cause increase in toxic loading of heavy minerals. Terrestrial species habitat fragmentation and loss
Invasive Species Introduction	Terrestrial (but also Marine, Freshwater)	Species fragmentation and loss due to competition from non-native species.
Sources: Nightengale and Simenstad 2001; Stanley et al. 2005; Spence et al. 1996; Williams and Thom 2001; Bolton and Shellberg 2001.		

Gaps in our Understanding of Habitat Process-Structure-Function and Land Use Impacts

While there is strong scientific evidence documenting how certain types of alterations or threats may result in specific changes to habitat structure and function, there are gaps in our understanding of how human land use activities can affect ecosystems. Some of the most significant needs for better understanding of habitat threats for Puget Sound's ecosystems are listed below:

- Nearshore ecosystem processes and linkages to watershed and marine systems, as well as the effects and implications of human activities on nearshore ecosystem processes and habitats (see goals 1 and 2 in Gelfenbaum et al. 2006).
- Deep-water habitat processes in Puget Sound and how those may be affected by future development such as further shoreline modifications, wastewater discharge, and tidal energy generation (see Beechie et al. 2007).
- The cumulative effects of multiple stressors on processes, habitat structure (i.e., biodiversity, spatial patterns in species abundances), and function.
- Resulting ecosystem process and habitat impacts from climate-induced changes in sea levels, air and water temperatures, precipitation and surface water movement patterns, Puget Sound circulation and water quality (Mantua et al. 2007). Impact assessment should examine risk to specific habitats by location.
- Effects of changes in environmental flow parameters (i.e., flood flows, pulses, base flows, and low flows) on riverine habitat, riparian functions, fish communities, and salmon populations.

Current Status of Puget Sound Threats and Habitat Structure

Studies and monitoring of Puget Sound have measured certain aspects of habitat structure (e.g., eelgrass meadows), human-induced threats (e.g., impervious surfaces), and ecosystem function (e.g., shorebird colonies). Rarely have ecosystem processes been addressed. Also, information that is Sound-wide tends to be limited in terms of data detail and accuracy, while the type, quality and quantity of localized information often vary widely among Puget Sound jurisdictions (Anchor Environmental 2007).

There are three major studies underway that will be important in improving our picture of the threats and health of Puget Sound habitats:

1. Puget Sound Change Analysis being conducted by the Nearshore Science Team of the Puget Sound Nearshore Partnership (PSNERP). This analysis will look at changes to shoreforms (based on a PSNERP typology), associated wetlands, and human modifications that have occurred between the 1850s-1870s and roughly 2006. The analysis area will cover the Puget Sound marine shoreline and river deltas extending from an average depth of the photic zone offshore up to 200 meters inland, and will include the contributing watershed conditions. The analysis is expected in late 2008.
2. Risk Analysis for the Puget Sound Ecosystem being conducted by NOAA Fisheries. This analysis will estimate the current status of ecosystem components and conduct a vulnerability assessment. This analysis is expected in early 2009.
3. The Puget Sound Future Scenarios project conducted by the University of Washington Urban Ecology Research Lab, in conjunction with PSNP, identified six possible futures for the Puget Sound region in 2050 (UW Urban Ecology Research Lab 2008). Future steps of this project will use the scenarios and modeling to assess nearshore functions and evaluate alternative restoration strategies.

Table S1-2 provides brief condition summaries for some habitat structures and threats at the Puget Sound level, based on available information (e.g., Ruckelshaus and McClure 2007; PSAT 2007a; Table 2). Appendix S1-2 provides increased details about land use, watershed and terrestrial habitats, and marine and estuary habitats based on Action Area workshop notes, WRIA plans, and reports and studies within counties and cities.

This section is not based on exhaustive literature searches or analysis of data. It is imperative that future studies provide a more complete picture of ecosystem processes and habitat structures and functions within Puget Sound, and describe how and where processes and habitats deviate from their natural conditions (i.e., Puget Sound Nearshore Partnership Change Analysis and NOAA Risk Assessment).

Table S1-2. Status of select habitat structures and threats at the Puget Sound scale.	
Habitat Structure	
Forest Cover	There were 5.2 million acres of forest cover in Puget Sound in 2001. Between 1991 and 2001, 2.3% of the forest cover was lost. Over the last 50 years, between 66% and 84% of old-growth forest has been lost.
Eelgrass (Zostera marina)	Puget Sound contained between 20,000 and 50,000 acres of eelgrass during 2005 monitoring. This Sound-wide area estimate is consistent with results from previous years (2000-2004). While overall eelgrass area appears stable, localized declines suggest otherwise.
Wetlands	Historically freshwater and saltwater marshes dominated portions of Puget Sound, particularly where larger rivers entered the Sound. It is estimated that about 80% of those wetlands have been lost. Scrub-shrub estuarine wetlands and riverine wetlands have declined over 90% from historic conditions, while estuarine emergent marshes have declined by about 67%.
Threats	
Modified Shoreline	Roughly one-third of the Puget Sound shoreline has been modified with armoring and docks. Numbers are not available for miles of diking, levees, and armoring in freshwater.
Impervious Surfaces	In 2001, impervious surfaces covered 3.3% of the overall watershed, but at elevations less than 1,000 feet, 7.3% of the land was covered. Between 1991 and 2001, impervious surfaces increased by 10.4% (from ~ 3 to 3.3%).
Sources: Collins and Sheikh 2005; Gaeckle et al. 2007; Ruckleshaus and McClure 2007; PSAT 2007a; PSAT 2007b	

How do current conditions compare to a "healthy" Puget Sound?

The Puget Sound Partnership goal for habitat is: "A healthy Puget Sound where freshwater, estuary, nearshore, marine, and upland habitats are protected, restored, and sustained." More specific or numeric goals for the amount and type of habitat needed to reach the goal of a healthy Puget Sound are not yet known. Regardless, to protect, restore, and sustain habitats, ecosystem processes that create and maintain habitat structure must be able to operate at the locations, rates and time scales that support their desired functions and values (Beechie and Bolton 1999; Goetz et al. 2004). At this time, however, it is difficult to assess the condition of processes. Some areas of Puget Sound have much greater information that can be used to conduct assessments, while others have very little information. The result is that there is variable and limited understanding of the integrity of various ecosystem processes throughout the Puget Sound watershed.

Assessment of ecosystem process integrity (i.e., unified, unimpaired, sound, resistant and resilient to disturbances) is critical for understanding current conditions and beginning to assess the extent of protection and restoration necessary to maintain a "healthy" Puget Sound. For freshwater areas, catchment-level analyses can be used, such

as those conducted for King County's Shoreline Master Program update. This analysis uses information, such as precipitation patterns, surficial geology, forest cover, and alterations such as impervious surfaces to estimate the integrity of the processes that affect water, sediment, wood, nutrients, toxics, and pathogens for a given catchment (King County 2007). Other catchment-level analyses have been completed in eastern Jefferson County and Birch Bay (Ecology 2007; Stephen Stanley, Washington Department of Ecology, pers. comm.) Similarly, process modeling at the drift cell scale has been conducted for marine shorelines using information on shore forms, sediment dynamics, and shoreline modifications. Examples include assessments of eastern Jefferson County[2] and Bainbridge Island[3]; and WRIA 9[4]. Such assessments can help to identify the degree and nature of process impairments and the importance of specific areas for protection and restoration of ecosystem processes.

Moving Ahead on Understanding Ecosystem Processes and Habitat Conditions

Increasing our understanding of ecosystem processes as the basis for assessing condition of habitat structure and ecosystem functions for humans and other species is critical to successful protection and restoration of Puget Sound (Goetz et al. 2004; Simenstad et al. 2006; Beechie et al. 2003). Assessment at the scale of the landscape (e.g., a marine drift cell or freshwater catchment) and site (e.g., a discrete habitat unit within a drift cell or catchment) should be conducted to identify process integrity and importance for specific areas, allowing natural resource managers to cater to specific needs in particular areas. Such assessments are an important component of restoration and protection planning, as discussed in the Response to Question S2. To be useful, these assessments need to consider the hierarchical organization of habitat structures and functions and the time and space scales that relate best to patterns of species use. This work should be conducted to provide a landscape level analysis or classification that can be applied across Puget Sound. Ultimately, this information will inform scientists and decision-makers about where and why ecosystem processes remain intact, are at risk, or are presently altered or absent and in need of restoration to meet desired goals.

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[3]Williams et al. 2004.

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Science Question 2 (S2): What do we know about the effectiveness and certainty of protection and restoration approaches aimed at addressing threats to habitat?

Human land use activities, such as logging, building roads and homes, and armoring shorelines, impact watershed and coastal ecosystems (NRC 1992; Booth 1991; Richards et al. 1996; Paul and Meyer 2001; Diefenderfer et al. 2007). Historically, many of these activities occurred without adequate measures to protect habitats and the processes that form them, leaving a legacy of alterations and impacts.

Since about the 1970s, federal, state, and local governments have implemented numerous measures designed to protect the environment and to manage and minimize the adverse consequences of growth with varying success (see Response to Question P1). These measures include:

- Protection of lands outright through acquisition and resource-based zoning (e.g., federal, state and local parks, forest resource lands, acquisition or tax incentives and conservation easements for targeted high resource areas).
- Land use, zoning, and environmental regulations (e.g., federal Clean Water Act, state Growth Management Act, local land use codes).
- Stewardship promotion through education and incentive programs (e.g., tax rebates, salmon and beach "watchers").
- Modified construction and operation techniques (e.g., low impact development, best management practices).
- Projects to restore and improve habitat, and mitigate for its loss (e.g., culvert removal, riparian planting, wetland restoration or creation).

Despite these efforts, a myriad of human uses of the landscape continue to alter and, by many measures, degrade habitat, leaving our ecosystems at increased risk from existing and future development. Of particular note is that many attempts to restore past impacts and mitigate for ongoing impacts have been unsuccessful at fully replacing the affected habitats or functions (NRC 1992; NRC 2001). Nationally, there has been an estimated 80% net loss of wetlands during the time that the Clean Water Act, Section 404 permitting program has been in place to protect wetland functions (NRC 2001). Within Puget Sound, monitoring by the Puget Sound Ambient Monitoring Program indicates that habitats and species using Puget Sound are in decline (PSAMP 2007b). In addition to habitat losses, we remain unsure about the level of effectiveness of our efforts, and about detailed causal relationships for past failures, because monitoring to evaluate the effectiveness of protection and restoration actions has been infrequent and often inadequate for understanding ecosystem responses (Roni et al. 2003; Beschta et al. 1994; Reeves et al. 1991).

This memorandum discusses the effectiveness of our approaches to protect and restore[5] habitats and identifies guiding scientific principles for future habitat protection and restoration.

Effectiveness of Efforts to Protect and Restore Habitat

Overall, little is known about the effectiveness of efforts to protect and restore habitat from an ecosystem standpoint. In general, monitoring efforts that assess restoration and mitigation projects have been increasing in recent years, while efforts to understand the ecological results from regulations, education, incentives, and other sorts of programs remain sparse.

[5] In restoration science, "restoration" is limited to those areas where the integrity of ecosystem processes can be reinstated. Habitat rehabilitation and substitution are used in instances where processes cannot be fully reinstated. For the purposes of this document, "habitat restoration" will cover all projects intended to improve habitat conditions.

Effectiveness and status and trend monitoring efforts by a number of entities, such as the Washington Salmon Recovery Funding Board, the Pacific Northwest Aquatic Monitoring Partnership, and individual project sponsors, should help to add to our knowledge about what is most and least effective for ecosystems from the standpoint of projects and the cumulative effects of beneficial and damaging activities.

Below is a brief overview of what is known about effectiveness of protection and restoration actions based on a very limited literature review and web search.

Habitat Protection Efforts

Habitat protection efforts can occur through acquisition and creation of reserves, regulations, education and incentive programs, and best management practices. There appears to be little, if any, Puget Sound-wide information about the ecosystem benefits resulting from these efforts. The information available mostly focuses on the intended outputs of the activities (e.g., number of people involved in outreach program, where growth occurs), and not the intended ecological outcome of habitat protection.

For example, there is general consensus that the Washington State Growth Management Act (GMA) is slowing sprawl and focusing growth in urban areas. Between 1995 and 2007 the amount of growth occurring within urban areas increased from 78% to 88% within King, Pierce, Snohomish, Clark, Kitsap, and Thurston Counties (CTED 2008). A study conducted within Thurston County showed a decreasing trend in the number of permits issued within protected areas between 1990 and 2006 (Reaugh and Toebee 2007). However, how that focused growth has protected or benefited ecosystems has not been studied.

The effectiveness of regulations like the GMA and associated Critical Areas Ordinances and the Shoreline Management Act (SMA) are likely to differ by jurisdiction since local governments have some flexibility in the regulations they adopt. For example, single-family residences are generally exempt from the requirement to obtain a shoreline substantial development permit under the SMA. Although these residences must still comply with the goals and policies of the SMA, with 30% or more of the shoreline armoring within Puget Sound occurring as a result of single-family residential development, there is a potential for significant, continuing impacts to Puget Sound health. Similarly, regulatory protections (such as the size of riparian buffers) adopted in Critical Areas Ordinances can vary widely, with each local government making an independent assessment of what the best available science says is necessary to protect those areas.

Acquisition may be the most effective means for long-term protection of habitat conditions. However, protected areas can be affected by land management practices, and changes in surrounding lands. Acquired lands can degrade based on changes to the habitat-forming processes that occur outside of the acquired areas (Lucchetti et al 2005). The value of the area also depends on the types of plants and animals that are targeted.

Habitat Restoration and Mitigation

Habitat restoration and mitigation project effectiveness monitoring has been increasing in recent years, but there is room for substantial improvement. There are a number of articles and reviews that assess the effectiveness of particular types of restoration or mitigation projects.

For example, in a review of 345 papers on effectiveness of stream rehabilitation techniques, Roni et al. (2008) found that reconnection of isolated habitats, rehabilitation of floodplains, and placement of instream structures have proven effective for improving habitat and increasing local fish abundance under many circumstances. Techniques that restore the natural processes which create and maintain habitats, such as riparian rehabilitation, sediment reduction methods (road improvements), dam removal, and restoration of floods, are more likely to be effective over long time frames, but little or no long-term monitoring has been conducted on these techniques. When instream restoration projects fail, it is most commonly the result of inadequate assessment of watershed processes and factors limiting biotic production, or lack of consideration of upstream or watershed-scale factors that influence the outcome of reach or localized rehabilitation projects, and insufficient monitoring and evaluation of adequate temporal and spatial scales (Roni et al. 2008).

Reviews of wetland mitigation project effectiveness have been conducted within Washington State and elsewhere. A Department of Ecology study of wetland mitigation found that of 45 projects, only 13 implemented their projects as planned and met their performance standards (Johnson et al. 2000). In the past 10 years, surveys of wetland and stream mitigation projects in King County found that 75% of projects did not meet performance standards (Mockler et al. 1998). Johnson et al. (2002) found that only 65% of the total acreage of wetlands lost in Washington State were replaced by created or restored wetlands.

Within marine habitats, eelgrass transplant projects have been assessed (see Williams and Thom 2001). Transplant success has been increasing as measures have accounted for controlling factors such as light and depth. Avoiding and mitigating for eelgrass impacts has also been studied within Puget Sound, particularly in conjunction with Washington State ferry facility projects. There is inconsistency in level of effort in the restorative actions and assessment of success, which renders comprehensive evaluation of success rates problematic.

As these examples show, there is project performance monitoring information, both for habitat structure and resulting functions. However, scientific certainty about project results is difficult to attain as projects differ in what they examine, how they collect data, and the time over which the project is studied. Projects also are undertaken under very different ecosystem conditions and are not considered comparable.

Scientific Principles Underpinning Ecosystem Protection and Restoration

In making its observations about the status of habitat in Puget Sound, the Land Use and Habitat Protection/Restoration Topic Forum team was cognizant of several scientific principles about ecosystem protection and restoration which are worth repeating here. They include:

- Restoration efforts must focus on landscape-scale ecosystem processes, such as the delivery and movement of water, sediment, wood, and nutrients, , and the relationship to reach scale processes and functions, as the basis of complex, high quality habitats and diverse, self-sustaining biological communities (Goetz et al. 2004; Beechie and Bolton 1999). Addressing the factors that impact ecosystem processes is critical for restoring habitats and ecosystem functions.
- Freshwater, estuarine, marine and terrestrial habitats are dependent on natural disturbance regimes. Ecosystem restoration needs to recognize natural variability and the role, rates, magnitudes, and locations of natural disturbances in renewing structure and supporting ecosystem functions (Reeves et al. 1995; Goetz et al. 2004; Hobbs and Norton 1996; Wissmar and Bisson 2003; Hood 2007).
- Restoration of ecosystem processes and functions depends on addressing problems within the appropriate time and spatial scales. Functions of particular areas depend on hydrologic, geologic, and topographic conditions (Goetz et al. 2004; NRC 2001). Restoration goals need to be compatible with these natural characteristics of the landscape (Beechie et al. 2003; Roni et al. 2002).
- The probability of a restoration action working is highly dependent on the landscape and site conditions. For example, if a disturbed site sits within a landscape that is intact, restoring the site will likely be more successful because the site will benefit from the surrounding intact landscape processes. Further, the site will be maintained in the long term because the landscape is intact (Figure S2-1; Thom et al. 2005).
- The distribution and array of habitats is a critical factor in determining the viability and health of plant and animal populations. The natural mosaic of habitats in the landscape represents both the culmination of physical and biological processes, and also the structure that animals are adapted to use. The flow of energy, materials, and species among the habitats is critical to resilience of populations, maintenance of biodiversity and self-maintenance of the ecosystem (Thom 2000).
- Protecting ecosystems by avoiding impacts is the best approach to ensure long-term integrity of ecosystem processes and habitat conditions. Protecting areas with high ecosystem integrity, especially those with documented

critical or important ecological functions in the landscape, assures the continued contributions of these areas to the ecosystem. Protection involves minimizing human stressors on existing processes, habitat structures, and ecosystem functions. Restoring habitat conditions is also an important strategy to employ, but is often less certain than protection and is usually more costly. However, in many areas restoration and other habitat improvements will be necessary to achieve desired ecological functions and values.

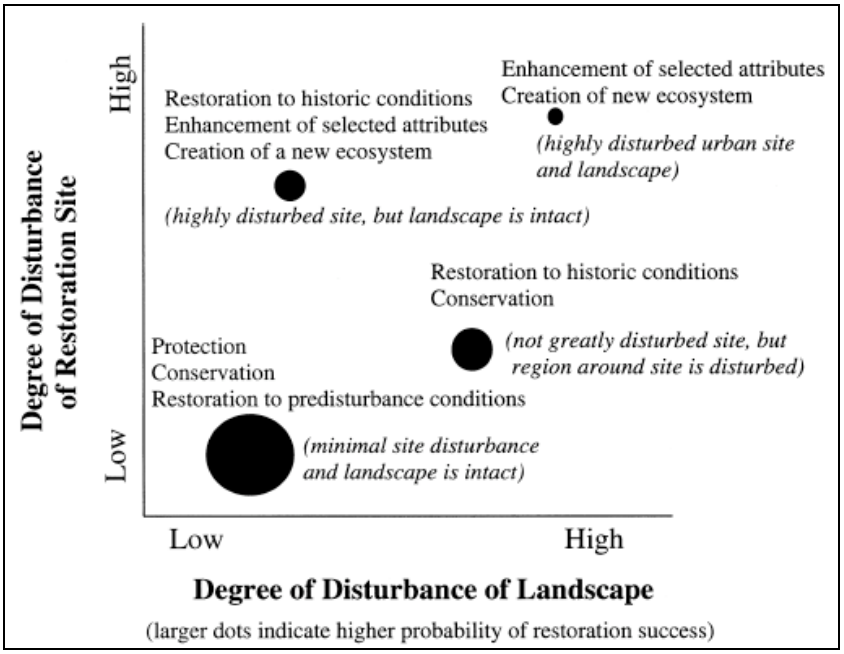

Figure S2-1: Different restoration strategies should be applied depending on the level of disturbance at the landscape and site scales (Thom et al. 2005; Shreffler and Thom 1993).

- Restoration of ecosystem processes should be prioritized for areas key to maintaining downstream aquatic ecosystems. Many lowland areas of Puget Sound have been significantly but not permanently altered (e.g., rural areas). Processes in many of these lowland terraces and valleys support the structure and functions of aquatic habitats (i.e., riverine, estuarine, nearshore). As these areas develop, watershed-based restoration and development (i.e., using smart growth measures) in key areas will be essential to minimizing ecosystem impacts.
- Mitigation should be sited and designed within a watershed context. Most mitigation is developed using an environmental review and assessment process that considers primarily site- and reach-scale conditions. National and state mitigation policies require mitigation sequencing which emphasizes avoidance, redesign or on-site mitigation. This has resulted in the creation of atypical habitats (e.g., wetlands with large areas of open water) with an overall loss of performance of functions. Locating mitigation in areas with a higher priority for restoration (e.g., areas with intact or minimally disturbed ecosystem processes) will result cumulatively in a greater net gain of function.
- Monitoring and adaptive management (i.e., using monitoring information to determine effectiveness and making changes in policy and strategies where desired goals are not being met), is critical to achieving ecosystem improvements. Adaptive management, if implemented properly, can reduce cost and increase effectiveness of actions. To date, there is no comprehensive adaptive management program for restoring Puget Sound. However, guidance documents have been prepared by the Puget Sound Nearshore Ecosystem Restoration Partnership (Thom et al. 2007), and for watersheds (e.g., Monitoring and Adaptive Management Plan for Puget Sound Chinook Salmon). Once established, an adaptive management program can provide direct benefit to improving our understanding of how to best and most efficiently restore Puget Sound.

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Policy Question 1 (P1): What policy approaches are being used to address land use management relative to habitat protection and enhancement in the Puget Sound region?

This paper contains a summary of the tools that exist relative to protecting and/or restoring "ecosystems." However, it omits specific information being covered by other Topic Forums such as water quantity, water quality, biodiversity, toxics, public health, and quality of life, which might normally be found in a discussion about habitat and land use.

Introduction

In creating the Puget Sound Partnership, the Legislature determined that the scope of what it would be charged with protecting and restoring wasn't simply habitat, but rather the Puget Sound ecosystem. (See RCW 90.71.300.) Accordingly, we examine the tools available to protect and restore Puget Sound using an ecosystem approach.

The term "ecosystem" means the sum of ecosystem processes, structures and functions that occur across the landscape, shaped by the geomorphology of an area.[6] (See Response to Question S1 for more details). An "ecosystem approach" recognizes that ecosystem components do not function as independent systems, rather, they exist only in association with one another.[7] In Puget Sound, the ecosystem includes terrestrial and aquatic (freshwater and marine) systems, all existing in association with one another.

From this ecosystem perspective, we will first examine the framework of laws and regulations that control the human activities in Puget Sound, in light of the major threats to ecosystem processes and habitats described in this report. Second, we will summarize the various voluntary programs and laws that exist in an attempt to influence (rather than mandate) the ways in which humans conduct activities, so that ecosystems are protected, restored or not further degraded. These programs and laws include incentives, education, and stewardship programs. Third, as we discuss these tools, we will identify gaps, where known, where no controls or programs exist to protect the ecosystem or key components of it. Finally, we will discuss the need for one additional tool: a strong monitoring and adaptive management program that continually informs decision-makers about the state of the ecosystem and whether the controls and programs used to protect and restore it are working effectively to achieve and sustain a healthy Puget Sound by 2020.

Controlling the Impacts of Human Activities on Puget Sound through Regulation

The threats that human activities pose to the health of the Puget Sound ecosystem (marine, terrestrial and freshwater aquatic systems) are documented in the Response to Question S1, as well as other Topic Forum reports. There are many regulatory programs (federal, state and local) that attempt to control these impacts. These programs will be described in detail below in two sections: terrestrial/freshwater systems and marine systems. The limitations of these regulatory programs are detailed in Response to Question P2.

[6]Fisher et al., Functional ecomorphology: Feedback between form and function in fluvial landscape ecosystems. Geomorphology 89 (2007) 84-96.

[7] (Bailey 1995a). Omernik and Bailey, *Distinguishing Between Watersheds and Ecoregions,* JAWRA, Vol. 33, No. 5 at 940 (1997).

Given the complexity of the regulatory systems that this paper will attempt to describe in a short summary, it is worth highlighting a few key points at the outset:

- Regulation of the environment is largely a new phenomenon which began in the 1970s, but impacts to the Puget Sound ecosystem have been occurring since the beginning of mass migration and settlement in the West in the 1800s.
- Legislators have tended to enact regulations that fix specific problems or focus on specific activities, and to vest authority to regulate in many different agencies (federal, state and local governments). This has sometimes created multiple layers of regulations or, in other cases, created a fragmented system of regulations that doesn't take into account the need to protect the entire spectrum of ecosystem processes, structures and functions.
- Most regulations aren't designed to address habitat protection at an ecosystem scale. Many regulations focus on controlling impacts from individual actions taken on specific sites. This can result in the disruption of ecosystem processes.
- The effectiveness of any regulation at achieving the protection sought is influenced by many factors including funding, political will, the effectiveness of the specific treatments called for in regulations at achieving the outcomes sought, the skill and experience of both regulatory staff and the person attempting to implement the requirements, etc.
- As a result of the limitations of the regulatory programs profiled in this paper, legal and permitted activities can still cause impacts to ecosystem processes, structures and functions even where the people implementing regulatory requirements follow all the rules.
- There is no "silver bullet" regulatory program that exists today which solves all of the problems associated with returning the Puget Sound to a healthy condition.

Regulation of Terrestrial and Freshwater Ecosystems

In order to understand how we reached the complex web of regulatory programs that exist today to control human impacts on the natural environment, we must look briefly at the past. The first set of standardized zoning laws was adopted by the federal government in the 1920s to grapple with the social and environmental stresses afflicting growing cities around the nation. Zoning laws were not viewed as environmental tools, but were mainly designed to address and prevent the effects of "nuisance" activities – air and water pollution, noise and industrial hazards.[8] There was little understanding about the complex interactions of ecological systems and the impacts of human populations on those systems.

Up until the 1970s, when a national environmental movement spread across the country, resulting in the adoption of the federal Clean Water Act, Clean Air Act, and Endangered Species Act (ESA), the protection of environmental resources was largely left to state and local elected officials to deal with on an ad hoc basis.

Although there are many federal laws today that are designed to protect certain natural resources (air, water, individual species, etc.), there is still no comprehensive, national framework that requires the protection and/or restoration of ecosystems as a whole, except in the case of national forest and range lands and where the recovery of endangered species (ESA) are involved. The issue is still dealt with mainly by states and local governments.[9] The result is significant.

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[8] *Growing Smart Legislative Guidebook*, 2002 Edition.

[9] It is interesting to note that unlike water quality, there is no overarching federal law relating to water quantity. Water supply laws vary greatly between the East and West Coasts. This is a legacy of the way in which the West was settled in the 1800s. For more information see the Water Quality and Water Quantity Topic Forum Papers.

From a policy perspective, it is often very difficult for state or local leaders to implement significant changes to land use activities using regulatory approaches in the absence of a major threat to the public health, safety or welfare. It often takes extreme situations (such as the Cuyahoga river fire in Ohio) to provoke public sentiment to the point where a political movement begins calling for more protection of the environment. After these movements subside, the political pendulum can often swing in the opposite direction over a number of years, as people's memories of the crisis that provoked the regulation fade, affecting the political will to continue environmental protections when landowners and industries complain about the constraints imposed by protective regulations.

State and Local Regulations

Washington's local experience has been similar to that of the rest of the nation. Although general police powers were granted to cities, counties and towns by the State Constitution in 1889,[10] the specific authority to engage in local planning wasn't adopted until 1959 and its provisions were optional.[11] For nearly 100 years, local zoning regulations and building permits were the main tools by which specific activities were either allowed or prohibited across the landscape. During that time the state grew steadily and human impacts to the environment were left largely unregulated.

In the early 1970s, consistent with the national environmental movement, Washington adopted three key environmental laws: the State Environmental Policy Act (SEPA), the Shoreline Management Act (SMA) and the Forest Practices Act (FPA). However, further attempts at statewide comprehensive land use planning failed for a variety of reasons.[12] Today, these three laws remain key tools in environmental protection for Puget Sound, although each of them was designed to be applied on a site or permit application scale, rather than an ecosystem scale.[13] The Clean Air Act, implemented by the Puget Sound Clean Air Agency, also protects air quality and limits discharges of certain pollutants within Pierce, King, Snohomish and Kitsap Counties.[14]

With intense population growth throughout the decade of the 1980s, Puget Sound residents began to feel the resulting impacts on their quality of life and demanded change.[15] This resulted in the Legislature's adoption of the Growth Management Act (GMA) in 1990 and 1991.[16] Only a few states have adopted such aggressive limits on the spread of growth across the landscape and most, including Washington, are still working through the policy and management questions that arise when local governments try to balance all of the competing needs of their citizens.

The GMA is a regulatory tool to manage and direct growth to certain places, while requiring certain infrastructure to accompany it. The Act requires counties choosing or required to plan under the GMA to establish urban growth areas as a central component of the "bottom up" or locally controlled growth management strategy, with limited oversight by regional appeal boards and the state Department of Community Trade and Economic Development. Conceptually,

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[10] See Wash. Const. Article XI, Section 11.

[11] See Chapter 36.70 RCW- the Planning Enabling Act. See also, Settle, Washington Land Use and Environmental Law and Practice (1983).

[12] At the same time that these three environmental overlays were enacted into law, the Legislature considered adopting a comprehensive state-supervised land use regulatory system (the State Land Planning Act), not only because a respected Model Land Development Code was published by the distinguished members of the American Law Institute, but also because Congress, through the leadership of Senator Henry M. Jackson, was on the verge of enacting large subsidies for states that had such legislation. But, when the ensuing oil embargo diverted national attention away from the issue, along with the funds, our State Legislature lost interest in comprehensive land use reform. See, *Guidance for Growth,* University of Puget Sound Law Review, 16:867 at 870-871; 875-877 (1993).

[13]However, it should be noted that recent responses by the forestry industry to ESA and Clean Water Act requirements have led to changes in the Forest Practices Act which provide better protection for fish and other species, and the adoption of HCPs which do provide protection at a broader landscape scale. More information on these efforts is provided in the summary set forth in Appendix P1-1.

[14] Chapter 70.94 RCW.

[15] *Guidance for Growth,* University of Puget Sound Law Review, 16:867 at 880-81 (1993).

[16] See Chapter 36.70A RCW.

urban growth areas (UGAs) are intended for compact, higher density urban development to enable more cost-effective urban services and infrastructure, while conserving open space, rural, agricultural, and natural resource lands by prohibiting urban development outside of the UGA.[17] The necessary corollary to containing urban growth within the UGA is zoning that restricts urban densities and development on the rural side of the boundary. [18] When used well, the Act is a powerful tool for local governments to concentrate growth.

The GMA has undergone a number of legislative amendments since its adoption. Most notably for purposes of habitat protection, the Legislature added a requirement in 1995 that the designation and protection of critical areas (which include wetlands, critical aquifer recharge areas, fish and wildlife habitat conservation areas, frequently flooded areas, and geologically hazardous areas) must be supported by best available science.

Apart from changes to the Shoreline Management Act and Forest Practices Act (discussed below), few other changes were made to the state's land use regulatory scheme throughout the 1990s, although federal ESA listings and new Clean Water Act requirements have had significant impact on land use activities in Puget Sound. Today, cities and counties spend a great deal of staff time working on growth planning issues and meeting compliance deadlines related to GMA. This work has not been without controversy or litigation.[19] In particular, the requirement to protect critical areas has spawned many lawsuits against several counties and cities, and push back from some citizens concerned about their property rights.

In addition to these major regulatory tools, there are a few other development regulations routinely used by many local governments to protect the environment, as well as public health and safety. They include some "older" tools such as zoning, clearing and grading regulations, as well as newer regulations such as stormwater or drainage regulations, comprehensive flood plans, flood hazard ordinances adopted consistent with FEMA regulations, low impact development standards, Built Green[20] programs, or other innovative design regulations. The Washington Department of Fish and Wildlife also regulates some aspects of impact to freshwater rivers and streams through its Hydraulic Permit Approval (HPA) program.

Finally, it is also important to note that local governments and special purpose districts such as ports, water, flood and sewer districts have planning and decision-making powers that can affect, in a positive or negative manner, terrestrial and freshwater resources and important estuarine habitats. Similarly, certain federal and state agencies are land managers with the authority to manage publicly-owned lands which can affect ecosystem processes, structures and functions. For example, the Department of Natural Resources manages state-owned aquatic lands (tidelands and shorelands) which it manages pursuant to the directives found in Ch. 79.105 RCW. Those directives include protecting the environment as well as fostering navigation and commerce. At the federal level, the U.S. Department of the Interior's Bureau of Land Management manages over 400,000 acres of federal lands in Washington State which include forests, rangelands, mountains and beaches, for a wide range of uses. Some of those uses include recreation, livestock ranges, oil, gas and mineral extraction, and conservation. (See Appendix P1-1 for additional information on the scope and authority of the BLM as a federal land manager.)

As noted above, many of these regulatory tools have not been studied for their effectiveness in achieving the results sought at the time of permitting. In addition, many government agencies and other commentators noted that those

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[17] *K. Dearborn & A. Gygi, Planner's Panacea or Pandora's Box: A Realistic Assessment of the Role of Urban Growth Areas in Achieving Growth Management Goals,* University of Puget Sound Law Review, 975, 976-77 (1993).

[18] *Id.*

[19] As noted, the requirement that local jurisdictions adopt critical areas regulations has been a driver of significant litigation, as well as a surge in property rights initiatives led by the farming community, which have been defeated at the polls. As a result, the 2007 Legislature granted a 3-year moratorium on the regulation of agriculture under critical areas protections, in order to provide time for the UW's Ruckelshaus Center to facilitate a stakeholder process to address the needs of agricultural interests.

[20] *Built Green* is a voluntary non-profit program created by the Master Builders Association of King and Snohomish Counties that encourages development using energy efficient, sustainable materials and construction techniques. Some jurisdictions are now adopting those principles into their design and construction standards or allowing their use through innovative design regulations.

agencies tasked with implementing regulatory programs do not have performance monitoring programs that measure whether habitat protections or mitigation measures required in regulations have been appropriately included in land use permits, and whether those protections or mitigation measures are effectively implemented on the ground. Most jurisdictions report a lack of funding to accomplish those tasks and further lack the staff to monitor whether the protections remain after a period of years (beyond the period where they hold bonds or other security for a project). Finally, many jurisdictions also report a lack of adequate funding for general code enforcement efforts (where activities take place outside of the permitting process).

Federal Regulations

Most of the federal regulations that protect terrestrial and freshwater aquatic ecosystems (aside from energy-related regulations) have tended to regulate activities that can cause impacts to water quality (Clean Water Act, 404 permits, 401 water quality certifications, etc.), federal forest lands, (e.g., the Northwest Forest Plan), flooding (e.g., FEMA's NFIP standards) and particular species (e.g., ESA and various other species-specific laws). A more lengthy description of federal regulatory programs can be found in Appendix P1-1.

The Northwest Forest Plan was created using an ecosystem approach and remains a strong tool for the protection of federal forest lands. In addition to federal forest regulations, two other federal laws, the Clean Water Act and Endangered Species Act, have had particular influence in Puget Sound.

First, although it had been applied to discharges of pollutants from industries for some time, the Clean Water Act's National Pollutant Discharge Elimination System (NPDES) regulations became applicable to counties and cities with populations of 100,000 or greater in 1995. The NPDES municipal stormwater permit protections now apply to all jurisdictions in Puget Sound with 10,000 or more in population, requiring them to adopt a multi-faceted program to control nonpoint stormwater discharges. This has included the adoption of new local regulations such as grading, clearing and drainage ordinances, as well as pollution discharge prohibitions, and the adoption of inspection and enforcement programs and the compliance with reporting requirements. (Additional details about this program can be found in the Water Quantity Topic Forum Discussion Paper).

Second, with the federal listings of local populations of Puget Sound Chinook salmon, Hood Canal summer chum and bull trout under the Endangered Species Act (ESA) in the late 1990s, and recent listings of steelhead salmon and Southern Resident killer whales, the ESA has had an impact on some activities in this state. The ESA protections now regulate and prohibit human activities that harm those species or habitat important for their life stages.[21] Land use activities which have a federal nexus (such as federal grant funding or require other federal permits) must go through a consultation process to ensure that the activities don't jeopardize the continued existence of listed species.

Although these ESA listings did not change Washington's land use law per se, concern over the salmon listings has led to several regional efforts to respond proactively through voluntary changes in land use practices, incentive programs, and significant habitat restoration plans.[22] Many jurisdictions also incorporated requirements to protect listed species into GMA critical areas regulations. All of these efforts have been voluntary collaborations convened by leaders across the region who came together to create plans that would respond to the needs of the listed species, while ensuring a vibrant regional economy.

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[21] Endangered Species Act of 1973, Pub. L. No. 93-205, 87 Stat. 884, as amended by Pub. L. No. 97-304, 96 Stat. 1411 (1982), *See*, 16 U.S.C. 1531-1541; ESA Regulations: *See*, 50 C.F.R. Part 17 (USFWS) and 50 C.F.R. Part 222 (NMFS). See Appendix P1-1 for further details.

[22] These include the Timber, Fish and Wildlife negotiations; the Tri-County Model 4(d) Rule Response Proposal – a salmon conservation program; the statewide Agriculture, Fish and Water negotiations; the Northwest Forest Plan; the Shared Strategy for Puget Sound's creation of the Puget Sound Chinook Salmon Recovery Plan, which was adopted by NMFS; and the Hood Canal Coordinating Committee's creation of a Summer Chum Recovery Plan.

Regulation of Marine Ecosystems[23]

Turning to the marine environment, the history of regulations described above is applicable here as well. The list of regulatory programs that exist today to protect marine resources at the state or local level is fairly short.

State and Local Regulations

The principal tool is the Shoreline Management Act, administered by local governments through local shoreline master programs, which are approved against a set of state regulations by the Department of Ecology.

In addition, the Washington State Department of Ecology adds together all of the local shoreline master programs to form the state's Coastal Zone Management Plan, which it prepares in compliance with the Coastal Zone Management Act.

The Washington Department of Fish and Wildlife (WDFW) regulates and licenses commercial and sport fishing, aquaculture, and regulates some development activities that potentially alter water flow affecting fish and shellfish through its Hydraulic Project Approval program.[24] In addition, WDFW maintains a list of priority habitats and species (PHS) for which they recommend protection of certain species and habitats.[25] WDFW also administers marine protected areas (MPAs) in Puget Sound within which fishing and harvesting of shellfish and other resources is restricted or prohibited.[26] The Department of Natural Resources (DNR) also manages state-owned tidelands, and regulates aquaculture and shellfish harvesting. The Washington State Parks and Recreation Commission regulates boat use and moorage in marine and freshwater areas associated with the state's park system.

At the county level, there is very limited local regulation of marine waters beyond the jurisdiction of the shoreline master programs implemented under the SMA. San Juan County is the only county to have adopted limits on the use of jet skis and other personal watercraft off its shores in order to protect local marine life and the public health, safety and welfare.

On a positive note, many Puget Sound counties have created Marine Resource Committees (MRCs) under the guidance of the Northwest Straits Commission. MRCs are citizen-based advisory committees committed to protecting and restoring marine resources. Although their work is advisory in nature, their research and policy recommendations for the protection and restoration of marine areas are important resources for local governments to consider in making changes to shoreline master programs and critical areas protections, and in proposing restoration projects.

Finally, it is also important to note that local governments and special purpose districts such as ports, water, flood and sewer districts have planning and decision-making powers that can affect, in a positive or negative manner, marine resources and important estuarine and marine habitats.

Federal Regulations

At the federal level, the regulatory picture is much more complex. As an estuary connected to the Pacific Ocean, Puget Sound frequently falls under a web of federal regulations. Those laws were analyzed by the Pew Commission and U.S. Commission on Oceans pursuant to the Oceans Act of 2000, during two comprehensive efforts to understand the state of our oceans and the effectiveness of the nation's ocean policy. In its final report, the Pew Commission noted the status of federal ocean governance:

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[23] The regulatory programs discussed in this section are summarized in Appendix P1-1.
[24] The HPA program is authorized under Chapter 77.55 RCW and WAC 220-110.
[25] The list includes fish, shellfish, certain marine mammals (porpoises, gray and killer whales, harbor seals, sea otters, and sea lions), shore birds, and other species.
[26] See, Fish and Wildlife Commission Policy 3013.

> Governance is a reflection of the knowledge and values of the society that creates it. Our ocean governance needs updating to reflect substantial changes in our knowledge of the oceans and our values toward them since our major ocean laws, policies, and institutions were established.
>
> Not a system at all, U.S. ocean policy is a hodgepodge of individual laws that has grown by accretion over the years, often in response to crisis. More than 140 federal laws pertain to oceans and coasts. Collectively, these statutes involve at least six departments of the federal government and dozens of federal agencies in the day-to-day management of our oceans and coastal resources. Authority over marine resources is fragmented geographically, as well. The Submerged Lands Act of 1953 gave most states authority over submerged lands and overlying waters from the shoreline out three miles. Federal territorial sovereignty extends 12 miles offshore, and consistent with the United Nations Convention on the Law of the Sea, the federal government controls ocean resources out 200 miles or more. The federal/state division of ocean jurisdiction makes it difficult to protect marine ecosystems because it divides their management into a nearshore and an offshore component with insufficient means or mandate to harmonize the two.
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> *America's Living Oceans, Course for Sea Change: Summary Report – Recommendations for a New Ocean Policy* at pp. 14-16, Pew Oceans Commission, Arlington, VA, May 2003 (emphasis added).

In its final report, the U.S. Commission Ocean Policy similarly made significant recommendations that would enhance the protection and governance over marine resources and oceans both within the U.S. and internationally. The Final Report is entitled An Ocean Blueprint for the 21st Century (U.S. Commission on Ocean Policy, Washington D.C., 2004). A summary of the critical actions they recommend is set forth in Response to Question P2.

Influencing Human Activities: Incentives, Education, Stewardship and Restoration Programs

There are currently numerous incentives, education and stewardship programs available in Washington State that may influence human activities in a way that results in positive outcomes for the environment. A summary of those programs is set forth in Appendix P1-2. It should be noted that this is not an exhaustive list and there may be programs which should be added. With regard to incentive programs, these are activities that provide landowners with benefits that in turn, induce them to protect or restore the ecosystem processes, structures and functions on their land.

Landowner Incentives Programs include: (1) Direct Financial Incentives (grants, subsidized loans, cost-shares, leases); (2) Indirect Financial Incentives (property tax or sales tax relief, such as Public Benefit Rating System programs); (3) Technical Assistance (referrals, education, training, design assistance programs); and (4) Recognition and certification for products or operations.

Puget Sound has a history of success with implementing landowner incentive programs. For example, many Conservation Districts throughout Puget Sound have been quite successful in working with rural landowners and farmers to create and implement individual farm plans. As a result, landowners and farmers have planted and fenced stream buffers and reduced the introduction of nutrients and pathogens to downstream aquatic ecosystems. Another successful tool is the Public Benefit Rating System program (PBRS), a form of indirect financial incentive. This tool is available today under state law, and has been proven effective in protecting critical habitats in urban and rural areas. For example, King, Clark and Whatcom Counties have used the voluntary PBRS program to reduce property taxes in exchange for a landowner granting protective habitat easements and/or restoring habitat on private property. However, despite this success in implementation, there isn't much data or studies that show whether these programs are achieving the environmental outcomes sought.

Conservation Markets encourage the sale of conservation products or credits from private land. Few examples exist for these types of incentives outside of wetland banking, although interest in these programs in growing. (See, e.g., the Ecosystem Services Marketplace program, an innovative water quality trading program designed to reduce stream

temperatures in the Willamette Basin; and Green House Gases (GHG) emission cap and trade programs being discussed across the nation.)

Stewardship Programs use land sales or exchanges, conservation easements, transfer or purchase of development rights. Acquiring property has the potential to provide long-term protection to habitat resources from a variety of risks. Public agencies, as well as non-governmental organizations such as land trusts and conservancies, often acquire property in one of two ways: acquire the entire property through a fee simple transaction, or, acquire a portion of a property's rights by either stripping the property of its development rights or acquiring a conservation easement with associated long-term deed restrictions and covenants. Successful examples of such stewardship programs include the Cascade Land Conservancy's acquisition efforts through its long-term protection plan known as the Cascade Agenda, and the King County and Snohomish County Transfer of Development Rights/Purchase of Development Rights Programs.

Education Programs include public and private outreach and education programs, which are either passive in nature (where a resident simply receives information in the mail or at an event), or active (where training occurs with the expectation that a person will volunteer to protect or monitor some portion of the ecosystem or the health of a species). There are many natural resource education programs designed to be taught in K-12 schools (e.g., education programs designed by state agencies such as WDFW or counties under their NPDES permit programs, and private programs such as Salish Sea Expeditions). There are programs for adults, as well, such as beach-watcher and beach seining volunteer organizations for salmon recovery; watershed-keeper education programs and the like. These programs may result in long-term volunteer engagement in efforts to protect and restore local aquatic systems; however their effectiveness has yet to be measured on a comprehensive scale.

Other Voluntary Efforts

Habitat Restoration Projects take place on public and private properties. Restoration project scale is often a function of project objectives, available funding, and property ownership. Effective restoration of aquatic and terrestrial resources results when a restoration project site is identified, through a technical planning process, to be functionally and physically connected to other ecosystem components. A commitment to monitoring and adaptive management strengthens the likelihood of achieving ongoing restoration project objectives. A variety of local, state, federal, and multi-jurisdictional plans provide guidance as to where habitat restoration projects should take place to achieve specific functional habitat outcomes. There are many habitat restoration plans or guidance documents in existence within the Puget Sound region. They include the various recovery plans adopted by NMFS and USFWS for ESA-listed species; U.S. Army Corps Ecosystem Restoration Plans; plans prepared by the Department of Natural Resources; and projects funded by the Recreation and Conservation Office (RCO) and Marine Resource Committees. In addition, many local governments have adopted natural resource restoration plans.

Watershed Planning Efforts have mainly resulted from the ESA listings of various salmon species. Planning is authorized under Ch. 39.34 RCW (funding watershed management plans), RCW 76.09.350 (landscape planning), and Ch. 90.82 RCW (watershed planning). Some of these voluntary efforts have led to successful adoption of recovery plans, including the Chinook Salmon Recovery Plan and Hood Canal Summer Chum Recovery Plans. The Washington Biodiversity Conservation Strategy is another example of ecosystem-scale planning for species biodiversity. (For more information on biodiversity issues, please refer to the Species, Biodiversity, and the Food Web Topic Forum Discussion Paper.)

In summary, there is a broad array of incentive, education, stewardship, and local planning programs that can be used to protect and restore the environment, and that have a history of success within Puget Sound. However, the tools have not been widely used, nor has their effectiveness been studied or documented. Due to time constraints for development of the Action Agenda, the Land Use/Habitat Protection and Restoration Topic Forum was unable to study each tool to determine which set of programs may provide the best outcomes in each Action Area across Puget Sound, depending on local circumstances. However, we believe that the potential for these programs may be substantial, and it has been largely untapped up until now.

Policy Question 2 (P2): Using the S1, S2, P1 results and risk analysis provided by NOAA, what needs to be done to address the documented threats to habitat from land use practices in the Puget Sound region?

In answering Question P2, the Land Use/Habitat Protection and Restoration Topic Forum has considered the scientific studies and literature cited in the Responses to Questions S1 and S2, the regulations and incentives available under federal, state and local law and programs described in Response to Question P1, as well as our collective professional experience and judgment. We were not able to consider the NOAA risk analysis in our work because it was unavailable.

Introduction

Our system of protecting the environment wasn't designed to protect the entire ecosystem of Puget Sound. Instead, it often prioritizes the human consumption of ecosystem goods and services over the protection of ecosystem-forming processes, structures and functions that provide or support many of those goods and services. We protect components of the system, but not the entire ecosystem. This report presents an analysis of the gaps and limitations existing in the protection and incentive tools that exist today in Puget Sound. It makes recommendations for fundamental changes that will challenge the commitment of policymakers, scientists and most importantly, our citizens, to our goal of a healthy Puget Sound. It is intended to provoke and inspire a community discussion, debate and critical thinking about what is possible if we are to achieve our goal by 2020.

Gaps and Limitations of Our Management Tools

As noted in the Response to Question P1, Washington's tools have developed over many years, driven by different issues. Although there are many tools available that can be used to protect some portions of the ecosystem, there is no "silver bullet" that will solve all of our concerns. GMA has proved to be an important tool for managing growth, not halting it. Even if it did, existing impacts of prior development and land alteration from human activities remain. Because regulations typically only address new development, improving the regulatory system for new development doesn't address this problem. A robust restoration program will still be needed to ensure the success of our efforts.

In order to take the next step forward in protecting Puget Sound, we need a specific examination of the limitations presented by our management tools. The following is a short summary of some of the criticisms that have been levied about them, when viewed in the context of protecting marine areas or terrestrial and freshwater systems from an ecosystem perspective.

Marine Areas

A myriad of federal regulations apply in marine areas, leading to conflicting institutional oversight. Regulations have focused mainly on the exploitation of resources to the detriment of marine life. Inadequate attention has been given to the protection and restoration of the ecosystem processes, structures and functions needed for survival.

At the state and local level, there is a burgeoning of beneficial programs and regulations, especially in recent years (for example, MRC research and policy developments, landowner incentives, marine protected areas, Shoreline Management Act, SEPA and GMA). However, there is no comprehensive Puget Sound-wide ecosystem plan for protecting and restoring marine life and marine areas, including the nearshore. As we seek to improve our protection strategies, we should consider spending more time analyzing not just how a regulatory program could work to protect marine drift cells through an ecosystem approach, but also which voluntary incentive tools can be effective in protecting them as well. Although voluntary programs enjoy wide public support, such programs have not been planned, promoted or funded in a comprehensive way in Puget Sound. We believe these programs have good potential when coupled with regulatory protections to provide positive outcomes for both the environment and for people.

Terrestrial and Freshwater Aquatic Systems

Puget Sound's health and species use are greatly affected by the condition of its terrestrial and freshwater ecosystems. Historically, federal, state and local approaches were aimed mainly at in-water effects of land use activities – an ecosystem perspective was lacking. More recently however, federal agencies have implemented ecosystem approaches through such actions as the Pacific Northwest Forest Plan (1994) and implementation of the federal Endangered Species Act, which explicitly calls for protecting listed species and their ecosystems. Arguably, the federal approaches are still being refined and there is much to learn, but they represent significant initial efforts to manage at the ecosystem level. State and local approaches have a similar history and are lagging behind the federal approaches.

Recently, Washington State has engaged in ecosystem-based approaches include the Forest and Fish Agreement and the SMA update process. In addition, the WDFW and Tribes created comprehensive management plans to address impacts to wild salmonids from hatcheries and recreational and commercial harvest activities. Local governments are behind farther still, but significant gains are being made at that level, too.[27] While historically, most governments have not pursued such comprehensive environmental planning, many have recently done so as part of the WRIA-based salmon recovery plans. These recovery plans are focused on ESA-listed salmon, mainly Chinook and chum salmon, but they provide a helpful template for assessing and understanding land use impacts on fresh and marine systems.

Typically, the least developed aspect of these plans is the linkages between fresh and marine waters and the role of healthy marine habitats, especially nearshore habitats and processes, on salmon recovery. This reflects the relatively immature state of our knowledge about the functions and values of marine nearshore environments; much of this knowledge deficit is being addressed by a wide variety of studies. However, the management of habitat, harvest, hydropower and hatcheries (the so-called 4-H's) is not well-integrated at the WRIA level and an "H-Integration" process is underway to ensure that (a) the local role of all the H's is understood; (b) actions related to recovery actions are not working at cross-purposes; and (c) actions are sequenced properly and strategically to achieve the best environmental outcomes. Given the role of salmon as a keystone species in the Pacific Northwest, these WRIA plans represent a good start at addressing ecosystem needs of the Puget Sound.

Finally, as to the availability and use of voluntary incentive programs in terrestrial and freshwater areas, the same comments apply here as stated in the previous section.

Limitations of Specific Regulatory Tools

The Growth Management Act

Because the Growth Management Act (GMA) is a management tool of widespread applicability, both geographically and substantively, in controlling the impacts of growth and development in Puget Sound, we single it out for special analysis.

The GMA has fundamentally changed the way that growth is dealt with in Washington. Growth (seen as new development for housing, jobs, recreation, other infrastructure and amenities) is now channeled into urban growth areas (UGAs). Outside UGAs, the Act restricts growth to prevent negative impacts on rural character and the environment.[28] While these changes are great improvements over the era of unrestricted growth prior to the adoption of the GMA in 1990, implementation of the Act hasn't always been easy, nor have local governments always understood the long-term implications of their planning choices. GMA is not designed to slow the overall pace of the region's growth as a whole

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[27]For example, from the mid-1980s to late 1990s, King County developed several comprehensive Basin Plans to deal with habitat, flooding, erosion and water quality issues. These plans have affected zoning, stormwater, and habitat protection and restoration and they often provide the basis for many actions being developed for salmon recovery within the county.

[28] We should note that the terms "urbanization" or "urbanizing" are frequently used as shorthand to refer not just to growth densities as defined under GMA, but to the host of human impacts that are seen as threats (or stressors) on ecosystem-forming processes, structures and function. In this summary, we intend the term to have its GMA meaning.

or limit habitat alteration (such as the loss of forest cover) outside of critical areas.[29] In some jurisdictions, the private market has quickly adapted to new restrictions and people have found new opportunities to exploit available land in ways that were unforeseen. The reality is that with only 15 years of experience making public policy under GMA, local governments are still learning how to improve growth management at the local level.

This is particularly true in the area of rural land management. The continued rate of development in rural areas is a concern. In the four-county region encompassed by Puget Sound Regional Council, rural development ranges between 4% and 45% of the population growth.[30] Although the trend in rural growth rates is downward from pre-GMA days, the potential for significant rural growth is still present given historical lot parcelization patterns in some areas and zoning in other areas that allows lots less than 10 acres in size (some as small as 1 and 2 acres).

Development in rural areas presents a concern for the ecosystem because it is in those rural areas where high-quality habitat and significant ecological processes remain partially or largely intact. The concern is that rural area forest cover is being converted to housing and other uses in 5-acre and smaller patchwork patterns at a fast pace. The network of infrastructure (primarily roads, but also other utilities) constructed to serve such development will further fragment the landscape and interrupt or modify the delivery, movement and storage of water, sediment, woody debris and migrating species.

There is also practical limitation in the GMA that has left some of its goals unrealized: Although state agencies such as CTED have the ability to review and comment on local ordinances before they are adopted, state agencies lack the authority to approve or deny proposed plans and regulations. Instead, citizens and state agencies must rely on an appeal process before the Growth Management Hearings Board (GMHB) and further appeals to court if they are not satisfied with the result. Appeals don't always freeze the status quo during the litigation process. Even where an action is challenged and later invalidated by a hearings board on appeal, savvy developers may vest a complete application and secure rights to build under the local government's action taken in contravention of GMA, if done before the act is invalidated. Where no appeals are filed, the GMHB has no jurisdiction to review a local plan or regulation adopted under GMA. This has added to the variability of protection afforded to the ecosystem across the Sound.

In addition, large-scale regional planning which could increase consistency and coordination in land use planning has yet to occur in the entirety of Puget Sound. Solid regional planning efforts, such as the Puget Sound Regional Council and the Thurston Regional Planning Council, don't exist outside of the counties participating in those efforts.

SEPA

Although SEPA was originally envisioned as a powerful tool to provide environmental protection, it has become a tool that provides information, rather than one that mandates specific environmental outcomes. Thus it is largely an ineffective tool in ensuring the best outcomes for Puget Sound. This is a result of regulatory reform efforts made during the 1980s and 1990s.

Other Development Regulations

When local regulations require mitigation of environmental impacts, those regulations generally do not require cumulative impacts to be addressed. This is in part due to statutory and constitutional limitations that limit a developer's responsibility for mitigation only to the direct impacts resulting from their activities. In addition, the "no net loss" standard for the protection of critical areas functions and values is not being met, and is unlikely to be met without

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[29] It should also be noted that non-traditional management tools exist as well. The Puget Sound Regional Council provides a regional planning framework for King, Snohomish, Pierce and Kitsap Counties under GMA. They develop and adopt joint planning policies, such as Vision 2040, which can lead to better coordination and outcomes for growth management among the participants. While not a "management tool" in the sense that the group is not a regulatory agency, the policies do matter. (For example, each participant's transportation plans must be consistent with the latest adopted PSRC planning policies or they will not achieve approval from PSRC, which has consequences).

[30] Puget Sound Trends, Nov. 2005 (Puget Sound Regional Council), available online at http://www.psrc.org/publications/pubs/trends/d5nov05.pdf

significant investment in comprehensive ecosystem restoration that transcends effects that occur beyond parcel boundaries. In part, this is because every jurisdiction in Puget Sound that has adopted critical areas regulations (and other development standards) offers numerous exemptions and compromises that allow for priority human activities and uses, such as road and bridge crossings over streams, ongoing agriculture, and vested lots with development potential.

Other Factors

All of the tools mentioned are limited by the laws that enact them, as well as other factors. Examples of these "other factors" include legal rights granted to various people through laws and legal entitlements. Examples of such factors include Washington's generous vesting laws[31], licenses, leases, or treaties that grant the right to extract or consume natural resources or species such as mining or shellfish leases owned by some landowners, legal, nonconforming uses and preexisting development built in earlier years without adequate environmental protections or mitigation, and constitutional limitations (i.e., the takings clause and substantive due process) afforded to people under state and federal laws. These factors naturally limit the effectiveness of new regulatory tools designed to protect the ecosystem, because they authorize or excuse activities that may cause stress or impact to the ecosystem. These factors, like others, highlight the inherent limits of using regulatory tools and the need to use alternative approaches (such as voluntary incentive programs, acquisition of property rights through easements and purchases, and education) to achieve protection and restoration.

ESA Listings

Federal listings of species have resulted in watershed (WRIA) recovery plans that address reach and watershed-scale conditions and processes. These plans are at various stages of early implementation, mostly focused on capital projects to protect and restore habitat. Prior to these plans, and still ongoing, are additional protections (mainly for the benefit of salmonids) provided by federal regulatory mechanisms such as Section 7 consultation[32] or where a Section 10 habitat conservation plan[33] is sought to allow activities that may result in incidental take of a species. While these ESA tools afford greater protection and scrutiny on specific listed species and their habitat needs, the listings have not yet resulted in noticeable ecosystem-wide benefits in Puget Sound. There are, however, a few examples of communities that have tried to take more of an ecosystem, multi-species approach to protect habitat against human-induced impacts, especially land development.[34] They include the San Diego Multi-Species Conservation Plan (MSCP) and the northern California gnatcatcher conservation plan.[35] These plans could prove useful as models for the creation of the Action Agenda, in terms of understanding the way in which scientists and policymakers worked together to make informed decisions to manage large ecosystems, and the tools that they used to accomplish the plans, monitor and adapt them over time.

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[31] The vested rights doctrine is a legal concept that protects a developer from having to comply with later-enacted changes in land use regulations. Washington's vesting doctrine grants such rights at the time that a developer files a complete permit application. The doctrine was created to protect a developer's investment expectations against fluctuating regulations (which people usually presume will be more stringent). Washington's vesting laws are commonly called "generous" because they "freeze" the land use control regulations that may be applied to a permit application at an earlier time than virtually any other state in the nation. Washington's vested rights doctrine runs contrary to the overwhelming majority rule that "development is *not* immune from subsequently adopted regulations until a building permit has been obtained *and* substantial development has occurred in reliance on that permit." Erickson & Assoc. v. McLerran, 123 Wn.2d 864, 868, 872 P.2d 1090 (1994) *citing* R. Settle, Washington Land Use and Environmental Practice, Section 2.7 (1983)).

[32] See, 16 U.S.C. Section 1536(a)(2) and 50 C.F.R. Section 402. *See,* Pacific Rivers Council v. Thomas, 30 F.3d 1050, 1054 (9th Cir. 1994); and Tennessee Valley Authority v. Hill, 437 U.S. 153, 98 S.Ct. 2279, 57 L.Ed.2d 117 (1978).

[33] *See*, 16 U.S.C. 1539(a)(2).

[34] Although this team did not have the time or resources to study them, some of the HCPs issued for large timber holdings may result in ecosystem benefits, given that they tend to be multi-species in coverage and extend across large areas of land.

[35] The southern california plans include: the California Natural Community Conservation Planning Act (NCCP), CA Fish and Game Code, Sections 2800-2835; and San Diego Multi-Species Conservation Plan, http://www.sdcounty.ca.gov/dplu/mscp/

Limitations of Voluntary Programs

Incentives, Education and Stewardship

These approaches address human behaviors and motivations through a combination of material (mostly monetary) incentives and education and involvement; the latter assumes well-informed and involved citizenry will modify behaviors for the sake of the larger system. Potentially, these approaches can provide benefits over and above what regulations and capital projects could provide. Incentive programs are particularly important in addressing the impacts of existing development that the regulatory program is not able to affect. A broad range of programs exist in Puget Sound. A summary is provided in Appendix P1-2. As with any tool, these programs have limits on their applicability and the extent of their reach.

For example, the programs aren't available for everyone. Even if they were, not all people are motivated by financial gain or altruism. Secondly, given the diversity of people and perspectives in the region, the most willing may not be situated in areas with the greatest need or potential for benefits. Third, these approaches take time, can often be costly to implement and likely require sustained effort over time, all of which are difficult for a government to accomplish. One of the conservation approaches with the most certain outcomes, land acquisition, also has notable complexities. When the purchaser is governmental, it is important to remember that federal, state, and local agencies possess variable conservation missions and publicly-owned land does not always translate to habitat protection and/or conservation. Some agencies prioritize public access, resource extraction, or other land uses that may pose a conflict with certain habitat protection goals. Habitat protection through property acquisition requires a long-term, well-funded, adaptive approach to resource management. Very few land managers and conservation easement holders possess long-term funding certainty for monitoring, maintenance, and resource management.[36] Finally, we haven't performed a comprehensive analysis of which tools are most effective in which situations. Regardless, we believe that these tools have great potential and should be studied further to determine which ones are effective and can be used strategically to provide protections for ecosystem health.

Habitat Restoration Projects

Historically, with regard to publicly funded habitat restoration projects, federal and state-funded projects haven't required an integrated, ecosystem plan as a prerequisite to construction. Without such a plan, it is likely that restoration projects will be performed in an opportunistic fashion, instead of in a deliberate manner in which projects contribute to restoring or recreating the building blocks of ecosystem processes, structures and functions which will sustain over time. More recently however, the development of WRIA salmon recovery plans has led the Salmon Recovery Funding Board (SRFB) to require projects to be an integral part of a WRIA or similar watershed-based plan.

Implementation of restoration projects even within a landscape context is hindered by an artificial separation between compensatory mitigation and restoration. Local governments will typically not consider listed restoration projects or opportunities as appropriate mitigation for a variety of reasons. This results in most mitigation projects being conducted onsite, even if the mitigation project will result in an overall net loss of function. Currently, resource scientists find that a combination of onsite mitigation and offsite restoration is needed in order to attain "no net loss" of ecosystem function. (See Appendix P2-2.)

Presumably, over time, as restoration and habitat mitigation projects are implemented, they will be better matched to their watershed context and, ultimately, much more successful at achieving the restoration goal. One of the more promising aspects of habitat restoration is the increasing emphasis on restoring natural process, such as by restoring forest cover or removing obstacles to floodplain processes, rather than simply creating overly engineered structures, such as pools or spawning substrates for salmon, in locales that would not historically or can no longer support those structures. Process-based restoration projects are complex, can take longer to plan and carry out and generally require a larger geographic scale to make a significant difference. They can be expensive and proponents are sometimes required to piece together the funding to support the project design, construction, monitoring and adaptive management. However, despite these barriers to moving such projects forward, process-based restoration and

[36] Pidott, *Reinventing Conservation Easements*, Land Lines, Volume 17, No. 2, Lincoln Institute of Public Policy (2005).

avoidance of artificial, out-of-context structure based restoration will be critical to long-term, cost and biologically effective restoration.

Conclusion

The regulatory tools with the best potential to protect or restore portions of the Puget Sound ecosystem are just over 30 years old, and our most comprehensive tool from a landscape perspective, GMA, is newer still. GMA is focused on managing growth, not preventing it. This means that although the region will benefit from this regulatory tool, it may not be effective in avoiding impacts to quality of life caused by ever-increasing population growth, and to continuing ecosystem degradation in areas of highly concentrated populations.

While protecting critical areas and shorelines is included among the regulatory mandates of the GMA, planning was not usually accomplished with ecosystem constraints taken into account before uses and zones were adopted. In addition, land use planning occurs on a jurisdiction-by-jurisdiction basis, with some coordination across cities and counties through countywide planning policies and occasionally on a multi-county scale. The number of jurisdictions involved in making land use decisions that affect a single ecosystem remains a significant issue which must be addressed in Puget Sound, if we are to move away from fragmentation and toward ecosystem protection and restoration.

The effectiveness of any regulation at achieving the protection sought is influenced by many factors including funding, political will, the effectiveness of the specific treatments called for in regulations at achieving the outcomes sought, the skill and experience of both regulatory staff and the person attempting to implement the requirements, etc.

As a result of the limitations of the regulatory programs profiled in this paper, legal and permitted activities can still cause impacts to ecosystem processes, structures and functions even where the people implementing regulatory requirements follow all the rules.

Many of the environmental protection tools that are available in Washington have an effect at the site scale, rather than at an ecosystem scale, often missing the need to protect key ecosystem-forming processes. All regulatory and voluntary, incentive-based tools contain exceptions and limits that reduce the certainty of results needed to ensure the sustainability of ecosystem processes, structures and function for a healthy Puget Sound. Net improvement of the ecosystem has not been the case, which strongly suggests that it may be unachievable under the present political/regulatory framework. There is no “silver bullet” regulatory program that exists today which solves all of the problems associated with returning the Puget Sound to a healthy condition.

What all of this tells us is that regulatory tools have their limits. A “one size fits all” regulation alone will not solve the problems facing Puget Sound. Instead, what decision-makers need is a common set of guidelines from the scientific community stating, to the best extent known, the outcomes regulations need to achieve in order to protect ecosystem processes. Against these guidelines local communities across Puget Sound could perform landscape-scale habitat assessments to understand where ecosystem processes remain intact, are at risk of degradation from human activities, or have been lost and need restoration. Using these landscape-scale assessments, government agencies and citizens can make more strategic choices about where to protect and restore ecosystem processes, structures and function in Puget Sound, and which suite of regulatory and incentive programs will achieve the outcomes described in the scientific guidelines.

Achieving this will take reform and realignment of federal, state and local laws and regulations. While still allowing some variation for local conditions and preferences, this approach will lead to better consistency in terms of environmental outcomes. It could also lead to a permitting program that streamlines multiple layers of review by various agencies with inconsistent goals for environmental outcomes.

Reform for the purpose of providing protection of marine resources and oceans at the national and international levels has been identified and prioritized by the U.S. Commission on Ocean Policy and the Pew Commission. Working together, they now have formed the Joint Ocean Commission Initiative and are now calling on the federal, state and

local governments of the United States and other nations to adopt and implement the reforms called for in their 2004 reports, and are providing a forum for continued collaboration, education and leadership toward those goals.

Recommendations for Achieving a Healthy Puget Sound by 2020

Between 1970 and 2000, Puget Sound grew by 1.3 million people, at an annual average growth rate of 1.8%.[37] The rate was greatest during the 1980s at 2.1%. The region's job base more than doubled during the same period, rising from about 760,000 to 1.9 million. The regional job growth rate averaged 3.1% per year, a full percentage point higher than the national average.

During the same period, human activities that threatened Puget Sound proceeded within a fragmented regulatory context where (1) governance was divided among hundreds of federal, state, local, and tribal governments; (2) consumption of natural resources accelerated, with economic goals often outweighing environmental protection; and (3) protection outcomes often differed or conflicted from agency to agency. While generally accepted by the public, voluntary programs have suffered from the same fragmentation in governance, protection and/or restoration goals and environmental results. Finally, until relatively recently, these laws and programs have been generally applied at a site scale, often without regard for the site's value and relationship to the larger context of ecosystem processes, structures and functions.

The result of this historically fragmented system is a Puget Sound ecosystem in serious decline and with an uncertain future. Regional planners tell us that between 2000 and 2040, the region is forecast to grow by an additional 1.7 million people, increasing 52% to reach a population of 5 million. The region's job base is expected to grow to more than 3.1 million, an increase of 64% during the period.[38] If we are going to continue to grow, we must do so in a manner that is smarter and more strategic than we have done in the past.

Given what we know about ecosystem processes, structures and functions, and the tools we have used to control human impacts to the ecosystem, the Topic Forum concluded that: In order to achieve the goal of a healthy Puget Sound by 2020 and support the predicted growth in people and jobs, this region needs a fundamental change in the way in which it manages natural resources and the human activities that impact them. We believe these fundamental changes must achieve three outcomes: (1) a clear statement of the ecosystem processes, structures and functions that must be protected to sustain Puget Sound over time; (2) a consistent set of policy goals that will lead to a sustainable Puget Sound ecosystem; and (3) a governance structure charged with and capable of ensuring that the policy goals are being met.

The following are the recommendations developed by the Land Use/Habitat Protection and Restoration Topic Forum based on the work of the team, the comments received at the public workshops and other public comments received, for consideration by the Puget Sound Partnership during its upcoming discussions on the creation of the Action Agenda.

Science and Research Preliminary Recommendations

1. Create a clear science framework and baseline information from which to act and measure progress.

- Perform a rapid, landscape-scale assessment across Puget Sound of the status of ecosystem processes, structures and functions. Using the best science and research known today, we recommend that a Sound-wide effort be undertaken over a period of 12-24 months to perform landscape-scale assessments identifying the status of important ecosystem processes, structures and function within marine drift cells and in the terrestrial and freshwater aquatic catchments in Puget Sound. The results of such a rapid assessment will improve our

[37] *Vision 2040*, Puget Sound Regional Council, February 14, 2008 at p. 5.

[38] Id.

knowledge in these areas and allow near-term, strategic efforts to protect and restore the ecosystem. The assessments should examine (1) the present condition of marine drift cells and watershed catchments within each Action Area (or whatever scale of assessment is determined to be most appropriate); (2) the land use policy decisions that have been made that may impact these areas; and (3) the areas that should be prioritized to preserve and restore ecosystem processes, structures and functions. This work will help inform policymakers and scientists needing to make strategic decisions about which areas need urgent action first. It will provide information about the character and rarity of habitat types, where they are spatially in relation to one another, and where threats are present which pose risk to the ecosystem processes, structures and/or functions. This information should also be provided to the NOAA Integrated Ecosystem Assessment science team for their consideration. [Note: An abbreviated Case Study of eastern Jefferson County was performed by the Land Use/Habitat Protection and Restoration Topic Forum in order to demonstrate how such a rapid assessment can be done. It is attached to this paper as Appendix P2-4.]

- Perform a comprehensive species natural history survey. A major limitation in achieving a clear science framework from which to act is the lack of a comprehensive natural history survey for Puget Sound. Such a survey would provide biological information on spatial and temporal distribution of its species and biological communities, which are both a primary resource, and which serve as an indicator of health for Puget Sound. Identify what species are or should be present; plan for their needs and translate that information into site scale protections. [For more information, see the Species, Biodiversity, and the Food Web Topic Forum Discussion Paper.]
- Perform a comprehensive/credible study of the cumulative effects of multiple stressors on the ecosystem.
- Until a cumulative effects study is complete, create and use an additive model and uniform, qualitative descriptors to assess the status of Puget Sound Ecosystem (i.e., use an additive model) and use more qualitative descriptors of the system state. (See, e.g., eastern Jefferson County Nearshore Assessment (Diefenderfer et al.) and the Birch Bay watershed assessment (Stanley et al).)
- Consider the conclusions of the NOAA Integrated Ecosystem Assessment for Puget Sound. As this work becomes available, it should be added to the existing scientific knowledge to form the science framework within which we act to restore Puget Sound.

2. Implement a strong monitoring and adaptive management framework to ensure that the Action Agenda achieves the results it seeks.

A critical part of the creation of a monitoring and adaptive management program will require the development of a common methodology for monitoring that is rapid, replicable and whose results can be readily interpreted and used by local governments and other actors at the watershed scale. It is recommended that as a monitoring framework for Puget Sound is created, status and trends monitoring protocols should be developed as an early action item so that other monitoring work that is already underway can be aligned with it.

3. Close our knowledge gaps through the adoption of a robust scientific research agenda.
   A comprehensive list of needed scientific research studies should be created and pursued by the Partnership and its partners (both public and private) in order to fill the gaps in scientific understanding described in this paper. Some of these gaps in understanding include:

- How nearshore and watershed processes affect the structure and function of freshwater, nearshore/marine ecosystems.
- How human activities affect freshwater and nearshore processes, structure and function. (See goals 1 and 2 in Gelfenbaum et al. 2006.) This includes a better understanding of how deep water habitat processes in Puget Sound may be affected by future development such as further shoreline modifications, wastewater discharge, and energy generation (see Beechie et al. 2007).
- The cumulative effects of multiple stressors on processes and habitat structure and function (see above).

- The effectiveness of riparian and upland (e.g. forests) buffers in protecting ecosystem processes, structures and functions in freshwater systems.
- Ecosystem process and habitat responses to climate-induced changes in sea levels, air and water temperatures, precipitation and surface water movement patterns, Puget Sound circulation and water quality (Mantua et al. 2007).

4. Establish a scientifically based strategy to choose restoration projects based on probability of success.

The location, type and extent of projects should be chosen consistent with site and landscape context and condition. For example, sites with a high degree of disturbance on both scales, in general have a low probability for restoration (in the scientific sense of returning an area to a semblance of its pre-development condition). Instead, creation of a new habitat or ecosystem, or enhancement of selected attributes, would be the most viable strategies to apply in these situations. In contrast, where the site and landscape are largely intact, restoration to historical (i.e., humans present, but insignificant disturbance) or pre-disturbance (i.e., before human) conditions would be viable options and the probability of success would be high. (See Figure P2-1.)

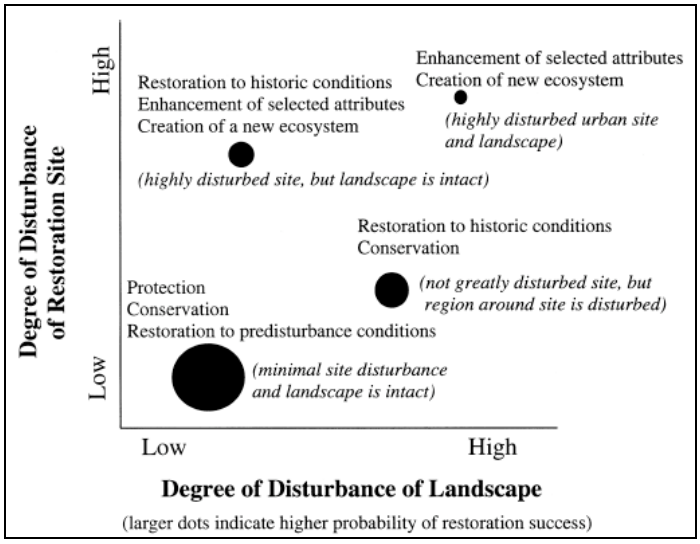

Figure P2-1. Restoration Strategies for Estuarine Systems Relative to Disturbance Levels at the Site and in the Landscape (from Shreffler and Thom 1993). The relative chance of success increases with the size of the dot.

5. Use a common philosophy to choose areas that require restoration of key processes.

The Topic Forum recommends prioritizing restoration of ecosystem processes for areas key to maintaining downstream aquatic ecosystems. Many lowland areas of Puget Sound have been significantly, but not permanently, altered (such as in rural areas). Processes in many of these lowland terraces and valleys support the structure and functions of aquatic resources (riverine, estuarine and nearshore areas). As these areas develop, watershed based restoration and development using smart growth or low impact measures will be essential to achieving no net loss of ecosystem processes, structures and functions. Examples of such project criteria are found in Appendix P2-3.

6. Build upon existing science-based conservation strategies and plans.

The Washington Biodiversity Conservation Strategy and Recovery Plans for Puget Sound Chinook and Hood Canal Summer Chum Salmon, Southern Resident Killer Whales and other species should be incorporated into the ecosystem plan for the restoration of Puget Sound.

Preliminary Policy Recommendations

1. Protection should be the preferred approach to ensuring that ecosystem processes, structures and functions are sustained over time. Where impacts have already occurred in areas that are critical to ecosystem processes, structures and functions, restoration projects should receive top priority for funding and other resources.

- Establish clear, scientific standards that define which habitat processes, structures and functions are critical for the proper functioning of the ecosystem as a whole, and where impacts to them should be avoided at all costs. Most protective regulations use a hierarchy to guide applicants and permit reviewers in how impacts will be evaluated. The hierarchy usually is stated as impacts should be "avoided, minimized, mitigated or, when all else fails, habitat should be restored." Clear standards need to be established that state when impacts are to be avoided at all costs, and when the other approaches may be appropriate, based on the ecosystem processes, structures and functions that are present on a given site in relation to the entire ecosystem. This will improve the certainty of environmental outcomes during the permitting process.
- Select tools that provide the greatest level of certainty of result for the longest duration of time over other protection tools or programs.
- Prioritize restoration projects. Restoration projects that address impacts to the most important ecosystem processes, structures and functions should receive early attention and funding.

2. The region should discuss its vision for a future quality of life.

We recommend that the Puget Sound Partnership lead a regional conversation about the projected population growth of our region to 5 million people by 2040, in order to understand its impacts on the quality of life for humans, the ecosystem of Puget Sound and our economy. The discussion should include the concepts of the maximum capacity of the region to accommodate increased population from a quality of life standpoint, and from the viewpoint of the resiliency of the ecosystem to sustain stressors over time. [39] Examples from other communities which have faced similar situations should be studied to provide options for consideration by our state. (For a summary of the concept of "resiliency," see Appendix P2-1.)

3. The Puget Sound Regional Council's Vision 2040 plan should be used throughout the Puget Sound region as a model for how to focus growth in a way that will protect Puget Sound.

The PSRC's plan supports the preservation of forest and agricultural resource lands; reduces growth levels in rural areas; supports maintaining the current urban growth boundaries; and encourages growth inside the designated urban growth boundaries, especially within designated regional growth centers.

- The focus should be to minimize land conversion to urban-style uses or intensities outside UGAs and to require best management practices and low impact development standards within resource and rural lands which have the highest value for preservation of habitat and ecosystems that support the health of Puget Sound.
- Within urban growth boundaries, critical existing ecosystem processes, structures and functions should receive special protection. Where such ecosystem processes do not exist, actions should concentrate on reducing polluted runoff, low impact development standards, and site-specific shoreline clean-up and restoration where it can make a difference.

4. Adopt a consistent set of habitat protection outcomes required to be achieved by all jurisdictions (federal, state or local) permitting land use activities within Puget Sound through a mix of regulations or incentive programs. The protective standard should be applied to all lands and aquatic or marine areas identified as critical to protecting ecosystem processes, structures and functions. Realign or replace existing programs or regulations that are either

[39] Similar discussions have occurred in other communities which have sought to control growth, including Boulder, Colorado, Petaluma, California and Lake Oswego, Oregon.

inconsistent or in conflict with the protective standard. Monitor results achieved by each jurisdiction in order to ensure habitat protection outcomes are being met.

In order to streamline permitting, avoid duplicative or conflicting regulatory requirements, and achieve consistent ecosystem outcomes, the Topic Forum recommends adoption of a single set of standards that describe the habitat protection outcomes required to be achieved by jurisdictions (federal, state or local governments) in permitting any land use activities that may affect the ecosystem(s) of Puget Sound.[40] The basic framework envisioned is as follows:

Standard: A standard should be adopted by the state that describes the performance outcomes desired for each of the components of habitat-forming processes, structures and functions of marine drift cells and terrestrial and freshwater aquatic areas. The protective standard should take into account the full range of natural physical and chemical factors that control ecosystem processes, as well as the effects of natural factors such as predation, disease and climate change in establishing protective standards that must be met, either through regulation, incentive-based programs or acquisition efforts.

Applicability: The standard should apply to a uniform set of land use, marine use or recreational activities that have been identified as threats (or stressors) to the health of Puget Sound ecosystem.

Strategies to protect: Jurisdictions required to meet the protective habitat standard should conduct watershed-scale (or drift cell-scale, for marine areas) assessment to identify the local conditions and where habitats should be protected and/or restored. With input from citizens, local agencies should employ a mix of regulatory and/or incentive-based programs to accomplish the protection (and/or restoration) outcomes described in the state standard. Where protection at the highest levels is desired to protect ecosystem processes, agencies should consider strictly limiting new development or other activities that alter habitat, and should use a mix of incentive-based programs to permanently protect those areas. Where restoration is necessary to return missing habitat processes, incentives or acquisition should be used to restore lands where existing development or other activities have altered it. Regulatory programs that permit development should be designed to take into account, to the maximum extent possible, cumulative effects of human stressors on the ecosystem.[41] Regulations should limit the expansion or continuation of nonconforming uses beyond the reasonable life cycle of the use.

What it would integrate: At a minimum, Washington State agencies with regulatory jurisdiction under the Forest Practices Act, Hydraulic Project Approval program, SEPA, Shoreline Management Act, Growth Management Act, CZMA, and Clean Water Act, should work to identify barriers within state and federal programs, laws or regulations that would need to be realigned, amended or eliminated in order to implement the habitat outcomes described in this section.

Implementation with accountability requirements: All jurisdictions (federal, state, local and tribal) with permitting authority over land and marine uses should be required to achieve the state standard established to protect and restore the habitat processes, structures and functions necessary for a healthy Puget Sound. This can be accomplished through a mix of regulation, incentive programs or acquisition efforts. The proper mix would be determined at the local level and monitored by a governing agency or group with final approval authority before the regulations or programs go into effect. Local governments would report permitting activity to the state agency. Monitoring of ecosystem conditions should be conducted the state or through the region, in consultation with local residents and governments to determine

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[40] The state laws most often discussed in this context are SEPA, SMA, and GMA. Other state statutes might include the Forest Practices Act and the Hydraulic Project Approval. Federal permits required under the Clean Water Act and the Endangered Species Act present additional challenges. Previous efforts at integrating state laws have foundered for a variety of reasons. For a report on the most recent effort, see the final report of the Land Use Study Commission on a consolidated land use code at www.cted.wa.gov/landuse/report/index.html. One of the issues that the Land Use Study Commission was unable to resolve was the basic governance model. The two basic models in existing state law are exemplified by the GMA and the SMA. (Our governance proposal is discussed in the next section.)

[41] See Appendix P2-2.

the effectiveness of the regulations and incentive programs, and the extent to which they are being properly implemented and achieving the results sought. The Shoreline Management Act provides an example of how such a program might work.

Successful implementation of a Sound-wide ecosystem-based management plan will require the full participation of the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, NMFS, EPA, Tribal governments and state agencies such as the Departments of Fish and Wildlife, Ecology, Community Trade and Economic Development, Puget Sound Partnership and perhaps others. An appropriate program or mechanism to issue 401 and 404 permits under the Clean Water Act must be created and agreed to by these agencies prior to the development of the plan.

5. At the federal level, the President and Congress should immediately adopt the recommendations of the U.S. Commission on Ocean Policy in its 2004 Final Report.

The recommendations are set forth in the U.S. Commission on Ocean Policy's Final Report entitled An Ocean Blueprint for the 21st Century. These recommendations address five main challenges: reforming ocean governance, restoring America's fisheries, protecting our coasts, cleaning coastal waters, and guiding sustainable aquaculture.

Critical Actions Recommended by the U.S. Commission on Ocean Policy
The following key recommendations provide the foundation for a comprehensive national ocean policy that will lead to significant improvements in ocean and coastal management.

Improved Governance

- Establish a National Ocean Council in the Executive Office of the President, chaired by an Assistant to the President.
- Create a non-federal President's Council of Advisors on Ocean Policy.
- Improve the federal agency structure by strengthening NOAA and consolidating federal agency programs according to a phased approach.
- Develop a flexible, voluntary process for creating regional ocean councils, facilitated and supported by the National Ocean Council.
- Create a coordinated management regime for activities in federal offshore waters.

Sound Science for Wise Decisions

- Double the nation's investment in ocean research, launch a new area of ocean exploration, and create the advanced technologies and modern infrastructure needed to support them.
- Implement the national Integrated Ocean Observing System and a national monitoring network.

Education—A Foundation for the Future

- Improve ocean-related education through coordinated and effective formal and informal efforts.

Specific Management Challenges

- Strengthen coastal and watershed management and the links between them.
- Set measurable goals for reducing water pollution, particularly from nonpoint sources, and strengthen incentives, technical assistance, enforcement, and other management tools to achieve those goals.
- Reform fisheries management by separating assessment and allocation, improving the Regional Fishery Management Council system, and exploring the use of dedicated access privileges.
- Accede to the United Nations Convention on the Law of the Sea to remain fully engaged on the international level.

Implementation

- Establish an Ocean Policy Trust Fund, based on unallocated revenues from offshore oil and gas development and new offshore activities, that is dedicated to supporting improved ocean and coastal management at federal and state levels.

6. Examine the entire spectrum of land ownership and ensure that management tools that protect the ecosystem are being used to address all phases of the process.

Land ownership can be understood to occur in phases across a time-continuum. These phases typically include lending, purchase, holding/occupancy, design (or re-design), permitting, construction, inspection, monitoring, and sale to a new owner. Understanding the factors that influence the decision-making of landowners at each phase of their ownership will improve our use of management tools that protect the ecosystem.[42]

7. Examine and promote the best incentive programs at the local level.

We recommend studying all available incentive programs to assess which ones will be most effective in concert with regulatory protections to provide the highest level of certainty for the protection of the Puget Sound ecosystem. Consider ecosystem cap and trade markets, offsets, and other innovative approaches. Based on this study, a suite of locally appropriate incentive programs should be adopted by local jurisdictions or offered by non-governmental organizations within each Action Area to support local protection efforts.

8. Require low impact development techniques to be used where appropriate in order to reduce the loss of forest cover and impacts from increases in impervious surfaces.

There is a growing body of knowledge about the potential use of so-called "low impact development" techniques to mitigate for the impacts caused by urbanization, such as the loss of forest cover and the increase in impervious surfaces, as well as to build in more sustainable ways using alternative materials, design techniques and energy systems to increase the efficiency of new buildings. Where those new development and design techniques are well-tested and appropriate for use given landscape conditions, we urge that they be required by state and local agencies. (For more discussion of LID issues and recommendations, please refer to the Water Quality Topic Forum Discussion Paper.)

9. Establish a centralized and transparent approach to managing information, maps, studies, plans and data related to the Puget Sound ecosystem and the Action Agenda.

A centralized approach to information management would maximize transparency, accessibility and the sharing of information to improve our scientific knowledge about the Puget Sound ecosystem.

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[42]At each phase in this cycle, opportunities arise for activities to occur that either promote or hinder the ecosystem processes, structures and/or functions that exist on or near the property. The factors that influence a landowner's decision to make use of his or her property at each phase need to be examined, understood and management tools applied (voluntary or regulatory) to promote the protection or restoration of the ecosystem. For example, the banking industry may finance only certain types of construction practices, which are well known and understood, rather than innovative, low impact development projects where the timeframes for approval are uncertain and technologies are less known to them. If incentives are applied to encourage LID in construction practices, but the banking industry isn't offering financing for those projects, the incentive program may not be effective.

10. Expand the availability of off-site mitigation programs both institutionally and functionally.

Where land or marine use are to be encouraged or where such uses are unavoidable, off-site mitigation may be appropriate if habitat structures or functions are deemed to be of lower relative importance and mitigation is not warranted on-site. Where these circumstances exist, off-site mitigation programs can encourage the funding of habitat or species restoration projects which have been identified and prioritized through such efforts as the creation of ESA recovery plans or other coastal and watershed-scale protection and restoration planning efforts. These programs need to be developed so that mitigation can be analyzed and transferred off-site readily during the permitting process to the locations in the watershed that provide the greatest benefits with respect to restoring ecosystem processes. Currently, barriers exist to fully implementing these types of programs. Such work needs coordination between federal/state/local governments. It will also require changes to many of the key state and local regulations highlighted in Response to Question P1.

11. Educate the public and business community about how to be stewards of their land.

In order to educate the public and business community about how to "do the right thing" or become stewards of their land, the Puget Sound Partnership should work with its partners in the public or private sector to create, if not already available, and promote sets of best practices for suites of land use activities that have the potential to impact ecosystem processes, structures or function. Examples of such activities may include hobby farming, aquaculture, recreational shellfish harvesting, residential development or maintaining residences along shorelines in freshwater or marine areas, and landscaping to enhance stormwater quality both on-site and downstream.

Preliminary Governance Recommendations

One of the key findings in Response to Question P1 is that there are simply too many governmental actors in Puget Sound with the authority to regulate human activities that pose threats to the ecosystem. They have acted in an uncoordinated fashion, with varying purposes and results. With each government balancing competing needs and making regulatory decisions, the certainty of outcome decreases and the potential for further ecosystem decline increases.

What the region needs instead is a system of governance where leaders are charged with and capable of ensuring that the Puget Sound ecosystem policy goals are being met. We believe that this requires simplicity. It is important to emphasize that this is not the recommendation for a "super agency" that takes away all responsibility from other state agencies or local governments. Rather, it is a recommendation for a process to create a uniform set of standards that local governments and state agencies will then implement. Local governments will still be able to consider local conditions and circumstances as they develop their implementation measures. This approach will address one major problem many local governments face with the GMA and critical areas regulations.

Under the current statute, scientific disputes over best available science are resolved through protracted litigation before the Growth Management Hearings Boards and the courts. This comes at a significant expense to local governments and diverts scarce resources away from productive measures to protect and improve habitat. It also delays implementation of meaningful regulations as these cases wind their way through the legal process.

The region has tried the uncoordinated, diffuse approach and it has not achieved success organically. Where a single agency or group has been empowered to bring people together to agree on the problem, set goals, and chart a course for correction (such as with salmon recovery planning or growth planning through PSRC) positive outcomes have been shown. The Partnership should actively lead the way. To that end we propose that:

1. The Puget Sound Partnership should convene the region's scientists to reach consensus on the outcomes necessary to protect (or restore) the Sound's ecosystem process, structures and functions described in this discussion paper.

2. Given that the Topic Forum recommends that these outcomes become state regulations, we urge the Partnership to seek rulemaking authority during the next Legislative session. We propose that the Partnership oversee the creation of the protective habitat standard outcomes referenced above and implementation across Puget Sound by local governments.

3. Recognizing that implementing the Action Agenda will likely happen at a local scale, the Partnership should create a nonprofit organization to create new organizations where none exist, or work with collaborative groups, where already in existence, around the Sound to implement the Action Agenda at the local level.

4. Given that the Partnership can play a key role in furthering the federal and international ocean policy reform called for in this paper, the Partnership should lobby Congress to enact the recommendations of the U.S. Commission on Ocean Policy.

Appendix S1-1: Major process tables for water, sediments, large woody debris, nitrogen, toxins and phosphorous. Adapted from Stanley et al. 2005.

Freshwater: Water Flow Process - Controls, Important Areas, Stressors and Environmental Responses						
Component of Process			Major Natural Controls	Important Areas	Stressors	Ecosystem Response
Delivery			Precipitation patterns	Recharge areas with higher amounts of precipitation	Change in precipitation	Alters timing, duration and frequency of delivery of water to aquatic ecosystems.
			Timing of snowmelt	Rain-on-snow zones Snow-dominated zones	Loss of forest	Increased frequency of rain-on-snow events. Loss of forest in snow-dominated zone reduces late spring to summer groundwater discharge to streams.
Movement	At the surface	Surface storage	Topography Surficial geology Soils	Areas of low gradient Floodplains	Draining and filling of wetlands Disconnecting stream from floodplain	Increase in water level fluctuations in downstream wetlands and loss of species richness. Increased peak flows downstream which affects stream structure. Disconnecting the stream from its floodplain through channelization or diking increases stream velocity and erosion, bedload transport and reduces structural complexity in streams.
	Below surface	Shallow subsurface flow	Topography Surficial geology	Areas on geologic deposits with low permeability	Loss of forest (>35%), impervious cover (>4%), roads (density).	Reduces recharge of shallow groundwater which can affect early growing season groundwater discharge to wetlands and streams. Increases overland flow and peak flows downstream.
		Recharge/Storage		Areas on geologic deposits with high permeability	Any loss of forest and impervious cover. Roads (density).	Reduces deep recharge of larger aquifers. Increases the 2-year peak flow which in turn affects stream structure. Decreases summer baseflows.
	Return to surface	Discharge	Topography Surficial geology	Slope breaks (steep above, gentle below) intersecting permeable deposits Stratigraphic pinchouts Contact areas between geologic deposits of different permeabilities	Loss of forest on permeable deposits intersecting stream corridors	Reduces recharge and subsequent discharge to water bodies and their associated groundwater systems which may include the hyporheic zone. This in turn impacts stream productivity.
Loss		Evaporation/ Transpiration	Vegetation Climate	Entire watershed	Any impervious cover	Alters water budget for watershed.

Appendix S1-1: Major process tables for water, sediments, large woody debris, nitrogen, toxins and phosphorous. Adapted from Stanley et al. 2005.

Freshwater: Sediment Process - Controls, Important Areas, Stressors and Ecosystem Response					
Component of Process		Major Natural Controls	Important Areas	Stressors	Ecosystem Response
Delivery	Surface erosion	Topography Soil erodibility Vegetative cover	Steep slopes with erodible soils	Loss of forest on erodible soils (K factor). Roads within 200' of streams (# road crossings) Urbanization	Increases sediment load to streams and wetlands. Increased sediment load raises elevation of wetland and decreases saturation of soils. Water quality, quantity and habitat functions are affected. Increased bedload in streams affects stream structure due to initial steepening of longitudinal profile. Stream adjusts by lowering gradient through bedload transport and deposition which alters stream structure. Increased in-stream erosion can "incise" and disconnect the stream bed from its floodplain and simplify stream structure. Species richness is decreased.
	Mass wasting	Topography Geology	Hazard areas for all slope movement processes including deep seated and shallow, rapid landslides	Roads (density), loss of forest	
	In-channel erosion	Transport capacity Riparian vegetation Vegetative cover	Stream corridors	Channelization of streams Urbanization (increases stream discharge)	
Movement	Sedimentation	Transport capacity	Depressional wetlands Lakes Floodplains and depositional channels	Draining and filling of depressional wetlands Channelizing streams with floodplains Increased streamflow (urbanization) Dams	Depressional wetlands and floodplains remove fine sediment through filtration by vegetation and sedimentation due to slower water velocities. When wetlands and floodplains are filled or floodplains are separated from the streams by channelization, greater quantities of sediment are transported downstream. This negatively affects the structure and function of these downstream wetlands and floodplains. Dams increase sediment storage but change the habitat structure and complexity downstream and upstream of the dam
Loss		Transport capacity	Decrease or increase in sediment storage	Same causes as for movement	Same response as above

Appendix S1-1: Major process tables for water, sediments, large woody debris, nitrogen, toxins and phosphorous. Adapted from Stanley et al. 2005.

Freshwater: Large Woody Debris Process – Controls, Important Areas, Stressors and Ecosystem Response				
Component of Process	Major Natural Controls	Important Areas	Stressor	Ecosystem Response
Streambank erosion and channel stability	Water energy Riparian vegetation Erodibility of soils In-channel wood	Unconfined channels (low gradient floodplains)	Channelization of streams in unconfined reaches	Channelization and armoring reduce erosion and the subsequent fall of trees into streams. Large wood is a principal factor in structuring habitat structure of streams. Large wood moderates scours and channel shifting and facilitates island formation. Large wood also plays an important role in providing habitat structure in estuarine and nearshore areas.
			Armoring of streams	
			Removing riparian vegetation	Reduces source of large woody debris for streams. Same effect to habitat structure in aquatic systems as above.
Mass wasting	Topography	Hazard areas for shallow, rapid landslides	Remove forest vegetation on high mass wasting hazard areas[43]	Reduces source of large woody debris for streams. Small streams recruit majority of wood from upslope areas. Similar effect to habitat structure in aquatic systems as above in erosion.
Windthrow	Riparian vegetation Weather patterns	Forest within 100' from aquatic resources	Removal of vegetation adjacent to stream	Windthrow is an important source of wood in steeper small channels. Reduces source of large woody debris for streams. Similar effect to habitat structure in aquatic systems as above in erosion.
Storage	Transport capacity of water	Channels with <4% gradient	Channelization of streams in unconfined reaches	Reduces capacity of stream to store wood which reduces supply of large wood to stream systems. Similar effect to habitat structure in aquatic systems as above in erosion.
			Increased streamflow[44]	
Breakage/ Decomposition	Biotic interactions	None identified	None identified	None identified

[43] Note that removal of forest vegetation on high hazard mass wasting areas is not legal under State rules

Appendix S1-1: Major process tables for water, sediments, large woody debris, nitrogen, toxins and phosphorous. Adapted from Stanley et al. 2005.

Freshwater: Nitrogen Process – Controls, Important Areas, Stressors and Ecosystem Response					
Component of Process		Major Natural Controls	Important Area	Stressor	Ecosystem Response
Delivery	Nitrogen sources	Weather patterns Biotic composition	Additional sources	Agricultural landuse (livestock, dairies, commercial crops) Septic systems (rural residential within 200' of streams)	Excess nitrogen can increase algal blooms in stream systems reducing dissolved oxygen levels and species richness. In nearshore marine systems, excess nitrogen can create conditions suitable for harmful algal blooms.
Movement	Biotic uptake and decomposition	Biotic cover and composition Hydrologic regime	Headwater streams	Channelization of headwater streams (<10m)	Uptake reduced by deepening of stream channel and removal of riparian vegetation. Base of stream food chain affected including photosynthetic and heterotrophic biota (i.e. fungi and bacteria) and invertebrates. As a result, biologic productivity of headwater streams is reduced.
	Nitrification	Hydrologic regime	Depressional wetlands (excluding bogs and fens)	Draining or filling of depressional wetlands	More nitrogen is transported downgradient.
	Adsorption	Hydrologic regime	Headwater streams	Channelization of headwater streams	Same effects as above.
Loss	Denitrification	Hydrologic regime	Depressional wetlands	Draining or filling of depressional wetlands	More nitrogen is transported downgradient (in both surface water and groundwater).
		Surficial geology Groundwater flow paths Reactive sites	Riparian areas with consistent suppy of shallow groundwater in permeable deposits	Interception of shallow groundwater flow before it discharges in riparian and floodplain areas	Nitrogen is transported downstream to estuaries and nearshore marine environments. See "Delivery" for additional response.

Appendix S1-1: Major process tables for water, sediments, large woody debris, nitrogen, toxins and phosphorous. Adapted from Stanley et al. 2005.

Freshwater: Toxins and Phosphorous Processes – Controls, Important Areas, Stressors and Ecosystem Response					
Component of Process		Major Natural Controls	Important Area	Stressor	Ecosystem Response
Delivery	Phosphorus sources	Climate patterns Surficial geology	Areas contributing additional sources	Agricultural and urban land use (application of fertilizer, livestock dairies)	Phosphorous is a limiting nutrient in freshwater ecosystems. Additional sources can exceed the capacity of soils to adsorb phosphorous which results in downgradient transport. In aquatic systems, especially lakes, excess phosphorous results in eutrophication and reduction in species richness. Though not a limiting nutrient in marine systems, phosphorous plays a role in promoting harmful algal blooms.
				Application of manure	
	Toxin sources		Areas contributing additional sources of toxins	Agricultural and urban land use (application of pesticides, herbicides, and other chemicals)	
	Surface erosion1	Soil type Surface hydrologic regime (frequency, magnitude & duration) Soil erodibility	Most soils derived by glacial deposits	Removal of vegetation and grading for new development	Naturally occurring phosphorous, adsorbed to sediment, is transported by overland flow to downgradient aquatic systems.
Movement	Biotic uptake and decomposition	Biotic cover & composition Hydrologic regime	See ecosystem response	See ecosystem response	Because this is an annual process of uptake in the growing season and release in the fall these areas (i.e. emergent & decidous vegetation) are not significant sinks for phosphorous and toxins in urban areas.
	Adsorption (P)	Soil characteristics	Areas with organic and clay soils	Draining or filling of depressional wetlands with mineral soils	Depressional wetlands are effective sinks for phosphorous. Draining and filling transports phosphorous downgradient to other aquatic systems.
				Loss of upland areas with clay soils	Increase transport of phosphorous downgradient.
	Adsorption (T)	Soil cation exchange capacity	Areas with organic and clay soils	Draining or filling of wetlands with organic and clay soils	Depressional wetlands are effective sinks for toxins. Draining and filling transports toxins downgradient to other aquatic systems.
	Sedimentation1	Water transport capacity (velocity)	Reduced storage of phosphorous & toxins	See Sedimentation Process	See Sedimentation Process

Appendix S1-1: Major process tables for water, sediments, large woody debris, nitrogen, toxins and phosphorous. Adapted from Stanley et al. 2005.

<table>
<tr><th colspan="7">Freshwater: Pathogen Processes – Controls, Important Areas, Stressors and Ecosystem Response</th></tr>
<tr><th colspan="2">Component of Process</th><th colspan="2">Major Natural Controls</th><th>Important Area</th><th>Stressor</th><th>Ecosystem Response</th></tr>
<tr><td rowspan="2">Delivery</td><td colspan="2" rowspan="2">Fecal inputs</td><td colspan="2" rowspan="2">Wildlife</td><td rowspan="2">Additional sources including commercial agriculture, rural residential & urban areas</td><td>Failed septic systems</td><td rowspan="2">Increased input of pathogens to aquatic ecosystems.</td></tr>
<tr><td>Discharge of untreated human and animal waste</td></tr>
<tr><td rowspan="5">Movement</td><td rowspan="3">Transport</td><td>Overland flow</td><td>Precipitation patterns Soils</td><td rowspan="3">Urban, rural and agricultural areas</td><td>Ditching & draining of saturated areas, removal of forest cover, soil disturbance, and impervious cover</td><td rowspan="4">Increased transport and movement of pathogens across the landscape and into aquatic ecosystems. This can result in the contamination of freshwater and marine waters and shellfish resources which results in increased public health risks.</td></tr>
<tr><td>Surface flows</td><td>Topography Surficial geology Soils</td><td>Channelization of streams</td></tr>
<tr><td>Subsurface flows & Recharge</td><td>Topography Surficial geology</td><td>Impervious cover Ditching in areas of low permeability</td></tr>
<tr><td colspan="2">Adsorption</td><td colspan="2" rowspan="2">Mineral and organic soils Surface water velocity</td><td rowspan="2">Wetlands and floodplains</td><td rowspan="2">Ditching, draining or filling depression wetlands with mineral and organic soils</td></tr>
<tr><td colspan="2">Sedimentation2</td></tr>
<tr><td>Loss</td><td colspan="2">Death</td><td colspan="2">UV radiation. Starvation and predation</td><td>Depressional wetlands and floodplains</td><td>Draining or filling of depressional wetlands with mineral and/or organic soils</td><td>Increased movement and transport of pathogens downgradient to freshwater and marine ecosystems.</td></tr>
</table>

Appendix S1-2: A preliminary overview of Action Area conditions and threats. Table refinements should be made based on input from the Topic Forum on April 28th and from the "Action Area Profiles" currently being developed.				
Action Area	Land Uses	Watershed and Terrestrial Habitats	Dominant Marine and Estuarine Habitats	Action Area-Specific Major Threats1
Strait of Juan de Fuca	Headwater areas largely protected in national park (Olympic), except for Hoko and Pysht areas. Outside of protected areas, most mid- to low-elevation areas are in forest and forestry uses. Three moderate-sized UGAs (Port Angeles, Sequim and Port Townsend) are present, located away or mostly away from major river headwaters, corridors and river mouths. Two UGAs (Port Angeles and Port Townsend) have significant development along marine nearhore areas. Otherwise, low elevation areas are dominated by mostly rural residential uses.	Terrestrial – higher elevations contain mixed conifer forests and hemlock and silver fir, lower elevation forests contain hemlock and fir with woodlands and shrubs lands in riparian areas. Freshwater – rivers include the Dungeness, Elwha, Lyre, Pysht, East and West Twin, and Hoko, with many smaller river and stream systems. Lakes Crescent and Sutherland are the largest natural lakes in the area.	Large amounts of rocky reef and kelp habitats (particularly towards western end); sand and gravel beaches and flats, large sand spits at Port Angeles (although affected by lack of sediment from Elwha) and Sequim (Dungeness River mouth), large embayments (Discovery Bay, Sequim Bay), estuaries at mouths of major rivers and many small creeks, moderate human shoreline uses at Neah Bay, Clallam Bay, Port Angeles, and Sequim.	Barriers, especially on the Elwha River, but also on many small stream and in floodplains where old culverts remain, affect fish passage and free flow of materials such as water, sediment and LWD. Forest cover loss and conversion to development is localized (in and near UGAs) and is localized conversion of natural stream systems to artificial ditches, floodplain development. Large woody debris (LWD) and forest type is affected by extensive past logging as well as more localized floodplain and riparian development. Localized riparian and floodplain development also create impacts for floodplains and riparian conditions. Nearshore areas are threatened by increased residential development, fecal coliform and nutrient additions to bays (especially Dungeness Bay), shoreline armoring, fish and shellfish harvest, commercial development along ports.

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Action Area	Land Uses	Watershed and Terrestrial Habitats	Dominant Marine and Estuarine Habitats	Action Area-Specific Major Threats1
Hood Canal	Western headwater and mid-reach areas are steep and largely contained in park (Olympic) and Forest Service lands with scattered rural development. Southern and eastern headwater areas are relatively flat and dominated by second and third growth forest and related timber harvesting activities and extensive rural development. Low elevation areas and marine shorelines mostly in rural development w/ variable degrees of development and alteration, the most intense of which are along the northeastern shores.	Terrestrial – higher elevations contain mixed conifer forests and hemlock and silver fir; lower elevation forests contain hemlock and fir with woodlands and shrub lands in riparian areas. Freshwater – major rivers include the Skokomish, Hamma Hamma, Duckabush, Dosewallips, Quilcene and Tahuya. Lake Cushman – an artificial reservoir - is the largest lake in the Action Area.	Dominated by sand and gravel beaches and flats, more sand beaches in Hood Canal than other Action Areas, embayments (Dabob and Quilcene bays), estuaries and wetlands at mouths of major rivers and many small creeks. Heavier human shoreline uses at Port Townsend and Belfair. Moderate uses at other small towns bordering the canal, like Seabeck and Brinnon.	Loss of forest cover, activities that increase impervious surfaces, shoreline modifications, habitat fragmentation; blockage of salmon access to high elevation river habitats.

Appendix S1-2: A preliminary overview of Action Area conditions and threats. Table refinements should be made based on input from the Topic Forum on April 28th and from the "Action Area Profiles" currently being developed.				
Action Area	Land Uses	Watershed and Terrestrial Habitats	Dominant Marine and Estuarine Habitats	Action Area-Specific Major Threats1
San Juan/ Whatcom	San Juan – rural lands dominate, some forestry, agriculture, conservancy lands, and a few small towns (UGAs). Whatcom portion – low elevation and marine shoreline areas, several medium to large UGAs, extensive rural residential and agriculture. Mid to higher elevation areas mostly in forestry and protected status, w/ scattered low density rural residential and agriculture.	San Juan – terrestrial habitats dominated by fir-hemlock-cedar forest, also significant patches of madrone forest, grasslands, scrub-shrub, and rock outcrops. Freshwater habitats are primarily small, intermittent streams and lakes. Whatcom - terrestrial – higher elevations have glaciers, rock outcrops, and hemlock and mixed conifer forests. Hemlock and Douglas fir forests line higher elevation streams, becoming riparian woodlands and shrub lands and crop lands along the river in the lowlands. Douglas fir, hemlock, and red cedar forests dominate upland areas in the Puget Sound lowlands. Freshwater – the Nooksack River is the major riverine system. Major lakes are Samish and Whatcom.	San Juan - dominated by rock cliffs, rocky reefs and kelp habitats on islands, interspersed gravel beaches, numerous small embayments within the islands, moderate human shoreline uses within major towns on larger islands (San Juan, Orcas, Lopez, Shaw), marinas on many islands. Whatcom - dominated by sand and gravel beaches and flats, some mudflats and rock cliffs, estuaries and wetlands at mouth of Nooksack River and small creeks, heavy human shoreline uses at Bellingham and Blaine.	Marine shoreline modifications, activities that increase impervious surfaces – transportation infrastructure, land conversion, loss of vegetation, upland/shoreline habitat connectivity.

Appendix S1-2: A preliminary overview of Action Area conditions and threats. Table refinements should be made based on input from the Topic Forum on April 28th and from the "Action Area Profiles" currently being developed.				
Action Area	Land Uses	Watershed and Terrestrial Habitats	Dominant Marine and Estuarine Habitats	Action Area-Specific Major Threats1
Whidbey Basin	Headwater areas largely protected in park (North Cascade) and wilderness lands. Mid-elevations mostly in forestry, protected uses, scattered small UGAs and rural residential development. In low elevation and along marine shorelines, UGAs ranging from small to large, mostly situated near the mouths of the Snohomish and Skagit Rivers. Extensive agriculture in lower and mid-valley floodplains of all major rivers.	Terrestrial – higher elevations have glaciers and hemlock and mixed conifer forests. Hemlock and Douglas fir forests line higher elevation streams, becoming riparian woodlands and shrub lands along larger rivers in the lowlands. Douglas fir, hemlock, and red cedar forests dominate upland areas in the Puget Sound lowlands. Freshwater – major river systems include the Skagit, Stilliguamish, and Snohomish. Largest lakes are reservoirs, include Baker and Ross.	Large freshwater influence from Skagit River, large estuary and wetland areas in Skagit, Padilla, and Everett bays, eelgrass meadows in sand and mud flat bays, large areas of sand and gravel beaches and flats. Whidbey and Camano islands provide some shoreline protection, some rocky/sandy cliffs, estuaries at mouths of major rivers and many small creeks. Heavy human shoreline uses in Everett, moderate shoreline uses along island shorelines.	Activities that increase impervious surfaces - transportation infrastructure, land conversion, agricultural practices, forest loss predominately along marine shorelines, and in low elevation areas. Mid elevation areas still recovering from extensive historic logging impacts. Dams on the Skagit and Baker Rivers; conversion of agricultural lands to non-agricultural uses; invasive plant species.
North Central Puget Sound	Mix of small to medium sized UGAs w/ extensive scattered rural residential development all in low elevation and low topographic relief settings. Scattered small agriculture and forestry.	Terrestrial- Douglas fir, hemlock, and red cedar forests dominate upland areas. Freshwater – many small streams and lakes such as Chico Creek and Wildcat Lake.	Dominated by sand and gravel beaches and flats, sometimes backed by feeder bluffs. Estuaries at mouths of many small creeks, heavy shoreline uses at Bremerton, moderate uses at Poulsbo, Port Orchard, Eagle Harbor, Keyport, Gig Harbor.	Marine (and freshwater) shoreline modification and vegetation removal, habitat fragmentation.

Appendix S1-2: A preliminary overview of Action Area conditions and threats. Table refinements should be made based on input from the Topic Forum on April 28th and from the "Action Area Profiles" currently being developed.				
Action Area	Land Uses	Watershed and Terrestrial Habitats	Dominant Marine and Estuarine Habitats	Action Area-Specific Major Threats1
South Central Puget Sound	Major and extensive UGAs in lower elevations and along Sound shorelines and estuaries. Medium to small UGAs scattered in surrounding low to mid elevation areas. Extensive rural and development outside UGAs and localized agriculture along undeveloped low elevation floodplains. Mid to high elevation forests in protected or commercial forestry activities.	Terrestrial - Douglas fir, hemlock, and red cedar forests in upland areas, riparian forests and woodlands along rivers and streams. Many forest have high proportion of deciduous trees relative to predevelopment condition. Freshwater - major river systems are the Green/Duwamish, Puyallup/ White, Cedar and Sammamish; large lakes are Washington and Sammamish (WA's second and sixth largest lakes, respectively); many smaller lakes and streams. The Green/Duwamish River and the Lake Washington systems have undergone dramatic "re-plumbing." The Duwamish has been straightened and dredged.	Dominated by sand and gravel beaches and flats, sometimes backed by feeder bluffs. Small, typically developed estuaries at mouths of major rivers (Duwamish, Puyallup), smaller estuaries at many small creeks. Significant portions of shoreline armored by railroad, heavy shoreline uses in many areas focused around Seattle, Tacoma, moderate uses throughout eastern side, less intensive shoreline uses on Vashon and Maury Islands.	Activities that increase impervious surfaces – transportation infrastructure, land conversion; dams on the Cedar, Green and White Rivers; blockage of salmon access to high elevation river habitats; armoring for railroad has reduced sediment inputs.
South Puget Sound	Headwaters of most major streams in protected status or forestry w/ scattered rural residential. Fort Lewis surrounds and protects large reach of Nisqually from major development. Scattered medium to small UGAs along marine areas and away from most major streams and stream mouths. Most low to mid elevation areas in scattered rural residential and forestry w/ some agriculture.	Terrestrial – Douglas fir, hemlock, and red cedar forests dominate upland areas. Riparian woodlands and shrubs along rivers. Contains historic prairie and grasslands. Freshwater –Nisqually is the major river system in the area. Smaller rivers include the Deschutes, Chambers-Clover system, and Kennedy-Greensborough.	Numerous embayments with little water circulation and subject to high tidal fluctuations. Dominated by sand beaches and flats, mud flats, large estuary at mouth of Nisqually, many small estuaries associated with streams, heavy human shoreline uses at Olympia (Budd Inlet), moderate at Shelton and Steilacoom.	Activities that increase impervious surfaces – transportation infrastructure, land conversion, private ownership of tide lands; water quality from stormwater runoff and septic. Increased turbidity.

[1] See Table S1-1 for an overview of threats common within the Puget Sound watershed. Those of particular concern are noted for each Action Area.
Sources: Ruckelshaus and McClure 2007; PSAT 2007a; PSAT 2007b; San Juan County Marine Stewardship Area Plan; County comprehensive plans; Puget Sound Chinook Salmon Recovery Plan; Department of Natural Resources Shorezone database.

Appendix S1-3: The East Jefferson County Case Study

Performing Ecosystem Rapid Assessments for the Puget Sound Action Areas

July 3, 2008

Introduction

Much has been written about the fact that Puget Sound and many of its species are in trouble. In enacting the Puget Sound Partnership legislation in 2007, the State Legislature announced that we can no longer wait to solve the problems contributing to the Sound's decline. In launching the Action Agenda project to guide our efforts, the Partnership has set a course to reach a healthy Puget Sound by 2020. NOAA scientists and others are performing a sound-wide risk assessment that should provide the scientific basis for further actions. This work is underway now and should be complete by 2010.

In the meantime, the Land Use/Habitat Protection and Restoration Topic Team Forum ("Forum") was charged with answering the question, "*What is the status of the habitat in Puget Sound?"* The preliminary answer is found in the Forum's Summary Paper. A critical finding in the Summary Paper is that there are significant gaps in our understanding about both the status of stressors or threats to habitat, and about the opportunities that may exist to preserve or restore important parts of the Puget Sound as an integrated landscape and seascape that functions together as an ecosystem.

Understanding the urgency to move forward now, the Topic Forum recommends that the Partnership pursue a rapid, watershed-scale "ecosystem assessment" within each Action Area. The purpose of the rapid assessment is to provide a coarse-scale to fine-scale understanding of the "habitat" threats/stressors and opportunities that exist in each Action Area.

The Forum believes that this information will serve two purposes. First, it will help the articulation of a set of "habitat outcomes" that describe a properly functioning ecosystem where ecosystem processes, structures and functions are intact. Second, once completed, the rapid assessment will provide early information to the Puget Sound Partnership and local leaders about the status of habitat across the Sound, and where opportunities exist in watersheds to make more strategic decisions about where to begin to provide enhanced protection and/or restoration activities throughout Puget Sound, until further scientific studies deliver more information to guide our work.

Before the Forum determined that it should make such a recommendation, it was felt that a rapid assessment should be attempted within a portion of Puget Sound in order to understand whether the recommendation would be feasible, and to better understand the challenges and benefits of such an approach. The Forum recognizes that there are benefits and drawbacks from a "rapid assessment" approach. The benefit of such assessments is that they can yield quicker results, are less detailed and quantitative, convene experts across disciplines (e.g., science, planning, law) and result in a faster resolution of information conflicts or gaps and synthesis of information to achieve recommendations. The drawback of such assessments is that there may be an increased risk of errors based on faulty information or a lack of local consensus on recommendations if local input is not considered. As such, the Forum believes that a strong adaptive management, monitoring and scientific research program should be used to support actions taken as a result of rapid assessments so that course corrections can be taken if errors are made. In addition, the Forum recommends that a public process that convenes and includes input from local stakeholders should accompany each rapid assessment.

The Importance of Planning at an Ecosystem or Watershed Scale

Much of the recent research concludes that the protection, management and regulatory activities could be more successful if they incorporated an understanding of "ecosystem" or "watershed processes," terms which mean that we should consider the natural environment in a more holistic, connected fashion. Traditionally, most planning has focused on the site scale without an understanding of watershed processes. Scientific studies have shown that watershed processes interact with landscape features, climate, and each other to produce the structure and functions of aquatic ecosystems that society is interested in protecting. As noted in Land Use/Habitat Protection and Restoration Topic Forum Paper, the tools that exist today to manage land use and human impacts to aquatic and terrestrial systems in Puget Sound are fragmented. One result of this fragmentation is that our tools are neither achieving a unified watershed approach nor ensuring protection of the habitat and natural systems that matter most for long-term health of Puget Sound.

Ecosystem-based characterizations[45] through rapid assessments can provide decision-makers with specific information in the short term about where those places are (or should be, if already lost or altered), and what challenges or opportunities

[45] In this paper, the term "ecosystem-based" or "watershed-based" characterizations is meant to refer to assessments of both upland aquatic and terrestrial habitats coupled with nearshore, coastal and deep subtidal habitats.

exist in making their protection (and restoration) a top priority. The Topic Forum Team believes that understanding habitat processes, structures and functions will improve land use planning and management, and will help identify the best areas for restoration and protection and the best locations for offsite mitigation. We also believe that the success rate of mitigation and restoration efforts will improve using a watershed approach. .

A unified and coordinated approach to the characterization and management of watersheds has been recommended by the Washington State Department of Ecology[46]. Such an approach requires the equal participation and endorsement by key state and federal agencies in conjunction with local planners and citizens at the planning level. Participants agree to a detailed management framework, based on the watershed characterization, which is then incorporated into a local adopted plan. The plan spans areas regulated under both the GMA and the SMA and can include multiple jurisdictions within a watershed. The detailed adopted plan streamlines the permitting process by identifying the best areas for mitigation (protection and restoration), the mechanisms for accomplishing such mitigation and what the monitoring requirements would be. Overall, this approach is predicted to reduce the time and cost typically associated with site by site review and enforcement, and provide a greater degree of certainty and predictability for local governments in regulating sensitive habitats at the permit level.

Watershed planning has been ongoing in many local areas across Puget Sound for years. However, watershed planning linked with nearshore, coastal and deepwater marine systems has only recently been attempted in very limited areas. Some efforts are organized around water supply, and others focused on salmon recovery planning. The Habitat Topic Forum believes that existing watershed plans (including salmon recovery or other species recovery plans) linked with emerging assessments and plans that include nearshore ecosystems should be used in performing rapid assessments, where those plans have characterized a watershed from a broader ecosystem perspective, to avoid duplicating prior efforts.

The Jefferson County Case Study – Purpose, Scope and Limits

The purpose of the case study was to understand the feasibility and challenges of performing a rapid ecosystem assessment in the Action Areas of Puget Sound. The Forum examined a number of potential areas and ultimately chose to focus on eastern Jefferson County because it presented an area where prior work had been done that could be used in a very short period of time.

Based on the time constraints of the development of the Action Agenda and the Topic Forum Papers, the Habitat Topic Forum limited the case study in several ways. First, the Habitat Topic Forum used only existing information which was available from prior scientific studies or research and public sources, such as information readily available from public agency websites. Second, the Forum did not consult with or seek the assistance of Jefferson County, the cities within the jurisdiction, or any organized local group prior to performing the assessment. Third, the Habitat Topic Forum assessed the status of ecosystem processes for the eastern portion of Jefferson County, rather than a single watershed. Finally, given time constraints, the Forum examined only one of several ecosystem processes, and its related structures and functions – water flow – and did not assess other important ecosystem processes which would ordinarily be included.

The Habitat Topic Forum recognizes that in an ideal setting, a rapid assessment would include participation and information from the local community being assessed, and should include an analysis of *all* ecosystem processes, structures and functions. It may also make more sense, depending on the location, to change the geographic scale (county, city, watershed, sub-basin) of rapid assessments to suit the local conditions or circumstances within each Action Area.

The Rapid Assessment Methodology

In terms of examining the watersheds in Puget Sound, the group decided to examine eastern Jefferson County according to the watersheds existing within the political boundary, and characterize each of them. However, based on time constraints, the Topic Forum Team was only able to consider a single process – water flow—rather than all ecosystem processes, which would have provided a more complete view of the area and better management recommendations. However, as noted above, the goal of our work was as much to determine the methodology for doing rapid assessments that would result in a watershed characterization, as it was to reach conclusions about the status of the watersheds in Jefferson County, itself. Assessments of nearshore conditions that are linked partially to watershed conditions in Jefferson County provided the first attempt in the State outside of ESA or forestry plans to comprehensively assess “ecosystem” conditions, and to prioritize actions and land use recommendations based on these assessments.

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[46]Developing a Watershed Characterization & Analysis Approach for Meeting Multiple Mandates in Washington State; prepared by the Washington State Department of Ecology, et. al., (Feb. 23, 2006).

This "learn by doing" approach brought together a diverse team of scientists, planners, regulators, attorneys, architects and natural resource consultants to quickly synthesize information that already existed and identify what other information might be helpful. We learned from each other about what was important ecologically in terrestrial and aquatic areas. We also examined the current GMA land use framework within these ecological systems exist and how protection of the land and water was, or could be, impacted in the future by land use policy decisions. Where possible, we discussed what incentive tools might be used to encourage local landowners to protect important ecological systems.

Characterizing an ecosystem begins at the broadest scale over which *processes* operate in the area being analyzed. From a land use management standpoint, this scale can be viewed on a countywide scale or other, large management unit. Next, the characterization provides an assessment of processes at the sub-basin or mid scale. From a land use management standpoint, the sub-basin scale allows for identification and prioritization of the best areas for protection, restoration and development. The mid or sub-basin scale assessment allows planners to evaluate and plan for the best patterns of development and mitigation at the fine or site scale. The fine scale is where structure and function operate and serve the essential life stages of fish or animals.

At each scale, the Topic Forum Team determined that it was important to examine a number of considerations:

- A basic Inventory of Land Type by GMA class
- Areas most sensitive to changes from land use
- Population – existing and future expected growth
- Water quality and water flow processes
- Habitat condition and Biodiversity (Biodiversity maps)
- Shoreline conditions and priority actions (Diefenderfer et al.)
- Identified priority areas for protection and restoration (Stanley, et al.)
- Planned or Potential Future Land/Shore development patterns (Jefferson County Future Land Use Maps)
- An overall synthesis of all of this information to develop a cohesive characterization of the study area that includes both terrestrial, freshwater and saltwater components.

The Watershed Assessment (upland and freshwater areas)

In the particular case of eastern Jefferson County, a watershed characterization had been previously performed which identified priority areas for restoration and protection, shown in a series of maps. See, *Draft Watershed Characterization of Jefferson County,* May 16, 2007, Version 3, Wash. State Dept. of Ecology, Shorelands and Environmental Assistance Program. This work was highly valuable in completing our work in such a short time frame. The approach and scientific methodology used in that work is set forth in selected part, below:

> 1.2 Approach[47]
>
> Characterizing processes within the watersheds of the study area is central to developing a successful watershed based mitigation plan. An adequate characterization will provide local jurisdictions with information on the best areas for mitigation, protection of watershed processes, and development.
>
> For example, this watershed characterization and analysis will help us identify areas that are important or key for maintaining watershed processes and how much these areas have been altered (Figures 3 and 4). A matrix (Figure 5) is then applied that evaluates the degree of importance and alteration for each basin, which in turn can produce a final map showing priorities for protection and restoration (Figure 6).
>
> Our management and regulation of these aquatic ecosystems have typically concentrated on the biological, physical, and chemical character of the individual lake, wetland, stream reach or estuary, and not on the larger watershed that controls these characteristics.
>
> However, the central assumption to this characterization approach is that the health of habitat and associated aquatic resources is dependent upon intact upgradient (upstream/upslope) watershed processes. Research has demonstrated that we must consider the watershed processes originating in terrestrial areas if we are to protect and restore our lakes, rivers, wetlands, and estuaries, (National Research Council 2001, Dale et al. 2000, Bedford and Preston 1988, Roni et al. 2002, Poiani et al. 1996, Gersib 2001, Gove et al. 2001).

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[47] *Draft Watershed Characterization of Jefferson County,* May 16, 2007, Version 3, Wash. State Dept. of Ecology, Shorelands and Environmental Assistance Program at pp. 2-3.

Watershed Processes*:* In this document, *watershed processes* refers to the dynamic physical and chemical interactions that form and maintain the landscape at the geographic scales of watersheds to basins (hundreds to thousands of square miles). These processes include the movement of water, sediment, nutrients, pathogens, toxins, and wood as they enter into, pass through, and eventually leave the watershed. For example, flooding by streams can create off-channel habitat that is important for fish. Much of the research concludes that protection, management, and regulatory activities could be more successful if they incorporated an understanding of watershed process

2.0 Methods

For this project, the tools proposed for application are: 1) DOE publication #05-06-027, "Protecting Aquatic Ecosystems: Volume 1, A Guide for Puget Sound Planners to Understand Watershed Processes." This document provides guidance on how to conduct a coarse scale characterization for multiple processes; 2) "Protecting Aquatic Ecosystems: Volume 2 Models for Understanding Watershed Processes." This is a draft document that presents numeric models for implementing the guidance presented in Volume 1 and is attached to this document in Appendix B. These tools represent one possible way to conduct a characterization and should not be considered the only method recommended by the Land Use and Habitat Team.

The hydrologic process was characterized for Jefferson County. The qualitative description for analyzing watershed processes is presented in appendices B through G of publication 05-06-027 (Volume 1). These appendices provide a tabular description of how to analyze the individual components of those processes. Volume 2 provides examples of numeric models that can be constructed to identify the geographic locations in a watershed that are key to the delivery, movement and loss of water (Tables B-1 and B-3 in Appendix B). The equations in these models use the environmental characteristics described in the tables as variables in equations that establish importance.

In general, variables are assigned maximum values of 1, 2 and 3; representing respectively, low, medium and high "importance" of a characteristic or "alteration" of a characteristic. The models are constructed so that higher total scores represent sub-basins or basins of greater importance for supporting a process in a watershed, or one with a higher degree of alteration to that process. The scoring is normalized to conditions specific in a watershed or basin. Thus the models provide a *comparison* of the *relative level of importance and alteration* of process components (see Step 3 and 4 of DOE publication 05-06-027). The scores do not represent a specific rate (e.g. rate of removal of sediment or nitrogen) or specific level of alteration of a process that can be compared to scores outside of an analysis area. We do not have enough information at this time to calibrate models to conditions throughout the state and establish relative importance of processes and alterations among different watersheds.

Appendix B of [the draft Watershed Characterization] presents the scoring methods in detail and a series of maps that display the results of the numeric models applied to the freshwater watersheds of Jefferson County.

3.0 Hydrogeologic Units

This characterization uses a hydrogeologic classification approach based on the "hydrologic-landscapes" work of Winter (2001) and the hydrogeologic work of Bedford (1999 & 1988). This landscape approach considers regional climate, surficial geology, topography, groundwater and surface flow patterns and morphology in relationship to aquatic resources. Jefferson County has already established hydrologic units for the County based previous watershed planning efforts (i.e. 2514). This characterization study modifies these hydrologic units in order to maintain the relationship between processes and the aquatic ecosystems that they influence (i.e. process, structure and function relationship). Whereas the County hydrologic units are based primarily on the surface water boundaries of major stream and river systems, this analysis groups units based on precipitation type, subsurface and surface water flow patterns, and geology and landform.

These units were also divided so that watersheds with significantly different levels/patterns of precipitation and geomorphology and were not compared to one another in the scoring. For example, because the watersheds within the Large River Unit (i.e. Big Quilcene) unit have higher precipitation levels they will score higher than the Small River unit if analyzed together. The Small River unit, however, support important aquatic ecosystems and should be characterized separately from the Large River unit so that characterization scores are not artificially suppressed by the scores for the higher precipitation levels in the watersheds of Large Rivers.

The Shoreline Assessment

In addition to the Jefferson County Watershed Characterization, the Forum Team also used the existing work of Diefenderfer, H.L., K.L. Sobocinski, R.M. Thom, C.W. May, S.L. Southard, A.B. Borde, J. Vavrinec, and N.K. Sather, Multi-

scale analysis of restoration priorities for marine shoreline planning. *Environmental Management.* Submitted December, 2007, (In Revision). The study is anticipated to be published soon. However, the following represents a short summary of the shoreline assessment project's methodology.

The area that was characterized by the study included the East Jefferson County shorelines. (West Jefferson County was not included because it consists of Federal and Tribal lands not subject to the County's jurisdiction under the Shoreline Management Act). The shorelines that were included can generally be characterized as *partially exposed, semi-protected* or *protected* according to Dethier (1990).

These marine shorelines were grouped into two Water Resource Inventory Areas (WRIAs), with similar geomorphological conditions: WRIA 17, which encompasses most of East Jefferson County, including shorelines on the Strait of Juan de Fuca, Admiralty Inlet, and North Hood Canal; and a small portion of WRIA 16, with shorelines on north Hood Canal. WRIA 17 is characterized by large and small bays with streams that are not associated with the Olympic Mountains. WRIA 16 is characterized by two major rivers, the Dosewallips and Duckabush, and smaller lowland streams. The study grouped the shorelines into two groups because of the difference in connection (or absence of a connection) to upland perennial streams or rivers.

The shoreline study documented an approach to determining the conservation or restoration strategy most likely to succeed based on current conditions at local and landscape scales. Their analysis was structured by an ecosystem conceptual model, which identified anthropogenic impacts, or stressors, as well as targeted ecosystem functions, and considered relevant spatial scales and hydrologic context. They used existing high quality, quantitative GIS data from multiple sources (state, tribal, and local county).

A scoring system, weighted by geomorphic class, was applied to available spatial data on stressors and functions at three scales: shore zone unit, drift cell reach, and watershed. The scoring system was simple, requiring minimal interpretation to achieve the maximum consistency in scoring result, while at the same time avoiding or double counting. An important part of the scoring system is that it was guided by quantitative data. Critical parameter values were derived from literature or percentile distributions of data.

Using the output from the watershed assessment to characterize such factors as sediment delivery and nutrient input, the nearshore assessment was able to score the relative "threat" of a damaged watershed to the receiving nearshore landscape (e.g., drift cell). Next, appropriate conservation and restoration strategies were paired with sites based on the likelihood of producing resilience to disturbance given the condition of local and landscape scale ecosystem structures and processes. This decision framework augments historical conditions and change analysis, as well as ecosystem valuation, providing a science-based planning tool in GIS. Id.

The Combined Ecosystem Assessment for East Jefferson County

To complete its analysis of the entire ecosystem in East Jefferson County, the Habitat Forum Team assembled the information from the prior watershed and marine shoreline assessments, along with the Jefferson County land use planning policies, land use designations and future land use map, surface water management plan, and proposed critical areas regulations and staff report. The team analyzed the County according to the existing GMA land types, beginning with urban growth areas ("UGA") or urbanized lands, if not formal UGAs, rural lands, and finally, natural resource lands (forest, mineral and agricultural). The team documented a short summary of the combined analysis in a table, considering General Habitat Status and Stressors on Water Processes, projected population growth, the status of upland/terrestrial habitat, the status of marine and shoreline areas, the status of freshwater systems and the status of biodiversity within each land type. After each land type was characterized, a synthesis of the status of the area according to hydrologic processes, structures and function was discussed, along with the stressors or threats currently or potentially faced by each land type given current adopted plans, zoning, or other land use controls. Finally, a synthesized set of recommendations was included for each land type, focusing on protecting areas at risk from existing or future stressors and restoring areas important for hydrologic processes.

The summary of the team's analysis is presented below, along with recommendations for reach land use type for preserving and restoring ecosystems functions within each area.

The Rapid Assessment Findings

Jefferson County is a rural county with a small population relative to other areas in Puget Sound. However, it is projected to nearly double in size by 2025, which has the potential to concentrate new population within a relatively small, habitable area of the County, due to steep, publicly-owned or lands that are not otherwise available for development. The County's current urban development is concentrated in areas where it has the least potential for disrupting hydrologic processes.

Large scale impacts to processes are low for most rural areas except in the Quimper peninsula. However, the greatest opportunity for restoration is in lands adjacent or upstream of urban development in Port Townsend and these areas may be subject to further degradation if future development pressure from the urban areas is not properly planned and located. The other major threat or stressor in this County is within rural lands that are largely forested and have a high potential for future clearing and habitat disruption, whether for forestry or for long-term conversion of the land to another, more intensive use. The marine shorelines in the County are in fairly good condition, considering existing development impacts, and score on average as "moderate" in terms of habitat health. The shorelines have few areas that are heavily damaged and modified. The primary threats to marine shorelines are the potential loss of nearshore riparian areas due to development; continued armoring; effects from upland watershed changes (agriculture – nutrients) and over-water structures. The Port Townsend shoreline is heavily impacted in terms of the feeder bluffs and sediment process.

Areas within Jefferson County were characterized for the health of hydrologic processes by the Department of Ecology. Their findings revealed:

> The Olympic Mountains and the adjoining lowlands have the largest relative area of "high" importance to watershed processes. This is due to the presence of higher precipitation (rain-on-snow, snow dominated zones), and areas important to surface and groundwater processes throughout this area (surface storage and infiltration, percolation and recharge). The Little Quilcene watershed was of lower overall importance due to a higher degree of impermeable deposits and lower relative rainfall.
>
> The headwaters for the Chimacum drift plain score as a "high importance" as do watershed areas draining to Tarboo and Quilcene Bays. The high importance of the Chimacum area is primarily due to the presence of wetlands and floodplains and relatively large areas of permeable deposits and moderate rainfall levels. The Tarboo Creek, Thorndyke Creek, Toandos Peninsula (west side), and Donovan Creek watersheds score high due to the presence of important areas for groundwater processes (infiltration, percolation and recharge). Other areas of lower importance were primarily the small nearshore marine watersheds that are in areas of low rainfall and fewer areas for storing surface water (i.e. wetlands and streams). (Figure 1)
>
> Large areas of the County are suitable for protection due to large tracks of forest (of all age classes) and low level of alteration including limited coverage by impermeable surfaces and roads. Key areas for restoration include the Chimacum Valley, Leland Creek, Donovan Creek and the lower reaches of the Big Quilcene. The most appropriate areas for development are limited to Port Townsend and the east side of the Quimper peninsula (Figure 3).

Therefore, alteration to water flow processes in rural areas (except Chimacum/Quimper peninsula) was found to be low to moderate. There are two main stressors present in rural and resources lands included nutrient loading into streams (and ultimately the marine areas) from farms located in the valleys, and clearing of mature forests either for commercial forestry or where the land is converting from forestry to other uses. Results of the marine shoreline characterization indicated that it was in good condition despite the relatively higher concentration of residential and some commercial uses there. The shoreline function scores on average are moderate. There are a few areas that are heavily damaged and modified. The primary threats to the healthy functioning of the shoreline areas are a loss of nearshore riparian habitat due to mainly residential development, continued bank armoring, and effects from upland watershed stressors. These upland watershed stressors include nutrient-loading into water from agriculture, and overwater structures. The Port Townsend shoreline is heavily impacted, due to significant alteration of sediment processes (i.e. isolation of feeder bluffs, shoreline armoring and breakwaters/groins).

In terms of water quality protection, although the County does not have an NPDES permit, it has adopted the 2004 Department of Ecology Stormwater Manual and, in last few years, has begun to develop stormwater comprehensive planning and an extensive outreach and education campaign through a contract with WSU Extension, and is working on a low impact development ordinance. Port Townsend is in the process of reviewing the DOE Stormwater Manual for adoption.

Overall Findings and Recommendations:

1. Understanding processes at a watershed scale will improve land use planning and management toward the goal of protecting ecosystem processes, structures and functions for the long-term health of Puget Sound. It will also help identify and prioritize the best areas for restoration and protection so that investments and efforts are made strategically, with better results.

2. The PSP should consider funding a focused, rapid assessment[48] pilot project (e.g. similar to Birch Bay) in areas across Puget Sound to determine where there is the greatest restoration opportunity and highest risk to resources. As part of this work, the PSP should convene multiple local stakeholders and agencies and perform a specific landscape analysis to select the future development/resource management scenario that best protects and restores the terrestrial and marine ecosystems. The results of the analysis should be compared to existing GMA Comprehensive Plans or other land use planning documents (including salmon recovery or other species recovery plans) to see where land use conflicts are likely to place marine and terrestrial ecosystems at risk of degradation.

3. The PSP should encourage or require that changes be made to adopted plans or that new plans be adopted to ensure the long-term protection of these natural resources. Ideally, the results of this rapid assessment process should lead to a new or revised system of permitting or incentive programs which encourage protection. For example, where protection outcomes and required protection methods are described in particular detail, streamlined permitting processes could be offered to developments following such methods. In addition, the plans could identify in advance the best areas for off-site mitigation (protection and restoration), the mechanisms for accomplishing such mitigation and what the monitoring requirements would be. Such an approach requires the equal participation and endorsement by key state and federal agencies in conjunction with local planners and citizens at the planning level.

4. Characterization of wildlife at a landscape scale must be part of watershed characterization efforts. This includes identifying core species and their critical habitat areas, connectivity of wildlife patches and designation of wildlife corridors as part of critical areas.

5. PSP needs to facilitate the storage and maintenance of watershed information and make it accessible via the web in various formats to citizens. We need to provide many more incentives to local agencies, citizens and landowners for conducting characterizations and preparing watershed based plans. This includes demonstrating how to integrate GMA and SMA planning efforts.

6. The PSP should fund an effectiveness study relative to the restoration of eelgrass beds in the east Jefferson County delta.

[48] The term "rapid assessment" is meant to convey the fact that this work would be done quickly, in 12-18 months time with a focused work program using technical staff trained to perform this type of work and land use planners and/or attorneys with extensive practical knowledge of Washington's land use and environmental regulations. We note that there are tradeoffs associated with speed. However, these assessments are seen as an urgent first step toward preserving the intact areas vital for a healthy Puget Sound, while scientists perform longer term studies that will tell us more about the Sound and where additional effort is needed.

Jefferson County Rapid Assessment - March 17, 2008

Land Use/Habitat Protection and Restoration Topic Forum Team

for the

Puget Sound Partnership Project

GMA Land Type: UGA	General Habitat Status and Stressors on Water Processes	Projected Population Growth	Upland /Terrestrial Habitat Status	Marine Areas Status	Freshwater Status	Biodiversity Wildlife networks
Port Townsend	Status: The UGA covers 11,332 acres; 4,466 acres are inside the city. The area has Moderate permeability. There are fewer streams, wetlands in this area. Port Townsend generally, has a low importance for water processes, and is lowest in the wetland ratings for the County. This is due to the fact that it has no deeper permeable deposits, lower rainfall and less precipitation delivery. Stressors: The area is "highly altered" due to impervious surfaces, lost forest cover, and roads. Main concerns: forest clearing; increasing impervious surfaces.	UGA: 10,227 Yr. 2000 13,329 Yr. 2024 City: 8,344 Yr. 2000	64% of overall watershed is forested. (Quimper Peninsula), but, Port Townsend Bay area has 20.6% of land in impervious surfaces.	The downtown core is built on fill. There is an existing marina at Port Hudson and __. There are many docks and, over-water structures in the city. The entire shoreline is altered, except for Fort. Worden, which has intact feeder bluffs. There are kelp beds in NW corner. Downtown is the main seawall/armored area. Water quality is generally good in the bay. Stormwater is the main potential source of nonpoint pollution. The sewer system is located near Fort Worden and the outfall pipe goes into good mixing zone in Admiralty Inlet.	There are a few, small streams in this area and Kai-Tai Lagoon. The lagoon is a transition wetland; it was previously part of estuary before it was cutoff. Kai-Tai Lagoon is a high restoration priority to return to tidal influence.	High biodiversity score due to lots of shorebirds, waterfowl; and marine mammals.
Comments re: Water Processes Protection & Restoration	City could remove some docks; improve circulation in marinas by adding outlet where dead-end. Restore estuary lagoon; Continue protecting shoreline functions (esp. northside bluffs) based on total function, add density here; (Need to consider quality of life issues, transportation, lack of access to jobs or economic engine, etc.) Encourage upland development in peninsulas like this – as long as you take care of the shorelands. Big incentive here for TDR may be a big help here – offsite mitigation should be considered in restoration areas in other basins especially in the Chimacum Valley sub-basins.					

GMA Land Type: Urban	General Habitat Status and Stressors on Water Processes	Projected Population Growth	Upland /Terrestrial Habitat Status	Marine Areas Status	Freshwater Status	Biodiversity Wildlife networks
Port Hadlock/ **Irondale**	Habitat Status: The UGA size is 1,320 acres, with 1,035 in the lower watershed. The UGA is rated "moderate" for permeability and for water processes. Total impervious area is good at less than 6% in the lower watershed. UGA 1320 acres; 1035 lower watershed; Stressors: Rated at "high risk" for significant loss of habitat due to density and growth pressures. Also groundwater withdrawal issues are serious in Chimacum Creek. The area looks rural on zoning maps, but actual build out shows there is only 24 acres of commercial agriculture here, and 2,880 acres of rural residential development. Zoning is R-5 and R-10 but the area is already highly parcelized into smaller lots. This is place to try to hold the line against more density & growth.	UGA: 2,553 Yr. 2000 4,906 Yr. 2024 City: 3,442 Yr. 2000 5,598 Yr. 2024	The area consists of pre-1900's clearing of the watershed, a resulting loss of forest cover from logging and rural residential development. Today, the area has 614 acres designated forestland; 70% forest cover; The Chimacum area scores high in importance for hydrologic processes primarily due to the presence of wetlands and floodplains and relatively large areas of permeable deposits and moderate rainfall levels. UGA is the host for entire Chimacum Watershed, which is impacted by forestry and agricultural impacts. Shellfish area threatened at the mouth of the creek at Port Hadlock. Aquifer recharge area with significant water supply wells covers part of the area.	Primary stressor in this area is fill and bulkheads. Up to 75% of shorelines in this area are altered by shore armoring (bulkheads). In addition, at the mouth of Chimacum Creek there are high concentration levels of nitrates from upland agriculture which cause seaweed blooms that kill eelgrass beds.	There is a net movement of surface water that recharges deep aquifers in this area. The area has sustained wetland alteration and loss over time, primarily from drainage ditches. Here, wetland restoration could help with removal of Nitrate Nitrogen through de-nitrification which would otherwise be transported to the bay and contribute to algal blooms and potentially low DO problems..	High biodiversity Opportunity in this UGA because it sits at the mouth of Chimacum Creek. The estuary presence drives score from low to moderate as move upstream (outside UGA).
Comments:	Complete the instream flow rules. Hold line on UGAs. Enforce zoning. Solve nutrient problem from upland ag sources. (Similar to urban/suburban creeks) Remove inter-tidal fill; Minimize or remove bulkheads; investigate nutrient problem (look at residential septic, too) Use incentives such as TDRs, etc. to prevent build out of small parcels in rural area. Look at Montgomery County, MD program. Could be good receiving area for off-site mitigation projects caused by impacts to wetlands from Pt. Townsend. Endorse community stewardship program for restoration.					

GMA Land Type: Urban/Other	General Habitat Status and Stressors on Water Processes	Projected Population Growth	Upland /Terrestrial Habitat Status	Marine Areas Status	Freshwater Status	Biodiversity Wildlife networks
Port Ludlow (master planned resort)	Habitat Status: At 23 acres in size, Port Ludlow has localized, highly urban conditions with local impacts, but within an overall rural context. Most of the surround area is in a forested condition. Stressors: Containing growth and preserving hydrologic processes surrounding it. There is a need to limit habitat fragmentation and roads crossings.	1,530 FY 2000 3,783 by 2024 The area is expected to more than double in size with master planned resort final phase build out.	This area has high importance due to its very permeable soils and current state of low alteration and low stressors. The major concern here is clearing for development.	There is a marina, bank armoring and over-water structures. Hydrologic functions are low on the inner part of the resort and rise to moderate as you move further out toward the edge of the resort. Water quality in the bay is monitored by the owners and consistently meets class AA standards, except in summer when there is a spike in fecal coli form.	This area has few wetlands and lower stream density relative to the rest of the county so has lower importance for water flow processes. No specific data here.	Biodiversity is rate at "medium" value within Port Ludlow. The presence of these species shows an indicator of ecosystem health.
Comments:	Zoning works if no rural cluster density bonuses (avoid sprawl); reduce forest loss/soil disturbance to protect water quality. Stay back from bluffs to prevent need for armoring. (see stressor list- use tools to limit or avoid) Implement the 20 acre zoning on the outside the devel. Use LID; Green Build standards. For marinas, docks or other overwater structures, Build or rebuild use the newest design see Diefendorfer et al. SMA update is opportunity; Culturally, they like incentives - See the list; PBRS, etc. Conservation easements, etc. Need to protect water quality. Subdivisions have slowed.					

GMA Land Type:	General Habitat Status and Stressors on Water Processes	Projected Population Growth	Upland /Terrestrial Habitat Status	Marine Areas Status	Freshwater Status	Biodiversity Wildlife networks
Rural Lands	<u>Habitat Status:</u> Glacial terraced areas: (Chimacum, Tarboo, Thorndyke, Boltron, Torindos) Higher permeability in these areas is important to groundwater flow processes and discharge to aquatic systems. <u>Stressors</u>: 65% forest cover can likely be maintained; High percentage of forest intact. High risk of conversion to rural uses. Loss forest cover; roads; increase in impervious. Surfaces; Will cause: Stream channel degradation. Water quality degradation, mostly from small hobby farms.	30% new growth projected here. 4,149 FY 2024	Hydrologic processes in the Duckabush and Dosewallips are under most stress from residential development. The channel migration zone and estuarine delta areas are at high risk of loss if not acquired or otherwise protected. Upstream areas in the Quilcene are at risk from residential development. Lower valley alluvial stream bases are really important.	Marine shoreline areas are in good shape. The biggest stress here is in Brinnon area, due to road crossing & development. Waterfront development is a stressor, but lower than elsewhere. Opportunities to protect processes exist. Recommend that they don't block streams, avoid road crossings in estuaries. There is a good fish corridor from South don't armor or disturb nearshore riparian areas. In Dabob Bay, there is some shellfish production and fairly good water quality there. There is a large concentration of R-5 zoning in marine shorelines. This can work with proper setbacks.		Quilcene Bay – relatively high biodiversity on the western and northern portions. In Dabob Bay, where Tarboo Creek comes in, there is high biodiversity. Extending inland up into the Quilcene Valley, biodiversity is high.
Comments:	Regulations - On hobby farms, encourage or require the use of BMPs or the NRCS Field Office Technical Guide and farm plans to prevent water quality impacts. There is a potential for increased density in these rural areas. The county should consider down-zoning or require merging of lots to develop. If the County intends to retain R-5 zoning or less, development needs to minimize impacts by using LID techniques where appropriate, minimizing road crossings; limiting clearing; use watershed context to impose protections. R-5 zoning may not make sense from a habitat standpoint in floodplains or riverine areas. Larger parcels may provide longer term protection of habitat in those areas. In the R-5 zone, a mix of non-regulatory incentives and education about protection may work better to obtain public support for protection.					

GMA Land Type: Natural Resource	General Habitat Status and Stressors on Water Processes	Projected Population Growth	Upland /Terrestrial Habitat Status	Marine Areas Status	Freshwater Status	Biodiversity Wildlife networks
Forest	<u>Habitat Status:</u> *This area consists of 88,000 acres of state/private lands.* *Large portions are in National Forest, and Commercial or Rural Forest.* *Zoning is 1du/40 acres;* <u>Stressors</u>: Commercial forest activities. Logging has impacts on forest cover; can impact riparian areas and unstable slopes result in erosion and sedimentation and resulting water quality problem.	Small in-holdings of residential development in Little Quilcene and up into forest on Dosewallips and Duckabush.	Overall, for these areas hydrologic processes are altered from commercial forest practices, but not severely degraded and are are still intact. Forest roads management practices and water quality need to be dealt with. The Quimper Peninsula has high to moderate permeability, but scored lower for wetland importance, It is currently in a highly altered state due to road density, forest clearing. There is less impervious surfaces here and a moderate to higher potential for restoration	Water quality is impacted from sedimentation resulting from clearing. There are some water temperature effects (temperatures are warmer in estuaries).	Quilcene – Variable condition. See map. Tends to increase with elevation up the rivers	
Comments:	Forest Practices Act is the primary tool here, plus ESA and CWA. The FPA doesn't address goal of maintaining hydrologically mature forests. Encourage DNR to complete a model for hydrologic impacts from logging. Encourage selective thinning; Use clearing limits; consider cap and trade systems and low impact development techniques to limit stormwater impacts and loss of forest cover. The Northwest Forest Plan is being implemented by the forest service. HCPs may govern other, private lands. Need more incentives (e.g., cap and trade systems or other set aside incentive programs to protect forest cover in the most important areas).					

GMA Land Type: Natural Resource	General Habitat Status and Stressors on Water Processes	Projected Population Growth	Upland /Terrestrial Habitat Status	Marine Areas Status	Freshwater Status	Biodiversity Wildlife networks
Agricultural Lands	Status: Agricultural lands comprise 4,400 acres, mostly in the Chimacum Valley and there is a small amount in Salmon and Snow Creeks that mostly consists of silage, grain, livestock and grazing. There used to be extensive dairies, but only 1 remains. Most farms have livestock, growing hay or specialized vegetables, producing cheese, or fruit. The County recently re- designated 3,900 acres as long-term commercial agricultural land of local importance. Stressors: Water quality impacts from nutrient loading into streams and ultimately nearshore waters.		The upland farm areas comprise 4,400 acres mostly in the Chimacum Valley and there is a small amount in Salmon and Snow Creeks. Major impacts to habitat are from nutrient and nitrates. Nearly all farms are located next to creeks, which then run downstream into the nearshore areas. Pollutants can also be transported through aquifers. The valley areas are significant sources of nitrification.		Varies across agricultural lands. Water quality is high in Chimacum area, low through other agricultural lands and improves again to high through the Forest Protection District.	
Comments:	Consider using the NFRCS Field Operating Technical Guide manual and encourage or require the use of farm plans to lessen the impacts overall from farms. Wetland restoration would greatly assist in nitrogen reduction. Consider offering new incentives in these areas, such as providing credits on peat soils, etc.					

GMA Land Type: Natural Resource	General Habitat Status and Stressors on Water Processes	Projected Population Growth	Upland /Terrestrial Habitat Status	Marine Areas Status	Freshwater Status	Biodiversity Wildlife networks
Mining	Status: There are presently no lands designated for mining in the County. Stressors: There is a single proposal for the Shine Quarry, which has not yet been approved.	N/A	N/A	N/A	N/A	N/A

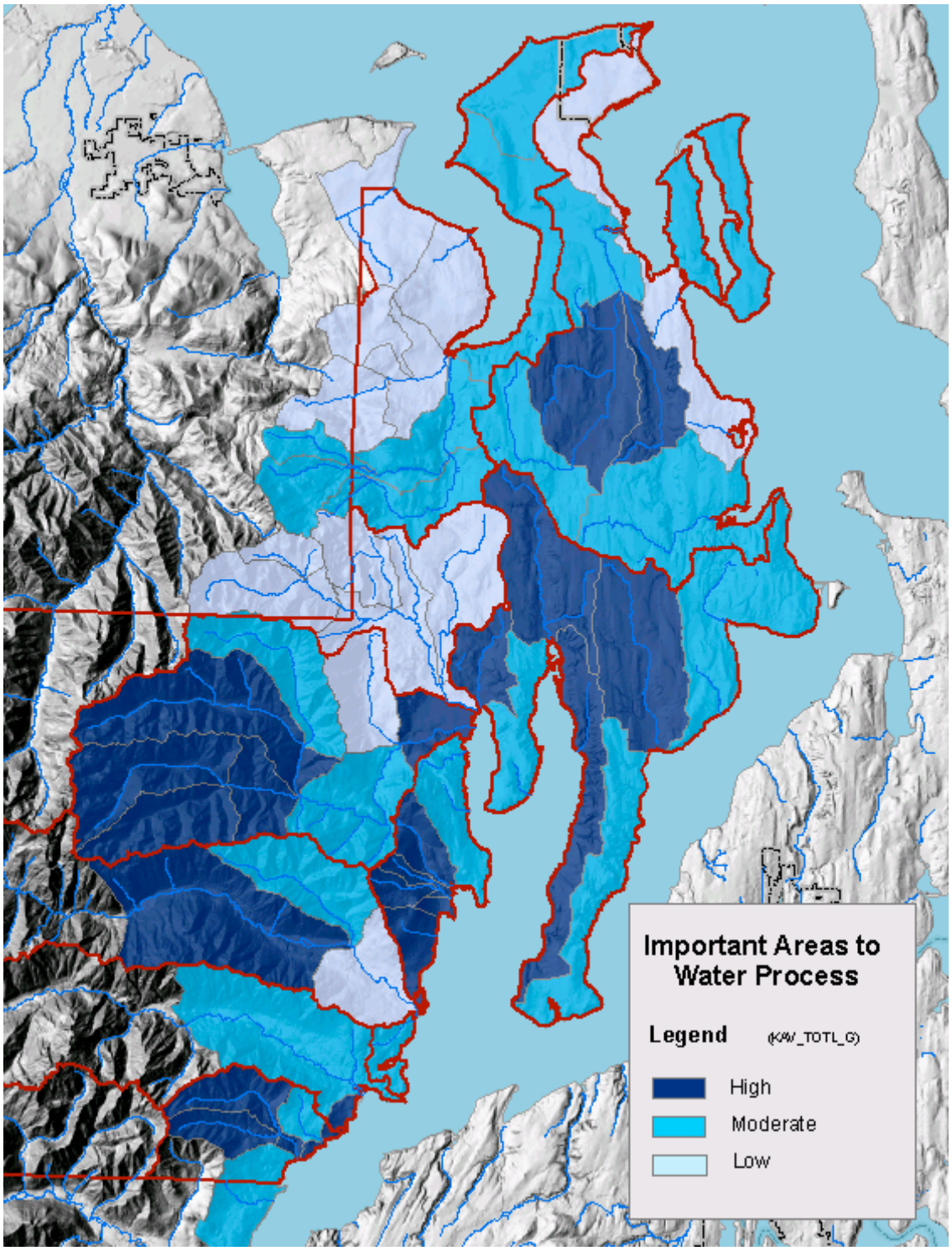

Figure 1. Important Areas for the Hydrologic Process. Dark blue represents a score of high importance; medium blue represents a score of medium importance and light blue represents a score of lower importance

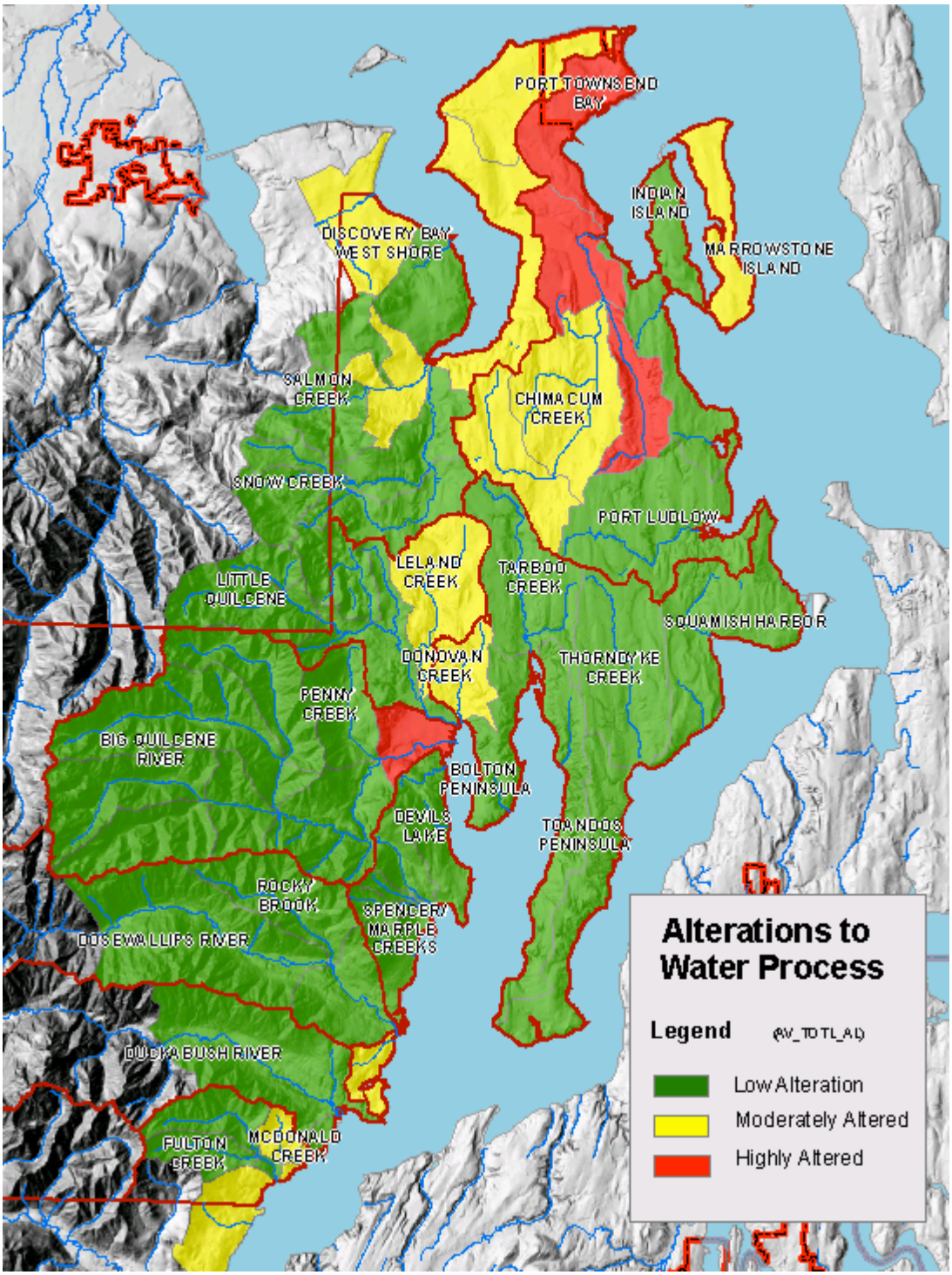

Figure 2. Sub-basins with a high level of alteration are shown in “red” and areas with low alteration in “green.”

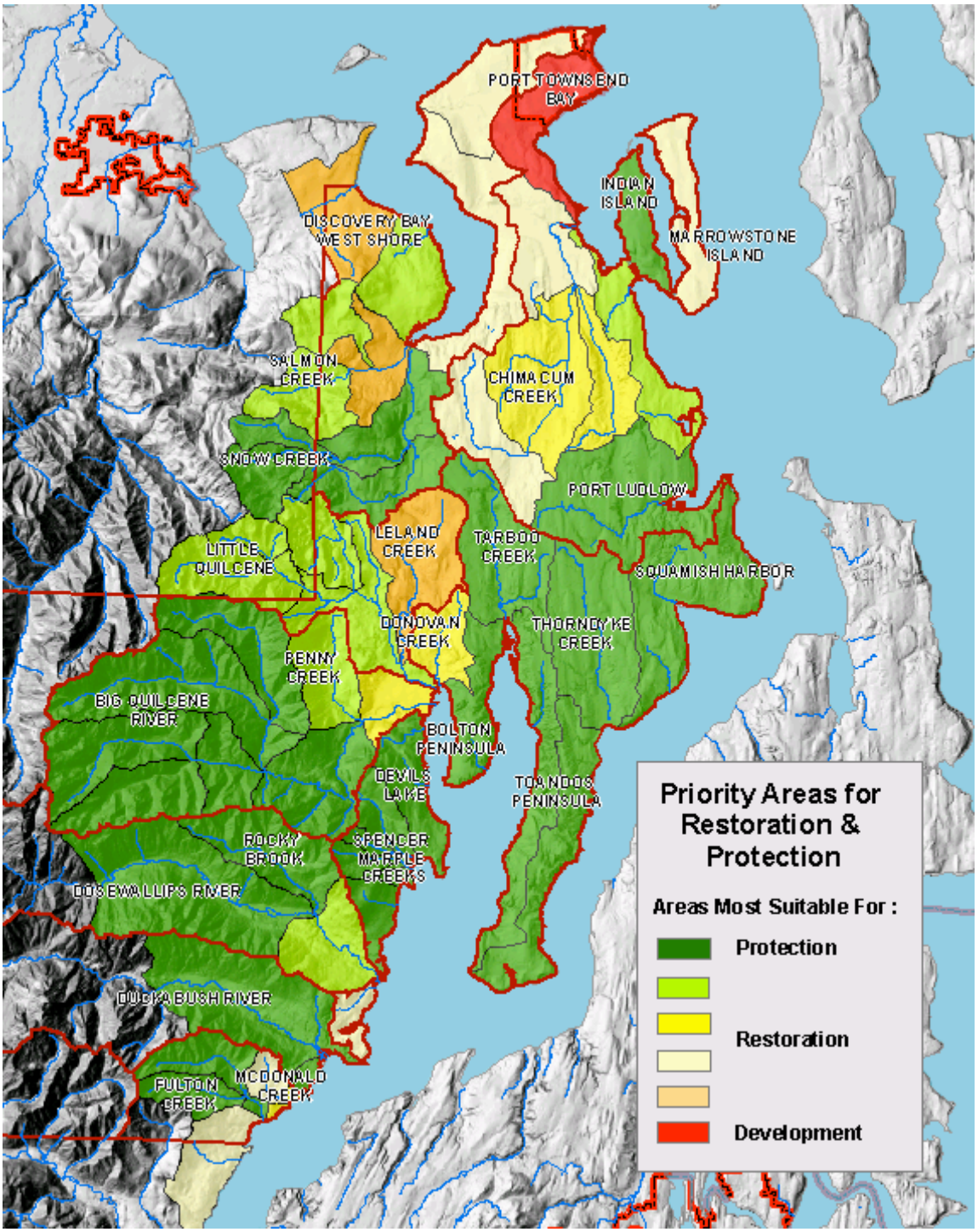

Figure 3. Priority areas for protection are shown in “green,” for restoration in “yellow,” and for development in “red.”

A-3.0 Detailed Analysis Matrix

Figure A-13. Detailed analysis matrix for creating final restoration and protection map for the hydrologic and denitrificatiton processes.. (Based on figure 8)

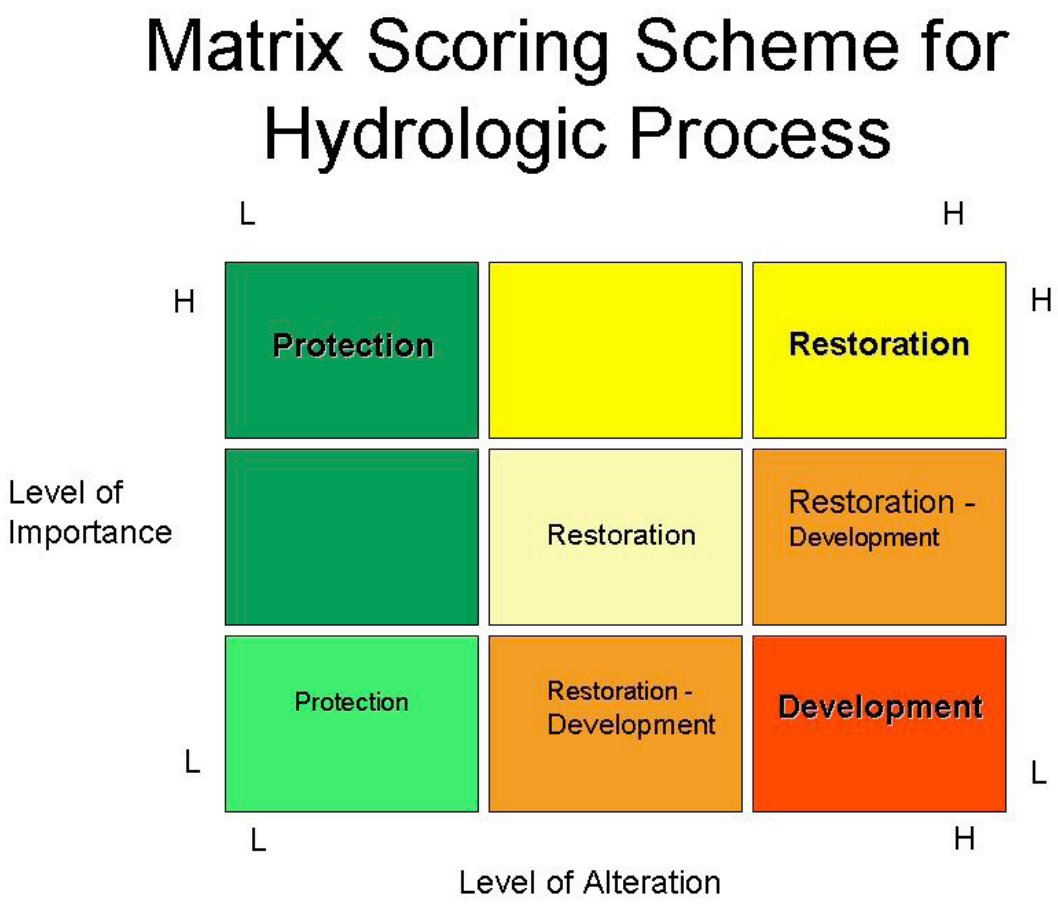

Figure A-13 depicts the detailed matrix for synthesizing the results of the importance and alteration maps for the hydrologic process (Figures 4 and 5). The matrix is based on watershed-based research indicating that areas with low levels of alteration to watershed processes should be protected and areas with higher levels of alteration to processes with a higher level of importance should be restored (Stanley et al. 2005).

Appendix P1-1: Summary of Key Environmental Regulations

The following is a non-exhaustive list of key regulations that exist through federal, state or local laws and regulations that have effect in the Puget Sound region. These laws and regulations are highlighted for the reason that they are tools that either directly or indirectly provide protection for some habitat-forming processes, structures or functions or, more generally, the needs of particular species of animals or fish. As noted in the Responses to Questions P1 and P2, there is no single regulation that provides protection from an ecosystem perspective as we have defined it. Instead, the framework of laws and regulations that exist in Puget Sound is largely fragmented, occasionally overlapping and mostly focused on individual parcels (site scale) or individual species.

Federal Laws

There are literally hundreds of federal laws that affect marine and ocean areas. There are scores more that affect individual species and upland terrestrial areas and freshwater habitats. For purposes of brevity, the Topic Forum presents below a summary list of some of the laws that have an obvious impact in Puget Sound, in terms of their regulatory effect.

The Endangered Species Act. Endangered Species Act of 1973, Pub. L. No. 93-205, 87 Stat. 884, as amended by Pub. L. No. 97-304, 96 Stat. 1411 (1982), See, 16 U.S.C. 1531-1541; ESA Regulations: See, 50 C.F.R. Part 17 (USFWS) and 50 C.F.R. Part 222 (NMFS). The Act protects species listed under the ESA, as well as critical habitats, from hunting, transport, or other harassment. Endangered species are managed by the U. S. Department of the Interior through the U.S. Fish & Wildlife Service (USFWS) and by the National Oceanic and Atmospheric Administration (NOAA Fisheries). Under the ESA, the following strategies are used:

- Directs all federal agencies to use existing authorities to conserve listed species and ensure their actions do not jeopardize the survival of listed species;
- Requires preparation of Recovery Plans;
- Prohibits "take" of a listed species (absent certain exceptions) (Section 9);
- Requires federal agency consultation with USFWS and NMFS (Section 7);
- Designates critical habitat;
- Implements international treaty, the Convention on International Trade in Endangered Species of Wild Fauna and Flora; and
- Allows for preparation of Habitat Conservation Plans that balance development with species conservation (Section 10).

The main protection provided for species listed under the ESA is found in Section 9, known as the "no take" provision. The term "take" is broadly defined to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in such conduct." (16 U.S.C. Section 1532(19)). In analyzing the legislative history of this definition, the 9th Circuit Court of Appeals noted that the Senate Report on the Act stated that the term "take" included ". . . every conceivable way in which a person can 'take' or attempt to 'take' any fish or wildlife." Palila v. Hawaii Dept. of Land and Natural Resources, 852 F.2d 1106, 1108 (1988) ("Palila IV").

In 1995, the U.S. Supreme Court upheld the federal rule promulgated by the USFWS interpreting the term "harm" to include "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering." Babbitt v. Sweet Home Chapter of Communities for a Greater Oregon, 115 S. Ct. 2407 (1995). (See, 50 C.F.R. Section 17.3(c) (USFWS definition of "harm"). NMFS adopted a similar definition of the term "harm" for the habitat of anadromous fish and marine mammals. (See, 63 Fed. Reg. No. 84 at pp. 24148 - 24150, (May 1, 1998)). The key difference in their definition is that it expands the definition of harm to include the terms breeding, spawning, rearing, migrating, feeding or sheltering.

A key provision of the Act is its Section 7 consultation requirement. Section 7 requires review of activities to determine whether they are likely to adversely affect the listed species. If so, further consultation and the preparation of a formal biological opinion is required to ensure that the activity will not jeopardize the continued existence of the species. See, 16 U.S.C. Section 1536(a)(2) and 50 C.F.R. Section 402. Section 7 applies to all federal agencies (and the state/local governments or private parties that have a nexus with a federal agency's action). An "action" that can trigger Section 7 review means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies in the United States or on the high seas. The term "action" includes, but is not limited to: (i) actions intended to conserve listed species or its habitat; (ii) the promulgation of regulations; (iii) the granting of licenses, contracts, leases, easements, rights-of-way, permits, grants-in-aid; or (iv) actions directly or indirectly causing modifications to land water or air. Pacific Rivers Council v. Thomas, 30 F.3d 1050, 1054 (9th Cir. 1994). The agency is required to insure that such actions are not likely to jeopardize the continued existence of the species or result in the destruction or adverse modification of its habitat. See, Tennessee Valley Authority v. Hill, 437 U.S. 153, 98 S.Ct. 2279, 57 L.Ed.2d 117 (1978).

Section 10 is a tool often used by large landowners to continue activities (such as commercial forestry), that may have an incidental impact on a listed species. It authorizes habitat conservation plans (HCPs). See, 16 U.S.C. 1539(a)(2). The "taking" must be incidental to and not the purpose of, the carrying out of an otherwise lawful activity. The applicant must submit a conservation plan based upon the best scientific and commercial data available which specifies: (a) the anticipated impacts which will likely result (i.e., the amount, extent and type of anticipated taking) from the proposed activity on the species or stocks; (b) the steps the applicant will take to monitor, minimize and mitigate such impacts; (c) the funding which will be available to implement such measures; (d) the alternative actions to the taking which were considered, and the reasons why they are not being used; and (e) such other measures as the agency may determine are necessary and appropriate for the conservation of the species or stocks. In order to approve an HCP, the Service must determine that the taking will be incidental, that the applicant will, to the maximum extent practicable, monitor, minimize and mitigate the impacts of such taking and, finally, that the taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild.

Coastal Zone Management Act of 1972. Under the Coastal Zone Management Act, all federal permitted actions, such as Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbor Act, must be evaluated for consistency with the CZM Program. Federally owned lands or lands held in federal trust are exempt from the state's coastal plan, at least with respect to direct federal activities. For a comprehensive review of the CZMA and other important laws, refer to the U.S. Commission on Ocean Policy's Final Report at Appendix 6 "A review of U.S. Coastal and Ocean Law".

Federal Clean Water Act (CWA). The Act prevents or permits discharges of pollutants to waters of the United States;

- NPDES permits are required for direct and indirect (point and nonpoint) source discharges into navigable waters;
- NPDES permits cover many activities including industrial, construction (1 acre or larger), municipal activities (10,000 in population or greater), boatyards, sand and gravel operations, etc.;
- Section 404 of the Act regulates filling but not dredging, draining or clearing of wetlands; and
- The Act is administered by the Environmental Protection Agency (EPA) except in states which have chosen to become the state administrator, such as here in Washington. By law, the Clean Water Act is implemented by the Washington State Department of Ecology.

Marine Mammal Protection Act. For a comprehensive review, refer to the U.S. Commission on Ocean Policy's Final Report at Appendix 6 "A review of U.S. Coastal and Ocean Law".

National Estuary Program, under Section 320 of the Clean Water Act. For a comprehensive review, refer to the U.S. Commission on Ocean Policy's Final Report at Appendix 6 "A review of U.S. Coastal and Ocean Law".

North American Wetlands Conservation Act. For a comprehensive review, refer to the U.S. Commission on Ocean Policy's Final Report at Appendix 6 "A review of U.S. Coastal and Ocean Law".

Wild and Scenic Rivers Act. The Act categorizes rivers according to their value as wild or scenic and, depending on the designation granted, provides heightened regulatory protection against alteration or impacts from human activities. This law is administered by the U.S. Forest Service.

National Environmental Policy Act (NEPA). For a comprehensive review of NEPA and other important laws, refer to the U.S. Commission on Ocean Policy's Final Report at Appendix 6 "A review of U.S. Coastal and Ocean Law". [Note: This summary was prepared by the U.S. Commission on Ocean Policy as cited above].

> The National Environmental Policy Act (NEPA)[49] has been called many things through its three decades of existence, including the Magna Carta or centerpiece of environmental law, and the "most important [of our] environmental legislation."[50] Signed into law in 1970 with the inspiring goal to "create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans,"[51] NEPA "sets forth a ringing and vague statement of purposes."[52] This vagueness grew into a powerful tool for challenging federal agency actions that ignored potential environmental impacts. Federal agencies' obligation to comply with NEPA is a common issue in federal environmental and natural resources law, including ocean and coastal law.
>
> Aside from its statements of policy objectives, NEPA's "action-forcing" mechanism is in Section 102, which requires all federal agencies to include a detailed statement of the environmental impact of all "major federal actions significantly affecting the quality of the human environment."[53]
>
> A "major" federal action is one that requires substantial planning, time, resources, or expenditure that a federal agency proposes or permits. Through conducting Environmental Assessment (EA) and Environmental Impact Statement (EIS) reviews, federal agencies are required to consider environmental impacts before action is taken.[54] Federal agencies are also required to consider the direct, indirect, and cumulative impacts of regulated federal activities.[55]

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[49] 42 U.S.C. § 4332(2)C)

[50] Arthur W. Murphy, *The National Environmental Policy Act and the Licensing Process: Environmentalist Magna Carta or Agency Coup de Grace?*, 72 Colum. L. Rev. 963, 965 (1972). For a thorough review of NEPA, *see* William H. Rodgers, Jr., Environmental Law, Chapter 9 (1994); James W. Spensley, *National Environmental Policy Act*, *in* Environmental Law Handbook 321 (J. Gordon Arbuckle et al. Eds., 12th ed. 1993); Michael C. Blumm, *A Primer on Environmental Law and Some Directions for the Future*, 11 VA. Envtl. L.J. 381, 382 (1992).

[51] 42 U.S.C. § 4331(a).

[52] Rodgers at 801.

[53] 42 U.S.C. § 4332(2)C

[54] The Environmental Impact Statement is a detailed statement prepared by the responsible official within the relevant federal agency that addresses: "(i) the environmental impact of the proposed action; (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented; (iii) alternatives to the proposed action; (iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long term productivity; and (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." 42 U.S.C. § 4332(2)C). Where there is a question as to whether a particular government action requires an environmental analysis, regulations implementing NEPA promulgated by the Council on Environmental Quality (CEQ) require the federal agency seeking to undertake the action to prepare an Environmental Assessment (EA). An EA is a document that "[b]riefly provide[s] sufficient evidence for determining whether to prepare an . . . [environmental analysis] or a finding of no significant impact." After preparation of the EA, if the agency makes a finding of no significant impact (FONSI), then preparation of an EIS is not necessary. CEQ's NEPA regulations are at 40 C.F.R. Part 1500 *et seq.*

[55] *See* 40 C.F.R. §§ 1502.16, 1508.7, and 1508.8.

In addition, NEPA mandates coordination and collaboration among federal agencies. Specifically, "[p]rior to making any detailed statement, the responsible federal official shall consult with and obtain the comments of any federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved."[56] Many federal agencies, including those with substantial ocean and coastal programmatic responsibilities, such as NOAA, EPA, and the U.S. Department of the Interior's Fish and Wildlife Service (USFWS)—and state agencies, nongovernmental organizations, and members of the public—frequently comment on NEPA documents. The Council on Environmental Quality (CEQ) in the Executive Office of the President, established under NEPA, plays the role of interagency dispute resolution mediator when necessary.

This is where NEPA's mandates end. The Supreme Court has declared that NEPA's reach is procedural rather than substantive: NEPA cannot "mandate particular results but only prescribe the necessary process."[57] Thus, once a federal agency has completed the detailed statement that NEPA requires, the agency may continue its proposed activity regardless of the actual impact upon the receiving environment, although other legal authorities still apply and might preclude or limit the federal agency's action.

The Bureau of Land Management, U.S. Department of the Interior. As noted in Response to Question P1, the federal Bureau of Land Management manages multiple uses of 400,000 acres of federal lands in Washington State. In order to understand the important role that the BLM can play in Puget Sound recovery, we provide a short history of its regulatory authority since its inception.

The BLM's roots go back to the Land Ordinance of 1785 and the Northwest Ordinance of 1787. These laws provided for the survey and settlement of the lands that the original 13 colonies ceded to the federal government after the War of Independence. As additional lands were acquired by the United States from Spain, France, and other countries, Congress directed that they be explored, surveyed, and made available for settlement. In 1812, Congress established the General Land Office in the Department of the Treasury to oversee the disposition of these federal lands. As the 19th century progressed and the nation's land base expanded further west, Congress encouraged the settlement of the land by enacting a wide variety of laws, including the Homesteading Laws and the Mining Law of 1872.

These statutes served one of the major policy goals of the young country-- settlement of the western territories. With the exception of the Mining Law of 1872 and the Desert Land Act of 1877 (which was amended), all have since been repealed or superseded by other statutes.

The late 19th century marked a shift in federal land management priorities with the creation of the first national parks, forests, and wildlife refuges. By withdrawing these lands from settlement, Congress signaled a shift in the policy goals served by the public lands. Instead of using them to promote settlement, Congress recognized that they should be held in public ownership because of their other resource values.

In the early 20th century, Congress took additional steps toward recognizing the value of the assets on public lands and directed the Executive Branch to manage activities on the remaining public lands. The Mineral Leasing Act of 1920 allowed leasing, exploration, and production of selected commodities such as coal, oil, gas, and sodium to take place on public lands. The Taylor Grazing Act of 1934 established the U.S. Grazing Service to manage the public rangelands. The Oregon and California (O&C) Act of August 28, 1937, required sustained yield management of the timberlands in western Oregon.

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[56] 42 U.S.C. § 4332(2)(C).

[57] Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 350 (1989); *see also* Vermont Yankee Nuclear Power Corp. v. Natural Resources Defense Council, 435 U.S. 519, 548 (1978); Kleppe v. Sierra Club, 427 U.S. 390 (1976). The Court stated that once an agency has made a decision subject to NEPA's procedural requirements, "[t]he only role for a court is to ensure that the agency has taken a 'hard look' at the environmental consequences; it cannot 'interject itself within the area of discretion of the executive as to the choice of the action to be taken.'" *Id.* at 410.

In 1946, the Grazing Service was merged with the General Land Office to form the Bureau of Land Management within the Department of the Interior. When the BLM was initially created, there were over 2,000 unrelated and often conflicting laws for managing the public lands. The BLM had no unified legislative mandate until Congress enacted the Federal Land Policy and Management Act of 1976 (FLPMA), Public Law 94-579 94th Congress.

In enacting the FLPMA, Congress recognized the value of the remaining public lands by declaring that these lands would remain in public ownership. Congress also gave us the term "multiple use" management, defined as "management of the public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people." The FLPMA is extremely influential in governing the BLM's management of federal lands. The effect that the adoption of the FLPMA has had across the U.S. is illustrated in the table below.

The BLM's Management of Public Lands
A Snapshot of Pre- and Post-FLPMA Management 1976 & 2000

Highlighted Area	Pre-FLPMA 1976	Post-FLPMA 2000
Acres Managed	450 million surface 822 million mineral estate administered	264 million surface 700 million mineral estate administered
BLM Employees	4,530	10,000
Types of Primary BLM Disciplines (not comprehensive)	Range Conservationists, Land Surveyors, Geologists, Foresters, Administrative Assistants	In addition to types of jobs in 1976: Wildlife Biologists, Wild Horse and Burro Specialists, Recreation Specialists, Economists, Hydrologists, Archaeologists, Sociologists, and Land Use Planners
Proximity of BLM lands to communities	Records show that in the West, cities having a combined population of 35 million people are within a three-hour drive of 66 million acres of BLM lands.	More than 4,100 communities with a combined population of 22.2 million people are located within 25 miles of BLM lands
Land Exchanges Patents or deeds issued Acres patented or deeded	 53 36,991 acres	 244 135,850 acres
Recreation sites Managed by BLM Fee Sites	 326 0	 3,191 335
Wild and Scenic Rivers	3 Wild and Scenic Rivers	36 Wild and Scenic Rivers

Highlighted Area	Pre-FLPMA 1976	Post-FLPMA 2000
Areas of Critical Environmental Concern Acres	0 0	838 14,045,540
Historical & Archeological Properties recorded Acres inventoried	11,076 1,133,956	235,574 14,416,221
Percentage of country's onshore oil and natural gas provided from federal lands	6% Oil and Gas	11% Natural Gas 5% Oil
Millions cubic feet (Mcf) of Natural Gas Produced on federal Land	1,080 million Mcf	2,139 million Mcf
Barrels of Oil Produced on federal Land	168,000,000	108,000,000
Coal Production on federal land - Total (short tons-2000 lbs) - WY Coal Production	54,782,326	404,787,030 325,180,000
AUMs livestock grazed	10.1 million	9.8 million
Acres of National Conservation Areas and National Monuments	57,000 acres	19 million
Number of Threatened and Endangered species	177 species of animals and plants	511 species of animals and 736 species of plants.

Highlighted Area	Pre-FLPMA 1976	Post-FLPMA 2000
Acres of Designated Wilderness and Wilderness Study Areas Managed by BLM	0	23,445,495

Source: Bureau of Land Management: http://www.blm.gov/flpma/snapshot.htm

State Laws

There are numerous state laws that are designed to protect habitat. We have selected a few of the major regulatory programs for emphasis below. This is not an exhaustive list, but is an attempt to focus on the tools that are the most widely used in Puget Sound to protect habitat at some scale, even if not at an ecosystem scale. Other laws and regulations are described in Response to Question P-1.

State Environmental Policy Act. SEPA recognizes "that each person has a fundamental and inalienable right to a healthy environment." RCW 43.21.020(3). SEPA creates both procedural and substantive mandates which can be used to require disclosure of significant adverse environmental impacts, mitigation of those impacts and even denial of permits. The requirements of SEPA are carried out at the state and local government level. A similar law is imposed at the federal level, the National Environmental Policy Act (NEPA). See, 42 U.S.C. Section 4331.

Shoreline Management Act. The SMA is quite short and depends on a system of state and primarily local control (including environment designations, development standards and regulations), to be implemented. Its basic premise is that no activity is allowed on the state's shorelines that is inconsistent with the Act or local implementing regulations and that development result in "no net loss" of shoreline functions. See, Wash. Real Property Deskbook, 3d Ed. Volume VI, Chapter 93. The regulatory reach of the SMA on aquatic systems is fairly broad. It applies to all shorelines of the state, marine waters, certain larger streams, large lakes and water reservoirs. It also includes shorelands extending 200 feet from the ordinary high water mark, and all wetlands and river deltas associated with streams, lakes and tidal waters subject to the Act.[58] However, the SMA is not merely a protective regulation. It balances development and preservation near shorelines, establishes a priority of uses for the shoreline, including an emphasis on water-dependent uses and public access; and the reduction of adverse environmental impacts of development and other activities occurring in the shoreline zone. See, Wash. Real Property Deskbook, 3d Ed. Volume VI, at 93-11.

To implement the Act, local governments must prepare Shoreline Master Programs based on standards set forth in the Shoreline Master Program Guidelines (WAC 173-26). Recent revisions to the Shoreline Master Program Guidelines require local governments to use an ecosystem or landscape approach when updating their master programs. Ecosystem wide processes and ecological functions must be characterized and the linkages with shoreline functions described. From this characterization and analysis, measures must be identified to protect and restore healthy and degraded shoreline processes and functions. Additionally, the environment designations, policies, development

[58]The SMA applies to "all shorelines of the state" which include both shorelines and shorelines of state-wide significance, marine waters of the state together with the lands underlying them out to the western boundary of the state in the Pacific Ocean, to streams with a mean flow of 20 cfs. or more, and to lakes larger than 20 acres in area and to water reservoirs. The SMA also applies to associated "shorelands" of all of these shorelines. Shorelands are defined as those lands extending landward for 200 feet in all directions as measured on a horizontal plane from the Ordinary high water mark, floodways and contiguous floodplain areas landward 200 feet from such floodways, and all wetlands and river deltas associated with the streams, lakes and tidal waters which are subject to the Act. Id. See, Ch. 90.58 RCW. The federally approved Coastal Zone Management Program (CZMP) for Washington contains all of the local shoreline plans, except that the coastal zone plan does not include rivers and wetlands. Id.

standards and regulations must be based on the characterization (which includes a comprehensive inventory of shoreline conditions).

Local governments are also required to monitor the implementation of their SMP and demonstrate that there will be "no net loss" of shoreline function. Recognizing that restoration will play a central role in the recovery of Puget Sound ecosystems, the guidelines stipulate the preparation of a restoration plan. The restoration plan is also based on the characterization. The Department of Ecology (statutory authority to review and approve shoreline plans) is presently encouraging local governments to implement the restoration plan using both regulatory and non-regulatory means. Though the preparation of ecosystem based shoreline plans is a welcome advancement in the state, local governments are not required to implement the results of the characterization outside of the narrow 200-foot-wide shoreline jurisdiction. This is unfortunate, since most processes that drive shoreline functions are located in watersheds that can extend several miles inland from the shoreline.

Forest Practices Act. All private and non-federally owned "forest lands[59]" fall within the purview of the Forest Practices Act (FPA). The current FPA (Chapter 76.09 RCW) was enacted in 1974. In replacing Ch. 76.08 RCW, a reforestation act dating back to 1945, the FPA created a coordinated, statewide system for regulating forest practices, requiring reforestation, and adding protections for water, fish and wildlife. Forest Practices rules impose standards for road construction, snag retention and for protecting streams, stream corridors and certain types of forested wetlands. The FPA requires 15 counties to adopt local regulations governing forest practices on lands which are permanently converting from forestry to other land uses, known as Class IV forest practices, by December 1, 2008. (To date, 11 jurisdictions have not yet enacted ordinances to regulate such activities.) The goal of the FPA is dual: to foster the state's commercial timber industry and to protect the natural environment. The Act is enforced by the Washington State Department of Natural Resources (DNR) through state regulations promulgated by the Forest Practices Board. Updates to the FPA were added in 1987, as a result of the "Timber, Fish and Wildlife" negotiations conducted by a wide array of stakeholders and state and federal agencies and tribal governments concerned about impacts of forest practices on certain salmon populations listed under the Endangered Species Act. The Forest Practices Act was again amended between 1999 and 2001 with the adoption of the Fish and Forest Agreement. The Agreement was reached to meet the requirements of both the ESA and Clean Water Act. The Forest and Fish Agreement resulted in the modification of rules and regulations related to:

- The protection of riparian areas, unstable slopes and wetlands;
- The construction, maintenance and abandonment of forest roads;
- The application of forest chemicals; and
- The implementation of a monitoring and adaptive management program to ensure that the program adapts over time based on new scientific information.

The Forest and Fish Agreement covers approximately 6.1 million acres of forest land on the west side of the Cascade mountains, including private and state forest lands. Washington's forest practices program operates under a Habitat Conservation Plan (HCP) pursuant to Section 10 of the ESA, and has been approved by the National Marine Fisheries Service and U.S. Fish and Wildlife Service, providing protections for all listed fish species and seven amphibian species.

There are several other HCPs governing forest practices in Puget Sound on private lands designed to protect aquatic species, as well as other species. They include both private landowners (West Fork Timber Company, LLC, Plum Creek Timber Company, Port Blakely, Green Diamond (Simpson) representing a combined 745,971 acres of land, and

[59]Forest lands mean "all land which is capable of supporting a merchantable stand of timber and is not being actively used for a use which is incompatible with timber growing." RCW 76.09.020(6) Merchantable timber means "a stand of trees that will yield logs and/or fiber: suitable in size and quality for production of lumber, plywood, pulp or other forest products, of sufficient value at least to cover all the costs of harvest and transportation to available markets." WAC 222-16-010.

public landowners (DNR, the City of Seattle and City of Tacoma) representing an additional, combined, 1.7 million acres of land affecting Puget Sound and its rivers.

The Growth Management Act. The GMA now applies to all 39 counties across the state, as well as to the cities located within them. (However, 10 of the 39 counties in the state are only required to adopt measures to designate and conserve natural resource lands of long-term commercial significance and to designate and protect critical areas. They are not required to adopt urban growth areas or comply with the other requirements of the Act). Local governments subject to GMA must now plan for the growth of their communities by adopting comprehensive plans and planning for the infrastructure needs of their communities using 10- and 20-year increments based on the state's population projections.[60] No longer just a guide, local governments must now adopt development regulations (zoning and development standards) that are consistent with those comprehensive plans. The Act requires planning for urban, rural and natural resource lands. (Natural resource lands include areas for forestry, agriculture and mining.) Urban growth boundaries are drawn beyond which dense development is to be prohibited to protect rural and natural resource lands.[61] Finally, the GMA mandates that local governments regulate and protect certain environmental functions and values in "critical areas." These areas include: fish and wildlife habitat conservation areas, wetlands, aquifer recharge areas, and frequently flooded areas. RCW 36.70A.172.[62]

Hydraulic Project Approval (HPA) program (RCW 75.20.100). The statute protects aquatic habitat, including wetlands, within ordinary high water mark of marine waters, lakes, ponds, and streams. It is administered by the Washington Department of Fish and Wildlife through the issuance of Hydraulic Project Approval permits. The HPA program has significant limitations and is an ineffective tool to protect habitat in most cases.

Water Quality: State and federal stormwater and water quality program; Clean Water Act NPDES- Effect of new nonpoint municipal stormwater permit requirements; local non-pollution ordinances; [See other Topic Forum reports]; Washington State Department of Health Water Supply Systems regulations.

Water Quantity: [See other Topic Forum reports] State Groundwater Code

WDFW Species Protection Rules:

Bald Eagle Protection Rules (WAC 232-12-292) The rules require Washington Department of Fish and Wildlife to identify and protect bald eagle habitat and buffer zones on all non-federal and non-tribal lands in Washington. A process is outlined for protecting habitat via management planning

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[60]These plans include future land use maps and land use designations which are consistent with those policies. These policies are required to meet 13 planning goals initially established by the Legislature. A recent amendment to the Act added the goals of the Shoreline Management Act as the 14th goal of the GMA. The Comprehensive Plan must contain plans and policies relating to the following 8 elements: land use; housing; capital facilities plan; utilities; rural element; transportation element; economic development; parks and recreation. Optional elements include conservation, solar energy, recreation, and subarea plans.
[61]There are many other specific requirements of the GMA that are not highlighted here. For additional details, see Chapter 36.70A RCW and the decisions of the three Growth Management Hearings Boards at www.gmhb.wa.gov.
[62]Recent court decisions have interpreted the GMA critical areas requirement to mean that the level of protection required to be met is a "no net loss of existing habitat functions and values" standard. However, the law does not require restoration. As yet, no jurisdictions in Washington apply their critical areas regulations from an ecosystem approach. They are mainly used to protect the functions and values found on specific sites.

Appendix P1-2: Incentive Programs

Appendix P1-2 was informed by two sources: The Washington Biodiversity Project website as well as a Washington Biodiversity Council document entitled, "Washington Incentives Spreadsheet Catalog, Working Paper, 2006".

Program Name	Lead Agency	Incentive Type	Geographic Scope	Sector (Land Use)	Species Focus	Website
Community Salmon Fund	NFWF	Financial Assistance	WA	Ag, Timber, Suburban, Business, etc.	Salmon	http://www.nfwf.org/programs/csf.htm
Conservation Easement Program (CEP)	Farm Services Agency (FSA)	Financial Assistance	National	Ag	Multiple	
Conservation Reserve Enhancement Program (CREP)	FSA; WSCC (Farm Bill)	Financial Assistance	National	Ag	Salmon	http://www.fsa.usda.gov/dafp/cepd/crp_statistics.htm
Conservation Reserve Program (CRP)	FSA (Farm Bill)	Financial Assistance	National	Ag	Multiple	http://www.fsa.usda.gov/dafp/cepd/crp_statistics.htm
Farm and Ranch Lands Protection Program	NRCS	Financial Assistance	National	Ag	Multiple	http://www.nrcs.usda.gov/programs/frpp
Five Star Restoration Challenge Grants	NFWF	Financial Assistance		Various	Multiple	http://www.nfwf.org/programs/5star-rfp.cfm
Forest Legacy Program	USFS (Farm Bill) DNR	Financial Assistance	National (2 WA projects FY 2006)	Timber	Multiple	http://www.dnr.wa.gov/htdocs/amp/forest_legacy/legacyhome.html

Program Name	Lead Agency	Incentive Type	Geographic Scope	Sector (Land Use)	Species Focus	Website
Forest Riparian Easement Program	DNR SFLO	Financial Assistance	WA	Timber	Multiple	www.dnr.wa.gov/sflo/frep
Grasslands Reserve Program	NRCS (Farm Bill)	Financial Assistance	National	Ag	Multiple	http://www.nrcs.usda.gov/programs/2005_allocations/
HCP Assistance Grants	WDFW USFWS	Financial Assistance	National	Various	At-risk species	
HCP Land Acquisition	WDFW USFWS	Financial Assistance	National	Various	At-risk species	
Landowner Incentive Program	FWS; WDFW	Financial Assistance	National (W. WA)	Various	At-risk species	http://wdfw.wa.gov/lands/lip/
Migratory Waterfowl Artwork Program	WDFW	Financial Assistance	WA	Various	Waterfowl	
North American Wetlands Conservation Act (NAWCA) Small Grants	USFWS	Financial Assistance	National	Various	Multiple	
Puget Sound Urban Resources Partnership	Multi-Agency	Financial Assistance	WA (W.WA)	Urban	Multiple	
Recovery Land Acquisition	WDFW USFWS	Financial Assistance	National	Various	At-risk species	
Regional Fisheries Enhancement Groups	WDFW	Financial Assistance		Various	Salmon	

Program Name	Lead Agency	Incentive Type	Geographic Scope	Sector (Land Use)	Species Focus	Website
Resident and Anadromous Fish and Wildlife Mitigation Program	BPA	Financial Assistance	National	Ag	Multiple	
Riparian Open Space Program	WDNR	Financial Assistance	WA	Timber	Multiple	http://www.dnr.wa.gov/htdocs/amp/riparian/index.html
Rocky Mountain Elk Foundation Grants	RMEF (Private)	Financial Assistance	Regional	Timber	Elk	
Rural Business Cooperative Service	USDA	Financial Assistance	National	Ag	Multiple	http://www.rurdev.usda.gov/wa/
Salmon Recovery Funding Board	SRF Board IAC	Financial Assistance	WA	Various	Salmon	http://www.iac.wa.gov/
Soil and Water Conservation Assistance	NRCS	Financial Assistance	National	Ag	Multiple	http://www.nrcs.usda.gov/programs/swca
Wildlife Forever Grants	Wildlife Forever (Private)	Financial Assistance		Various	Multiple	
Marsh Program	Ducks Unlimited (Private)	Financial Assistance Technical Assist.	National?	Various	Waterfowl	
Wetland Reserve Program	NRCS (Farm Bill) Ducks Unlimited	Financial Assistance Technical Assistance	National	Ag	Multiple	http://www.nrcs.usda.gov/programs/2005_allocations/

Program Name	Lead Agency	Incentive Type	Geographic Scope	Sector (Land Use)	Species Focus	Website
Sustainable Agriculture Research and Education (SARE)	USDA Western Region	Financial Assistance, Research, Education	National	Ag	Multiple	http://wsare.usu.edu
Chehalis Fisheries Restoration Program	USFWS	Financial Assistance; Technical Assist.	WA (Chehalis River Basin, including Grays Harbor and tributaries)	Various	Salmon	
Conservation Security Program	NRCS	Financial Assistance; Technical Assist.	National	Ag	Multiple	http://www.wa.nrcs.usda.gov/programs/csp
Family Forest Fish Passage Program	DNR, WDFW, IAC	Financial Assistance; Technical Assist.	WA	Timber	Fish	http://www.dnr.wa.gov/sflo//ffpp
National Wetland Refuge Challenge Cost Share	USFWS	Financial Assistance; Technical Assist.	National	Various	Multiple	
Partners for Fish & Wildlife Program	USFWS	Financial Assistance; Technical Assist.	National	Various	Multiple	http://www..fws.gov/partners

Program Name	Lead Agency	Incentive Type	Geographic Scope	Sector (Land Use)	Species Focus	Website
Private Stewardship Program	USFWS	Financial Assistance; Technical Assist.	National	Various	At-risk species	http://endangered.fws.gov/grants/private_stewardship.html
Volunteer Cooperative Fish& Wildlife Enhancement Prog.	WDFW	Financial Assistance; Technical Assist.	WA	Various	Multiple	
WA State Ecosystem Conservation	USFWS	Financial Assistance; Technical Assist.	National?	Various	Multiple	
Wetlands Mitigation Program	WDOT	Financial Assistance; Technical Assist.	WA	Various	Multiple	
Wildlife Habitat Incentive Program	NRCS (Farm Bill)	Financial Assistance; Technical Assist.	National	Ag and Urban	Multiple	http://www.nrcs.usda.gov/programs/2005_allocations/index.html
Forest Land Enhancement (FLEP)	USFS (Farm Bill) DNR	Financial Assistance; Technical Assist.; Educational Assistance	National	Timber	Multiple	

Program Name	Lead Agency	Incentive Type	Geographic Scope	Sector (Land Use)	Species Focus	Website
Environmental Quality Incentives Program	NRCS (Farm Bill)	Financial Assistance; Technical Assist; Educational Assist	National	Ag	Multiple	http://www.nrcs.usda.gov/programs/eqip
Current Use Taxation/Public Benefit Rating System (PBRS)	Local Gov't.	Property Tax Reduction	Counties (Chelan, King, Pierce, Clark Thurston - others?)	Various – Conservation emphasis set at local level.	Multiple	
Development Rights (Transfer or Purchase)	Local Gov't.	Legal/ Statutory	Local option (King, Snohomish, Thurston, Whatcom -others?)	Various	Multiple	
Habitat Conservation Plan (HCP)	USFWS	Legal/Statutory	National	Various	At-risk species	
American Tree Farm System	NGO	Market Incentives	National	Various	Multiple	http://www.treefarmsystem.org/cms/pages/69_1.html
Envirostars	Urban counties in the Puget Sound	Market Incentives	WA	Urban	Multiple	www.envirostars.com
Organic Certifications	WSDA	Market Incentives	WA	Ag	Multiple	http://agr.wa.gov/FoodAnimal/Organic/default.htm

Program Name	Lead Agency	Incentive Type	Geographic Scope	Sector (Land Use)	Species Focus	Website
Puget Sound Fresh	NGO/counties	Market Incentives	WA	Ag	Multiple	http://dnr.metrokc.gov/wlr/farms/
Salmon Safe	Salmon Safe	Market Incentives	WA and OR	Ag; Urban; Natural Area, Campus	Salmon	www.salmonsafe.org
Smart Wood	Rainforest Alliance	Market Incentives	National?	Timber	Multiple	http://www.rainforest-alliance.org/programs/forestry/smartwood/
Earth Heroes	King County	Recognition	WA	Urban	Multiple	http://www.metrokc.gov/earthlegacy/
Farming and the Environment Vim Wright Award	Farming and the Environment	Recognition	WA	Ag	Multiple	http://www.farmingandtheenvironment.org/
Founders of a New NW	Sustainable NW	Recognition	WA?	Various	Multiple	http://www.sustainablenorthwest.org/programs/founders.php
WA Natural Heritage Register	WDNR	Recognition	WA	Various	Multiple	
Backyard Forest Stewardship	WDNR	Technical Assistance	WA	Timber	Multiple	

Program Name	Lead Agency	Incentive Type	Geographic Scope	Sector (Land Use)	Species Focus	Website
Cascade Land Conservancy	NGO	Technical Assistance	WA	Various	Multiple	http://cascadeland.org/
Conservation Districts	WCC (Farm Bill)	Technical Assistance	National	Various	Multiple	
Conservation of Private Grazing Land Program (CPGL)	NRCS (Farm Bill)	Technical Assistance	National	Ag	Multiple	http://www.wa.nrcs.usda.gov/
Ecotrust	NGO	Technical Assistance	National	Ag, Timber, Salmon		http://www.ecotrust.org/forestry/
Forest Stewardship Council	NGO	Technical Assistance	International	Timber	Multiple	http://www.fsc.org/en/
Forest Stewardship Program	DNR/USFS	Technical Assistance	WA?	Timber	Multiple	http://www.dnr.wa.gov/htdocs/rp/steward.htm
Infrastructure DATABASE	WA State	Technical Assistance	WA	Various	Multiple	http://www.infrafunding.wa.gov/ContactInformation.htm
Jobs in the Woods	USFWS	Technical Assistance	National	Timber	Multiple	
Land Trust Alliance (local land trusts)	NGO	Technical Assistance	National	Various	Multiple	http://www.lta.org
Mountains to Sound Greenways Trust	NGO	Technical Assistance	Seattle to Cascades	Various	Multiple	http://mtsgreenway.org/
Nature Conservancy	NGO	Technical Assistance	National	Various	Multiple	http://www.nature.org/

Program Name	Lead Agency	Incentive Type	Geographic Scope	Sector (Land Use)	Species Focus	Website
NRCS Technical Assistance	NRCS	Technical Assistance	National	Ag	Multiple	
Northwest Natural Resources Group	NGO	Technical Assistance	WA	Timber	Multiple	http://www.nnrg.org/
Pacific Forest Trust Conservation Easements and Land Trusts	NGO	Technical Assistance	Regional	Timber	Multiple	www.pacificforest.org
Resource Conservation & Development Program	NRCS (Farm Bill)	Technical Assistance	National	Various	Multiple	
River Network	NGO	Technical Assistance	National	Various	Multiples	http://www.rivernetwork.org/
Small Forest Landowner Office	WA DNR	Technical Assistance	WA	Timber	Multiple	http://www.dnr.wa.gov/sflo/
Small Farms Team	WSU Coop Extension	Technical Assistance	WA	Ag	Multiple	http://ext.wsu.edu/
Stewardship Partners	NGO	Technical Assistance	WA	Ag, Timber, Sustainable Building	Multiple	http://www.stewardshippartners.org/index.html
Stewardship Planning Programs	King County	Technical Assistance	King County, WA	Various	Multiple	http://dnr.metrokc.gov/wlr/cao

Program Name	Lead Agency	Incentive Type	Geographic Scope	Sector (Land Use)	Species Focus	Website
Trust for Public Lands	NGO	Technical Assistance	National	Various	Multiple	http://www.tpl.org
Urban and Community Forestry Program	DNR/ Washington Community Forestry Council	Technical Assistance	WA	Urban	Multiple	http://www.dnr.wa.gov/htdocs/rp/urban/urban.htm
Washington Forest Stewardship	WSU Coop Extension	Technical Assistance	WA	Timber	Multiple	http://ext.wsu.edu/kudos/
Center for Sustaining Agriculture & Natural Resources (CSANR)	WSU Coop Extension	Technical Assistance, Research, Education	WA	Ag (including urbanizing areas)	Multiple	http://csanr.wsu.edu

Appendix P1-3: Monitoring and Adaptive Management to Ensure Ecosystem Health over Time

As mentioned in Response to Question P1, the success of regulations or incentive programs in achieving habitat protection is largely unknown and dependent on strong monitoring and adaptive management programs. Few regulatory programs explicitly require monitoring of effectiveness or environmental outcomes. But, there are strong examples of such programs that are being used elsewhere that should be considered by the Partnership.

One example of such an adaptive management program is the Driver-Pressure-State-Impact-Response (DPSIR)[63] approach used by European countries to assess management strategies in marine systems. This approach combines socioeconomic analysis with spatial analysis of pollutant transport and impact on the catchment-coastal zone system. Id. (The DPSIR framework permits the identification of the impact of socioeconomic development on the qualitative state of both marine and superficial waters.)

Monitoring and adaptive management programs are sparse in Puget Sound. Although good examples of programs do exist (e.g., PSNERP's monitoring program, the former PSAT water quality monitoring program, and some stormwater monitoring under NPDES permits), there are few regulatory programs that require their use. This is an area where a significant gap exists in management tools in Puget Sound. As discussed in Response to Question S2, little is known about the effectiveness of our habitat/land use management tools (either regulatory or voluntary). Although a few Growth Boards decisions recently held that local regulations to protect critical areas must include a monitoring and adaptive management framework, this requirement is not a statutory requirement and not all jurisdictions include such programs. For those that do intend to include such monitoring and adaptive management programs, the work in many places is just beginning.

The monitoring and adaptive management plan must be able to produce information that enables these decision-makers to track the progress of health in Puget Sound at multiple scales (e.g., regional, action area, catchment, drift cell or by jurisdiction) and over relevant time frames. To get there, the monitoring and adaptive management plan must include basic descriptive monitoring:

- Setting goals and tracking implementation of strategies and actions;
- Tracking status and trends of key marine, freshwater and terrestrial species, watershed conditions (or conditions at a catchment or drift cell scale) and the major human threat factors, as well as natural factors (food web, disease, ocean and climate conditions);
- Determining the effectiveness of strategies and actions; and
- Validating hypotheses (which tell us whether the implemented actions caused the resulting ecosystem change and/or biological change in key species).

[63]N. Pirrone et al., *The Driver-Pressure-State-Impact-Response (DPSIR) approach for integrated catchment-coastal zone management; preliminary application to the Po catchment-Adriatic Sea coastal zone system,* Reg. Environ. Change (2005) 5: 111-137. See also, Thom et al., *Adaptively Addressing Uncertainty in Estuarine and Near Coastal Restoration Projects,* Journal of Coastal Research, SI, 40: 94-108 (Winter 2005).

Appendix P2-1: A Discussion about Sustainable Living: What is the "Carrying Capacity" of Puget Sound – for people, for the ecosystem, and for the economy?

At Policy Recommendation No. 2 in the Response to Question P2, we recommend that the PSP begin a community conversation about what the future holds for a healthy Puget Sound over the next 50 years, as we face staggering population growth projections. In order to achieve a healthy Puget Sound, we believe that this includes three inextricably linked parts: healthy people, a healthy ecosystem and a healthy economy.

The Quality of Life Topic Forum and Public Health Forum are discussing two of these components: how we define our "quality of life" in terms of physical and emotional or spiritual health for people living in Puget Sound, as well as the elements of a healthy economy. The Land Use/Habitat Protection and Restoration Topic Forum intends to contribute to this discussion by framing the question about what it means to have a healthy ecosystem. To do this, we asked our scientists a simple, yet scientifically complex, question in layman's terms: How much stress can the Puget Sound ecosystem tolerate before it breaks down? What follows is an insightful response which we hope contributes to this community conversation.

Q. How much stress can the Puget Sound ecosystem tolerate before it breaks down?

A. This question is stated a bit differently in the ecological literature, something like "At what point does the ecosystem assume another state?" The theory of stable ecosystem states is summarized in Gunderson, 2000[64]. It basically says that if you push a system hard enough it will shift to another state that is somewhat stable (i.e., resistant to change). By "state" we mean the quantitative and qualitative description of species types, the numbers of species, their abundances, the flow of energy, the support of resources, the functions, etc.

To move the system back up into the undegraded state takes "energy" which means money (and lots of it) when it comes to restoring an ecosystem. That's why conservation/preservation of ecosystems is preferred because it takes less energy/money than restoring.

In terms of Puget Sound, the multiple stressors acting together (i.e., accumulate) result in a cumulative impact on the ecosystem and thus can alter its state. Once the cumulative impacts reach a certain point, the system shifts (degrades) to another state.

For Puget Sound, the system is stressed in various ways, but scientists don't think that the system overall has shifted into another state. We could verify this with an analysis of data on a variety of indicators. However, certain parts of the system, like Commencement Bay, are in an altered state. To bring Commencement Bay back to its undegraded state would take a huge effort. In comparison, large portions of the straits and the San Juan Islands are in something approximating pre-disturbance states. So, at the least we have these contrasting end members (low stress/high function, vs. high stress/low function). What we don't know is the shape of the curve between these two, and the amount and kind of stresses that cause the shift.

We are not nearly at a point where we can state accurately what level of stress (i.e., the threshold level), and what combinations of stressors, will move the entire Sound into an altered state. Major changes in fundamental controlling factors could do this, like what has happened in the Columbia River estuary. There, dams have significantly altered hydrodynamics, logging and land conversion in the watersheds, and levees and dikes have eliminated connections with vital floodplain wetland areas. The system has shifted from a marsh macrodetritus based food web to a plankton based food web with effects ramifying throughout the food web of the system.

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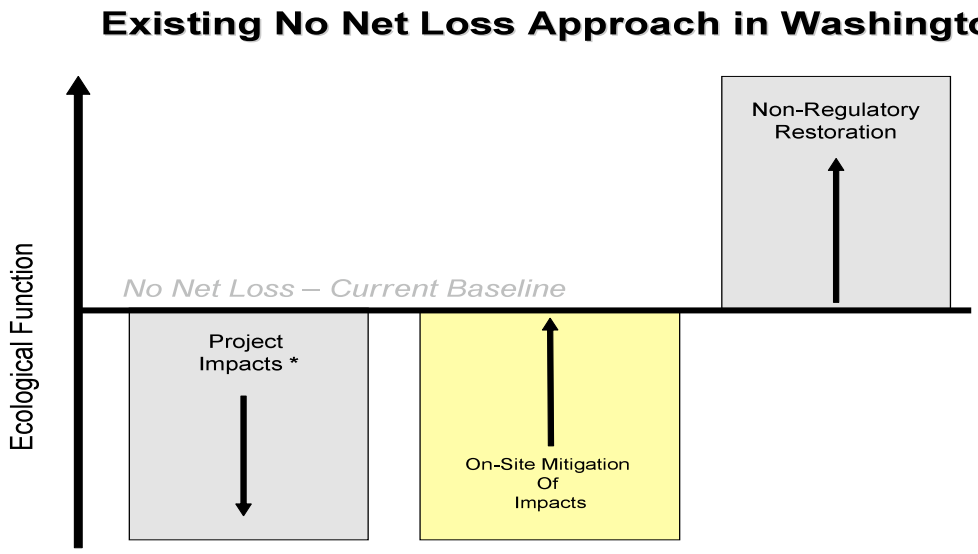
[64]Gunderson, *Ecological Resilience in Theory and Application*, Annu. Rev. Ecol. Syst. 2000.31:425-439.

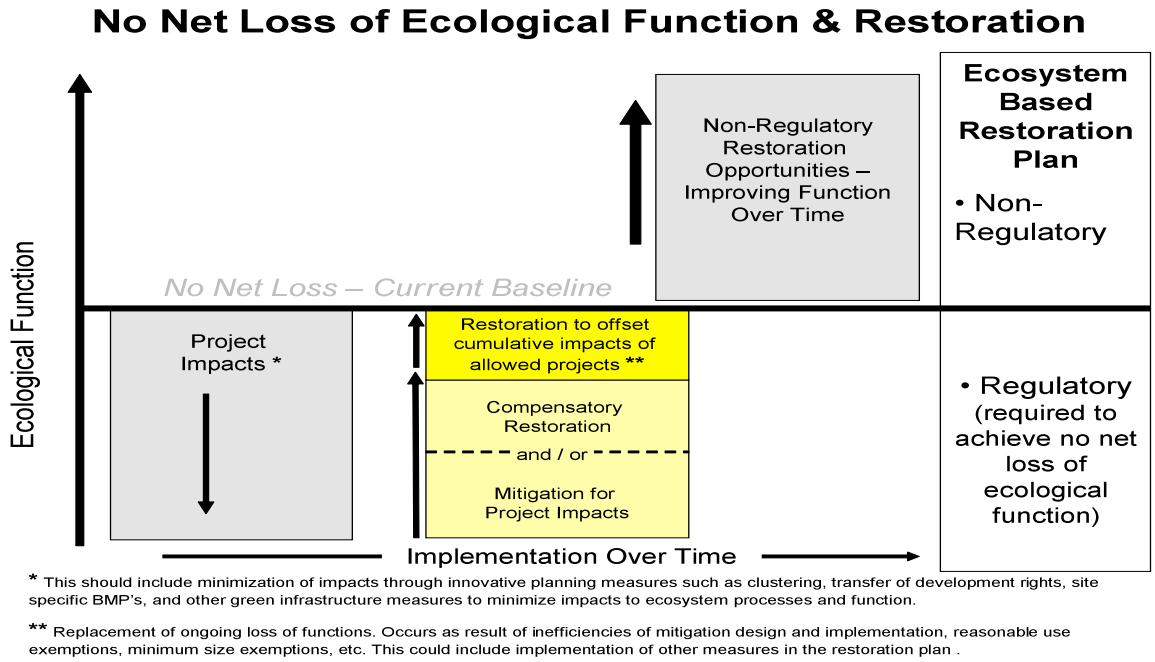
Some researchers are trying to piece together information that shows a shift in the food web in Puget Sound, but that is not finished and probably won't be conclusive evidence. At this juncture we can point to loss of tidal habitats, degradation of existing habitats, alterations in fish communities, contamination in food webs, hypoxia events, loss of eelgrass in some areas, etc., as evidence that the system is stressed, and may be on the verge of shifting to a significantly altered system. However, what "on the verge" means is not known.

We need a comprehensive/credible study of the cumulative effects of multiple stressors on the ecosystem. Short of that, our scientists will need to rely on adding impacts up (i.e., use an additive model) and use more qualitative descriptors of the system state. An additive model is what we and others have applied to county shorelines (e.g., Jefferson County Nearshore Assessment) and watersheds (e.g., the Bellingham watershed study performed by Stephen Stanley et al.). Extending these additive model assessments consistently throughout Puget Sound would go a long way toward addressing this question.[65]

[65] Ron Thom, Ph.D., Battelle, Pacific Northwest Labs, Sequim, Washington 2008.

Appendix P2-2: An Illustration of Our Proposal to Create a New Restoration Standard





* This should include minimization of impacts through innovative planning measures such as clustering, transfer of development rights, site specific BMP's, and other green infrastructure measures to minimize impacts to ecosystem processes and function.

** Replacement of ongoing loss of functions. Occurs as result of inefficiencies of mitigation design and implementation, reasonable use exemptions, minimum size exemptions, etc. This could include implementation of other measures in the restoration plan .

Appendix P2-3: Protection and Restoration Strategies for Puget Sound Ecosystems

Examples of Project Types and Targeted Ecosystem Benefits (adapted from Johnson et al. 2003).

Strategy	Project Type	Targeted Ecosystem Benefit
Protection	Land acquisition	Preserves existing intact ecological features, functions, and processes at site scale and/or enables the application of additional strategies without human land use constraints, but requires long-term management.
	Land use regulations	Limits or prohibits potentially harmful land use activities on or adjacent to the land surrounding the site, thereby protecting habitat-forming processes and features.
Conservation	Land conservation	Limits land use impacts harmful to salmon habitat such as sediment, contaminants, nutrient loading.
	Easements	Benefits ecological features through legal protection of critical areas, potentially allowing for complementary restoration strategies to take place.
	Riparian fencing	Deters livestock from degrading stream-side areas.
	Manure management	Minimizes the inputs of nutrients and bacteria into stream corridor.
	Tide gate/culvert replacement	Promotes water temperature reduction, dissolved oxygen availability, increased habitat access.
	Invasive species removal	Increases opportunities for native species propagation.
	Riparian fencing	Protects riparian zones from disturbances.
Restoration	Tide gate removal	Restores partial or full hydrologic connection to slough habitat improving water quality, access to lost habitat types and processes, and potential removal of invasive plant species.
	Dike breaching	Provides similar benefits as tide gate removal, this application requires significant earth moving activities to allow tidal energy to influence historic slough signatures and can involve tidal channel excavation.
	Culvert upgrades/culvert installation	Provides similar benefits to above restoration activities through the improvement of water quality, access to lost habitat types and processes, and potential removal of invasive species.
	Elevation adjustment	Restores elevation of site to level that will support appropriate wetland vegetation.
Creation	Material placement	Mimics habitat function and complexity through the placement of material at a given elevation.
	Tidal channel modification	Restores more natural flows and mimics tidal channel structure.

Appendix P2-4: An Ocean Blueprint for the 21st Century by the U.S.Commision on Ocean Policy (2004).

NOTE: Due to its large size, this document is available through the website at http://www.oceancommission.gov