

Alliance for a Healthy South Sound

LIO 5-Year Ecosystem Recovery Plan – First Elements

Submitted October 8, 2015

TABLE OF CONTENTS

Section 1. LIO Overview	3
South Sound LIO	3
South Sound Inlets and Island Groups	4
Section 2. Local Ecosystem Recovery Context – Vital Signs and Pressures	7
Identification of PSP Vital Signs to Include in This Submission	7
AHSS Pressures	8
AHSS Decision Process	10
Section 3. Recovery Approaches	13
AHSS Recovery Approaches for Selected PSP Vital Signs	13
PSP Vital Signs for Land Cover/Development and Floodplains	13
PSP Vital Signs for Estuaries and Shoreline Armoring	16
PSP Vital Sign for Freshwater Quality	20
PSP Vital Signs for Marine Water Quality, Swimming Beaches, OSS	22
PSP Vital Sign for Shellfish	23
PSP Vital Signs for Chinook and Orca	24
AHSS Recovery Approaches Aligned with 2016/17 Puget Sound Strategic Initiatives	27
Habitat Strategic Initiative	27
Shellfish Strategic Initiative	29
Stormwater Strategic Initiative	30
Tables and Figures	32
Table 1. PSP Priority Vital Signs and Relevant 2020 PSP Recovery Targets Addressed in Initial AHSS Planning Elements	32
Table 2. Content Considered in Selection of PSP Vital Signs to Address in Initial AHSS Planning Elements	35
Table 2A. Crosswalk of AHSS Focus Areas with PSP Vital Signs	44
Figure 1. Conceptual model showing LIO priority pressures (sources and stressors), Vital Signs, and priority relationships	46

Table 3. South Sound Pressures and Stressors and Related PSP Vital Signs Highlighted in Initial Planning Elements.....	47
Table 4. Content Considered in Selection of Pressures and Stressors to Highlight in Initial AHSS Planning Elements.	49
Appendix 1. LIO NTAs Mapped to Puget Sound Recovery Prototype Results Chains	52
Appendix 2. LIO Vital Signs Schematics.....	53
Figure A2.1. AHSS Approaches to PSP Vital Sign for Land Cover	53
Figure A2.2. AHSS Approaches to PSP Vital Sign for Floodplains	54
Figure A2.3. AHSS Approaches to PSP Vital Sign for Estuaries.....	55
Figure A2.4. AHSS Approaches to PSP Vital Sign for Shoreline Armoring	56
Figure A2.5. AHSS Approaches to PSP Vital Sign for Freshwater Water Quality	57
Figure A2.6. AHSS Approaches to PSP Vital Sign for Marine Water Quality	58
Figure A2.7. AHSS Approaches to PSP Vital Sign for OSS	59
Figure A2.8. AHSS Approaches to PSP Vital Sign for Swimming Beaches	60
Figure A2.9. AHSS Approaches to PSP Vital Sign for Shellfish Beds	61
Figure A2.10. AHSS Approaches to PSP Vital Sign for Chinook Salmon	62
Figure A2.11. AHSS Approaches to PSP Vital Sign for Orca	63

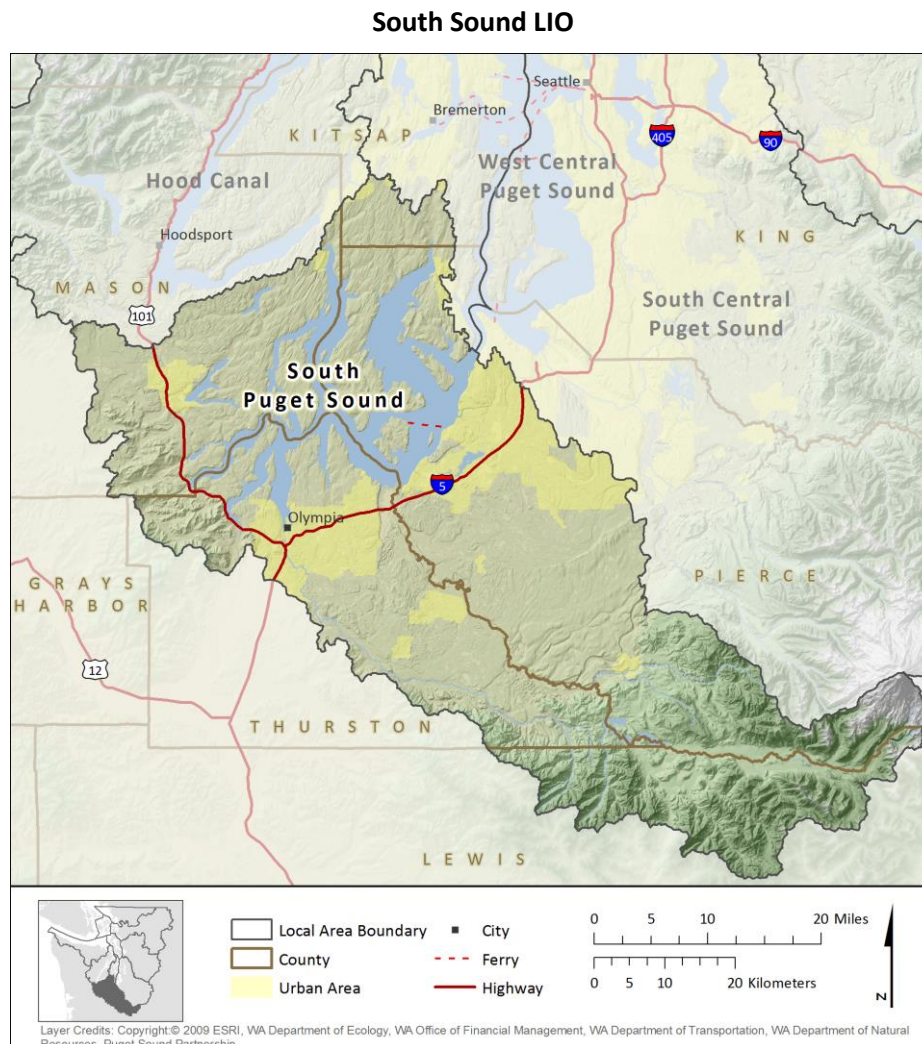
Authors: This document was prepared by AHSS staff in consultation with, and under the direction of, the AHSS Technical Team; with input from PSP staff. The AHSS Council also provided input. The AHSS Executive Committee approved submittal.

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Section 1. LIO Overview

As we passed this morning a narrow arm going to the Southward we put back & pursued it with very rainy weather & soon found it inclining a little to the Eastward to meet the large opening we passed yesterday, making the land on the left of us a large Island, on the south side of which we encampd for the night & found the country exceeding pleasant, & the Soil the richest I have seen in this Country — The Woods abound with luxuriant Ferns that grow over head.

*Diary of Archibald Menzies, 24 May, 1792
Present day Harstine Island, Mason County*

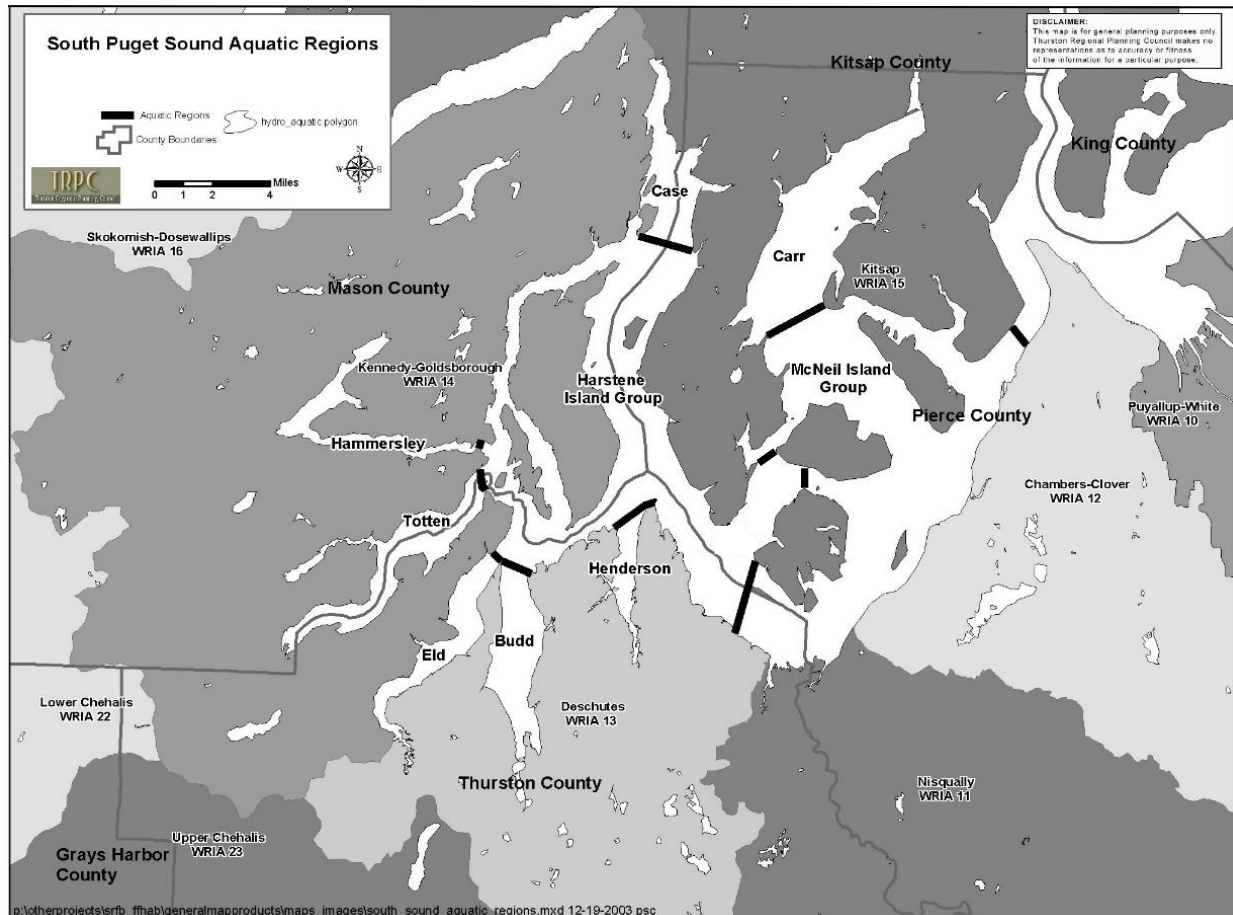


South Puget Sound is the southern end of the larger Puget Sound fjord estuary complex, separated from central Puget Sound by a narrow, shallow sill associated with the Tacoma Narrows.

There are nine distinct South Puget Sound inlets and island groups.

- Budd Inlet
- Case Inlet
- Hammersley Inlet & Oakland Bay
- Henderson Inlet
- Totten & Skookum Inlets
- Carr Inlet
- Eld Inlet
- Hartstene Island Group
- McNeil Island Group

South Sound Inlets and Island Groups



The Nisqually River is the only major river system in South Puget Sound. In much of the South Sound, steep bluffs bordering Puget Sound are intersected by small, steep ravines that drain the upland areas. There are a number of estuarine bays and lagoons located along the shorelines where these streams intersect with Puget Sound. When combined the numerous streams that drain into South Puget Sound rival the biological output of large Puget Sound systems.

The total surface area of marine waters in South Puget Sound is approximately 394 square kilometers, and there are more than 450 miles of shoreline. More than 50% of South Puget

Sound is less than 36.6 meters deep, and only a very small percentage is deeper than 100 meters. Tidal ranges in South Sound are extensive, with maximum ranges upwards of 20 feet.

Hydrographically, South Puget Sound is very different from the main basin of Puget Sound. Many of the larger-scale physical and chemical processes found in greater Puget Sound are muted or accentuated in the South Sound. This presents a unique set of conditions for physical, chemical, and biological interactions. Much of the South Sound has slow circulation and sensitivity to nutrients, causing a trend to low dissolved oxygen.

Five Watershed Resource Inventory Areas (WRIA) drain into South Puget Sound:

- WRIA 11 – Nisqually
- WRIA 12 – Chambers-Clover
- WRIA 13 – Deschutes
- WRIA 14 – Kennedy-Goldsborough
- WRIA 15 – Kitsap

Of these five WRIA, only the Nisqually, Deschutes, and Kennedy-Goldsborough WRIA drain exclusively into South Puget Sound. WRIA 15 – Kitsap shares its drainage with Central Puget Sound north of the Tacoma Narrows and Hood Canal. WRIA 12 – Chambers-Clover also extends north of the Tacoma Narrows to Commencement Bay.

Because of its stable and diverse economy, high quality of life, and relatively lower cost of living, South Puget Sound is among the fastest growing areas in Washington State. Between 2000 and 2010, the populations of Mason and Thurston Counties grew by 22%, the 4th and 6th highest rates of growth among Washington State counties during that time; Pierce County grew at 14%. Between 2015 and 2040, the Office of Financial Management projects a population growth rate of 34% for Mason and Thurston Counties, and a growth rate of 25% for Pierce County.

Much of the population in South Sound is clustered in and around the towns and cities of Shelton, Olympia, Lacey, Tumwater, Steilacoom, University Place, Lakewood, Tacoma, DuPont, the community of Allyn, and along shorelines. Land use varies from urban populations to rural and mixed use.

The waters of the South Sound provide some of the finest shellfish habitat in the world and present an array of recreational, commercial, and tribal harvest opportunities. Washington leads the country in production of farmed clams, oysters, and mussels, with an annual economic impact of over \$185 million, and Washington shellfish growers directly and indirectly employ over 2,700 people. The commercial shellfish industry is thriving, demand is expanding in markets worldwide, and clean water is the essential catalyst for continued success. Recreational use of the shorelines for clam digging, swimming, boating, fishing, and beach combing on state, county, city, and private beaches is popular.

Use of marine waters and nearshore areas by juvenile salmon and trout rates high in South Puget Sound, not only for salmonids coming from freshwater systems in the area, but also during summer when salmon from elsewhere in Puget Sound, and even British Columbia, are known to feed in the rich South Sound.

The Alliance for a Healthy South Sound (AHSS) Executive Committee is comprised of representatives from the following organizations:

- Nisqually Indian Tribe
- Mason County
- Pierce County
- Squaxin Island Tribe
- Thurston County

The AHSS Council consists of representatives from the following organizations:

- Capitol Lake Improvement & Protection Association
- Chambers-Clover Creek Watershed Council
- City of Tumwater
- City of Olympia
- City of Lakewood
- Deschutes Estuary Restoration Team
- LOTT Clean Water Alliance
- Mason County
- Mason County Conservation District
- Nisqually Indian Tribe
- Nisqually Land Trust
- Nisqually River Council
- Oakland Bay Shellfish Protection Area
- Pierce Conservation District
- Port of Olympia
- South Puget Sound Salmon Enhancement Group
- Squaxin Island Tribe
- Tacoma-Pierce County Public Health
- Taylor Shellfish
- Thurston County
- Thurston ECO Network
- West Sound Watersheds Council
- Wilcox Farms
- WSU Extension

Section 2. Local Ecosystem Recovery Context – Vital Signs and Pressures

This section provides a description of the Puget Sound Partnership (PSP) Vital Signs that AHSS elected to include in this submission, the process used to identify those Vital Signs, and a brief description of pressures in the South Sound.

Identification of PSP Vital Signs to Include in This Submission

To inform identification of which PSP Vital Signs to include in this deliverable, AHSS first went through a process to identify priority South Sound ecosystem components or “focus areas.” These South Sound focus areas (or “South Sound Vital Signs”) are elements of the ecosystem we care about and that can serve as a logical framework for organizing our recovery planning. They were identified based on familiarity with the South Sound ecosystem, existing ecosystem protection and restoration plans and programs, ecosystem pressures/ stressors and endpoints, priorities of AHSS jurisdictions, and input from the AHSS Council. South Sound Vital Signs are expressed in terms of broad, directional goals; as part of the next steps in our planning process, South Sound-specific recovery objectives and quantifiable targets will be identified within each South Sound Vital Sign at the inlet (sub-watershed) scale.

AHSS identified nine Vital Signs for South Puget Sound. The list below is not in priority order.

1. Protection and restoration of forests for ecosystem benefits and sustainable harvest.
2. Protection and restoration of prairie/oak woodlands.
3. Protection and restoration of freshwater wetlands and streams.
4. Protection and restoration of marine nearshore habitat.
5. Improved freshwater water quality.
6. Improved marine water quality.
7. Expansion of healthy, productive shellfish populations and harvest.
8. Increase in abundance and distribution of native salmon species and harvest.
9. Human well being.

AHSS then cross-walked the nine South Sound Vital Signs to the PSP Vital Signs and recovery targets. All PSP Vital Signs and targets have a corollary in the South Sound Vital Signs. To focus this initial deliverable, AHSS identified a subset of PSP Vital Signs that are most acted on by current and ongoing work in the South Sound to include here. These are: **Land Development/Cover, Floodplains, Estuaries, Shoreline Armoring, Freshwater Water Quality, Marine Water Quality, On-Site Sewage, Shellfish Beds, Swimming Beaches, Chinook Salmon, and Orca.**

Human well being is extensively addressed by current and ongoing South Sound priorities and work; however determining how to document these efforts in the format required in this initial

deliverable was not possible in the time available. Human well being efforts will be described and integrated in the broader South Sound recovery strategy development process.

The PSP Vital Signs discussed in this deliverable are summarized in **Table 1**, and the information used to inform selection of these Vital Signs is summarized in **Table 2**. **Table 2A** presents the crosswalk between the South Sound Vital Signs and the PSP Vital Signs and recovery targets. Pressures that are addressed in this deliverable are cross walked to PSP Vital Signs that in **Figure 1**, and discussed further in the next section. Descriptions of individual PSP Vital Signs are provided in the discussion of recovery approaches, later in this document.

AHSS Pressures

Pressures highlighted in this initial deliverable are summarized in **Table 3**, and the information used to inform the selection of pressures to highlight here is summarized in **Table 4**.

In the South Sound, as in other parts of Puget Sound, human activities influence and may disrupt many natural processes. Intact natural processes are critical for maintaining a sustainable and productive ecosystem, an ecosystem that provides goods and services vital to the South Sound economy and healthy, thriving human communities, including:

- Clean and abundant water for human use and consumption.
- Natural resource-based industries such as fishing, shellfishing and shellfish aquaculture, agriculture, and forestry.
- Cultural and traditional uses guaranteed to South Sound Tribal Nations.
- Recreation and tourism values.
- Aesthetic values and other culturally and economically important services.

Preparing a list of priority human pressures on the ecosystem is a complex task for at least two reasons. First, many activities that can threaten or disrupt natural processes (“pressures”) also provide important benefits to humans (see above). The goal, therefore, is not to eliminate all pressures, but instead to understand and manage their influence to optimize both ecosystem and human benefits. Second, pressures operate on a series of nested spatial and temporal scales such that the most significant pressure in any given sub-watershed or any particular drift cell is highly dependent on the particular conditions and context in each specific place. AHSS identified pressures to highlight in this deliverable using existing assessments. Most pressures assessments, including the ones used here, focus at least in part on the prevalence of the pressure in the environment. This means places that are relatively less impacted by existing pressures, or pressures that have not yet been fully expressed, may show up as “lower” priority when, in fact, they should be the focus of special attention to prevent adverse impacts in the future. Similarly, pressures operate differently on different natural process or species endpoints, so a pressure that may appear less important overall may nonetheless be critically important to a particular species in a particular place.

In 2014 AHSS prepared a list of priority human pressures in South Puget Sound and used that list to shape identification of recovery sub-strategies and Near Term Actions submitted for inclusion in the 2014 Puget Sound Action Agenda. To prepare an updated list of human pressures on the South Sound ecosystem for this effort, AHSS started from the 2014 work and examined two additional recent pressure assessments:

1. The Monitoring and Adaptive Management Phase 1 effort, completed in late 2014, examined and updated pressures on salmon throughout the South Sound and produced results for the South Sound watersheds and the Nisqually watershed. This process worked from existing pressure evaluations captured in the All Salmonid Species Recovery Plan for the Marine Waters of South Puget Sound and the Chinook Salmon Recovery Plan for the Nisqually Watershed and relied on local experts to evaluate and generate updated pressures lists.
2. The Puget Sound Pressures Assessment, completed in late 2014, used a combination of structured expert elicitation and geospatial analysis to rank the potential impact of human stressors. These stressors can be cross-walked with their sources to generate lists of pressures. Results are provided for South Sound watersheds and for the Nisqually watershed.

Each assessment was reviewed, and individual assessment results were tabulated, along with the 2014 AHSS priority pressures list. Two of the assessments, the 2014 AHSS work and the Puget Sound Pressures Assessment, produced results at the stressor level. Stressor results were cross-walked to the standard menu of human pressures used in PSP recovery planning for comparison to the other assessments.

The result of these efforts is a set of tables that allows comparison across the existing assessments. A binning process was used to identify pressures that were ranked highly in multiple assessments. Pressures that were identified as priorities in both of the locally focused assessments (the 2014 South Sound work and the monitoring and adaptive management work) were placed in bin 1; pressures identified as priorities in one or more of the locally focused assessments were placed in bin 2.

AHSS focused this initial recovery planning work on the subset of pressures that were identified as priorities in both local pressure assessments (i.e., bin 1, as described above). These are the following pressures: **Housing & Urban Areas; Roads and Railroads (including culverts); Shipping Lands and Dredged Waterways; Abstraction of Surface Water; Abstraction of Ground Water; Freshwater Shoreline Infrastructure; Marine Shoreline Infrastructure; Domestic and Municipal Wastewater to Sewer; Runoff from Residential and Commercial Lands; Agricultural and Forestry Effluents; and Air-Borne Pollutants.** To that list the AHSS Technical Team recommended, and the AHSS Executive Committee approved, addition of two stressors that were identified in only one of the local assessments but are known and significant problems in the south sound: **Dams, Freshwater and Marine Levees, Floodgates, Tidegates, and Domestic and Commercial Waste Water to On Site Sewage.**

Pressures were then cross-walked to stressors using the PSPA stressor/pressure crosswalk provided by PSP, emphasizing stressors that had a “high” or “very high” relationship to initial priority pressures. Pressures/stressors from the resulting menu were crosswalked to the PSP substrategies identified by AHSS as best representing our current and emerging work, and then were further reduced (or focused) based on the content of AHSS’s current near-term actions included in the 2014 Action Agenda. This resulted in a quite limited list of pressures and stressors to highlight in this initial effort, as follows.

Housing & Urban Areas, Commercial & Industrial Areas, Tourism & Recreation Areas, Annual & Perennial Non-Timber Crops, Runoff from Residential and Commercial Lands: these pressures are grouped because they generally represent pressure on the natural environment in the form of increased stormwater runoff, uptake of freshwater resources for human consumption, increased coverage by impervious surfaces, and altered peak and low water flows.

Roads & Railroads (Including Culverts): transportation infrastructure in South Sound has a significant impact on ecosystem function. Vehicle pollution and runoff into freshwater and marine water systems, and impediments to natural ecosystem function such as railroad levees and culverts, are significant stressors.

Freshwater & Marine Levees, Floodgates & Tidegates, and Freshwater & Marine Shoreline Infrastructure, Dams: this group of pressures shares several related stressors, including shoreline hardening, culverts and other fish passage barriers, altered peak and low flows from land cover change, prevention of flood flows, and shading of shallow water habitat. Addressing these pressures is considered a vital element of restoring natural ecosystem function in South Sound.

Agricultural & Forestry Effluents: given the large number of tribal, private, and government-owned forest lands, in addition to significant agricultural activities, South Sound partners are concerned with limiting persistent toxic chemicals in aquatic systems as well as conventional water pollutants.

OSS - Domestic and Commercial Wastewater to On-site Sewage Systems: limiting the introduction, spread, or amplification of human pathogens into South Sound’s ecosystem affects multiple South Sound Vital Signs, including marine water quality, swimming beaches, shellfish beds, and freshwater quality.

AHSS Decision Process

At the initiation of the recovery planning effort, the AHSS Executive Committee identified seven principles to guide the work. These seven principals are the primary touchstone used in scoping and developing all recovery planning documents. They are:

1. *Get to actions.* The purpose of planning is to get to a set of actions that are appropriate to local conditions and locally supported. Planning is not an end to itself – it is a means of developing and documenting appropriate actions.
2. *Be inclusive.* Include the interests and experts in South Sound to facilitate local acceptance and support.
3. *Communicate clearly.* Ensure PSP terminology is used to facilitate consideration and roll up at the Puget Sound scale.
4. *Acknowledge PSP priorities.* Ensure it is clear where our work corresponds with PSP priority areas (i.e., shellfish, stormwater, habitat) to facilitate review and acceptance.
5. *Work with our local geography.* Use a sub-watershed (or inlet-based) approach to developing understanding of what is important, what is needed, and what is possible to ensure the strategy addresses the differences inherent in South Sound geography and gets us to a scale that is actionable.
6. *Build on existing work.* Use what we currently have in the South Sound Recovery Strategy, the South Puget Sound Action Area Basis report (2008), the local recovery plans, the M& work, and other documents.
7. *Take on the hard questions.* This is an unprecedented planning effort; we need to use this time to really delve into what is necessary and what is possible in South Sound.

Flowing from the seven principles, development of planning documents and PSP deliverables follows the same general decision process:

First, drafts are outlined to determine what content and decisions are needed. This relies heavily on the PSP requirements and mandatory templates for deliverables.

Second, initial content is developed starting with existing AHSS plans and work, extending out to plans and work from individual AHSS jurisdictions (e.g., Tribes, counties) and organizations (e.g., Lead Entities), and then reaching to broader South Sound and/or Puget Sound-scale work. The South Sound Technical Team does the primary work to develop content. The Technical Team is made up of representatives of each of the AHSS member jurisdictions, plus members with other technical expertise from the AHSS Council (e.g., representatives from Lead Entities, health departments, conservation districts). Many Technical Team members have been working directly on South Sound recovery issues for many years and were involved in development of the initial formation of AHSS, the initial AHSS recovery planning documents, and multiple other watershed- or jurisdiction-based ecosystem protection and restoration efforts. The Technical Team consults with the AHSS Council during content development. The PSP Ecosystem Recovery Coordinator also is consulted to ensure deliverables will meet PSP requirements.

Finally, the AHSS Executive Committee is briefed on emerging content and offers direction. Revisions are made and documents finalized as needed. The Executive Committee makes final decisions about the key features in recovery planning content (e.g., selection of Vital Signs, identification of pressures and substrategies). The Technical Team is responsible for executing AHSS direction and producing the details of the deliverables that are required for this effort.

Over time, as the broader 5-year recovery strategy is developed, AHSS has planned a series of workshops in the South Sound to further expand participation and ensure the recovery strategy reflects the most current understanding of the South Sound ecosystem, a broad array of interests from across South Sound, and the most robust ideas and approaches for ecosystem recovery.

Section 3. Recovery Approaches

This section describes AHSS current and emerging recovery approaches as crosswalked to the PSP Vital Signs and substrategies. Information is first presented by PSP Vital Sign (also shown in the Schematics in Appendix 2) and then by Strategic Initiative (also shown in the Prototype Results Chains in Appendix 1).

AHSS Recovery Approaches for Selected PSP Vital Signs

This Section describes AHSS's current and emerging approaches to PSP Vital Signs nested within the substrategies and prototype results chains defined by PSP. Our focus in this effort was on identifying the PSP substrategies that seem to best describe current and emerging AHSS work, so that our work can be considered in the context of PSP-scale Puget Sound recovery efforts.

PSP Vital Signs for Land Cover/Development and Floodplains

Changes in land cover give rise to many stressors on the ecosystem, including direct loss or degradation of habitat and numerous related stresses such as habitat fragmentation, shoreline armoring, barriers to animal movement and migration, altered flow patterns, and non-point pollution. Ecosystem processes and functions in the Chambers-Clover Creek watershed has been particularly affected by urbanization pressures and associated stressors.

In Thurston County between 1992 and 2011, large-scale changes detectable from satellite imagery indicated that approximately 11,518 acres were changed into low, medium, or high-density developed land cover, and approximately 42,152 acres of land were converted from forest stands to non-forest vegetation or high, medium, or low-density development.¹

AHSS work on land cover/development is focused on direct protection of intact areas (e.g., through acquisition and transfer/purchase of development rights programs), on improvement and implementation of land management programs and regulations such as comprehensive plans and critical area programs, and on working with a wide variety of partners to restore freshwater systems and habitats. In fast-growing South Sound significant effort also is oriented towards ensuring stewardship of rural and working lands (including working forests) for continued benefit of people and ecosystem processes and functions, protecting remaining intact shorelines and critical areas, restoring wetlands and riparian corridors, and encouraging compact, urban growth. Special efforts are being taken to protect remaining South Sound prairie habitat, including prairie oak woodland habitat and prairie species of special concern: the Taylor's checkerspot butterfly, Streaked Horned lark, Mazama pocket gopher, and Oregon spotted frog.

¹ Thurston Regional Planning Council website: <http://www.trpc.org/434/Urbanization>

AHSS work in floodplains is focused on maintaining and restoring floodplain function while protecting people and property from adverse effects of flooding. Functional river floodplains provide important ecological services like flood attenuation and ground water recharge. Floodplains include a diverse suite of salmon habitat that support salmon population viability. Diverse floodplain habitats like off-channel ponds and oxbows increase the abundance of salmon by increasing the capacity of the system to support juveniles during their freshwater rearing phase. Floodplain habitats are also important for spawning. Side-channels, braids, overflow channels, and terrace tributaries increase the available spawning habitat and are known hot spots for many species of spawning salmon. These habitats provide relatively stable spawning conditions that buffer against the impact of large floods.

In South Sound, the Nisqually and Deschutes Rivers have the largest floodplains. The Nisqually has large sections of intact functional floodplain with a few reaches constrained by levees or other development. A 2004 off-channel habitat assessment of the Nisqually River below the Alder-LaGrande hydropower complex found that nearly 60% of the floodplain habitat was functional while approximately 30% was severely degraded. Over 70% of the severely degraded floodplain habitat was found in one five-mile section of the Nisqually.

In the Deschutes River dikes, levees, and other floodplain constrictions have not been identified as a limiting factor. However, the river is noted as being naturally erosive due to its relatively young geologic age. As erosion continues within the migration zone future hardening or diking may lead to the loss of off-channel habitat. Currently 72% of the 343 river reaches are rated as having little to no off-channel habitat (WRIA 13 Limiting Factors Analysis).

Work in South Sound will contribute directly to the following PSP land cover/development and floodplains recovery targets:

- The average annual loss of forested land cover to developed land cover in non-federal lands does not exceed 1,000 acres per year, as measured with Landsat-based change detection.
- Restore 268 miles of riparian vegetation or have an equivalent extent of restoration projects underway.
- [Puget Sound] Basin-wide loss of vegetation cover on ecologically important lands under high pressure from development does not exceed 0.15% of the total 2011 baseline land area over a five-year period.
- The proportion of [Puget Sound] basin-wide growth occurring within UGAs is at least 86.5% (equivalent to all counties exceeding their population growth goals by 3%), with all counties showing an increase over their 2000–2010 percentage.
- Restore, or have projects underway to restore, 15% of degraded Puget Sound floodplain area, and have no net loss of floodplain function in any watershed.

AHSS identified seven PSP substrategies to represent our current and emerging work related to the PSP land cover/development recovery targets.

A1.3, B1.3, C1.6 – These substrategies have to do with improving, strengthening, and streamlining implementation of laws, plans, regulations, and permits to further protection and restoration of Puget Sound, and on increasing compliance with and enforcement of environmental laws, regulations, and permits. County growth management work and critical area updates, and habitat conservation plans (e.g., such as those for prairie habitats and species) can fall under these substrategies.

A2.2, A6.1 – These substrategies have to do with freshwater and terrestrial restoration projects, including those identified as high-priority projects in salmon recovery workplans. In South Sound recent freshwater and terrestrial restoration projects have included work at Ohop Creek in the Nisqually watershed, where efforts to restore the entire Ohop Valley reach of Ohop creek are reaching fruition, restoring 6 miles of stream to its original meander pattern, restoring hydrologic connections to adjacent floodplains and wetlands, and restoring/revegetating 400 acres of riparian and wetland areas. In the Deschutes work was recently completed to restore and revegetate riparian habitat in Tumwater Valley and Pioneer Park, restoring 1 mile of river corridor (3.63 acres) and providing community engagement and education, as well as bank stabilization, erosion and temperature control, shade, and filtration of surface water. In Kennedy-Goldsborough Creek, work is ongoing to remove fish passage barriers, protect and restore wetland and riparian areas, and improve channel complexity and off channel habitat. Projects to date, including removal of the Kennedy-Goldsborough dam, have opened and improved miles of stream habitat, and Coho have been steadily increasing since restoration began. Restoration in the Chambers-Clover watershed has focused on fish passage barrier removal and marine shoreline restoration planning. Recent projects include passage improvement at Shera’s Falls, bypass channels at Morey Pond and Breseman Forest Dam, and project feasibility and design at Titlow Lagoon and Chambers Dam.

A5.3, A5.4, A6.1 – These substrategies have to do with floodplain protection and restoration, including floodplain projects identified as high-priority projects in salmon recovery workplans. In the South Sound seasonal flooding is an issue in the Nisqually and Deschutes rivers and in smaller tributary and urban streams. In the Nisqually watershed, an aggressive protection initiative has resulted in the permanent protection of nearly 80% of the floodplain habitat.

D5.3 – This substrategy is meant to capture the extensive and varied work in South Sound that has to do with education and stewardship related to land management and floodplains. This includes, for example, Thurston County’s work to steward and preserve rural and working lands through transfer and purchase of development rights, voluntary stewardship, open space tax, and agricultural tourism programs in Thurston County’s emerging working lands strategy; the Nisqually Community Forest work; and Pierce County biodiversity and open space planning efforts.

South Sound pressures highlighted in this initial effort that are addressed (reduced) by work related to land cover/development and floodplains include the following: **Housing & Urban Areas; Commercial & Industrial Areas; Annual & Perennial Non-Timber Crops; Roads &**

Railroads (Including Culverts); Dams; Freshwater & Marine Levees, Floodgates, Tidegates; Freshwater & Marine Shoreline Infrastructure; and Agricultural & Forestry Effluents.

South Sound stressors highlighted in this initial and reduced by land cover/development and floodplains work include:

- A1. Conversion of land cover for residential, commercial, and industrial use
- A3. Conversion of land cover for transportation & utilities
- C. Shoreline hardening
- D. Shading of shallow water habitat
- E1. Dams as fish passage barriers
- E2. Culverts and other fish passage barriers
- J1. Altered peak flows from land cover change
- K1. Altered low flows from land cover change
- L. Flow regulation – prevention of flood flows
- M1. In channel structural barriers to water, sediment, debris flows
- M2. Other structural barriers to water, sediment, debris flows
- U2. Non-point source, persistent toxic chemicals in aquatic systems
- V2. Non-point source, non-persistent toxic chemicals in aquatic systems
- X2. Non-point source conventional water pollutants

Other pressures and stressors of importance in South Sound that are not highlighted in this initial effort also are reduced through work on land cover/development and floodplains, and will be described in future planning efforts.

Current and emerging AHSS approaches to the PSP Vital Sign for land development/cover are summarized in Figure A2.1; current and emerging AHSS approaches to the PSP Vital Sign for floodplains are summarized in Figure A2.2.

PSP Vital Signs for Estuaries and Shoreline Armoring

Estuaries are one of the most productive habitats on the planet. In Puget Sound, estuaries of all sizes from small “pocket estuaries” to large river deltas are vital habitat for Chinook and other salmon. Pocket estuaries such as those common in South Sound provide critical functions, including rearing (feeding and growth), refuge from predators and extreme events, and opportunity for physiological transition for juvenile salmon, primarily early fry migrants of very small size. The importance of estuary habitat for natal and non-natal Chinook has been widely documented, and estuary restoration is considered a top priority for salmon recovery.

Many AHSS partners are working on restoring South Sound pocket estuaries that have been separated from Puget Sound by human intervention such as tidal dikes and rail levees. The Puget Sound Action Team identified 62 pocket estuaries within South Puget Sound representing all Island and Inlet groups. Subsequent analysis of the dataset indicate that there are likely

significantly more pocket estuaries present. Identification, protection, and restoration of these critical habitats has long been a focus of South Sound recovery work.

The Nisqually and Deschutes estuaries are the largest estuaries in South Sound. The Deschutes estuary is heavily modified. The Deschutes River is cut off from its estuary in Budd Inlet in 1951 by the 5th Avenue dam. The proposed removal of the dam would restore up to 346 acres of estuarine and intertidal habitat. The Nisqually estuary has been the focus of the largest estuary restoration effort in the Pacific Northwest, with over 900 acres restored since 2002.

Estuary work in South Sound will contribute directly to the PSP recovery targets for estuaries:

- All Chinook natal river deltas meet 10-year salmon recovery goals (or 10% of restoration need as proxy for river deltas lacking quantitative acreage goals in salmon recovery plans). The ongoing Nisqually River delta work contributes to this target.
- 7,390 quality acres are restored basin-wide, which is 20% of total estimated restoration need. Restoration work in numerous smaller South Sound estuaries and work to remove the Deschutes River tide gate and dam and restore the Deschutes River estuary contribute to this target.
- From 2011 to 2020, the total amount of armoring removed should be greater than the total amount of new armoring in Puget Sound (total miles removed is greater than the total miles added).

AHSS identified eleven PSP substrategies to represent our current and emerging work related to the PSP estuary recovery targets. The first three sets of substrategies reiterate the substrategies identified for South Sound work related to the land development/cover and floodplains PSP Vital Signs. This is to reflect our view that protecting and restoring ecosystem processes and functions in freshwater and uplands systems is a critical to the successful maintenance and restoration of ecological processes and functions in estuaries and other nearshore habitats.

A1.3, B1.3, C1.6 – These substrategies have to do with improving, strengthening, and streamlining implementation of laws, plans, regulations, and permits to further protection and restoration of Puget Sound, and on increasing compliance with and enforcement of environmental laws, regulations, and permits. County growth management, especially shoreline master planning, critical area updates, and habitat conservation plans (e.g., such as those for prairie habitats and species) can fall under these substrategies.

A2.2, A6.1 – These substrategies have to do with freshwater and terrestrial restoration projects, including those identified as high-priority projects in salmon recovery workplans, as described above.

A5.3, A5.4, A6.1 – These substrategies have to do with floodplain protection and restoration, including floodplain projects identified as high-priority projects in salmon recovery workplans, as described above.

B2.1; B3.1, A6.1 – These substrategies have to do with permanently protecting shorelines and priority nearshore ecosystem processes, especially in sensitive areas, and can include projects identified as high priorities in salmon recovery workplans. AHSS specifically identified development of a long-term conservation and low-impact public access strategy for McNeil Island as an action in the 2014 Action Agenda. While the State’s decision to maintain the special commitment center on the Island has changed the opportunity (and need) to develop such a strategy at this point, other work to protect South Sound shorelines continues. In particular the Capital and Nisqually land trusts have done extensive work to protect nearshore lands in all of the South Sound inlets and Island groups.

B2.2, A6.1 – These substrategies speak directly to nearshore and estuary restoration projects. In 2014 South Sound identified four specific estuary restoration projects for inclusion in the Puget Sound Action Agenda. These are: (1) the Chambers Bay estuarine and riparian enhancement project in WRIA 10/12, which would increase salt marsh and restore marine riparian habitat within and around Chambers Bay, improving shallow-water refuge and increasing foraging opportunity and rearing capacity for early life stages of Chinook, chum, and pink salmon; (2) Sequelitchew Creek estuary restoration; (3) John’s Creek/Bayshore estuary restoration, which will fully restore 74 acres of ecologically and culturally significant estuary, nearshore, riparian, and prairie oak habitat in the Oakland Bay watershed; and finally (4) the Deschutes estuary restoration through removal of the 5th avenue dam in Olympia, which will restore 346 acres of estuarine and intertidal habitat within sight of the State Capital, in the Southern reaches of Puget Sound. Work at John’s Creek is substantially underway and will be complete in 2016. AHSS expects the other estuary restoration actions to continue in the 2016-2017 Action Agenda and that additional estuary restoration actions will be put forward. In addition to the estuary restoration actions listed in the 2014 Action Agenda, in recent years, estuary restoration also has been accomplished or substantially moved forward at Mission Creek on Budd Inlet, Skookum Creek on Totten Inlet. And additional estuary restoration projects are in the active planning/development phase, including the mouth of Kennedy/Goldsborough Creek on Oakland Bay, and Whiteman Cove in Case Inlet.

B2.3 – This substrategy covers shoreline armoring removal projects. Armoring and/or overwater structures have been removed, or are in process of being removed at a number of locations in South Sound including Frank’s Tidelands (Budd Inlet), the Collier property (Hammersly Inlet/Pickering Passage), and Penrose Point State Park (Carr Inlet). We expect that shoreline armoring removal projects will continue – and potentially accelerate – as South Sound recovery work continues. Potential future shoreline armoring removal projects have been identified at a number of sites including Burfoot Park and Evergreen College (Budd and Eld Inlets respectively). Most shoreline armoring removal work has taken place in the marine/nearshore environment; however AHSS also will continue to work with partners to remove and mitigate adverse impacts of shoreline alteration in freshwater systems.

D5.3 – This substrategy is meant to capture the extensive and varied work in South Sound that has to do with education and stewardship related to shorelines and nearshore habitats, species, processes, and functions.

South Sound pressures highlighted in this initial effort that are addressed (reduced) by work related to estuaries and shoreline armoring are the same as those listed about for work related to land cover/development and floodplains, plus the following: **Tourism & Recreation Areas.**

South Sound stressors highlighted in this initial effort that are reduced by estuary and shoreline armoring work include:

- A1. Conversion of land cover for residential, commercial, and industrial use
- A3. Conversion of land cover for transportation & utilities
- C. Shoreline hardening
- D. Shading of shallow water habitat
- E1. Dams as fish passage barriers
- E2. Culverts and other fish passage barriers
- J1. Altered peak flows from land cover change
- K1. Altered low flows from land cover change
- L. Flow regulation – prevention of flood flows
- M1. In channel structural barriers to water, sediment, debris flows
- M2. Other structural barriers to water, sediment, debris flows
- U2. Non-point source, persistent toxic chemicals in aquatic systems
- V2. Non-point source, non-persistent toxic chemicals in aquatic systems
- X2. Non-point source conventional water pollutants

Other pressures and stressors of importance in South Sound that are not highlighted in this initial effort also are reduced through work on estuaries and shoreline armoring, and will be described in future planning efforts.

Current and emerging AHSS approaches to the PSP Vital Sign for estuaries are summarized in Figure A2.3. Current and emerging AHSS approaches to the PSP Vital Sign for shoreline armoring are summarized in Figure A2.4.

AHSS is not at this time specifically describing work related to PSP Vital Sign for eelgrass, although we expect estuary restoration and other work related to marine/nearshore habitat and marine water quality will, over time, also yield eelgrass improvements.

PSP Vital Sign for Freshwater Quality

The health of lakes, rivers, streams, and other freshwater resources are a direct reflection of the condition and use of the surrounding landscapes. The work related to land cover/land development, floodplains, and estuaries describe above is critical to protecting and maintaining water quality in freshwater systems. In addition, AHSS work on freshwater quality seeks to reduce the quantity and speed of runoff from developed lands and to reduce the amount of pollution (both conventional and toxics) in runoff. AHSS jurisdictions also make significant investments in freshwater quality monitoring and in outreach and communication with communities about freshwater quality status and trends and actions individuals can take to improve water quality in their watersheds.

AHSS work on freshwater quality will contribute directly to the PSP recovery targets for freshwater quality:

- At least half of all monitored streams should score 80 or above on the Water Quality Index.
- Reduce the number of "impaired" waters.
- Protect small streams that are currently ranked "excellent" by B-IBI for biological condition, and improve and restore streams ranked "fair" so their average scores become "good."

AHSS identified fifteen PSP substrategies to represent our current and emerging work related to the PSP recovery targets for freshwater quality.

A1.3, B1.3, C2.1, C2.4, C1.6, – These substrategies have to do with improving, strengthening, and streamlining implementation of laws, plans, regulations, and permits to further protection and restoration of Puget Sound, and on increasing compliance with and enforcement of environmental laws, regulations, and permits. In particular for freshwater quality, these relate to programs that address stormwater management and permitting, and that seek to improve on-site stormwater management and reduce the speed, quantity, and pollution present in runoff. County toxics reduction programs also fall under these substrategies.

A2.2, A6.1, A5.3, A5.4, A6.1 – These substrategies have to do with freshwater and terrestrial restoration projects, and floodplain protection and restoration, as described earlier in this document. They are included here to reinforce the importance of land cover/land development to protecting and maintaining water quality in freshwater systems.

C2.1 – This substrategy calls for management of urban stormwater at the basin and watershed scale. Watershed-based stormwater management is a focus of AHSS jurisdictions. AHSS put forward two actions related to watershed based stormwater management for the 2014 action agenda: development of a balanced funding strategy (of local, state, and federal funding) for NPDES municipal stormwater permit implementation; and development of specific sub-basin scale nutrient reduction plans, working from the Department of Ecology South Sound Dissolved Oxygen Study. AHSS is still exploring whether there will be interest and sponsorship in moving

these or similar actions forward for the 2016 Action Agenda. Although the need for this work remains great, it is not clear that a local sponsor can emerge to move the work forward.

C2.3 – This substrategy focuses on fixing problems caused by existing development and will be used as the place for anticipated future actions related to stormwater retrofits and other work oriented towards managing stormwater runoff from urban and suburban areas.

C3.1, C3.2, C9.4 – These substrategies have to do with improving stormwater management at working farms and include farm programs that are contained in local pollution identification and correction programs. Conservation Districts in each of the AHSS member counties do significant work with farm programs and we expect this work to continue and expand in the future. This work is important to freshwater quality broadly and critical to shellfish water quality in some areas.

C2.5, D5.3 – These substrategies address stormwater-related education, training, assistance, and stewardship actions. AHSS jurisdictions have made extensive investments in stormwater assistance, education, and training. The 2014 Action Agenda included three specific actions in this area: development of stormwater education programs for small communities including Oakland Bay, Hamersley Inlet, Case Inlet, Pickering Passage, and the Nisqually watershed; prevention of pollution of shellfish beds through inlet-based/inlet-scale community/resident education, outreach, and support; and implementation of the Shore Stewards program to engage shoreline homeowners in implementation of best management practices to reduce pollution inputs and improve nearshore habitat. We expect these or similar actions to continue and expand into the future.

C5.1, C5.2, C9.4 – These substrategies capture the work that many counties and other jurisdictions and partners are doing to implement programs to manage and control pollution from small and large on-site sewage systems, some of which operate as part of broader pollution identification and correction programs. Each of the AHSS counties has a significant OSS program. Substrategy **C5.3** addresses improving and expanding funding for OSS programs.

South Sound pressures highlighted in this deliverable that are addressed (reduced) by work related to freshwater quality include: **Housing & Urban Areas, Commercial & Industrial Areas, Runoff from Residential and Commercial Lands, and OSS - Domestic and Commercial Wastewater to On-site Sewage Systems.**

South Sound stressors highlighted in this deliverable that are reduced by freshwater quality work include:

- A1. Conversion of land cover for residential, commercial, and industrial use
- A3. Conversion of land cover for transportation & utilities
- J1. Altered peak flows from land cover change
- S2. Introduction, spread, or amplification of human pathogens
- U2. Non-point source, persistent toxic chemicals in aquatic systems

- V2. Non-point source, non-persistent toxic chemicals in aquatic systems
- X2. Non-point source conventional water pollutants

Other pressures and stressors of importance in South Sound that are not highlighted here also are reduced through work on freshwater quality, and will be described in future planning efforts.

Current and emerging AHSS approaches to the PSP Vital Sign for freshwater quality are summarized in Figure A2.5.

PSP Vital Signs for Marine Water Quality, Swimming Beaches, OSS

AHSS approaches to the PSP Vital Signs for marine water quality, swimming beaches, and OSS all build off, or are subsets of, the AHSS approaches to freshwater quality. Freshwater and marine water quality are, of course, inexorably connected, especially in an area such as South Sound which is dominated by numerous inlets and small estuaries directly fed by surface water runoff and by relatively short, relatively small freshwater streams. In addition to work to improve freshwater quality and to address surface water runoff (described above), work to reduce pathogens through the OSS programs and farm programs is particularly important to the ecosystem services provided by good marine water quality, such as shellfish production.

AHSS work will directly contribute to the PSP recovery targets for marine water quality, OSS, and swimming beaches:

- Keep dissolved oxygen levels from declining more than 0.2 milligrams per liter in any part of Puget Sound as a result of human input. (Marine water quality)
- All monitored beaches in Puget Sound meet EPA standards for what is called enterococcus, a type of fecal bacteria. (Swimming beaches)
- Inventory all on-site sewage systems in Marine Recovery Areas and other specially designated areas; be current with inspections at 95%; and fix all failures. (OSS)
- Phase in an expansion of Marine Recovery Areas and other specially designated areas to cover 90% of Puget Sound's unsewered marine shorelines. (OSS)

AHSS's work on marine water quality nests in the same substrategies as its work for freshwater water quality (described above). Substrategies for swimming beaches and OSS are a subset of those substrategies. In particular, South Sound counties and health districts tasked with repair and maintenance of on-site septic systems face continuing challenges related to identifying failing systems, funding repairs and maintenance, and ongoing monitoring. Each AHSS county submitted an action related to achieving a self-sustaining septic repair loan program to the 2014 Action Agenda. These programs ultimately will lead to increased OSS repairs and replacements, better reporting of OSS issues, and improved OSS operation and maintenance. Those actions are nested under substrategy **C5.3**, and we expect them to continue into the future. (We note that while OSS may primarily be thought of as an issue in the nearshore, it also can be a concern in the freshwater environment; similarly South Sound has both freshwater and marine swimming beaches.)

South Sound pressures and stressors highlighted in this deliverable that are addressed (reduced) by work related to marine water quality, OSS, and swimming beaches are the same as those described for freshwater quality, above. Other pressures and stressors of importance in South Sound that are not highlighted in this deliverable also are reduced through work on freshwater quality, and will be described in future planning efforts.

Current and emerging AHSS approaches to the PSP Vital Sign for marine water quality are summarized in Figure A2.6, swimming beaches in Figure A2.7, and OSS in Figure A2.8.

AHSS is not at this time specifically describing work related to PSP Vital Signs for toxics in fish and marine sediment quality, although we expect that work to improve fresh and marine water quality will, over time, also yield improvements in the PSP Vital Signs for toxics.

PSP Vital Sign for Shellfish

Harvesting of shellfish in the South Sound has a long history, beginning with the original native tribes. Tribal harvest continues in the present day alongside recreational harvest and larger-scale commercial production. The ability for tribes to harvest is a significant cultural tradition, and the commercial shellfish industry is a major economic engine in the South Sound. However, pollution from stormwater runoff and failing on-site sewage systems impair marine water quality and lead to frequent harvest restrictions and closures of shellfish beds.

AHSS work will directly contribute to the PSP recovery targets for shellfish:

- A net increase from 2007 to 2020 of 10,800 harvestable shellfish acres, which includes 7,000 acres where harvest is currently prohibited.

Improved marine water quality is the most critical component to improving shellfish beds, and the South Sound shellfish bed work nests within the same PSP substrategies identified for that work (see above). AHSS actions captured under substrategies **C2.5** and **D5.3** include two efforts specifically focused on shellfish-related education and stewardship. These are the prevention of pollution of shellfish beds through inlet-based/inlet-scale community/resident education, outreach, and support; and implementation of the Shore Stewards program to engage shoreline homeowners in implementation of best management practices to reduce pollution inputs and improve nearshore habitat. We expect these or similar actions to continue into the future.

Finally, shellfish bed-related work also includes efforts to restore native shellfish populations, particularly the native Olympia oyster, substrategy **C7.2**.

South Sound pressures and stressors highlighted in this deliverable that are addressed (reduced) by work related to shellfish beds are the same as those described for marine water quality, swimming beaches, and OSS, above. Other pressures and stressors of importance in

South Sound that are not highlighted in this deliverable also are reduced through work on freshwater quality, and will be described in future planning efforts.

Current and emerging AHSS approaches to the PSP Vital Sign for shellfish beds are summarized in Figure A2.9.

PSP Vital Signs for Chinook and Orca

AHSS is committed to increase the productivity, life history diversity, and ultimately the abundance and distribution of all native salmon species, including listed species, in the South Sound. Native species in the South Sound include Pink and Chum, Coho, Chinook, Cutthroat trout, and Steelhead. South Sound jurisdictions have long taken a multi-species approach to salmon recovery, emphasizing the importance of non-listed species both in their own right for economic and cultural reasons, but also because of the contributions that work to benefit these species makes to numerous other species including shellfish, forage fish, and listed Chinook.

The Nisqually River is the only system in South Sound that supports naturally occurring Chinook salmon. The historic natural Nisqually Chinook stock is believed to be extirpated, and the current stock is supported by a mix of naturally spawning and hatchery-reared Chinook that originated primarily from the Green River. Between 2004 and 2010, escapement of Nisqually Chinook has averaged around 2,100 with approximately 70% of those being hatchery strays. The Nisqually Indian Tribe, along with the Washington Department of Fish and Wildlife, recently completed a Nisqually Chinook Stock Management Plan that integrates hatchery and harvest activities in order to promote the development of a locally adapted and self-sustaining Nisqually Chinook stock. The key components of the plan include harvest rates that support natural Chinook recovery, a mainstem weir that will exclude hatchery fish from the bulk of the spawning grounds, and the implementation of a stepping stone hatchery program which will reduce domestication risks on the natural population.

While the Nisqually River is the only natal Chinook water body in South Sound, the marine waters and marine and nearshore habitats south of the Tacoma Narrows provide important juvenile Chinook rearing habitat for multiple Chinook stocks. Fish ecology research conducted by the Nisqually and Squaxin Island Tribes found stocks from throughout Puget Sound using South Sound's extensive nearshore habitat.

AHSS work will directly contribute to the PSP recovery targets for Chinook salmon and orca:

- Stop the overall decline and start seeing improvements in wild Chinook abundance in two to four populations in each biogeographic region.
- Achieve an end-of-year census of 95 individual Southern Resident Killer Whales, which would represent a 1% annual average growth rate from 2010 to 2020.

The AHSS strategies for Chinook and orca are not separate; improvements in salmon populations, even in the South Sound where southern resident killer whales are rarely seen, contribute directly to orca recovery by increasing the prey base on which they depend.

For purposes of this initial work, AHSS has emphasized the PSP substrategies that capture habitat work related to salmon recovery (and therefore orca population growth). These include substrategies related to implementation of growth and stormwater management, shoreline protection, and critical areas (**A1.3, B1.3, C1.6**); protection and restoration of lakes, wetlands, floodplains, streams, and other freshwater and upland ecosystem habitats, processes, and functions (**A2.2, A5.3, A5.4, A6.1**); and protection and restoration of nearshore habitats, processes, and functions, in particular estuaries (**B2.1., B3.1, B2.2, B2.3, A6.1**). AHSS actions implementing these strategies in the context of salmon recovery are largely defined by the watershed-based salmon recovery plans and related four-year work plans, and will continue.

In addition to the habitat-related work, salmon recovery requires freshwater and marine water quality sufficient to support necessary ecological processes and functions, such as adequate food webs and prey species. AHSS water quality work is addressed earlier in this document.

Stewardship actions in this area (**D5.3**) are extensive and include work carried out by the salmon recovery Lead Entities, Salmon Enhancement Groups, Conservation Districts, and numerous other local and watershed-based entities. These include, in particular, salmon stewards and stream teams in the Nisqually watershed and in Pierce, Thurston, and Mason counties; and public salmon education and outreach associated with salmon viewing at the Deschutes River, Kennedy Creek, McClain Creek, and Donkey Creek.

Finally, we note in this section that salmon recovery will take more than (simply) habitat restoration and water quality. Addressing hatchery and harvest issues, and integrating and adaptively managing all salmon recovery efforts is needed. We have brought forward substrategy **A6.3** (implement harvest, hatchery, and adaptive management elements of salmon recovery) to emphasize this point.

Salmon recovery work contains elements of all the work described in previous sections and addresses (reduces) all the South Sound pressures and stressors highlighted in this initial effort, plus many more.

Current and emerging AHSS approaches to the PSP Vital Sign for Chinook salmon are summarized in Figure A2.10, and orca in Figure A2.11. In addition, salmon recovery work is described in detail in the WRIA 10, 11/12, 13, 14 and 15 recovery plans and workplans.

AHSS is not at this time specifically describing work related to PSP Vital Signs for forage fish.

PSP Substrategies Most Closely Related to AHSS Current and Anticipated Future Work

- A1.3 Improve, strengthen, and streamline implementation of laws, plans, regulations, and permits consistent with protection and recovery targets
- A2.2 Implement and maintain priority freshwater and terrestrial restoration projects
- A5.3 Protect and maintain intact and functional floodplains
- A5.4 Implement and maintain priority floodplain restoration projects
- A6.1 Implement high priority projects identified in each salmon recovery watershed's 3 year work plan
- A6.3 Implement harvest, hatchery, and adaptive management elements of salmon recovery
- B1.3 Improve strengthen, and streamline implementation and enforcement of laws, regulations, and permits that protect the marine and nearshore ecosystems and estuaries
- B2.1 Permanently protect priority nearshore physical and ecological processes and habitat, including shorelines, migratory corridors, and vegetation particularly in sensitive areas such as eelgrass beds and bluff backed beaches
- B2.2 Implement prioritized nearshore and estuary restoration projects and accelerate projects on public lands
- B2.3 Remove armoring, and use soft armoring replacement or landward setbacks when armoring fails, needs repair, is non protective, and during redevelopment
- B3.1 Protect intact marine ecosystems particularly in sensitive areas and for sensitive species
- C1.6 Increase compliance with and enforcement of environmental laws, regulations, and permits
- C2.1 Manage urban runoff at the basin and watershed scale
- C2.3 Fix problems caused by existing development
- C2.4 Control sources of pollutants
- C2.5 Provide focused stormwater-related education, training, and assistance
- C3.1 Target voluntary and incentive-based programs that help working farms contribute to Puget Sound recovery
- C3.2 Ensure compliance with regulatory programs designed to reduce, control or eliminate pollution from working farms
- C5.1 Effectively manage and control pollution from small on-site sewage systems
- C5.2 Effectively manage and control pollution from large on-site sewage systems
- C7.2 Restore and enhance native shellfish populations
- C9.4 Develop and implement local and tribal pollution identification and correction (PIC) programs
- D5.3 Enable and encourage residents to take informed stewardship actions addressing infiltration, pollution reduction, habitat improvement, forest cover, soil development, critical areas, reductions in shoreline armoring, and specific actions identified in sub-strategy D5.1

AHSS Recovery Approaches Aligned with 2016/17 Puget Sound Strategic Initiatives

Habitat Strategic Initiative

AHSS work related to the habitat strategic initiative is focused on protection and restoration activities related to: forests, prairie/oak woodlands, other terrestrial and freshwater habitats, and marine/nearshore habitats.

AHSS's strategy is still emerging as our planning work is moving forward; however it flows from a science-based theory of change that is informed by local habitat conditions and authorizing environment, and assessments and knowledge and that emphasize protection and restoration of ecosystem processes and functions. We think about this in three main categories or themes: structure, relationships, and science.

With respect to **structure**, we need the laws, programs, and commitments to implementation to ensure that we protect existing intact habitat. This is combination of regulatory programs and voluntary and incentive-based programs to support and encourage habitat stewardship actions. We will continue to lose ecosystem processes and functions if we can't stop further habitat loss. In a fast-growing region like the South Sound, which also has some significant undeveloped and rural areas, attention to this is a critical part of future success. State-wide laws and exemptions that undercut these efforts and encourage continuing habitat loss (such as the single-family HPA exemption) must be changed. Structure also includes the laws, regulations, and programs, including voluntary and incentive-based programs that encourage and support habitat restoration.

Relationships or "authorizing environment" encompasses a broad set of ideas around creating public understanding and will for ecosystem protection and restoration, and ensuring the groups and institutions working for ecosystem protection and restoration can work effectively together. At the broadest level we need to understand what people want and value from the ecosystem, and we need people to understand all the services the ecosystem provides and how their actions enhance or detract from those services. We need this from landowners and residents, from business, and from decision makers (both within and from outside the South Sound). We need there to be trusted sources of information on ecosystem issues and many opportunities for people to interact with and gain pleasure and value from the ecosystem. We also need relationships with on-the-ground groups – the land trusts, salmon enhancement groups, and others who may work most directly with landowners, project design, and project implementation. We need to support strong, credible leaders and project managers at that level to continue to build trust and understanding in the broader community.

Science can tell us where projects should go, and structure can support them, but it is largely relationships that brings them to fruition. The more people understand and appreciate what the ecosystem does, the better and more confident they will be that they can experience both ecosystem restoration and economic vitality – indeed that a healthy, functioning ecosystem is

necessary to economic vitality – and the more support there will be for protection and restoration efforts on the ground in neighborhoods, with community leaders, and with decision makers and policy setters.

Science speaks to our commitment to have a clear and thorough grounding of our work in credible data and information, and to respond to data and information on causes of problems in the ecosystem, and what is needed to protect and restore ecosystem processes and functions, even if that information is inconvenient or difficult. It speaks to our work to continuously observe and understand more about what the ecosystem needs and how it responds, and to apply that information in our structures, relationships, and actions. In the South Sound we have invested heavily in science-based watershed analysis and in development of analytical tools. For example, the Squaxin Island Tribe produced a nearshore assessment tool to help better understand the potential interactions between upland and adjacent nearshore conditions and use this information to site projects in places where they will most contribute to ecosystem processes and functions and be more likely to become self-sustaining. (*As Assessment Approach-Tool for Identifying Restoration Opportunities in Marine Nearshore Areas of South Puget Sound* (2014).)

If we have the right structures and the right relationships, and if we can base our decisions in science, we believe our actions will be effective and successful, and that we can protect and restore the ecological and socio-economic health of South Puget Sound.

For the habitat strategic initiative we identified a number of PSP substrategies to describe our work, as follows.

With respect to structure, we are working in areas described by substrategies **A1.3, B1.3, and C1.6**. These substrategies have to do with improving, strengthening, and streamlining implementation of laws, plans, regulations, and permits to further protection and restoration of Puget Sound, and on increasing compliance with and enforcement of environmental laws, regulations, and permits. County growth management work and critical area updates and habitat conservation plans (e.g., such as those for prairie habitats and species) fall under these substrategies, as do voluntary efforts such as the Thurston County Working Lands strategy.

We are taking direct action in the environment on projects related to riparian restoration, wetlands protection and restoration, floodplain protection and restoration, estuary recovery, and marine/nearshore habitat restoration falling under PSP substrategies **A2.2, A5.3, A5.4, B2.1, B3.1, B2.2, and A6.1**. Stewardship, education, and outreach work nests under PSP strategy **D5.3**. Finally, specific to salmon recovery, we have brought forward PSP substrategy **A6.3**, which covers the work we are doing to integrate harvest and hatchery management work with habitat efforts. This work is described in more detail earlier in this document (please see Section 3), and our theories of change for habitat protection and restoration efforts are summarized in the schematics for land cover, floodplains, estuaries, shoreline armoring, and Chinook salmon (see figures A2.1–A2.4). Moving forward, we will continue to seek projects with a clear basis in science, synergistic or supportive effects in the drainage/watershed,

opportunities to provide multiple benefits (e.g., through flood hazard abatement plus floodplain restoration) and engage land owners and residents, and that increase our resilience to climate change, particularly changes in precipitation patterns and related flows, and sea level rise.

Work in the habitat strategic initiative will seek to reduce the following pressures: **Housing & Urban Areas; Commercial & Industrial Areas; Annual & Perennial Non-Timber Crops; Roads & Railroads (Including Culverts); Dams; Freshwater & Marine Levees, Floodgates, Tidegates; Freshwater & Marine Shoreline Infrastructure; and, Agricultural & Forestry Effluents.** Related stressors also will be reduced. It will contribute to the PSP recovery targets for **land cover/development, floodplains, estuaries, Chinook, and orca.**

Moving forward our work is likely more about continuing and expanding our project implementation in these areas and less about filling specific gaps in terms of types of work, pressures addressed, or geographic distribution of activities.

Shellfish Strategic Initiative

For the shellfish strategic initiative AHSS is focused on preserving the shellfish beds we have and achieving reductions in pollution to restore additional shellfish growing areas. We identified a number of PSP substrategies to describe our shellfish work, as follows.

Substrategies **A1.3, B1.3, and C1.6** describe work to strengthening, and streamlining regulatory programs but also, particularly in the shellfish area, to improve voluntary programs that engage landowners and residents in stewardship such as Community Shellfish Farms. Portions of the South Sound are covered by shellfish protection districts, and implementation of their protection and restoration plans is an important element of our overall approach to shellfish. South Sound also is home to long-standing commercial shellfish growers and industry. Working with them will continue to be a priority moving forward.

As in other areas throughout the sound, we are working to reduce water pollution from runoff and from on-site septic systems to ensure shellfish are harvestable. Much of this work is about building strong community understanding and relationships, since many of the actions needed to protect and restore shellfish beds rely on individual property owners. Our work is nested under substrategies **C5.3** (which addresses funding OSS specifically), **C2.5**, where our focus will remain on customized outreach efforts for each inlet focused on preventing pollution and supporting recovery of shellfish beds more broadly, and **C2.1**, which currently holds our watershed-scale efforts to manage runoff and reduce pollution. Moving forward we expect also to have actions under substrategies **C1.6** and **C2.2** (on reducing sources of pollution), **C2.3** (retrofits), **C3.1** and **C3.2** (farm pollution reduction programs, which are critical in South Sound given the rural nature of much of our geography), and **C3.1** and **C5.2** (OSS programs more broadly).

Portions of the South Sound are covered by pollution identification and correction programs, such as the Pierce County Shellfish Partners program, which brings together the Pierce Health District, Pierce County Surface Water Management, Pierce Conservation District, Harbor Wildwatch, and Citizens for a Healthy Bay, along with a number of other governments, agencies, and organizations to protect and improve water quality in the shellfish watersheds. These programs are covered by substrategy **C5.9**. Work to improve and expand these PIC programs and, as described in three of our 2014 NTAs, to develop stable, self-sustaining funding mechanisms for septic repair loan programs will continue to be a priority moving forward, as will expanding public understanding, response, and control of other sources of pollution (i.e., from surface water runoff) to improve shellfish outcomes.

Work in the shellfish strategic initiative will seek to reduce the following pressures: **Runoff from Residential & Commercial Lands** and **OSS**. Related stressors also will be reduced. In addition to the recovery target for shellfish beds, our work will contribute to the PSP recovery targets for **fresh and marine water quality, OSS, and swimming beaches**.

Stormwater Strategic Initiative

AHSS work in the stormwater strategic initiative, like the other two strategic initiatives, is a combination of working towards the right structure, supporting relationships, and making decisions using science.

In stormwater, as with shellfish beds, our structure work is described by substrategies **A1.3**, **B1.3**, and **C1.6**. Work under these substrategies has to do with improving, strengthening, and streamlining regulatory programs but also with improving and expanding voluntary programs that engage landowners and residents in stewardship actions around stormwater, such as rain garden programs and toxics reduction programs, both of which are well developed and important in the South Sound.

As with shellfish, work related to runoff is focused on slowing the rate of runoff through retrofits, rain gardens, green infrastructure, and other stormwater collection mechanisms, and reducing the pollution in runoff by addressing toxics at the source (e.g., helping residents reduce the toxicity of their household and yard products and properly use and manage the products they have), and by capturing and collecting pollution from stormwater before it enters freshwater and marine systems. Stormwater work is a combination of engineered structures, “formal” green infrastructure (like rain gardens), and restoration and reliance on natural systems such as forest cover, riparian areas, and floodplains. The stormwater work is nested under substrategies **C2.1** (which has to do with managing stormwater at a watershed scale), **C1.6** and **C2.2** (toxics reduction), **C2.3** (retrofits), and **C3.1** and **C3.1** (farm programs).

There is a strong relationships/community element in our stormwater work through helping people understand stormwater issues, make better stormwater decisions individually at home and in the sense of support for community stormwater programs and investments, and to see stormwater as a valuable water resource. We put these efforts under substrategies **D5.2** and

C2.5. In particular, work includes development of education and outreach programs around non-NPDES stormwater programs in small communities, which we expect to continue and expand in the future.

Work in the stormwater strategic initiative will seek to reduce the following pressures: **Land Development & Land Cover** and **Runoff from Residential & Commercial Lands**. Related stressors also will be reduced. AHSS stormwater work will contribute to the PSP recovery targets for **land cover/development, freshwater quality, marine water quality, estuaries, OSS, shellfish beds, swimming beaches, and Chinook**.

Tables and Figures

Table 1. PSP Priority Vital Signs and Relevant 2020 PSP Recovery Targets Addressed in Initial AHSS Planning Elements.

PSP Vital Sign	Related ecosystem or human wellbeing components; or related pressure (sources or stressors)	PSP 2020 recovery targets that South Sound ecosystem recovery will contribute to directly
Land development and Land cover	Pressures: <ul style="list-style-type: none"> • Housing & urban areas Ecosystem Components: <ul style="list-style-type: none"> • Forests • Prairie/oak woodlands • Freshwater wetlands, lakes, and streams • Riparian vegetation 	<ul style="list-style-type: none"> • By 2020, average annual loss of forested land cover to developed land-cover in non-federal lands does not exceed 1,000 acres per year and 268 miles of riparian vegetation are restored or restoration projects are underway. • By 2020, the proportion of basin-wide growth occurring within Urban Growth Areas is at least 86.5% (equivalent to all counties exceeding goal by 3%) and all counties show an increase over their 2000-2010 percentage. • Basin-wide, by 2020, loss of vegetation cover on indicator land base over a 5-year period does not exceed 0.15% of the 2011 baseline land area.
Floodplains	Ecosystem Components: <ul style="list-style-type: none"> • Floodplains, including both natal Chinook and non-natal rivers, and smaller streams and FW systems • FW tidal wetlands • Riparian vegetation 	<ul style="list-style-type: none"> • Restore, or have projects underway to restore, 15% of degraded Puget Sound floodplain area, and have no net loss of floodplain function in any watershed.
Estuaries	Ecosystem Components: <ul style="list-style-type: none"> • River deltas, including both natal Chinook and non-natal rivers • Deltas associated with smaller streams • Pocket estuaries and embayments 	<ul style="list-style-type: none"> • By 2020, all Chinook natal river deltas meet 10-year salmon recovery goals (or 10 percent of restoration need as proxy for river deltas lacking quantitative acreage goals in salmon recovery plans) and 7,380 quality acres are restored basin-wide, which is 20 percent of total estimated restoration need.
Shoreline armoring	Pressure: <ul style="list-style-type: none"> • Shoreline armoring Ecosystem Components: <ul style="list-style-type: none"> • Freshwater wetlands, lakes, and streams • Marine nearshore habitat including beaches and embayments 	<ul style="list-style-type: none"> • From 2011 to 2020, the total amount of armoring removed is greater than the total amount of new armoring in Puget Sound (total miles removed > total miles added); feeder bluffs receive strategic attention for removal of existing armoring and avoidance of new armoring; and soft shore techniques are used for all new and replacement armoring unless it is demonstrably infeasible.

PSP Vital Sign	Related ecosystem or human wellbeing components; or related pressure (sources or stressors)	PSP 2020 recovery targets that South Sound ecosystem recovery will contribute to directly
Shoreline armoring	<p>Pressures:</p> <ul style="list-style-type: none"> • Marine shoreline infrastructure • FW shoreline infrastructure <p>Ecosystem Components:</p> <ul style="list-style-type: none"> • Freshwater wetlands, lakes, and streams • Marine nearshore habitat including beaches and embayments 	<ul style="list-style-type: none"> • From 2011 to 2020, the total amount of armoring removed is greater than the total amount of new armoring in Puget Sound (total miles removed > total miles added); feeder bluffs receive strategic attention for removal of existing armoring and avoidance of new armoring; and soft shore techniques are used for all new and replacement armoring unless it is demonstrably infeasible.
Freshwater quality	<p>Ecosystem Components:</p> <ul style="list-style-type: none"> • Freshwater wetlands, lakes, and streams • Lotic benthic invertebrates 	<ul style="list-style-type: none"> • By 2020, at least 50 percent of all monitoring stations with suitable data have Freshwater Water Quality Index scores of 80 or higher. • By 2020, achieve a decrease in the number of impaired waters (303(d) list) in Puget Sound freshwaters. • By 2020, 100 percent of Puget Sound lowland stream drainage areas monitored with baseline B-IBI scores of 42-46 or better; retain these “excellent” scores, and mean B-IBI scores of 30 Puget Sound lowland drainage areas improve from “fair” to “good.”
Marine water quality	<p>Ecosystem Components:</p> <ul style="list-style-type: none"> • Marine waters including open waters and embayments 	<p>Dissolved Oxygen in Marine Waters</p> <ul style="list-style-type: none"> • By 2020, human-related contributions of nitrogen do not result in more than 0.2 mg/L reductions in dissolved oxygen levels anywhere in Puget Sound.
OSS	<p>Ecosystem Components:</p> <ul style="list-style-type: none"> • Freshwater wetlands, lakes, and streams • Marine waters including open waters and embayments 	<ul style="list-style-type: none"> • By 2020, all on-site sewage systems in marine recovery areas and other areas with equivalent enhanced operation and maintenance programs are inventoried, 95 percent are current with inspections, and all failed systems are fixed. • Designations of marine recovery areas or designation of other areas with equivalent enhanced operation and maintenance are expanded to 90 percent of marine shorelines not primarily served by sewers.
Shellfish beds	<p>Ecosystem Components:</p> <ul style="list-style-type: none"> • Marine Nearshore habitat including beaches and embayments • Freshwater wetlands, lakes, and streams (water quality services) • Marine waters including open waters and embayments • Marine sessile filter feeders 	<ul style="list-style-type: none"> • A net increase from 2007 to 2020 of 10,800 harvestable shellfish acres, which includes 7,000 acres where harvest is currently prohibited.

PSP Vital Sign	Related ecosystem or human wellbeing components; or related pressure (sources or stressors)	PSP 2020 recovery targets that South Sound ecosystem recovery will contribute to directly
Swimming beaches	Ecosystem Components: <ul style="list-style-type: none"> • Freshwater wetlands, lakes, and streams (water quality services) • Marine waters including open waters and embayments 	<ul style="list-style-type: none"> • By 2020, all monitored Puget Sound beaches meet enterococcus standard.
Chinook	Ecosystem Components: <ul style="list-style-type: none"> • Listed and non-listed salmon species 	<ul style="list-style-type: none"> • By 2020, we stop the overall decline and start seeing improvements in wild Chinook abundance in two to four populations in each biogeographic region.
Orca	Ecosystem Components: <ul style="list-style-type: none"> • Listed and non-listed salmon species • Forage fish • Marine waters including open waters and embayments 	<ul style="list-style-type: none"> • By 2020, achieve an end of year census of southern resident killer whales of 95 individuals, which would represent a 1 percent annual average growth rate from 2010 to 2020.

Table 2. Content Considered in Selection of PSP Vital Signs to Address in Initial AHSS Planning Elements.

AHSS Ecosystem Component or Pressure	Information Source(s): <i>related elements</i>	Related PSP Vital Signs: <i>relevant PSP Indicators/ Targets</i>	Included in AHSS 2-year plan (Y/N/Under consideration)	Reason for Including/not including
Forests	<ul style="list-style-type: none"> • South Sound profile (2014) and basis document (2008) • Ongoing priority work in AHSS jurisdictions (e.g., Thurston County working lands strategy; Nisqually Community Forest) • PSPA endpoints: <i>managed and unmanaged subalpine & lower elevation forests</i> • Nisqually and South Sound monitoring & adaptive management work KEAs: 	Land development/cover: <ul style="list-style-type: none"> • The average annual loss of forested land cover to developed land cover in non-federal lands does not exceed 1,000 acres per year, as measured with Landsat-based change detection • The proportion of basin-wide growth occurring within UGAs is at least 86.5% (equivalent to all counties exceeding their population growth goals by 3%), with all counties showing an increase over their 2000 - 2010 percentage. 	Yes	South Sound has a relatively high percentage of managed forest land in both the Nisqually and Deschutes watersheds, and lowland forests that drain to South Sound inlets. Some of these forests are in transition to new management regimes (e.g., community forestry) which present important new opportunities. Preserving the function of this forest is critical to freshwater and marine water quality and preserving their ecosystem services is vital to the South Sound culture and economy. AHSS jurisdictions have ongoing or anticipated future high-priority work related to forest cover retention and management.
Prairie/oak woodlands	<ul style="list-style-type: none"> • South Sound profile (2014) and basis document (2008) • Ongoing priority work in AHSS jurisdictions (e.g., Thurston County HCP). • PSPA endpoints: <i>Oregon white oak woodlands; Lowland grasslands</i> • Nisqually and South Sound monitoring & adaptive management work KEAs: 	Land Development/cover: <ul style="list-style-type: none"> • Basin-wide loss of vegetation cover on ecologically important lands under high pressure from development does not exceed 0.15% of the total 2011 baseline land area over a five-year period • The proportion of basin-wide growth occurring within UGAs is at least 86.5% (equivalent to all counties exceeding their population growth goals by 3%), with all counties showing an increase over their 2000–2010 percentage. 	Under consideration	Actions related to prairie/oak woodlands will be considered as part of the 2-year plan of near-term actions if a clear nexus can be drawn to one of the PSP Strategic Initiatives; otherwise they will be addressed in the broader 5-year recovery strategy.

AHSS Ecosystem Component or Pressure	Information Source(s): <i>related elements</i>	Related PSP Vital Signs: <i>relevant PSP Indicators/ Targets</i>	Included in AHSS 2-year plan (Y/N/Under consideration)	Reason for Including/not including
Freshwater wetlands, lakes, and streams	<ul style="list-style-type: none"> • South Sound profile and basis document (2014) • AHSS NTAs from 2014 Action Agenda • Example PSPA endpoints: <i>lakes and ponds; large rivers; large and small streams; slope and depressional wetlands</i> • Nisqually and South Sound monitoring & adaptive management work example KEAs: <i>water quality; freshwater hydrology condition; habitat connectivity condition; nutrient supply; sediment dynamics transport and storage; hydrology low flow regime; organic matter inputs, retention and processing;</i> 	<p>Land Development/cover:</p> <ul style="list-style-type: none"> • Restore 268 miles of riparian vegetation or have an equivalent extent of restoration projects underway; (3) Basin-wide loss of vegetation cover on ecologically important lands under high pressure from development does not exceed 0.15% of the total 2011 baseline land area over a five-year period. <p>Freshwater quality:</p> <ul style="list-style-type: none"> • By 2020, at least 50 percent of all monitoring stations with suitable data have Freshwater Water Quality Index scores of 80 or higher. • By 2020, achieve a decrease in the number of impaired waters (303(d) list) in Puget Sound freshwaters. • By 2020, 100 percent of Puget Sound lowland stream drainage areas monitored with baseline B-IBI scores of 42-46 or better; retain these “excellent” scores, and mean B-IBI scores of 30 Puget Sound lowland drainage areas improve from “fair” to “good”. 	Yes	Work on freshwater wetlands, lakes, streams and other freshwater systems is critical to salmon recovery and to maintenance and restoration of freshwater ecological processes and functions including provision of clean, abundant water for people. AHSS jurisdictions have ongoing or anticipated future high-priority work related to protection and restoration of freshwater wetlands, lakes, and streams.

AHSS Ecosystem Component or Pressure	Information Source(s): <i>related elements</i>	Related PSP Vital Signs: <i>relevant PSP Indicators/ Targets</i>	Included in AHSS 2-year plan (Y/N/Under consideration)	Reason for Including/not including
Riparian vegetation	<ul style="list-style-type: none"> • South Sound profile (2014) and basis document (2008) • AHSS NTAs from 2014 Action Agenda • PSPA endpoints: <i>riparian vegetation</i> • Nisqually and South Sound monitoring & adaptive management work example KEAs: <i>nutrient supply; riparian spatial extent and continuity; riparian community structure; prey population size; food web community composition.</i> 	Land Development/cover: <ul style="list-style-type: none"> • Restore 268 miles of riparian vegetation or have an equivalent extent of restoration projects underway • Basin-wide loss of vegetation cover on ecologically important lands under high pressure from development does not exceed 0.15% of the total 2011 baseline land area over a five-year period. 	Yes	Work on riparian vegetation is critical to salmon recovery. AHSS jurisdictions have ongoing or anticipated future high-priority work related to protection and restoration of riparian vegetation.
Floodplains, including both natal Chinook and non-natal rivers, and smaller streams	<ul style="list-style-type: none"> • South Sound profile (2014) and basis document (2008) • AHSS NTAs from 2014 Action Agenda (• Example PSPA endpoints: <i>floodplains; large rivers; large and small streams; slope and depressional wetlands</i> • Nisqually and South Sound monitoring & adaptive management work example KEAs: <i>floodplain channel interactions and connectivity, structure, and function; sediment dynamics-sediment delivery.</i> 	Floodplains: <ul style="list-style-type: none"> • Restore, or have projects underway to restore, 15% of degraded Puget Sound floodplain area, and have no net loss of floodplain function in any watershed. 	Yes	Work on floodplains is critical to salmon recovery and provides important additional benefits to humans by reducing adverse impacts of flooding. AHSS jurisdictions have ongoing or anticipated future high-priority work related to protection and restoration of floodplains.

AHSS Ecosystem Component or Pressure	Information Source(s): <i>related elements</i>	Related PSP Vital Signs: <i>relevant PSP Indicators/ Targets</i>	Included in AHSS 2-year plan (Y/N/Under consideration)	Reason for Including/not including
River deltas, including both natal Chinook and non-natal rivers and smaller streams	<ul style="list-style-type: none"> • South Sound profile (2014) and basis document (2008) • AHSS NTAs from 2014 Action Agenda • Example PSPA endpoints: <i>river deltas; freshwater tidal wetlands</i> • Nisqually and South Sound monitoring & adaptive management work example KEAs: <i>estuarine habitats-distribution, condition, extent; tidal channel formation and maintenance-extent of channels.</i> 	Estuaries: <ul style="list-style-type: none"> • All Chinook natal river deltas meet 10-year salmon recovery goals (or 10% of restoration need as proxy for river deltas lacking quantitative acreage goals in salmon recovery plans) • 7,390 quality acres are restored basin-wide, which is 20% of total estimated restoration need. 	Yes	Restoration of large and small estuaries provides important refuge and feeding areas for salmon and supports marine and nearshore ecological processes and functions that maintain marine nearshore structure and support numerous species (e.g., forage fish). AHSS jurisdictions have ongoing or anticipated future high-priority work related estuaries including the Nisqually and Deschutes River Deltas.
Pocket estuaries and embayments	<ul style="list-style-type: none"> • South Sound profile (2014) and basis document (2008) • AHSS NTAs from 2014 Action Agenda • Example PSPA endpoints: <i>embayments</i> • Nisqually and South Sound monitoring & adaptive management work example KEAs: <i>tidally influenced wetlands-extent; estuarine habitats-distribution, condition, extent.</i> 	Estuaries: <ul style="list-style-type: none"> • 7,390 quality acres are restored basin-wide, which is 20% of total estimated restoration need. 	Yes	Restoration of large and small estuaries provides important refuge and feeding areas for salmon and supports marine and nearshore ecological processes and functions that maintain marine nearshore structure and support numerous species (e.g., forage fish). AHSS jurisdictions have ongoing or anticipated future high-priority work related estuaries including numerous small and pocket estuaries.

AHSS Ecosystem Component or Pressure	Information Source(s): <i>related elements</i>	Related PSP Vital Signs: <i>relevant PSP Indicators/ Targets</i>	Included in AHSS 2-year plan (Y/N/Under consideration)	Reason for Including/not including
Marine nearshore habitat including beaches and embayments	<ul style="list-style-type: none"> • South Sound profile (2014) and basis document (2008) • AHSS NTAs from 2014 Action Agenda • Example PSPA endpoints: <i>embayments, beaches, rocky shores, eelgrass, kelp and other submerged vegetation</i> • Nisqually and South Sound monitoring & adaptive management work example KEAs: <i>coastal sediment supply-extent, distribution, condition of wind and wave dependent features; intertidal habitat zone-extent and condition.</i> 	<p>Shoreline armoring:</p> <ul style="list-style-type: none"> • From 2011 to 2020, the total amount of armoring removed is greater than the total amount of new armoring in Puget Sound (total miles removed > total miles added); feeder bluffs receive strategic attention for removal of existing armoring and avoidance of new armoring; and soft shore techniques are used for all new and replacement armoring unless it is demonstrably infeasible. <p>Shellfish beds:</p> <ul style="list-style-type: none"> • A net increase from 2007 to 2020 of 10,800 harvestable shellfish acres, which includes 7,000 acres where harvest is currently prohibited. <p>Swimming beaches:</p> <ul style="list-style-type: none"> • By 2020, all monitored Puget Sound beaches meet enterococcus standard. 	Yes	Protection and restoration of marine-nearshore habitat is vital for healthy shellfish beds and for maintenance of marine-nearshore processes and functions.
Marine waters including open waters and embayments	<ul style="list-style-type: none"> • South Sound profile (2014) and basis document (2008) • Example PSPA endpoints: <i>open water; embayments</i> • Nisqually and South Sound monitoring & adaptive management work example KEAs: <i>productivity – fish growth; predator population size; food web community composition.</i> 	<p>Dissolved Oxygen in Marine Waters:</p> <ul style="list-style-type: none"> • By 2020, human-related contributions of nitrogen do not result in more than 0.2 mg/L reductions in dissolved oxygen levels anywhere in Puget Sound. <p>OSS:</p> <ul style="list-style-type: none"> • By 2020, all on-site sewage systems in marine recovery areas and other areas with equivalent enhanced operation 	Under consideration	Actions related to marine waters will be considered as part of the 2-year plan of near-term actions if a clear nexus can be drawn to one of the PSP Strategic Initiatives (e.g., actions related to pollution from vessels; actions to address human caused dissolved oxygen alterations); otherwise they will be addressed in the broader 5-year recovery strategy.

AHSS Ecosystem Component or Pressure	Information Source(s): <i>related elements</i>	Related PSP Vital Signs: <i>relevant PSP Indicators/ Targets</i>	Included in AHSS 2-year plan (Y/N/Under consideration)	Reason for Including/not including
		<p>and maintenance programs are inventoried, 95 percent are current with inspections, and all failed systems are fixed.</p> <ul style="list-style-type: none"> Designations of marine recovery areas or designation of other areas with equivalent enhanced operation and maintenance are expanded to 90 percent of marine shorelines not primarily served by sewers. <p>Shellfish beds:</p> <ul style="list-style-type: none"> A net increase from 2007 to 2020 of 10,800 harvestable shellfish acres, which includes 7,000 acres where harvest is currently prohibited. <p>Swimming beaches:</p> <ul style="list-style-type: none"> By 2020, all monitored Puget Sound beaches meet enterococcus standard. <p>Orca:</p> <ul style="list-style-type: none"> By 2020, achieve an end of year census of southern resident killer whales of 95 individuals, which would represent a 1 percent annual average growth rate from 2010 to 2020. 		
Marine sessile filter feeders	<ul style="list-style-type: none"> South Sound profile (2014) and basis document (2008) AHSS NTAs from 2014 Action Agenda Example PSPA endpoints: <i>sessile filter feeders</i> 	<p>Shellfish beds:</p> <ul style="list-style-type: none"> A net increase from 2007 to 2020 of 10,800 harvestable shellfish acres, which includes 7,000 acres where harvest is currently prohibited. 	Yes	Maintenance and expansion of shellfish beds and the shellfish industry is a long-standing priority in South Sound.

AHSS Ecosystem Component or Pressure	Information Source(s): <i>related elements</i>	Related PSP Vital Signs: <i>relevant PSP Indicators/ Targets</i>	Included in AHSS 2-year plan (Y/N/Under consideration)	Reason for Including/not including
Listed and non-listed salmon species	<ul style="list-style-type: none"> • South Sound profile (2014) and basis document (2008) • AHSS NTAs from 2014 Action Agenda • Example PSPA endpoints: <i>Chinook salmon, Coho salmon, Cutthroat trout, Chum and pink salmon</i> • Nisqually and South Sound monitoring & adaptive management work example KEAs: <i>all KEAs relate.</i> 	<p>Chinook:</p> <ul style="list-style-type: none"> • By 2020, we stop the overall decline and start seeing improvements in wild Chinook abundance in two to four populations in each biogeographic region. <p>Orca:</p> <ul style="list-style-type: none"> • By 2020, achieve an end of year census of southern resident killer whales of 95 individuals, which would represent a 1 percent annual average growth rate from 2010 to 2020. 	Yes	Salmon recovery is a long-standing priority in South Sound.
Forage fish	<ul style="list-style-type: none"> • South Sound profile (2014) and basis document (2008) • Example PSPA endpoints: <i>Herring, surf smelt</i> • Nisqually and South Sound monitoring & adaptive management work example KEAs: <i>prey population size; food web community composition</i> 	<p>Orca:</p> <ul style="list-style-type: none"> • By 2020, achieve an end of year census of southern resident killer whales of 95 individuals, which would represent a 1 percent annual average growth rate from 2010 to 2020. 	Under consideration	Actions related to marine waters will be considered as part of the 2-year plan of near-term actions if a clear nexus can be drawn to one of the PSP Strategic Initiatives; otherwise they will be addressed in the broader 5-year recovery strategy. We believe that numerous habitat-related efforts will provide collateral benefits for forage fish, especially beach spawners.

AHSS Ecosystem Component or Pressure	Information Source(s): <i>related elements</i>	Related PSP Vital Signs: <i>relevant PSP Indicators/ Targets</i>	Included in AHSS 2-year plan (Y/N/Under consideration)	Reason for Including/not including
Pressure: Housing & urban areas	<ul style="list-style-type: none"> • South Sound profile and basis document (2014) • AHSS NTAs from 2014 Action Agenda • PSPA pressures • Nisqually and South Sound monitoring & adaptive management work 	Land cover/development: <ul style="list-style-type: none"> • By 2020, average annual loss of forested land cover to developed land-cover in non-federal lands does not exceed 1,000 acres per year and 268 miles of riparian vegetation are restored or restoration projects are underway. • By 2020, the proportion of basin-wide growth occurring within Urban Growth Areas is at least 86.5% (equivalent to all counties exceeding goal by 3%), and all counties show an increase over their 2000-2010 percentage. • Basin-wide, by 2020, loss of vegetation cover on indicator land base over a 5-year period does not exceed 0.15% of the 2011 baseline land area. 	Yes	High priority pressure in both local South Sound pressure assessments and the PSPA.
Pressure: Marine shoreline infrastructure	<ul style="list-style-type: none"> • South Sound profile and basis document (2014) • AHSS NTAs from 2014 Action Agenda • PSPA pressures • Nisqually and South Sound monitoring & adaptive management work 	Shoreline armoring: <ul style="list-style-type: none"> • From 2011 to 2020, the total amount of armoring removed is greater than the total amount of new armoring in Puget Sound (total miles removed > total miles added); feeder bluffs receive strategic attention for removal of existing armoring and avoidance of new armoring; and soft shore techniques are used for all new and replacement armoring unless it is demonstrably infeasible. 	Yes	High priority pressure in both local South Sound pressure assessments and the PSPA.

AHSS Ecosystem Component or Pressure	Information Source(s): <i>related elements</i>	Related PSP Vital Signs: <i>relevant PSP Indicators/ Targets</i>	Included in AHSS 2-year plan (Y/N/Under consideration)	Reason for Including/not including
Pressure: FW shoreline infrastructure	<ul style="list-style-type: none"> • South Sound profile and basis document (2014) • AHSS NTAs from 2014 Action Agenda • PSPA pressures • Nisqually and South Sound monitoring & adaptive management work 	Shoreline armoring: <ul style="list-style-type: none"> • From 2011 to 2020, the total amount of armoring removed is greater than the total amount of new armoring in Puget Sound (total miles removed > total miles added); feeder bluffs receive strategic attention for removal of existing armoring and avoidance of new armoring; and soft shore techniques are used for all new and replacement armoring unless it is demonstrably infeasible. 	Yes	High priority pressure in both local South Sound pressure assessments and the PSPA.

Table 2A. Crosswalk of AHSS Focus Areas with PSP Vital Signs

SS Focus Area/Vital Sign	Related PSP Vital Signs (Targets)
Protection and restoration of prairie/oak woodlands	<ul style="list-style-type: none"> • Land cover (Loss of forested land cover in non-Federal lands; proportion of growth occurring within UGAs) • Freshwater WQ (B-IBI scores; decrease in impaired water; FW quality index scores) • Summer stream flows (Increasing flows in Nisqually, shift Deschutes from strongly to weakly decreasing trend)
Protection and restoration of freshwater wetlands	<ul style="list-style-type: none"> • Floodplains (Restoration of degraded floodplain areas and no additional loss of floodplain function from 2011 baseline) • Freshwater WQ (B-IBI scores; decrease in impaired water; FW quality index scores) • Summer stream flows (Increasing flows in Nisqually, shift Deschutes from strongly to weakly decreasing trend) • Land cover (Miles of riparian vegetation restored)
Protection and restoration of marine nearshore habitat	<ul style="list-style-type: none"> • Shoreline armoring (Net decrease in miles of armoring) • Estuaries (Number of estuary acres restored) • Chinook (Stop overall decline; increase abundance at population level) • Forage fish (Squaxin Island Pass herring target) • Eelgrass (20% increase relative to baseline) • Orca (Increase population growth rates to achieve 95 individuals) • Marine sediment quality (SCI, Sediment Quality Triad index, and sediment quality standards scores) • Toxics in fish (Contaminant levels below health thresholds; contaminant-related fish diseases at background levels)
Protection and restoration of forests for ecosystem benefits and sustainable harvest	<ul style="list-style-type: none"> • Land cover (Loss of forested land cover in non-Federal lands; proportion of growth occurring within UGAs) • Freshwater WQ (B-IBI scores; decrease in impaired water; FW quality index scores) • Summer stream flows (Increasing flows in Nisqually; shift Deschutes from strongly to weakly decreasing trend)
Improved freshwater water quality	<ul style="list-style-type: none"> • Freshwater WQ (B-IBI scores; decrease in impaired water; FW quality index scores) • Chinook (Stop overall decline; increase abundance at population level) • Orca (Increase population growth rates to achieve 95 individuals) • Marine sediment quality (SCI, Sediment Quality Triad index, and sediment quality standards scores) • Toxics in fish (Contaminant levels below health thresholds; contaminant-related fish diseases at background levels)
Improved marine water quality	<ul style="list-style-type: none"> • Marine WQ (Reductions in dissolved oxygen caused by human-related contributions of nitrogen) • Eelgrass (20% increase relative to baseline) • Chinook (Stop overall decline; increase abundance at population level) • Forage fish (Squaxin Island Pass herring target) • Orca (Increase population growth rates to achieve 95 individuals) • Swimming beaches (Monitored beaches meet enterococcus standard) • Marine sediment quality (SCI, Sediment Quality Triad index, and sediment quality standards scores) • Toxics in fish (Contaminant levels below health thresholds; contaminant-related fish diseases at background levels)

SS Focus Area/Vital Sign	Related PSP Vital Signs (Targets)
Expansion of healthy, productive shellfish populations and harvest	<ul style="list-style-type: none"> • Shellfish beds (Number of harvestable acres) • On-Site Septic (Percent current with inspections; number fixed)
Increase in abundance and distribution of native salmon species and harvest	<ul style="list-style-type: none"> • Chinook (Stop overall decline; increase abundance at population level) • Orca (Increase population growth rates to achieve 95 individuals)
Human well being	<ul style="list-style-type: none"> • Swimming beaches (Monitored beaches meet enterococcus standard)

Figure 1. Conceptual model showing LIO priority pressures (sources and stressors), Vital Signs, and priority relationships. Relationships among the elements are shown with arrows. Vital Signs are either shown as ecosystem and human wellbeing components (green and brown ovals) or identified with green text boxes for pressure-related Vital Signs.

[See attached 11x17 PDF file]

Table 3. South Sound Pressures and Stressors and Related PSP Vital Signs Highlighted in Initial Planning Elements

*PSP Vital Signs that are also pressures are identified in the last column and in bold text.

Pressures	Stressors	PSP Vital Sign
Housing & Urban Areas	A1. Conversion of land cover for residential, commercial, and industrial use	Land cover , floodplains, freshwater quality, marine water quality, Chinook, Orca, shellfish beds, swimming beaches, OSS
	J1. Altered peak flows from land cover change	
	K1. Altered low flows from land cover change	
	K1. Altered low flows from land cover change	
Roads & Railroads (Including Culverts)	A3. Conversion of land cover for transportation & utilities	Land cover , estuaries, shoreline armoring , floodplains, freshwater quality, marine water quality, Chinook, Orca
	E2. Culverts and other fish passage barriers	
	J1. Altered peak flows from land cover change	
Freshwater Levees, Floodgates, Tidegates	C. Shoreline hardening	Shoreline armoring , Chinook, Orca, freshwater quality, marine water quality, floodplains, estuaries
	E2. Culverts and other fish passage barriers	
	J1. Altered peak flows from land cover change	
	K1. Altered low flows from land cover change	
	L. Flow regulation -- prevention of flood flows	
	M2. Other structural barriers to water, sediment, debris flows	
Freshwater Shoreline Infrastructure	C. Shoreline hardening	Shoreline armoring , Chinook, Orca, floodplains, freshwater quality, marine water quality, estuaries
	D. Shading of shallow water habitat	
	E2. Culverts and other fish passage barriers	
	M1. In channel structural barriers to water, sediment, debris flows	
Marine Levees, Floodgates, Tidegates	C. Shoreline hardening	Chinook, Orca, shoreline armoring , freshwater quality, marine water quality, floodplains, estuaries
	E2. Culverts and other fish passage barriers	
	M2. Other structural barriers to water, sediment, debris flows	
Marine Shoreline Infrastructure	C. Shoreline hardening	Shoreline armoring , Chinook, Orca, floodplains, freshwater quality, marine water quality, estuaries
	D. Shading of shallow water habitat	
	E2. Culverts and other fish passage barriers	
	M2. Other structural barriers to water, sediment, debris flows	

Pressures	Stressors	PSP Vital Sign
Dams	E1. Dams as fish passage barriers	Chinook, Orca, freshwater quality, marine water quality, floodplains, estuaries, shoreline armoring
	L. Flow regulation – prevention of flood flows	
Runoff from Residential and Commercial Lands	S2. Introduction, spread, or amplification of human pathogens	Freshwater quality, marine water quality, shellfish beds, swimming beaches
	U2. Non-point source, persistent toxic chemicals in aquatic systems	
	V2. Non-point source, non-persistent toxic chemicals in aquatic systems	
	X2. Non-point source conventional water pollutants	
Agricultural & Forestry Effluents*	U2. Non-point source, persistent toxic chemicals in aquatic systems	Chinook, Orca, freshwater quality, marine water quality
	V2. Non-point source, non-persistent toxic chemicals in aquatic systems	
	X2. Non-point source conventional water pollutants	
OSS - Domestic and Commercial Wastewater to On-site Sewage Systems	S2. Introduction, spread, or amplification of human pathogens	Freshwater quality, marine water quality, shellfish beds, swimming beaches, OSS

Table 4. Content Considered in Selection of Pressures and Stressors to Highlight in Initial AHSS Planning Elements.

LIO Priority Source*	Related LIO Priority Stressor	Vital Sign(s) Affected by Source or Stressor	Information Source(s)	Included in 2-year plan (Y/N/Under consideration)	Reason for Including/not including
Housing and urban areas	Conversion of land for residential & commercial development	Land cover , floodplains, freshwater quality, marine water quality, Chinook, Orca, shellfish beds, swimming beaches, OSS	<ul style="list-style-type: none"> • South Sound Basis Document/ profile • Monitoring and Adaptive Management work • PSPA • Technical Team knowledge 	Yes	<ul style="list-style-type: none"> • Identified as priority pressure in both local assessments (South Sound Basis Document/profile and monitoring and adaptive management work). • Also identified as a high-priority South Sound pressure in the PSPA. • Current ongoing and anticipated future work to addressing this stressor will be submitted for 2016 Action Agenda.
Roads & Railroads (Including Culverts)	Conversion of land cover for transportation & utilities	Land cover , estuaries, shoreline armoring , floodplains, freshwater quality, marine water quality, Chinook, Orca	<ul style="list-style-type: none"> • South Sound Basis Document/ profile • Monitoring and Adaptive Management work • PSPA • Technical Team knowledge 	Yes	<ul style="list-style-type: none"> • Identified as priority pressure in both local assessments (South Sound Basis Document/profile and monitoring and adaptive management work). • Also identified as a high-priority South Sound stressor in the PSPA. • Current ongoing and anticipated future work to addressing this stressor will be submitted for 2016 Action Agenda.
Freshwater Levees, Floodgates, Tidegates	Shoreline hardening	Shoreline armoring , Chinook, Orca, freshwater quality, marine water quality, floodplains, estuaries	<ul style="list-style-type: none"> • South Sound Basis Document/ profile • Monitoring and Adaptive Management work • PSPA • Technical Team knowledge 	Yes	<ul style="list-style-type: none"> • Identified as priority pressure in one local assessment and by the South Sound Technical Team. • Current ongoing and anticipated future work to addressing this stressor will be submitted for 2016 Action Agenda.

LIO Priority Source*	Related LIO Priority Stressor	Vital Sign(s) Affected by Source or Stressor	Information Source(s)	Included in 2-year plan (Y/N/Under consideration)	Reason for Including/not including
Freshwater Shoreline Infrastructure		Shoreline armoring , Chinook, Orca, floodplains, freshwater quality, marine water quality, estuaries	<ul style="list-style-type: none"> • South Sound Basis Document/ profile • Monitoring and Adaptive Management work • PSPA • Technical Team knowledge 	Yes	<ul style="list-style-type: none"> • Identified as priority pressure in both local assessments (South Sound Basis Document/profile and monitoring and adaptive management work). • Also identified as a high-priority South Sound stressor in the PSPA. • Current ongoing and anticipated future work to addressing this stressor will be submitted for 2016 Action Agenda.
Marine Levees, Floodgates, Tidegates		Chinook, Orca, shoreline armoring , freshwater quality, marine water quality, floodplains, estuaries	<ul style="list-style-type: none"> • South Sound Basis Document/ profile • Monitoring and Adaptive Management work • PSPA • Technical Team knowledge 	Yes	<ul style="list-style-type: none"> • Identified as priority pressure in one local assessment and by the South Sound Technical Team. • Current ongoing and anticipated future work to addressing this stressor will be submitted for 2016 Action Agenda.
Marine Shoreline Infrastructure		Shoreline armoring , Chinook, Orca, floodplains, freshwater quality, marine water quality, estuaries	<ul style="list-style-type: none"> • South Sound Basis Document/ profile • Monitoring and Adaptive Management work • PSPA • Technical Team knowledge 	Yes	<ul style="list-style-type: none"> • Identified as priority pressure in both local assessments (South Sound Basis Document/profile and monitoring and adaptive management work). • Also identified as a high-priority South Sound stressor in the PSPA. • Current ongoing and anticipated future work to addressing this stressor will be submitted for 2016 Action Agenda.
Dams		Chinook, Orca, freshwater quality, marine water quality, floodplains, estuaries, shoreline armoring	<ul style="list-style-type: none"> • South Sound Basis Document/ profile • Monitoring and Adaptive Management work • PSPA • Technical Team knowledge 	Yes	<ul style="list-style-type: none"> • Identified as a high-priority South Sound pressure in the PSPA. • Also identified as a high-priority South Sound stressor in the PSPA. • Current ongoing and anticipated future work to addressing this stressor will be submitted for 2016 Action Agenda.

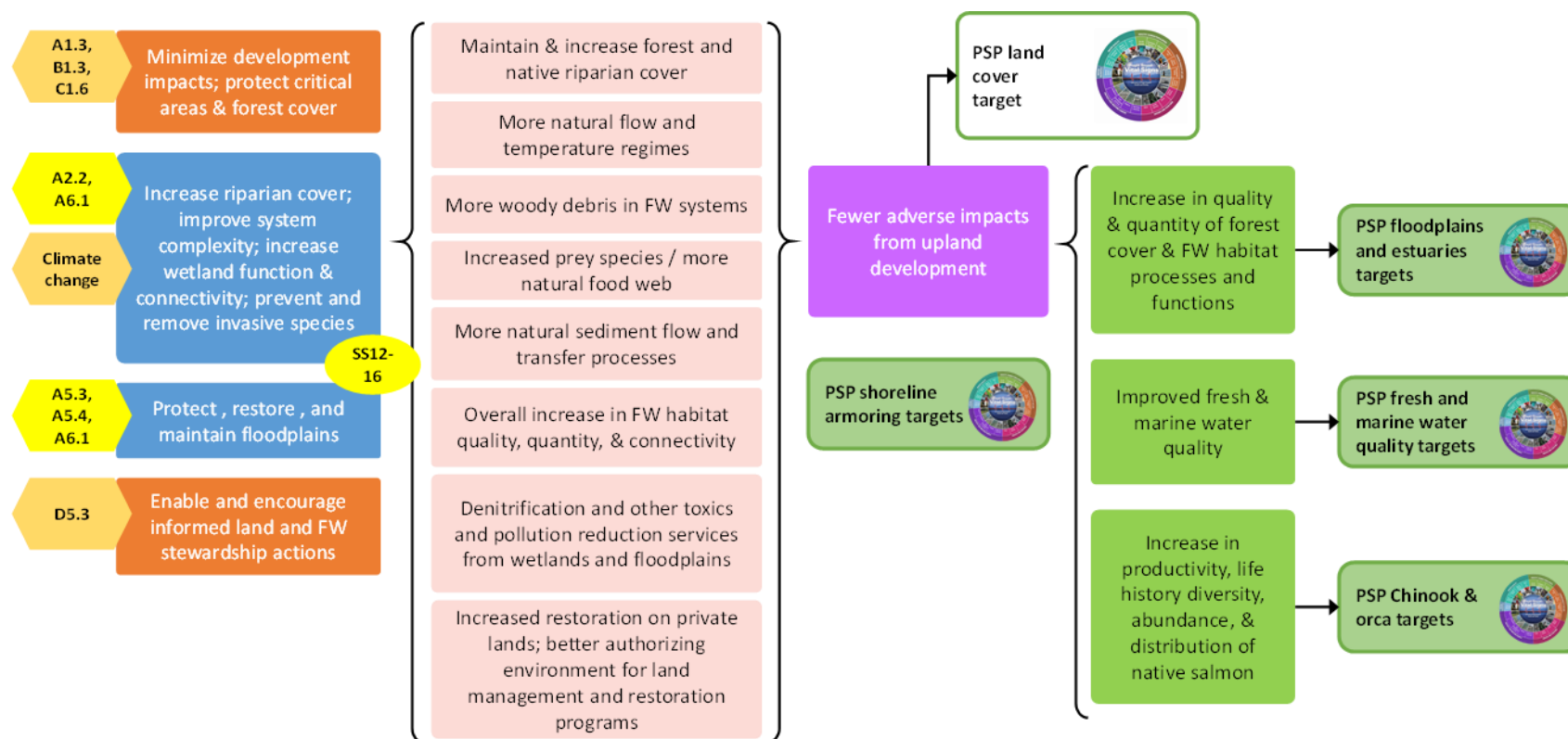
LIO Priority Source*	Related LIO Priority Stressor	Vital Sign(s) Affected by Source or Stressor	Information Source(s)	Included in 2-year plan (Y/N/Under consideration)	Reason for Including/not including
Runoff from Residential and Commercial Lands		Freshwater quality, marine water quality, shellfish beds, swimming beaches	<ul style="list-style-type: none"> • South Sound Basis Document/ profile • Monitoring and Adaptive Management work • PSPA • Technical Team knowledge 	Yes	<ul style="list-style-type: none"> • Identified as priority pressure in both local assessments (South Sound Basis Document/profile and monitoring and adaptive management work). • Also identified as a high-priority South Sound stressor in the PSPA. • Current ongoing and anticipated future work to addressing this stressor will be submitted for 2016 Action Agenda.
Agricultural & Forestry Effluents*		Chinook, Orca, freshwater quality, marine water quality	<ul style="list-style-type: none"> • South Sound Basis Document/ profile • Monitoring and Adaptive Management work • PSPA • Technical Team knowledge 	Yes	<ul style="list-style-type: none"> • Identified as priority pressure in both local assessments (South Sound Basis Document/profile and monitoring and adaptive management work). • Also identified as a high-priority South Sound stressor in the PSPA. • Current ongoing and anticipated future work to addressing this stressor will be submitted for 2016 Action Agenda.
OSS - Domestic and Commercial Wastewater to On-site Sewage Systems		Freshwater quality, marine water quality, shellfish beds, swimming beaches, OSS	<ul style="list-style-type: none"> • South Sound Basis Document/ profile • Monitoring and Adaptive Management work • PSPA • Technical Team knowledge 	Yes	<ul style="list-style-type: none"> • Identified as a high-priority South Sound pressure in one local assessment and by the South Sound Technical Team. • Identified as a high-priority South Sound pressure in the PSPA. • Current ongoing and anticipated future work to addressing this stressor will be submitted for 2016 Action Agenda.

Appendix 1. LIO NTAs Mapped to Puget Sound Recovery Prototype Results Chains

[See attached 11x17 PDF file]

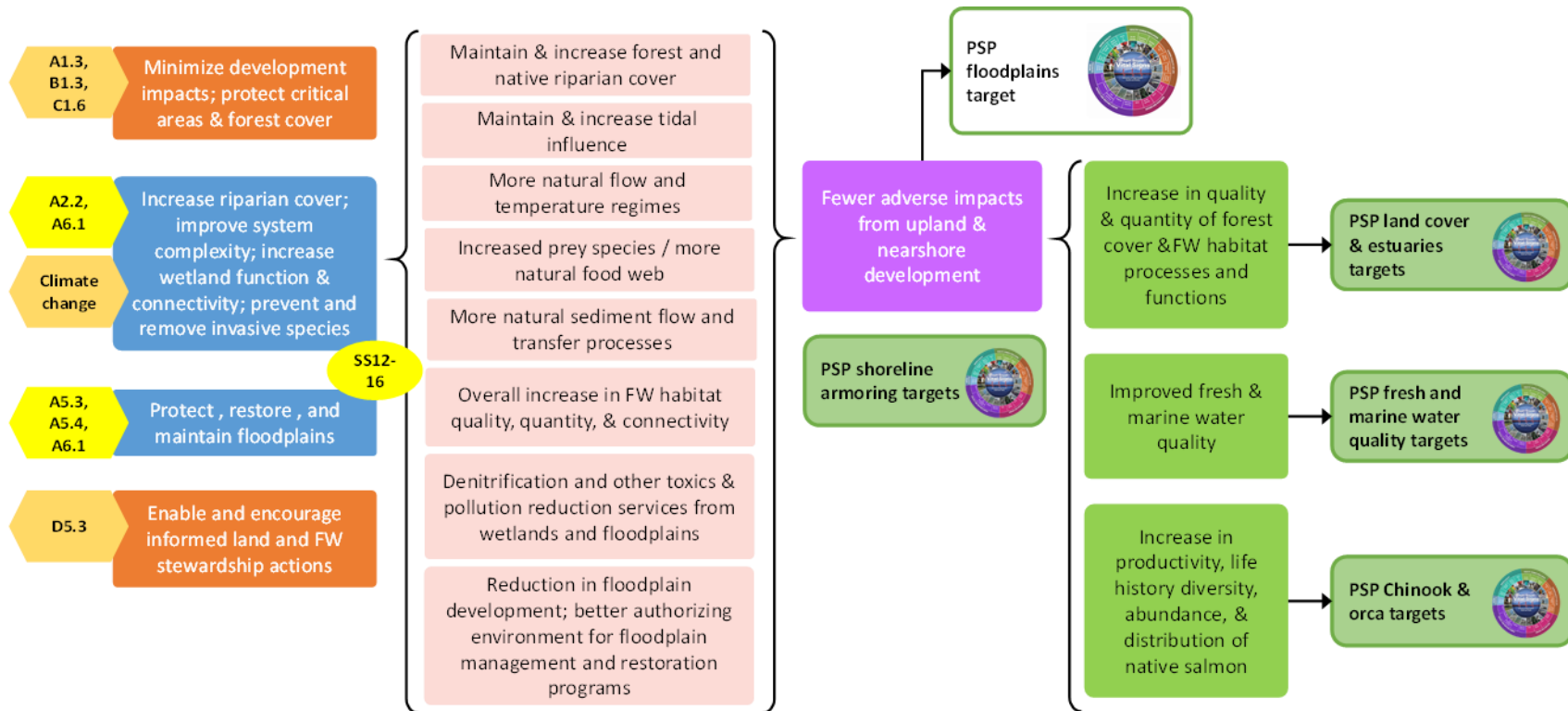
Appendix 2. LIO Vital Signs Schematics

Figure A2.1. AHSS Approaches to PSP Vital Sign for Land Cover



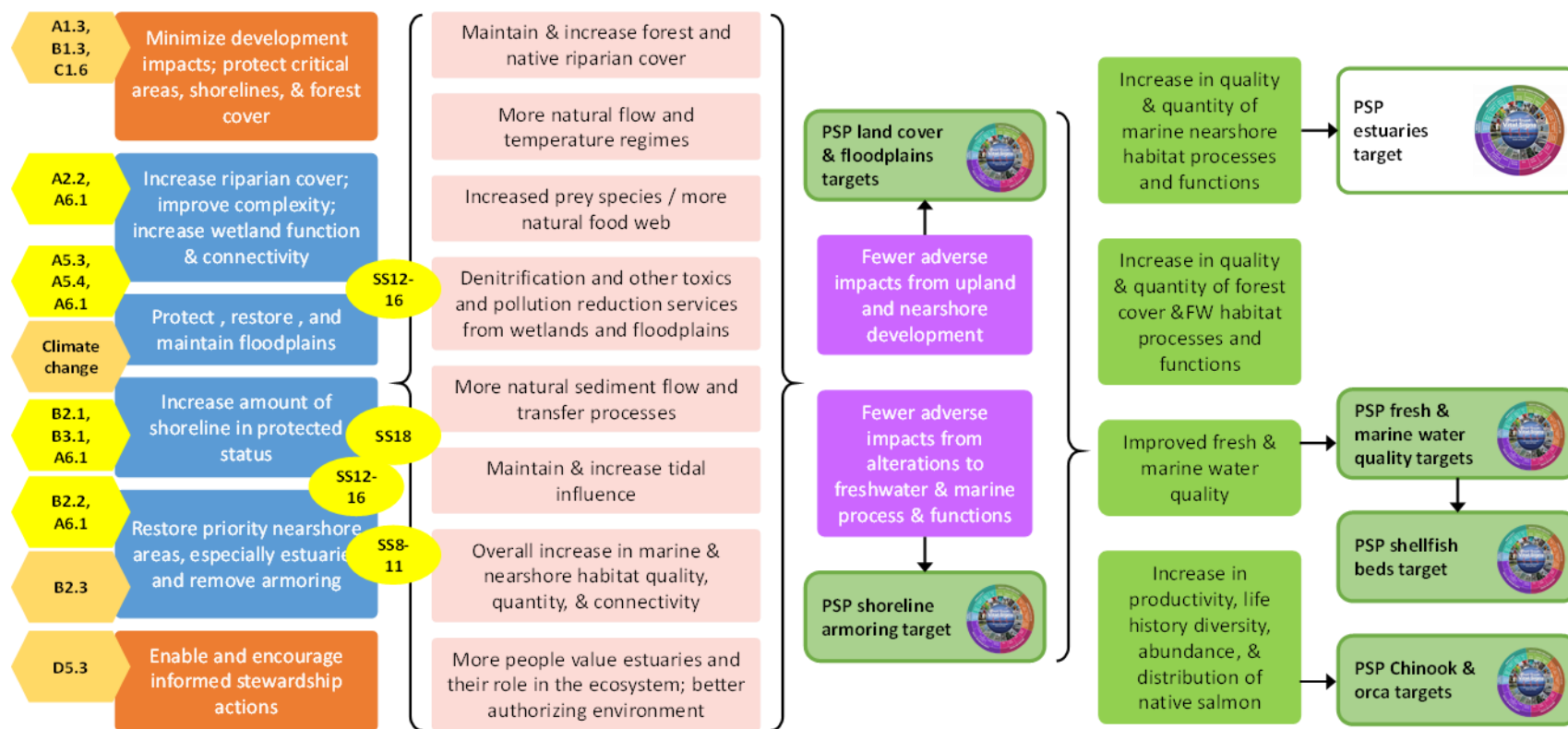
Anticipated changes in the system (pink boxes) are provided as examples. Additional changes and benefits also will be seen. This schematic focuses approaches and outcomes most directly related to the PSP recovery targets for land development/cover. Improved land use and management also contributes significantly to pollution reduction and species restoration outcomes. Climate change will be addressed throughout current and future approaches.

Figure A2.2. AHSS Approaches to PSP Vital Sign for Floodplains



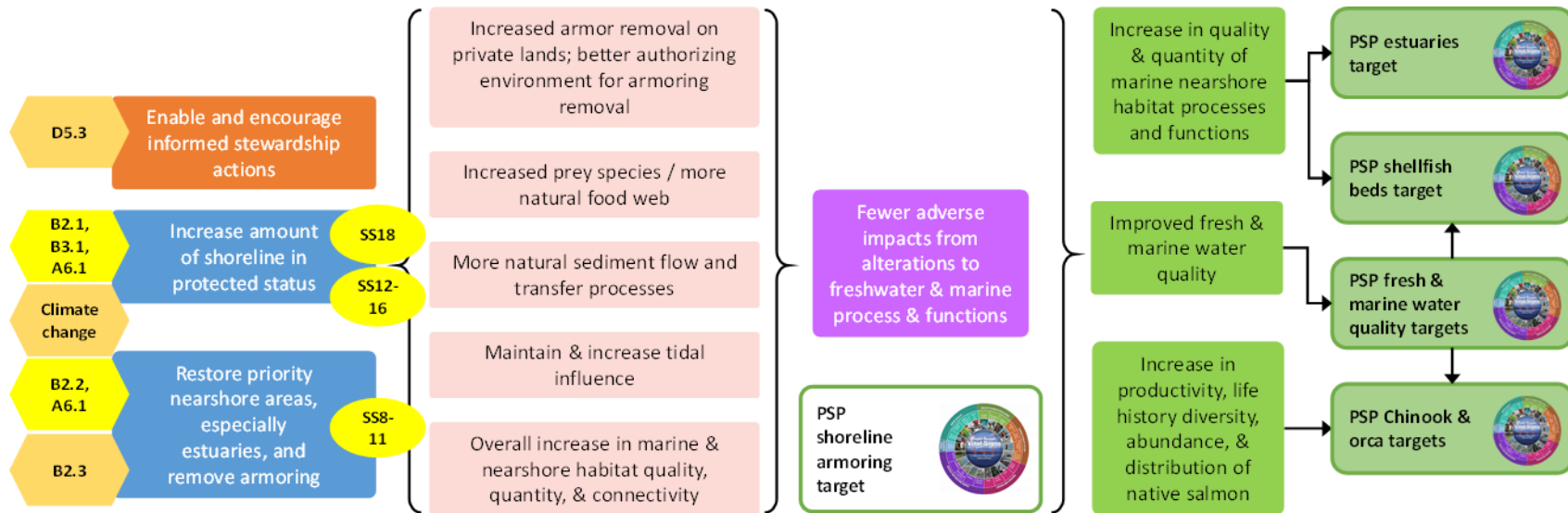
Anticipated changes in the system (pink boxes) are provided as examples. Additional changes and benefits also will be seen. This schematic focuses approaches and outcomes most directly related to the PSP recovery targets for floodplains. Other approaches and outcomes, particularly work related to PSP recovery targets for land development/cover and estuaries, also contribute significantly to floodplain protection and restoration. Climate change will be addressed throughout current and future approaches.

Figure A2.3. AHSS Approaches to PSP Vital Sign for Estuaries



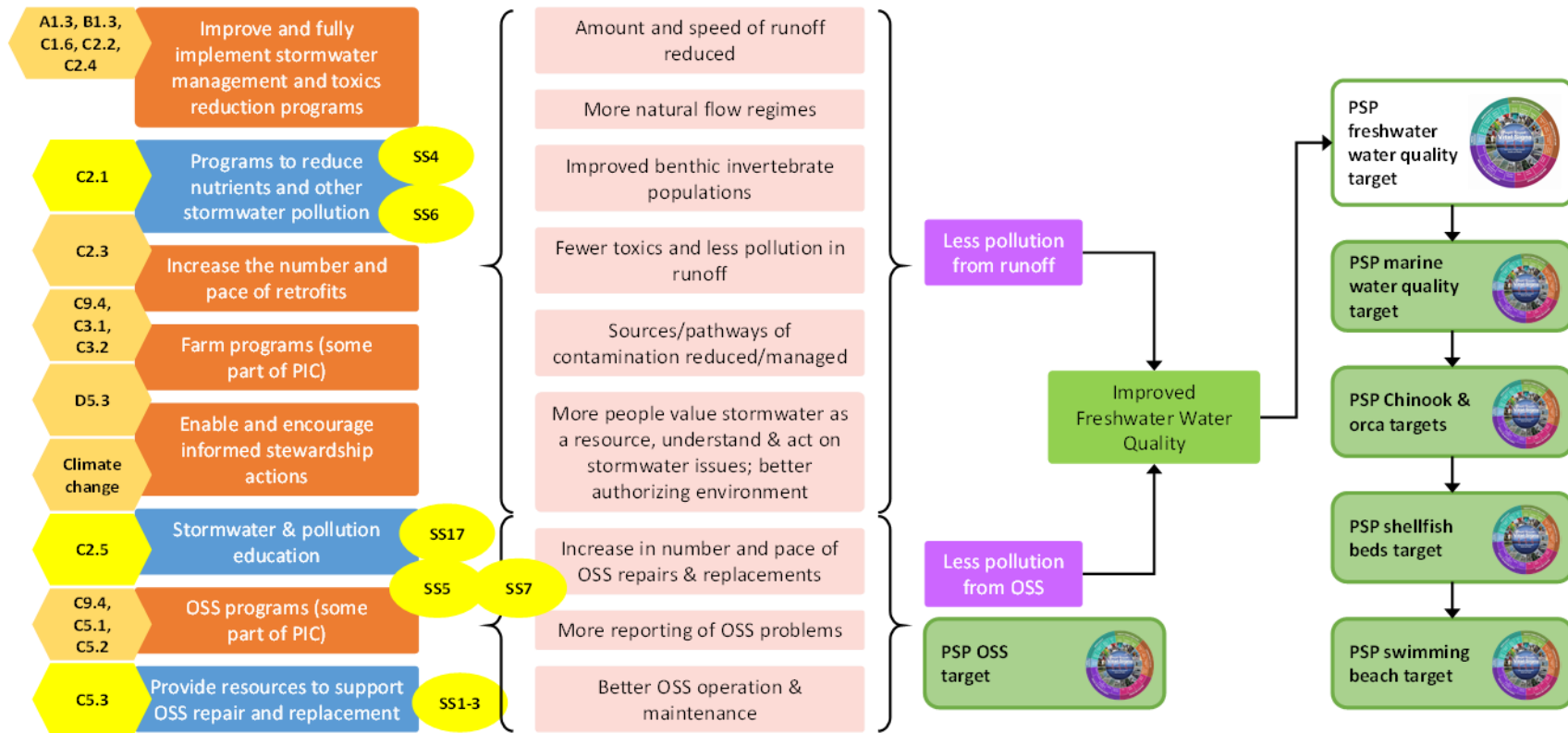
Anticipated changes in the system (pink boxes) are provided as examples. Additional changes and benefits also will be seen. This schematic focuses approaches and outcomes most directly related to the PSP recovery targets for estuaries. Other approaches and outcomes, particularly work related to PSP recovery targets for land development/cover and floodplains and to fresh and marine water quality improvement, also contribute significantly to estuary protection and restoration.

Figure A2.4. AHSS Approaches to PSP Vital Sign for Shoreline Armoring



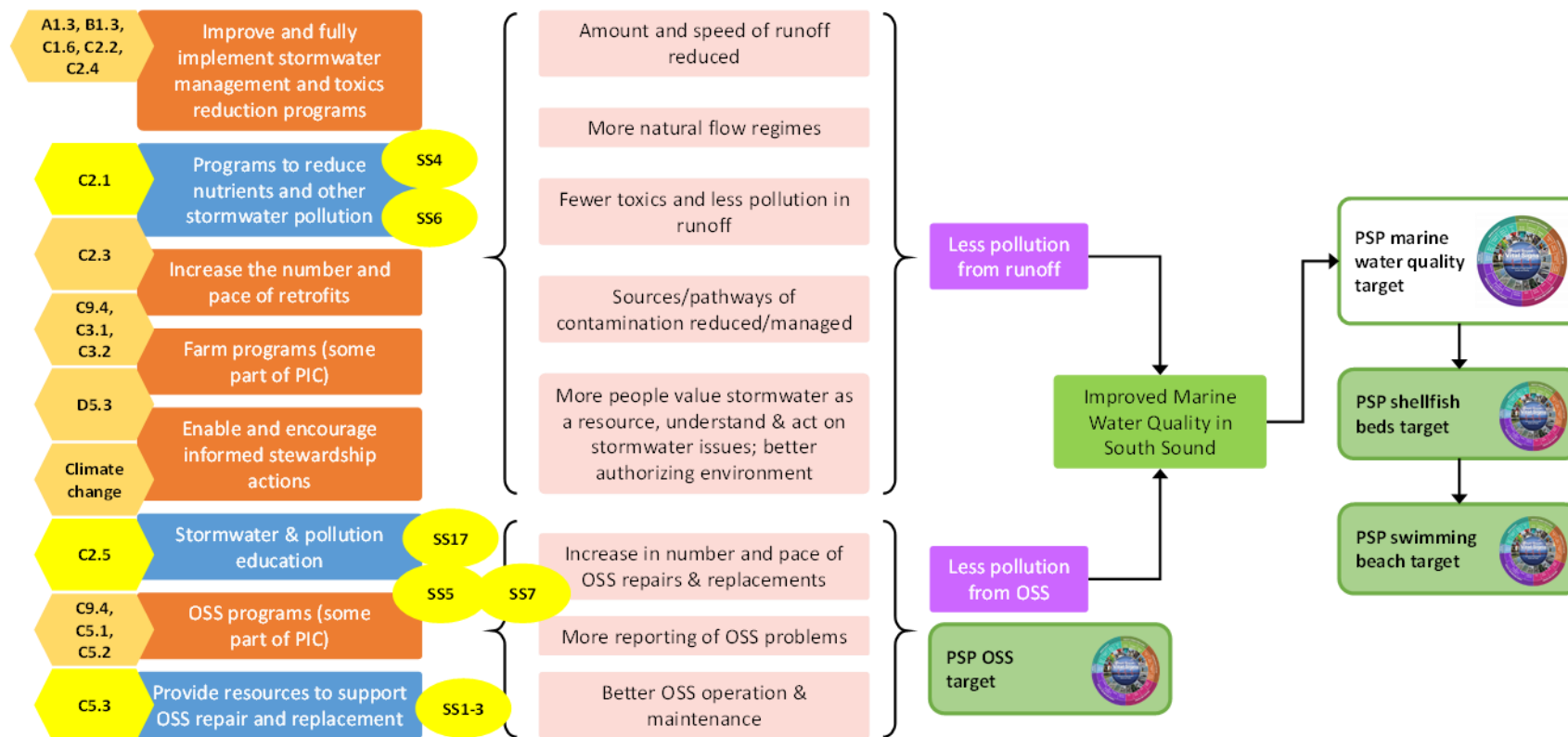
Anticipated changes in the system (pink boxes) are provided as examples. Additional changes and benefits also will be seen. This schematic focuses approaches and changes most directly related to the PSP recovery targets for shoreline armoring. Other work, particularly that which contributes to the PSP land cover/ land development, floodplains, and estuaries targets, also makes important contributions to reductions in shoreline armoring. Climate change will be addressed throughout current and future approaches.

Figure A2.5. AHSS Approaches to PSP Vital Sign for Freshwater Water Quality



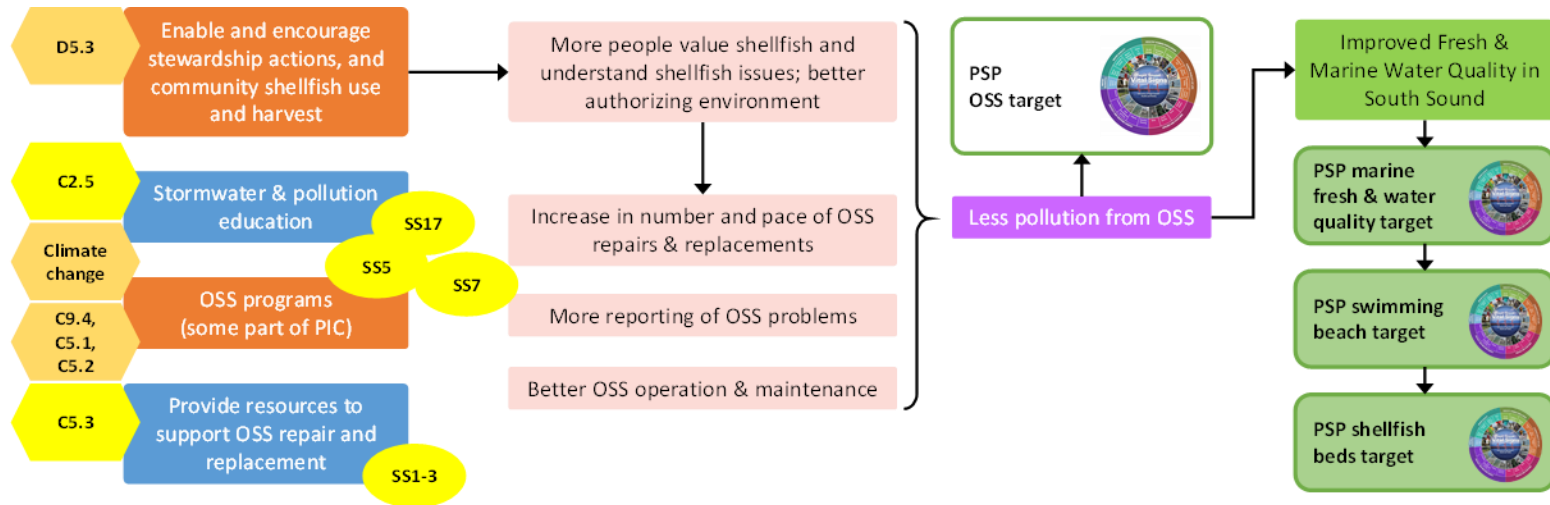
Anticipated changes in the system (pink boxes) are provided as examples. Additional changes and benefits also will be seen. This schematic focuses on approaches and changes most directly related to the PSP recovery targets for freshwater quality. Other work, particularly work related to PSP land cover/ land development and floodplains targets, also makes important contributions to improved freshwater quality. The contribution of this and other work to summer stream flows will be addressed in later planning efforts. Climate change will be addressed throughout current and future approaches.

Figure A2.6. AHSS Approaches to PSP Vital Sign for Marine Water Quality



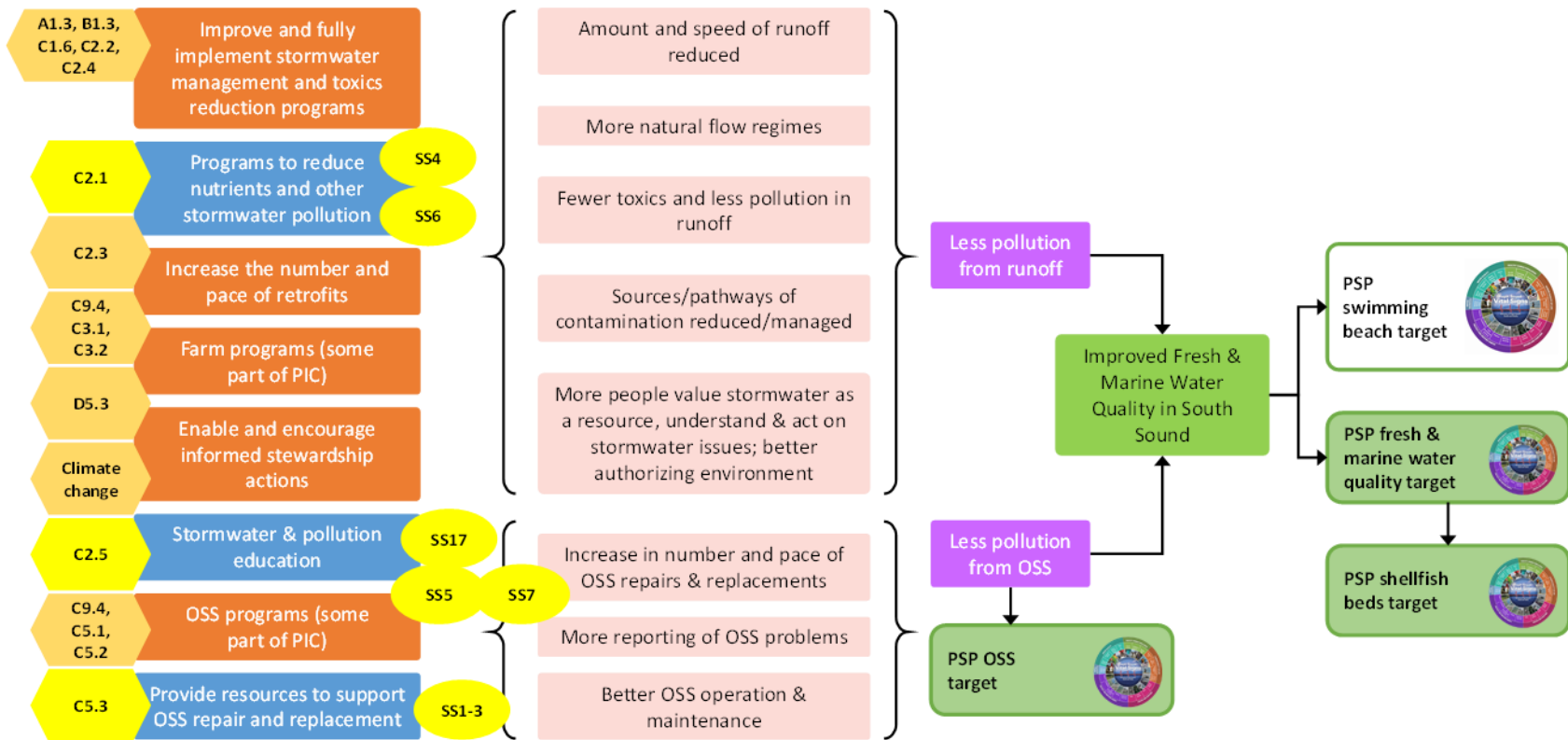
Anticipated changes in the system (pink boxes) are provided as examples. Additional changes and benefits also will be seen. This schematic focuses on approaches and changes most directly related to the PSP targets for marine water quality. Improvements in FW water quality also contribute directly to improvements in marine water quality. Other work, particularly work related to the PSP land cover/ land development and floodplains targets, also makes important contributions to improved fresh and marine water quality. Climate change will be addressed throughout current and future approaches.

Figure A2.7. AHSS Approaches to PSP Vital Sign for OSS



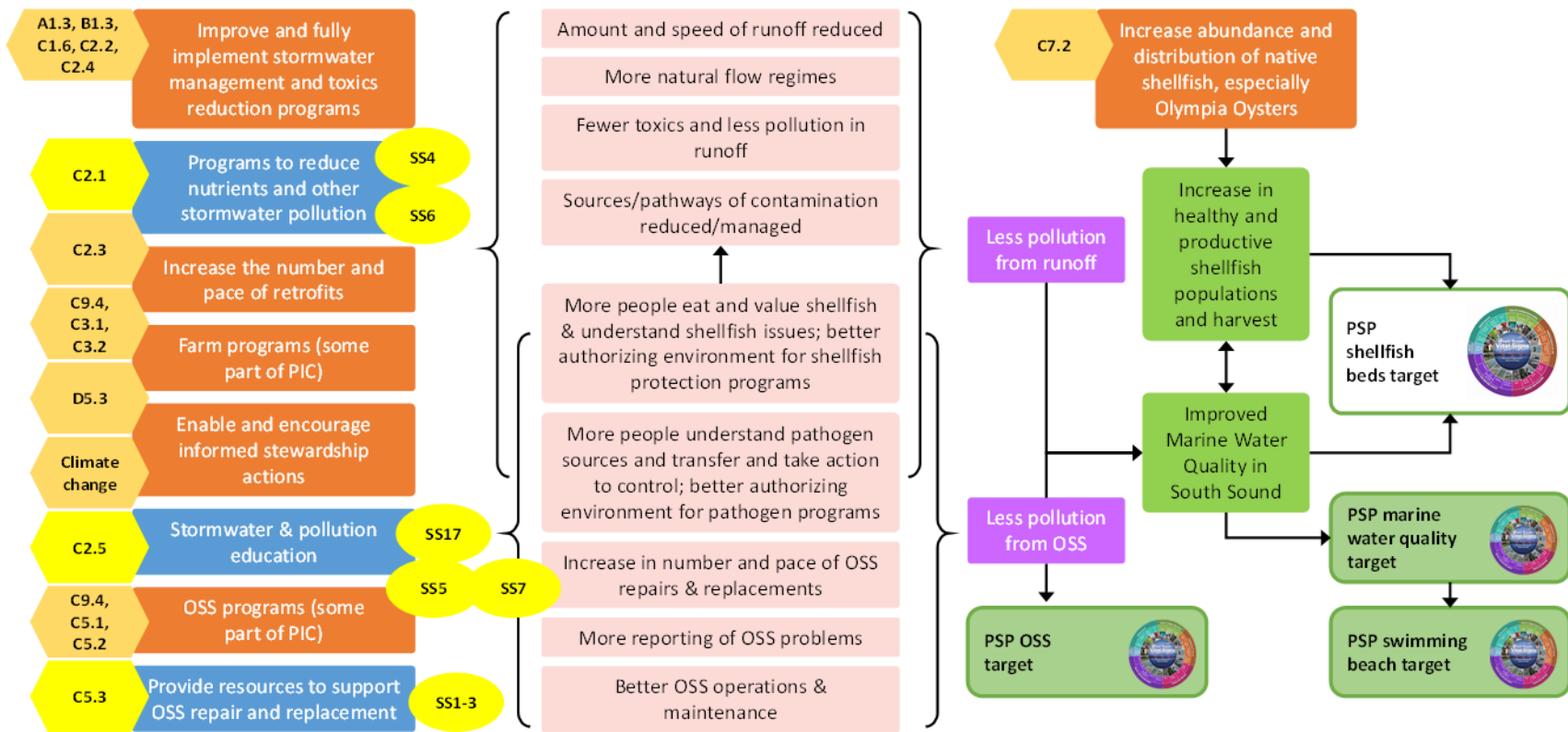
Anticipated changes in the system (pink boxes) are provided as examples. Additional changes and benefits also will be seen. This schematic focuses approaches and changes most directly related to the PSP recovery targets for OSS. Climate change will be addressed throughout current and future approaches.

Figure A2.8. AHSS Approaches to PSP Vital Sign for Swimming Beaches



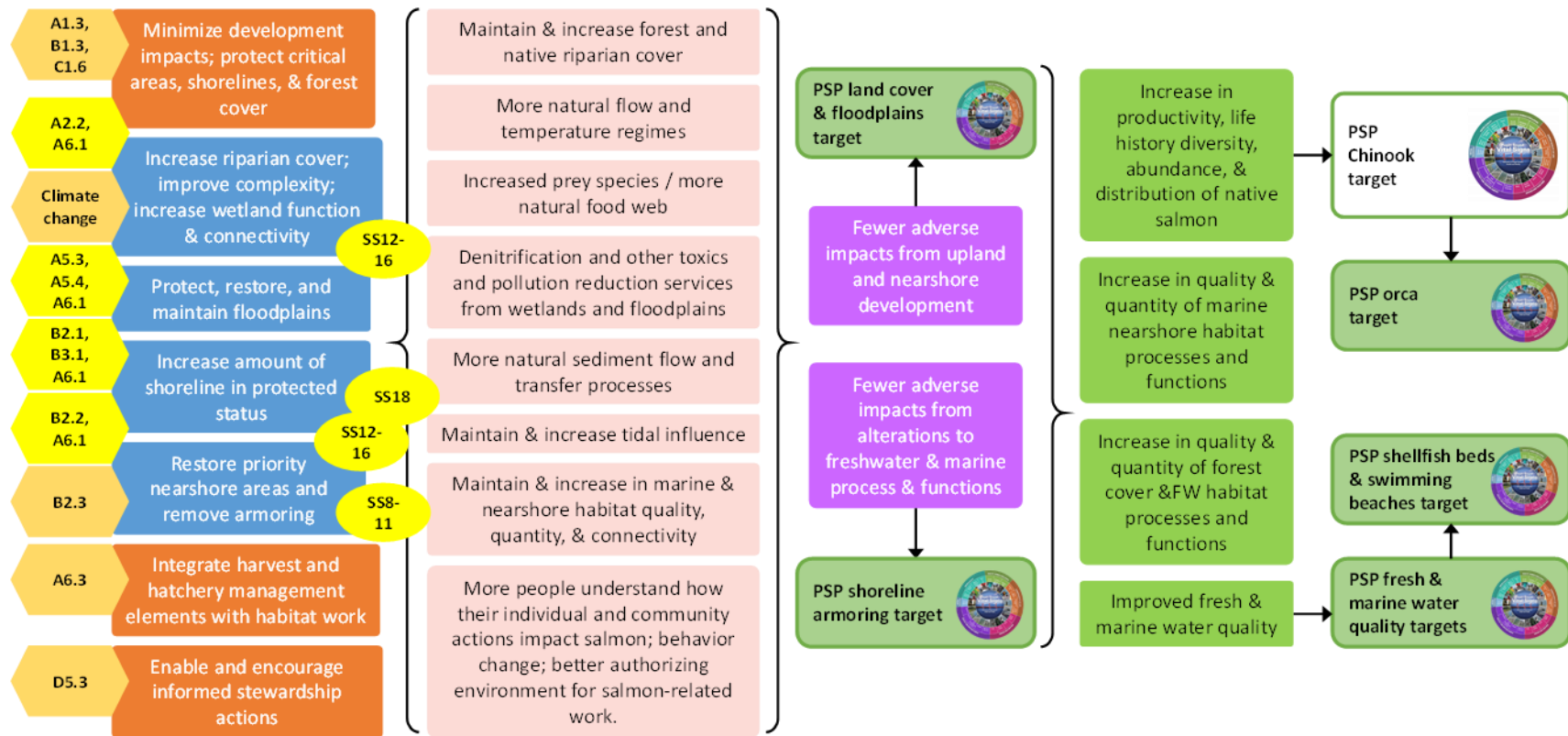
Anticipated changes in the system (pink boxes) are provided as examples. Additional changes and benefits also will be seen. This schematic focuses approaches and changes most directly related to the PSP recovery targets for swimming beaches. Climate change will be addressed throughout current and future approaches.

Figure A2.9. AHSS Approaches to PSP Vital Sign for Shellfish Beds



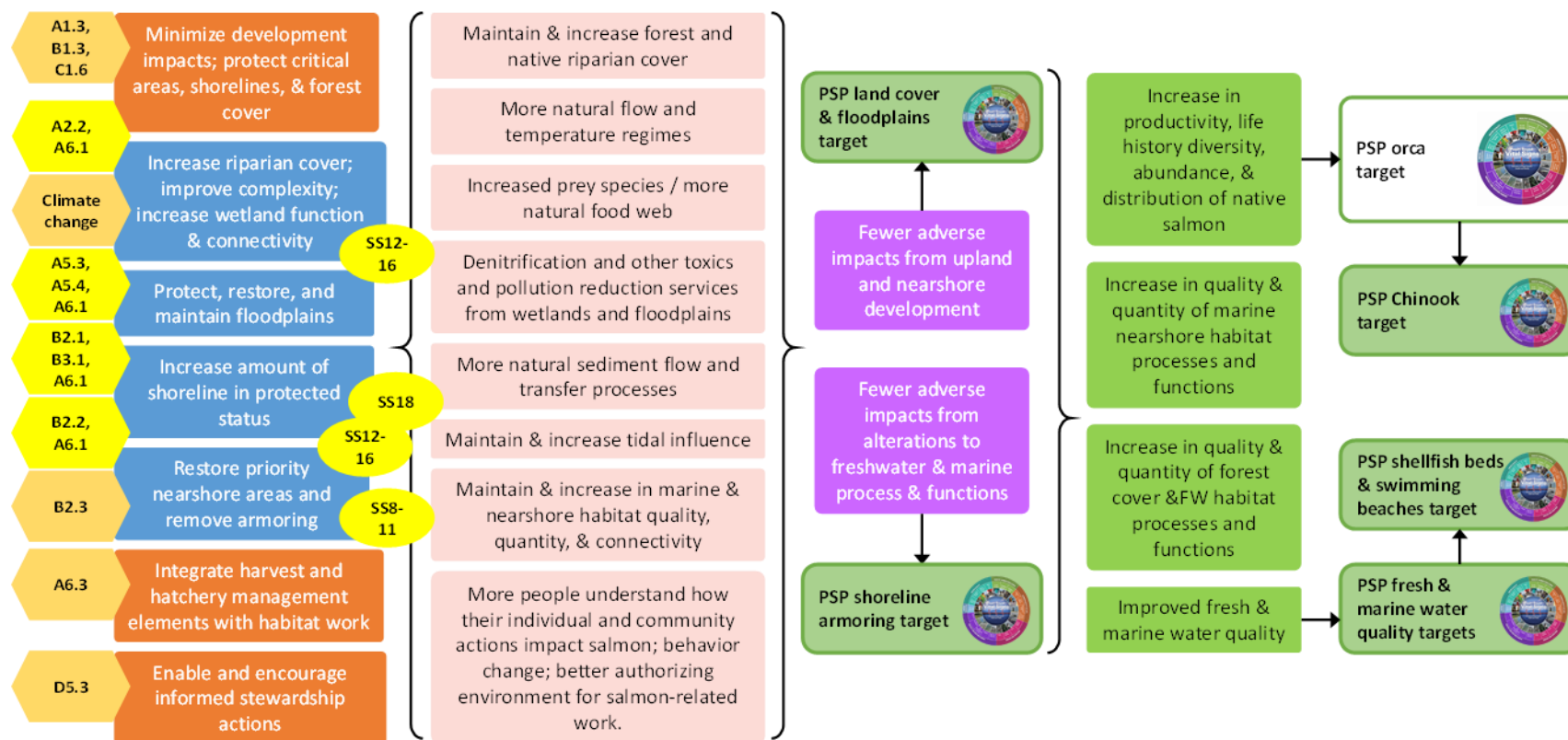
Anticipated changes in the system (pink boxes) are provided as examples. Additional changes and benefits also will be seen. This schematic focuses approaches and changes most directly related to the PSP recovery targets for shellfish beds. Climate change will be addressed throughout current and future approaches.

Figure A2.10. AHSS Approaches to PSP Vital Sign for Chinook Salmon



Anticipated changes in the system (pink boxes) are provided as examples. Additional changes and benefits also will be seen. This schematic focuses on habitat work that contributes to the PSP recovery target for Chinook salmon. Other work, particularly that related to PSP recovery targets for land cover/development and floodplains, and fresh and marine water quality, also make critical contributions to salmon recovery. This and other work related to forage fish recovery, also critical to salmon recovery, will be addressed in later planning efforts. Climate change will be addressed throughout current and future approaches.

Figure A2.11. AHSS Approaches to PSP Vital Sign for Orca



Anticipated changes in the system (pink boxes) are provided as examples. Additional changes and benefits also will be seen. AHSS believes that the South Sound's function as an nursery area for numerous salmon stocks contributes significantly to overall salmon recovery in Puget Sound and in that way makes important contributions to recovery of the orca population. Work on forage fish, also critical in the orca food web, will be addressed in later planning efforts. Climate change will be addressed throughout current and future approaches.