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Options for Setting 2020 Recovery Targets for the Puget Sound Ecosystem

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Summary prepared by Scott Redman, Puget Sound Partnership staff

At its June 16-17, 2011 meeting, the Puget Sound Partnership's Leadership Council will adopt ecosystem recovery targets as a key feature of the 2011 revision of the Action Agenda. For the Puget Sound Partnership, ecosystem recovery targets are policy statements that reflect the region's commitments to and expectations for recovery, or a measurable path to recovery, by 2020 based on scientific understandings of the ecosystem.[1]

Tables 1 through 18 present options for recovery targets for a number of key ecosystem conditions, key pressures, and programmatic conditions including most items on the Partnership's Dashboard of Ecosystem Indicators:

Human health
1. Swimming beaches

Water quantity
2. Summer stream flow

Water quality
3. Freshwater water quality
4. Benthic invertebrate communities in small streams[2]
5. Dissolved oxygen in marine waters[6]
6. Marine sediment quality[3]
7. Toxic contaminants in fish

Programmatic indicators
8. Action Agenda implementation

Habitats
9. River mouth estuaries[4]
10. Floodplains[5]
11. Land development
12. Land use and land cover

Pressure reduction indicators
13. On-site sewage systems[6]
14. Shoreline armoring

Species and food webs
15. Chinook salmon abundance
16. Southern resident killer whales (orcas)
17. Pacific herring
18. Upland birds

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[1] Applying a U.S. Fish and Wildlife definition of the "SMART" mnemonic for developing performance objectives, targets will be (S) specific, (M) measurable, (A) achievable, (R) results-oriented, and (T) time-fixed. For the Puget Sound Partnership, "results-oriented" would mean that the target would relate to ambitions for a recovered Puget Sound ecosystem.

[2] Originally developed as an element of target setting for "runoff from the built environment"

[3] Renamed from "toxics in sediment" to better represent the topic addressed

[4] Originally developed as an element of target setting for "estuaries, nearshore restoration, and shoreline alteration"

[5] Developed in April and May 2011 as it became clear that this topic was not covered elsewhere.

[6] Originally developed as an element of target setting for "wastewater"

Target setting is not being advanced for some of the Partnership's Dashboard of ecosystem indicators:

- Recreational fishing permits -- spring 2011 workshops and ECB discussion suggested that this indicator is not appropriate for target setting in June 2011
- Commercial fisheries harvest -- indicator not advanced for target setting in 2011 on advice of indicator champion
- Funding for Puget Sound -- spring 2011 workshops and ECB discussion suggested that this indicator is not appropriate for target setting in June 2011
- Marine water quality -- spring 2011 workshops and ECB discussion suggested that this indicator is not appropriate for target setting in June 2011
- Sound behavior index – indicator is under construction in 2011
- Quality of life index – indicator is under construction in 2011

The target options presented in this package are based on:

- March 2011 (draft) target setting brief sheets authored by indicator champions and technical reports authored by Puget Sound Partnership staff and interdisciplinary teams of advisors or co-authors
- Discussion at three April 2011 workshops on target setting
- Discussions in early May with various caucus groups, especially the business community, local governments, tribal staff, and salmon recovery watershed leads
- Addenda or revisions to the brief sheets or technical reports created in early May 2011 for some of the target setting topics
- Discussion at two May 2011 workshops on target setting
- Discussion at a May 24 and 25 target setting work session of the Ecosystem Coordination Board
- Discussion at the May 26 meeting of the Salmon Recovery Council
- Written comments received by the Partnership through June 3, 2011.

Material in the tables below also includes a summary of Science Panel members' review of the brief sheets and technical reports. The options and discussions presented in the following tables may not address issues identified by the Science Panel members' review, which were presented to Partnership staff as target options continued to be refined throughout the month of May.

Partnership staff have endeavored to develop materials that are responsive to comments made at workshops and in writing. The options in this document are intended to reflect (1) the best available scientific understanding of Puget Sound future conditions related to target-setting topics and (2) a range of achievable and recovery-oriented ecosystem outcomes for 2020 and beyond. Preferences expressed by the Ecosystem Coordination Board, recommendations from the Salmon Recovery Council, and recommendations from Partnership staff, and other information on the target setting topics and various target options are provided to support the discussion and adoption of targets at the June 16 and 17 meeting of the Leadership Council.

A list of brief sheets and reports, workshop summaries, and comment summaries is provided at the end of this document. These materials are posted online at:

http://www.mypugetsound.net/index.php?option=com_docman&task=cat_view&gid=135&Itemid=172

Table 1. Swimming beaches

A functioning, resilient ecosystem requires:	• Water quality at swimming beaches that protects human health
This measure provides an indication of:	• Water quality at marine swimming beaches from May through September <u>Progress toward ecosystem recovery goals</u> • ***A healthy human population support by a healthy Puget Sound*** • ***Waters*** *and sediments* ***of sufficient quality so that waters are safe for*** *drinking,* ***swimming,*** *shellfish harvest and consumption, and other human uses and enjoyment, and are not harmful to the native marine mammals, fish, birds, and shellfish of the region.*
Current conditions:	• From 2004 to 2010, 48% of routinely monitored (e.g., "core") beaches consistently meet standards every year; 35% of core beaches met standards except for one or two years; 17% of core beaches fail to meet standards almost every year. • In any year from 2004 to 2010, 7 to 15 beaches have failed to meet the marine water quality standard for enterococcus (a type of fecal bacteria).
Bottom line of Science Panel member's review:	• "The science appears to be appropriate and the brief sheet describes the basis of the target which is based on EPA's standard for beach closure to protect human health."
Biophysical constraints that affect what might be achieved by 2020:	• Drier summers with reduced rainfall during the swimming season might improve water quality at swimming beaches that are most affected by wet-weather runoff.
Socio-economic conditions that affect what might be achieved by 2020:	• Location of stormwater and wastewater infrastructure in proximity to swimming beaches • Growing human population and extent and pattern of land development can affect pollutant loads
Decisions on target setting for this topic might also consider:	• Targets set for shellfish beds restored • Option 4 has been adopted as a target for the Governor's GMAP for natural resources • The BEACH program monitors only marine swimming beaches; some local jurisdictions monitor conditions at freshwater swimming beaches
Options for 2020 targets	1. By 2020, all monitored Puget Sound beaches meet enterococcus standard 2. By 2020, 95% of all monitored Puget Sound beaches meet enterococcus standard 3. By 2020, all core Puget Sound beaches meet enterococcus standard 4. By 2020, 95% of core Puget Sound beaches meet enterococcus standard
ECB preferences	In written preferences expressed on May 24, 2011: 6 of 14 ECB members supported option 1. Four members supported setting no target, three supported option 2, and one supported option 4

Staff recommendation	Adopt option 1 – this option best ensures that marine waters of Puget Sound will be safe for swimming. This is a measure that directly affects the broad public use of Puget Sound. Significant effort will need to be made to protect and enhance monitoring resources available to state and local health departments to ensure adequate monitoring coverage of swimming beaches and to avoid closures based upon lack of monitoring capacity.
Other items that might be included in a Leadership Council resolution	• Develop a robust system of indicators and strategies to effectively address water quality at swimming beaches -- marine and fresh water; to protect recreational uses at other locations and seasons (SCUBA diving, wind surfing, kayaking); and to track the issuance of swimming advisories.

Table 2. Summer stream flow

A functioning, resilient ecosystem requires:	• Summer stream flows that support salmon habitat needs, other ecosystem needs, and provide water for people.
This measure provides an indication of:	• Summer stream flows to support salmon habitat needs, measured via the lowest 30-day average flow observed during the June through October period. <u>Progress toward ecosystem recovery goals</u> • ***River and stream flow levels sufficient to sustain people fish, and wildlife, and the natural functions of the environment*** • ***A healthy Puget Sound where freshwater****, estuary, nearshore, marine, and upland* ***habitats are protected, restored, and sustained***
Current conditions:	• For 13 rivers, representing 68% of Puget Sound's watershed area, monitored from 1975 to 2010: o 3 rivers show increasing trends in summer low flows – Cedar (strong evidence), Nisqually and Skokomish (weak evidence); o 6 rivers show no trend – Dungeness, Elwha, Green, Nooksack, Puyallup, and Skagit o 4 rivers show declining trends in low summer flows – Snohomish (weak evidence), Deschutes, North Fork Stillaquamish, Issaquah Creek (all with strong evidence)
Bottom line of Science Panel member's review:	• "The scientific uncertainties are adequately described. There is a risk that the state of this indicator will have little to do with the Action Agenda by 2020, but this could be mitigated by using additional [flow] indicators."
Biophysical constraints that affect what might be achieved by 2020:	• Expected climate changes will result in decreased summer low flows (related to decreased snow pack and loss of glaciers combined with higher air temperatures). Increased glacial melt may temporarily increase summer low flows in glacially-fed rivers.
Socio-economic conditions that affect what might be achieved by 2020:	• Surface water withdrawals for consumptive uses, flow management by dams, ground water withdrawals, and increase in impervious land cover can all affect summer stream flows. • Flow restoration goals may not be achievable by 2020 given: the nature of the trend metric, the level of implementation effort needed to increase flows to change recent trends, and the funding and legal tools available to accomplish implementation.
Decisions on target setting might also consider:	• Targets set for benthic invertebrate communities in small streams, freshwater water quality index, and Chinook salmon abundance. • Option 1 has been adopted as a target for the Governor's GMAP for natural resources • The Puget Sound Recovery Implementation Technical Team (RITT), which provides scientific advice to the region's salmon recovery effort, supports the interim use of this indicator and the GMAP target but recommends a) expanding the location and number of stream gages to better represent salmon-bearing streams with independent populations and b) the development of ecological flow indicators

Options for 2020 targets	1. By 2020, 100% of streams have stable or increasing flows. 2. By 2020, meet the following river-specific targets: a. Maintain stable or increasing flows in highly regulated rivers: Nisqually, Cedar, Skokomish, Skagit, Green b. Monitor low flow in Elwha River after dam removal c. Maintain stable flows in unregulated rivers that are currently stable: Puyallup, Dungeness, Nooksack d. Restore low flows to bring the Snohomish River from a weakly decreasing trend to no trend e. Restore low flows to bring the Deschutes River, North Fork Stillaguamish River, and Issaquah Creek from a strongly decreasing trend to a weakly decreasing trend
ECB preferences	In written preferences expressed on May 25, 2011: six of 13 ECB members supported option 2. Three members supported option 1, two supported setting no target, one supported combining options 1 and 2, and one expressed no clear preference.
Staff recommendation	Adopt option 1 – All of the options are scientifically defensible. This option is easier to communicate to the public. It expresses an expectation of better results for streams with declining conditions (e.g., option 1 is stronger than option 2 for Deschutes, North Fork Stillaguamish, and Issaquah Creek). Finally, it has the advantage of consistency with the existing GMAP measure.
Other items that might be included in a Leadership Council resolution	a. Explore how to develop a robust system of indicators and strategies that more effectively address diverse aspects of stream flow and water availability. Consider using a 7-day average flows instead of 30-day; including more gages; addressing concerns over the WY 1975-current time period; using a 2-way indicator that includes the adequacy of flow levels (both status and trend); and developing an hydrologic index that captures "environmental flows"

Table 3. Freshwater water quality

A functioning, resilient ecosystem requires:	• Freshwater water quality that protects aquatic life and other uses of the state's waters
This measure provides an indication of:	• Quality of flowing freshwaters compared to (a) water quality criteria for conventional pollutants and (b) "better" conditions of sediment and nutrient concentrations as observed during a benchmark period; parameters are combined into an Index where a score of 80 indicates that water quality criteria are met and conditions compare favorably to benchmark conditions for sediments and nutrients. <u>Progress toward ecosystem recovery goals</u> • ***Waters*** *and sediments* ***of sufficient quality so that waters are safe for drinking, swimming, shellfish harvest and consumption, and other human uses and enjoyment, and are not harmful to the native marine mammals, fish, birds, and shellfish of the region*** • ***A healthy Puget Sound where freshwater****, estuary, nearshore, marine, and upland* ***habitats are protected, restored, and sustained***
Current conditions:	• Current Freshwater Quality Index scores for major rivers in Puget Sound are in the mid 70s, an improvement of about 0.4 units per year since 1995 when the index began. Scores have improved most strongly in the Nisqually and Deschutes systems. No Puget Sound basins have had significantly declining scores. • Projecting current trends into the future suggests that average index scores will reach 80 by 2025 (if no flow adjustment is included) or by 2060 (using flow adjusted scores)
Bottom line of Science Panel member's review:	• "The Index is valuable as an indicator even though it has its limitations. The short-comings of the Index … including scientific uncertainties, should not prevent the Leadership Council from adopting these targets …."
Biophysical constraints that affect what might be achieved by 2020:	• Expected climate changes are likely to worsen index scores for temperature, oxygen, pH, and winter scores for nutrients and sediment. Climate changes are likely to improve summer index scores for nutrients and sediment.
Socio-economic conditions that affect what might be achieved by 2020:	• Adoption of management practices to control non-point sources of sediment, nutrients, and fecal coliform bacteria. • Extent and pattern of land development can affect stream hydrology and pollutant loads
Decisions on target setting might also consider:	• Targets set for benthic invertebrate communities in small streams • Central Puget Sound region index scores have remained stable or improved slightly over the past ten years: improved watershed management activities may be balancing the negative driver of a growing human population • Option 1 has been adopted as a target for the Governor's GMAP for natural resources

Options for 2020 targets	1. By 2020, average of scores from long-term stations on 14 major rivers in 12 basins is 80 or higher. 2. By 2020, average of scores from long-term stations on 14 major rivers in 12 basins is 80 or higher and average of scores from long-term stations on urban streams is 80 or higher. 3. By 2020, all long-term stations demonstrate stable or increasing/improving trends in Freshwater Water Quality Index scores. 4. By 2020, at least 50 percent of long-term stations with suitable data have Freshwater Water Quality Index scores of 80 or higher. 5. By 2020, at least 50 percent of all monitoring stations with suitable data have Freshwater Water Quality Index scores of 80 or higher.
ECB preferences	In written preferences expressed on May 24, 2011: six of 15 ECB members supported option 5. Four members supported option 3, four supported a combination of options 4 and 5, and one supported another option.
Staff recommendation	Adopt option 1 – Each of the options is consistent with available scientific information. This option maintains a focus on larger streams (small streams are addressed elsewhere). It has the advantage of creating an expectation of improvement at lower scoring stations to attain an average of 80. Finally, it is consistent with the target adopted for GMAP.
Other items that might be included in a Leadership Council resolution	a. Develop a robust system of indicators and strategies to effectively address the health of Puget Sound's flowing freshwater systems

Table 4. Benthic invertebrate communities in small streams

A functioning, resilient ecosystem requires:	• Lowland streams that support the salmonids and invertebrates native to this region
This measure provides an indication of:	• Biological health of wadeable, lowland streams as reflected by communities of benthic invertebrates <u>Progress toward ecosystem recovery goals</u> • ***Waters*** *and sediments* ***of sufficient quality so that waters*** *are safe for drinking, swimming, shellfish harvest and consumption, and other human uses and enjoyment, and* ***are not harmful to the native marine mammals, fish, birds, and shellfish of the region*** • ***A healthy Puget Sound where freshwater****, estuary, nearshore, marine, and upland* ***habitats are protected, restored, and sustained*** • ***Healthy and sustaining populations of native species in Puget Sound, including a robust food web***
Current conditions:	• Sound-wide results have not been reported, but King County data show that about 37% of sites have scores of 38 or better (rated "good" or "excellent") with the remaining 63% rated "fair" or "poor."
Bottom line of Science Panel member's review:	• Since "urban stormwater causes two distinct problems (changing the timing and intensity of flows in streams and washing pollutants into the streams and ultimately into Puget Sound) … adopt[ing] at least two targets to cover the broad issue of urban stormwater makes sense…. Narrowing to one target is not advised … —progress is needed on both streamflow and contamination."
Biophysical constraints that affect what might be achieved by 2020:	• Improvement in B-IBI scores lags behind improvements to flow and water quality
Socio-economic conditions that affect what might be achieved by 2020:	• Resources committed to redevelopment and/or stormwater retrofit projects to improve stormwater management and stream health • Development practices may degrade stream health in urbanizing areas • Economic conditions between 2011 and 2020
Decisions on target setting might also consider:	• Several Dashboard indicators address other concerns about the impacts of runoff from the built environment: freshwater water quality, marine sediment quality, toxics in marine fish, shellfish beds restored, swimming beaches • The biological health of small, lowland streams is not currently addressed by the Dashboard of ecosystem indicators

Options for 2020 targets	1. By 2020, 90% 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 10 Puget Sound lowland drainage areas improve from rating of "fair" (28 – 36) to "good" (35 - 38 or better). 2. By 2020, 90% 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 20 Puget Sound lowland drainage areas improve from "fair" to "good." 3. By 2020, 90% 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." 4. By 2020, 100% 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 10 Puget Sound lowland drainage areas improve from "fair" to "good." 5. By 2020, 100% 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 20 Puget Sound lowland drainage areas improve from "fair" to "good." 6. By 2020, 100% 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."
ECB preferences	In written preferences expressed on May 24, 2011: six of 15 ECB members supported option 6. Three members supported option 5; two supported option 4; two supported a combination of 4, 5, or 6; one supported option 1 and one option 3. Thirteen of 15 ECB members preferred an option specifying that 100% of streams with excellent scores maintain these scores.
Staff recommendation	Adopt option 4 – this coincides with ECB members' preferences for a target maintaining conditions at 100% of excellent stations but reflects an understanding that it will be difficult to improve conditions in 10 (rather than 20 or 30) lowland drainage areas given (a) the magnitude of retrofit and redevelopment implied and (b) uncertainty that invertebrate community scores can demonstrate measurable improvements in fewer than 10 years. This option launches the region in a strongly positive direction and provides an opportunity to evaluate the costs and effectiveness of strategies designed to improve this measure.
Other items that might be included in a Leadership Council resolution	a. Consider adjustments to target established in June 2011 based on analyses and decisions related to: the effects of development on B-IBI scores; the effectiveness of stormwater management practices, and stream health needed to support salmon recovery or other aspects of a functioning, resilient ecosystem b. Develop a robust system of monitoring and indicators to characterize status and trends in aquatic systems that receive runoff from the built environment. Describe the costs and implementation approach for such a system.

Table 5. Dissolved oxygen in marine waters

A functioning, resilient ecosystem requires:	• Dissolved oxygen concentrations in marine waters to support Puget Sound species, communities, and food webs.
This measure provides an indication of:	• Human-related contributions to depressed dissolved oxygen concentrations in Puget Sound marine waters. A measureable (i.e., 0.2 mg/L) decrease in dissolved oxygen (D.O.) concentrations related to human-related causes is a violation of Washington State water quality standards. <u>Progress toward ecosystem recovery goals</u> • ***Waters*** *and sediments* ***of sufficient quality so that waters*** *are safe for drinking, swimming, shellfish harvest and consumption, and other human uses and enjoyment, and* ***are not harmful to the native marine mammals, fish, birds, and shellfish of the region*** • ***A healthy Puget Sound where*** *freshwater, estuary, nearshore****, marine****, and upland* ***habitats are protected, restored, and sustained***
Current conditions:	• Hood Canal, South Puget Sound, and perhaps the Whidbey Basin are nutrient sensitive areas of Puget Sound. Modeling will be complete in early 2012 to identify areas that may experience 0.2 mg/L reductions in D.O. from human-related causes. Some areas of South Puget Sound and lower Hood Canal may not meet the water quality standard related to D.O. reductions from human-related causes.
Bottom line of Science Panel member's review:	• "This number (0.2 mg/l) is based on the water quality standards outlined in the clean water act … this target is clearly defined and scientifically defensible."
Biophysical constraints that affect what might be achieved by 2020:	• Time lag (of 1 to 2 years) in environmental response to reduced loadings
Socio-economic conditions that affect what might be achieved by 2020:	• Permitting schedules and wastewater facilities planning schedules • Resources (from utility fees, grants, or loans) for improved wastewater treatment infrastructure • Limited availability of affordable, reliable, sufficiently-demonstrated nitrogen removing technologies for OSS at single-home applications. • Financial and technical assistance to control non-point source pollution
Decisions on target setting might also consider:	• Level of effort needed to achieve this target is not yet known: baseline analysis of current locations with dissolved oxygen reduced by human-related contributions of nitrogen expected to be complete in summer 2012 • Several Dashboard indicators address other concerns about the impacts of wastewater on the Puget Sound ecosystem: freshwater water quality, marine water quality, toxics in sediment, toxics in fish, shellfish beds restored, swimming beaches, eelgrass. • The pressure of wastewater on dissolved oxygen in marine waters is indirectly addressed by the marine water quality Dashboard indicator (which is not currently proposed for a 2020 target)

Options for 2020 targets	1. By 2020, human-related contributions of nitrogen do not result in more than 0.2 mg/L reductions in dissolved oxygen levels in sensitive areas of Puget Sound. 2. 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.
ECB preferences	In written preferences expressed on May 24, 2011: 8 of 15 ECB members supported option 1. Three members supported option 2; three supported neither; and one supported a combination of both options 1 and 2.
Staff recommendation	Adopt option 1. This option focuses attention on conditions in particularly sensitive areas of Puget Sound. The Leadership Council should understand that this option will be measured using ecosystem modeling that is under development by the Department of Ecology with initial results available in summer 2012. Option 2 would require development and application of additional modeling capacity and delay the region's ability to track, evaluate and respond to this measure.
Other items that might be included in a Leadership Council resolution	a. Consider adjustments to target established in June 2011 based on analyses and decisions related to the effectiveness of wastewater treatment and OSS operation and maintenance programs. b. Develop a robust system of indicators and strategies to effectively address and reduce harms from wastewater treatment plant and OSS

Table 6. Marine sediment quality

A functioning, resilient ecosystem requires:	• Sediment quality that supports functioning, healthy communities of sediment-dwelling invertebrates.
This measure provides an indication of:	• Quality of marine sediments based on levels of chemical contamination, toxicity testing, and benthic invertebrate communities. This indicator assesses conditions based on findings of an established status and trends monitoring program that evaluates conditions in individual regions of Puget Sound and in urban bays. <u>Progress toward ecosystem recovery goals</u> • *Waters and **sediments of sufficient quality so that waters** are safe for drinking, swimming, shellfish harvest and consumption, and other human uses and enjoyment, and **are not harmful to the native marine mammals, fish, birds, and shellfish of the region*** • ***A healthy Puget Sound where** freshwater, estuary, nearshore**, marine**, and upland **habitats are protected, restored, and sustained***
Current conditions:	• All eight regions of Puget Sound monitored from 1997-2009 demonstrated minimum exposure to toxic chemicals in sediment. Four of eight regions demonstrated unimpacted benthic invertebrate communities. The other four regions demonstrated likely impacted communities. • Two of four Puget Sound urban bays monitored from 1998-2010 demonstrated minimum exposure to toxic chemicals in sediment. The other two urban bays that have been monitored showed improving chemistry index scores but low levels of exposure. Benthic community results are available for only three urban bays: one appears unimpacted, one has likely impacted communities, and the third is on the border of unimpacted-likely impacted.
Bottom line of Science Panel member's review:	• "This target is well grounded in science and in available data… The authors have done an excellent job describing the target, exploring the available information, discussing the uncertainties, and recommending the target."
Biophysical constraints that affect what might be achieved by 2020:	• Reservoirs of some toxic contaminants persist in the Puget Sound ecosystem long after sources are controlled; measurable reductions in persistent compounds may not occur in the 2020 timeframe • Natural recovery of contaminated sediments depends on incoming load of clean(er) sediment
Socio-economic conditions that affect what might be achieved by 2020:	• Time needed to find safe substitutes of chemicals currently in use and to change behaviors • Resources available for stormwater retrofit, improved wastewater treatment, and site clean up • Individuals' preferences and behaviors with regard to (1) use and disposal of pharmaceutical, personal care products, and other consumer products and (2) generation of toxic chemicals from residential heating, transportation, etc.
Decisions on target setting might also consider:	• Targets established for toxics in fish • Option 3 is currently met • Implementing Option 4 requires a definition of "minimally affected" benthic community

Options for 2020 targets	1. Chemistry measures reflect "minimum exposure" (i.e., mSQS is <0.1 and the SCI is >93.3), Sediment Quality Triad Index (SQTI) scores reflect "unimpacted" conditions (i.e., SQTI values >83), and no measurements exceed Sediment Quality Standards set in the Washington State sediment management standards. 2. Chemistry measures reflect "minimum exposure" and Sediment Quality Triad Index (SQTI) scores reflect "unimpacted" conditions 3. Chemistry measures reflect low levels of exposure (i.e., mSQSq is 0.1 - <0.3 and SCI = >80 - 93.3) and SQTI measures reflect "likely unimpacted" conditions (i.e., SQTI values from >57 – 83) 4. Chemistry measures reflect "minimum exposure," benthic community scores reflect "minimally affected" conditions, and no measurements exceed Sediment Quality Standards set in the Washington State sediment management standards.
ECB preferences	In written preferences expressed on May 24, 2011: 9 of 14 ECB members supported option 1. Two members supported option 4 and one each supported options 2 and 3 or provided no response.
Staff recommendation	Adopt option 1 – This option reflects an improvement in urban bays to meet water quality standards, to demonstrate minimal chemical exposure in the environment, and to reduce the number of benthic communities that are affected by exposure to toxic chemicals.
Other items that might be included in a Leadership Council resolution	a. Consider adjustments to target established in June 2011 based on development of benthic index and new understandings of thresholds protective of marine ecosystem and human health. b. Develop a robust system of indicators and strategies to effectively address levels of toxic contaminants in Puget Sound ecological systems.

Table 7. Toxics in fish

A functioning, resilient ecosystem requires:	• Fish populations not harmed by toxic contaminants and fish safe for consumption by predators and humans.
This measure provides an indication of:	• Exposure of marine fish to toxic chemicals relative to levels that might harm the health of fish populations throughout the food web and pose health risks to human consumers of fish. <u>Progress toward ecosystem recovery goals</u> • ***Waters and sediments of sufficient quality so that waters are safe for*** *drinking, swimming, shellfish harvest and consumption, and* ***other human uses and enjoyment, and are not harmful to the native marine mammals, fish, birds, and shellfish of the region*** • ***A healthy Puget Sound where*** *freshwater, estuary, nearshore****, marine,*** *and upland* ***habitats are protected, restored, and sustained*** • ***A healthy human population support by a healthy Puget Sound***
Current conditions:	• PCBs in Puget Sound bottomfish and salmon have declined since the 1970s. PCBs remain relatively high in bottomfish from urban bays and in "resident " Chinook salmon. The Washington Department of Health has issued consumption advisories for English sole from eight of 17 areas in Puget Sound and for Chinook salmon Puget Sound-wide because of high PCB levels. High PCBs levels in Pacific herring and Pacific hake illustrate the degree to which Puget Sound's food web is contaminated. These species along with Pacific salmon represent a large component of the food web that supports Puget Sound's apex predators including harbor seals and orca whales. • A similar pattern exists for PBDEs in these species, but long-term trends are less clear. • Liver disease in English sole caused by exposure to PAHs has been tracked in some Puget Sound locations for over 20 years.
Bottom line of Science Panel member's review:	• "The choice of [herring and English sole] appears appropriate. Setting targets to reduce a suite of toxics [will] provide a good handle on both water quality [and] accumulation of toxics [to] salmon and Orca. Also, toxics in bottom fish and herring should provide good indication for human health effects… Because of the importance of this dashboard indicator, some options for the target levels should be implemented while developing more in-depth information on thresholds…."
Biophysical constraints that affect what might be achieved by 2020:	• Reservoirs of some toxic contaminants persist in the Puget Sound ecosystem long after sources are controlled; measurable reductions in persistent, biaccumulative compounds may not occur in the 2020 timeframe • Natural recovery of contaminated sediments depends on incoming load of clean(er) sediment
Socio-economic conditions that affect what might be achieved by 2020:	• Time needed to find safe substitutes of chemicals currently in use and to change behaviors • Resources available for stormwater retrofit, improved wastewater treatment, and site clean up • Individuals' preferences and behaviors with regard to (1) use and disposal of pharmaceutical, personal care products, and other consumer products and (2) generation of toxic chemicals from residential heating, transportation, etc.

Decisions on target setting might also consider:	• Targets established for marine sediment quality • Partnership's interests in supporting human health
Options for 2020 targets	1. By 2020, toxics in marine fish exhibit a declining trend. Target is achieved if each of 14 declines is observed in PSAMP monitoring through 2020: a. Bioaccumulative toxics: PCBs (4 metrics) and PBDEs (4 metrics) i. PCBs and PBDEs in Central and Southern Puget Sound herring and urban English sole (sampled biannually) exhibit a declining trend. ii. PCBs and PBDEs in Northern Puget Sound herring and non-urban English sole (sampled biannually) exhibit no increasing trend b. PAHs (4 metrics) and endocrine disrupting compounds (EDCs) (2 metrics) i. English sole in Puget Sound urban bays exhibit a declining trend in toxics-related disease (feminization of male English sole, altered reproductive timing of female English sole) ii. PAHs in Central and Southern Puget Sound herring and urban English sole (sampled biannually) exhibit a declining trend. iii. PAHs in Northern Puget Sound herring and non-urban English sole (sampled biannually) exhibit no increasing trend 2. By 2020, toxics in fish are below threshold levels. Target is achieved if each of the following conditions is observed in PSAMP monitoring results from 2019 or 2020: a. Bioaccumulative toxics – 95% of samples meet the following thresholds: i. Concentrations of PCBs and PBDEs in Puget Sound herring and English sole are below adverse effects thresholds (e.g., 2,400 ng PCB/g lipid and 1,400 ng PBDE/g lipid) ii. Concentrations of PCBs in indicator species are below human-health screening levels (e.g., Department of Health screening levels for recreational or subsistence consumption rates, currently 33 ng PCB/g and 10 ng PCB/g fish tissue, respectively for a non-cancer endpoint). b. PAHs and EDCs – all samples meet the following thresholds: i. English sole in Puget Sound exhibit no PAH-related liver disease ii. English sole in Puget Sound exhibit no toxics-related reproductive impairment iii. PAHs in herring are below an effects threshold. 3. By 2020, toxics in marine fish have been reduced to background levels. Target is achieved if each of the following conditions is observed in PSAMP monitoring results from 2019 or 2020: a. Bioaccumulative toxics: levels of PCBs and PBDEs in 95% of sampled Puget Sound herring and English sole (sampled biannually) are equivalent to background conditions (i.e., the cleanest conditions in Puget Sound) b. PAHs and EDCs i. 98% of English sole sampled from any Puget Sound location exhibit no PAH-related liver disease ii. 95% of English sole sampled from any Puget Sound location exhibit no toxics-related reproductive impairment iii. 95% of herring and English sole sampled from any Puget Sound location exhibit PAHs (in bile) equivalent to background conditions

ECB preferences	In written preferences expressed on May 24, 2011, eight of 14 ECB members recommended a combination of the options presented in May 19 meeting materials. Four members supported none of the options presented. The options presented above reflect a re-combination of the concepts presented in the May 19 ECB materials. Two members supported option 3 from the May 19 packet (concentrations below human health screening levels).
Staff recommendation	Adopt option 2 – This option reflects the best available scientific information about levels necessary to protect human health related to fish consumption of Puget Sound species, as well as the health of the fish themselves.
Other items that might be included in a Leadership Council resolution	a. Consider adjustments to target established in June 2011 based on new understandings of thresholds protective of fish, predator, and human health. b. Develop a robust system of indicators and strategies to effectively address levels of toxic contaminants in Puget Sound ecological systems.

Table 8. Action Agenda implementation

A functioning, resilient ecosystem requires:	• Programs and activities by governments, business, social organizations, and individuals that contribute to recovery of the Puget Sound ecosystem
This measure provides an indication of:	• Extent to which actions intended to advance ecosystem recovery are implemented
Current conditions:	• The status of 146 near-term actions in the 2008/09 Action Agenda as of spring 2011: 62% are completed or on plan -- 13 (9%) are completed and 78 (53%) are on plan -- and 38% are not launched or need attention -- 13 (9%) are not launched and 42 (29%) need attention. Among the 30 highest-ranked actions for Priorities A, B, and C, 24 (80%) are on plan or completed, while 6 (20%) need attention or are not yet launched.
Bottom line of Science Panel member's review:	(not reviewed)
Biophysical constraints that affect what might be achieved by 2020:	(none identified)
Socio-economic conditions that affect what might be achieved by 2020:	• Economic conditions from 2011 to 2020 • Funding to implement the Action Agenda • Complexity of actions needed and institutional situations
Decisions on target setting might also consider:	• Targets set for other topics • The extent to which near-term actions (NTAs) are discretely scoped and time-bound
Options for 2020 targets	1. 90% of all NTAs are on-plan or completed. 2. 80% of all NTAs are on-plan or completed. **3.** 100% of all funded NTAs are on-plan or completed. **4.** 100% of the funded high-priority Near Term Actions are completed and 80-90% of other funded actions are completed.
ECB preferences	In written preferences expressed on May 25, 2011, six of 14 ECB members supported not setting a target or some other target. Three of the "other" votes were for "100% of all NTAs are on-plan or completed." Five members supported option 4 and three supported option 3. There was discussion about whether this indicator should remain on the Partnership's Dashboard of ecosystem indicators.
Staff recommendation	Adopt no target and remove this measure from the Dashboard of Indicators. Implementation information will be fully reported by the Partnership as a key aspect of the agency's accountability assignment. The Dashboard, as an ecosystem evaluation tool, is more appropriately focused on ecosystem conditions and pressures.
Other items that might be included in a Leadership Council resolution	

Table 9. River mouth estuaries

A functioning, resilient ecosystem requires:	• Tidally-influenced wetland habitats at the estuaries of Puget Sound's major rivers to provide ecosystem functions, goods, and services
This measure provides an indication of:	• Extent to which wetlands at 16 large river mouth estuaries support salmon recovery and provide other ecosystem functions, goods, and services. (Wetland extent is only one of five key ecological attributes needed for functioning river deltas.) <u>Progress toward ecosystem recovery goals</u> • ***A healthy Puget Sound where*** *freshwater,* ***estuary****, nearshore, marine, and upland* ***habitats are protected, restored, and sustained*** • ***A quality of human life that is sustained by a functioning Puget Sound ecosystem***
Current conditions:	• Across all types of tidal wetlands, present-day wetland extent is 17-19% of historic extent in Puget Sound. At 16 large river mouth estuaries, overall present-day wetland extent is about 45% of historic extent but is as little as 1-3% in the most high developed areas (Duwamish and Puyallup).
Bottom line of Science Panel member's review:	• Scientific information rated as "fair" (e.g., limited information about reference conditions, baselines, and/or non-linearities). "A cause-effect model … would have been helpful in communicating how pressure reductions would have resulted in beneficial use… Since the emphasis is on salmon the target is set only on one organism and not applicable to other ecological services. "
Biophysical constraints that affect what might be achieved by 2020:	• Rising sea-level may reduce extent of wetlands at Puget Sound's river mouth estuaries
Socio-economic conditions that affect what might be achieved by 2020:	• Areas of historic wetlands have been converted to other uses and these transformed landscapes provide other valued services (e.g., ports, agricultural lands, utility and transportation infrastructure) • Restoration projects depend on financial resources (total cost not yet known) and social buy-in (which has proven difficult); rate of restoration envisioned in 2005 has not been accomplished in the last six years
Decisions on target setting might also consider:	• Targets set for eelgrass and Chinook abundance • Historic extent of estuarine wetland acreage is currently used as a surrogate for resilient status in the absence of socio-political consensus about how much of which ecosystem goods and services society wants and is willing to pay for. • Restoration need based on achieving 80% of historic extent was developed in spring 2011 for consideration as a system-wide numeric benchmark. Other articulations of restoration need have been developed in 10-year salmon recovery goals. • The Recovery Implementation Technical Team (RITT) "supports using 80% of historic as a starting point a) to identify a scope of estuary restoration, b) to identify policy options for long-term targets, and c) most importantly, to make a commitment to trajectories for estuary restoration on a watershed-by-watershed basis that lead to salmon recovery." • Present-day extent of estuarine wetland acreage is not currently monitored. Changes from restoration activities in the river mouth deltas are tracked, but the effects of other activities (e.g., river restoration and flow management) are not assessed.

Options for 2020 targets	Target options presented in advance of the May 24-25 ECB meeting: 1. By 2020, 80% of restoration need in major river deltas is achieved basin-wide 2. By 2020, 30% of restoration need is achieved basin-wide and at least 15% of restoration need is achieved at each river mouth estuary 3. By 2020, 15% of restoration need is achieved basin-wide and 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) 4. By 2020, all Chinook natal river deltas meet identified 10-year salmon recovery restoration goals (or 10% of restoration need as proxy for other goals) 5. By 2020, some portion of restoration need is achieved but 10-year salmon recovery goals are not met in all Chinook natal river deltas 6. Do not set a target for river mouth estuaries in June 2011
ECB preferences	In written preferences expressed on May 25, 2011, five of 13 ECB members supported option 4. Three members supported option 3, three supported an "other" option (referred to as 4+), and one each supported options 1 and 6.
Salmon Recovery Council recommendation	The May 26, 2011 discussion by the Salmon Recovery Council expressed support for option 3 with special reference to the attention this option provides to non-Chinook natal rivers.
Staff recommendation	Adopt option 3, but re-word to reverse the phrases: By 2020, 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) and 15% of restoration need is achieved basin-wide. This recommendation coincides with ECB support for option 4, option 3, and the preferences for something a bit more than option 4. The re-arrangement emphasizes the reliance on locally agreed to 10-year salmon recovery goals. It also aligns with the Salmon Recovery Council recommendation.
Other items that might be included in a Leadership Council resolution	a. Continue assessments (via Puget Sound Nearshore Ecosystem Restoration Program and/or salmon recovery efforts) to refine projections of the extent, configuration, and condition of wetlands at major river mouth estuaries needed for a functioning, resilient ecosystem. b. Develop a robust system of indicators and strategies to effectively address interests in river mouth estuaries, including additional ecosystem functions and services. c. Recognition of the imperative to reconcile the need for restoration in estuaries with the need to protect and sustain a viable agricultural economy in the Puget Sound Basin.

Table 10. Floodplains

A functioning, resilient ecosystem requires:	• Freshwater floodplains that support natural processes and deliver ecological services to keep people and property safe during flood flows, support fisheries production, and provide water filtration and ground water recharge.
This measure provides an indication of:	• Extent, connectivity, and function of tidal and non-tidal freshwater floodplains associated with large rivers and their major tributaries. <u>Progress toward ecosystem recovery goals</u> • ***A healthy Puget Sound where freshwater****, estuary, nearshore****,*** *marine, and upland* ***habitats are protected, restored, and sustained*** • ***A quality of human life that is sustained by a functioning Puget Sound ecosystem***
Current conditions:	• Extensive loss of floodplain wetlands and forests has occurred through shoreline armoring, construction of levees and agricultural, residential and commercial/industrial development. NOAA estimates that 73% of Puget Sound wetlands have been lost, most of which occurred in floodplains.
Bottom line of Science Panel member's review:	(not reviewed)
Biophysical constraints that affect what might be achieved by 2020:	• Hydrologic shifts and variability related to a changing climate is likely to alter the interactions between rivers and their floodplains.
Socio-economic conditions that affect what might be achieved by 2020:	• Floodplain recovery objectives and actions need to recognize the significant social and economic values of floodplains. Objectives and actions that advance human safety and protect economic activities are more likely to succeed than those advance solely on ecological merits.
Decisions on target setting might also consider:	• Targets set for Chinook abundance and river mouth estuaries • "Functional floodplain area" can be defined according to existing 100-year floodplain, the existing mapped channel migration zone (CMZ) , and the riparian habitat area (as defined by the NMFS Biological Opinion)—or some combination thereof—where "functional" refers to hydrogeomorphic connection (i.e. a lack of hardened shoreline) as well as to the existence of wetland/forest land cover and natural flood storage.

Options for 2020 targets	*Option 0, discussed on May 25 (ECB) and 26 (Salmon Recovery Council):* • By 2020, 25% of degraded floodplain areas are restored or floodplain projects to achieve that outcome are underway across Puget Sound and there is no loss of floodplain function or area in any Puget Sound watershed relative to a 2012 baseline. *May 23 revisions to the ECB meeting materials:* Do not yet set 2020 targets, but conduct the work plan mentioned below and establish one of the following near-term targets: 1. In the near term, the total amount of functional floodplain area increases on a Sound-wide basis in rural areas and there is no loss of riparian or floodplain functions in any urban areas. 2. In the near term, the total amount of functional floodplain area increases on a Sound-wide basis and there is no additional loss of functional floodplain area in any individual watershed 3. In the near term, the functional floodplain area in 50% of Puget Sound's 16 major river basins increases. 4. In the near term, there is no additional loss of functional floodplain area or flood storage capacity due to development or shoreline armoring (i.e. structural hydromodifications) in any watershed.
ECB preferences	In written preferences expressed on May 25, 2011, 12 of 15 ECB members supported "option 0" as introduced and amended during the board's discussion. One member each supported option 1, option 4, and none of the options.
Salmon Recovery Council recommendation	The May 26, 2011 discussion by the Salmon Recovery Council expressed support for "option 0."
Staff recommendation	Adopt option 2 – This option is consistent with option 0 in that it expresses an expectation of a Sound-wide increase in functional floodplain area and no additional loss of functional floodplain for any river, but recognizes that more analysis and discussion is needed to define the extent of floodplain restoration that is achievable and results-oriented in the 2020 timeframe. Option 0 is extraordinarily ambitious. Both options 0 and 2 are well connected to the requirements of NOAA Fisheries' biological opinion related to development in floodplains as affected by the federal flood insurance program.
Other items that might be included in a Leadership Council resolution	a. Over the next two years, the Partnership and partners should work to develop ad refine indicators (and an associated 2020 targets) addressing floodplain extent and level of condition (connectivity, condition and flood storage capacity). This work will include identification of the most important floodplain areas on which to focus recovery and protection efforts (e.g.. the entire 100-year floodplain or a narrower, more dynamic and ecologically critical portion of the floodplain). The two-year work plan would include completion of Ecology's current Sound-wide mapping of CMZs and hydromodifications due to shoreline alteration (to be completed 2013) as well as development of a land cover-based measure of riparian and floodplain condition.

Table 11. Land development

A functioning, resilient ecosystem requires:	• Puget Sound landscapes that provide important habitat and hydrology functions and a land base to support the built environment for a growing human population
This measure provides an indication of:	• Extent to which development is focused to less important, less sensitive areas, thus limiting the amount of conversion occurring in areas that are relatively important for providing hydrologic and habitat functions. <u>Progress toward ecosystem recovery goals</u> • ***A healthy Puget Sound where*** *freshwater, estuary, nearshore**,** marine**,** and* ***upland habitats are protected, restored, and sustained*** • ***A quality of human life that is sustained by a functioning Puget Sound ecosystem***
Current conditions:	• Recent development trends relative to important and/or sensitive areas have not yet been analyzed and reported.
Bottom line of Science Panel member's review:	• "The memorandum provides general well-accepted scientific rationale for considering changes in land use associated with increasing human population and uses a scientifically based (and ultimately peer reviewed) decision support tool (Watershed Characterization) to guide land use to inform…indicators… I would assign a good/fair standard to the science provided here, emphasizing that the scope of work beyond what this memorandum covers is very large."
Biophysical constraints that affect what might be achieved by 2020:	• Spatial arrangements of waterways, shorelines, geologic features, and existing infrastructure
Socio-economic conditions that affect what might be achieved by 2020:	• Local government and private sector decisions and perspectives about growth inside and outside of urban growth areas (UGAs) • Patterns of existing development and infrastructure (including job centers and transportation corridors) • Preferences and values about where to live, importance of resource lands, etc. • Economic conditions between 2011 and 2020
Decisions on target setting might also consider:	• Setting this target in conjunction with the target for land use/land cover Dashboard indicator • Geographic overlays of watershed analysis units with UGAs, transportation corridors, job centers, etc. (not yet available)
Options for 2020 targets	Establish objective (revised after ECB discussion) but no numeric target: 1. Reduce the rate of conversion of forest cover to developed land cover in watershed characterization units identified for "protection" and "restoration" while accommodating a growing human population in the Puget Sound basin. (no options identified)
ECB preferences	In discussion and written preferences expressed on May 24, 2011, ECB members supported the proposal to delay action on this target until October 2011.

Staff recommendation	Delay setting a target on this topic until October 2011. As suggested below, continue analysis and engagement through summer and fall 2011 to bring target options to the Leadership Council at the October 2011 meeting.
Other items that might be included in a Leadership Council resolution	a. Convene expanded interdisciplinary team to continue analysis and stakeholder engagement to develop options for numeric targets for extent of land development in "Protection" and "Restoration" analysis units. Numeric target options would be available for Leadership Council consideration by October 2011 or soon thereafter as agreed by the interdisciplinary team. b. Establish a workgroup of the coordinated monitoring program to identify both the existing and needed data and resources to create and implement a system of land development and land use/land cover indicators to characterize local and regional trends by county and/or action area as well as changes of forest lands, farmlands, riparian areas.

Table 12. Land use/land cover

A functioning, resilient ecosystem requires:	• A mosaic of forestlands, agricultural lands, open space, natural lands (i.e., forest, prairie), and developed lands and related infrastructure to support habitat needs, support natural processes, and generate ecosystem services
This measure provides an indication of:	• Extent of forest cover and its conversion to developed land covers. <u>Progress toward ecosystem recovery goals</u> • ***A healthy Puget Sound where*** *freshwater, estuary, nearshore****,*** *marine****,*** *and* ***upland habitats are protected, restored, and sustained*** • ***A quality of human life that is sustained by a functioning Puget Sound ecosystem***
Current conditions:	• As of 2006, 58% of the non-federal lands of the basin were forested (CCAP). Historical forest cover has been described as covering almost 90% of the Puget Sound basin before European settlement (DNR 2010). • From 1996 to 2001, forest cover was converted to developed at a rate of 5.8 square miles per year. From 2001 to 2006, forest-to-developed conversion occurred at a rate of 3.4 square miles per year.
Bottom line of Science Panel member's review:	• Supports "suggestion … to re-link the land use/land cover target with the land development pressure reduction target and to delay them as a package… Additional detail is needed to defend the assumptions behind the target options."
Biophysical constraints that affect what might be achieved by 2020:	• Time needed for forests to grow and mature • Climate shifts and variability might affect (1) the distribution and seasonal timing of life cycle events of tree species; (2) forest disturbances; and (3) suitability of forest for cultivation
Socio-economic conditions that affect what might be achieved by 2020:	• Local and state government and private sector decisions and perspectives about the conversion of forest lands • Patterns of existing development and infrastructure (including job centers and transportation corridors) • Preferences and values about where to live, importance of resource lands, etc. • Economic conditions between 2011 and 2020, especially related to forestry and home building industries
Decisions on target setting might also consider:	• Regional implementation technical team (RITT) suggestion that this measure should focus on net gains for riparian areas and land uses necessary to restore the pattern of flows and water quality needed for salmon recovery and a suggestion to use information in the recovery chapters and other sources to determine the mix of land use required for salmon recovery and set that as the target. • Setting this target in conjunction with the target for land development • Recent rates of forest conversion to developed lands (need to confirm/understand signals from various data sources) • Interests in land cover other than forest

Options for 2020 targets	1. Extent of non-federal forest cover is stable or increases from 2006 to 2021, as measured by the Coastal Change Analysis Product (CCAP) land cover data product conversions from forested land in non-federal ownership to developed land classes. 2. Non-federal forest cover is converted to developed land cover at a rate of 0 to 0.08 percent per year from 2006 to 2021 (as measured by the CCAP land cover data product) 3. Non-federal forest cover is converted to developed land cover at a rate of 0.08 to 0.13 percent per year from 2006 to 2021 (as measured by the CCAP land cover data product) 4. Non-federal forest cover is converted to developed land cover at a rate of greater than 0.13 percent per year from 2006 to 2021 (as measured by the CCAP land cover data product) 5. Set no target in June 2011 – set this target in late 2011 (or later) concurrent with target setting for land development
ECB preferences	In written preferences expressed on May 24, 2011, five of 15 ECB members supported the proposal to delay action on this target (e.g., until October 2011). Five members supported option 1 if it also included federal lands. Three members supported option 1 as written and one each supported another option or offered no clear preference.
Staff recommendation	Delay setting a target on this topic until October 2011. We recommend using the expanded interdisciplinary team convened to advance land development targets and strategies to continue analysis and engagement about land cover/land use targets through summer and fall 2011 to bring target options to the Leadership Council at the October 2011 meeting.
Other items that might be included in a Leadership Council resolution	a. If appropriate, consider adjustments to target established in June 2011 based on analyses and decisions related to target setting for land development b. Develop a robust system of indicators to characterize local and regional trends in land cover and land use, especially related to forest cover, farmlands, and riparian areas. c. Identify, coordinate, and produce consistent data on changes in land use and land cover

Table 13. Management of On-Site Sewage Systems

A functioning, resilient ecosystem requires:	• Management of wastewater in a manner that protects aquatic resources and human health
This measure provides an indication of:	• Proper operation and maintenance of on-site sewage systems (OSS) <u>Progress toward ecosystem recovery goals</u> • ***A healthy human population supported by a healthy Puget Sound that is not threatened by changes in the ecosystem*** • ***Fresh and marine waters*** *and sediments* ***of a sufficient quality so that the waters in the region are safe for drinking, swimming, shellfish harvest and consumption, and other human uses and enjoyment, and are not harmful to the native marine mammals, fish, birds, and shellfish of the region.***
Current conditions:	[reserved]
Bottom line of Science Panel member's review:	• "It is not clear what [this objective] is based on from a scientific perspective… I recommend that the Leadership Council adopt these targets for wastewater and on-site sewage."
Biophysical constraints that affect what might be achieved by 2020:	(none identified)
Socio-economic conditions that affect what might be achieved by 2020:	• Funding and design of OSS operation and maintenance programs at 12 local health jurisdictions, including their approaches to inventorying systems, notifying homeowners, inspecting systems, and reporting results • Local health jurisdictions' designation of marine recovery areas and other areas with equivalent enhanced operation and maintenance programs • Resources available to property owners for OSS repair
Decisions on target setting might also consider:	• Targets for other indicators related to the impacts of OSS on the Puget Sound ecosystem: freshwater water quality, shellfish beds restored, swimming beaches • The pressure of OSS on sensitive marine environments is not fully addressed by other Dashboard indicators

Options for 2020 targets	1. By 2020, all on-site sewage systems in marine recovery areas are inventoried, 75% are current with inspections, and all failed systems are fixed. 2. By 2020, all on-site sewage systems in marine recovery areas are inventoried, 90% are current with inspections, and all failed systems are fixed. 3. By 2020, all on-site sewage systems in marine recovery areas are inventoried and are current with inspections, and all failed systems are fixed. 4. By 2020, all on-site sewage systems in marine recovery areas and other areas with equivalent enhanced operation and maintenance programs are inventoried, 75% are current with inspections, and all failed systems are fixed. 5. By 2020, all on-site sewage systems in marine recovery areas and other areas with equivalent enhanced operation and maintenance programs are inventoried, 90% are current with inspections, and all failed systems are fixed. 6. By 2020, all on-site sewage systems in marine recovery areas and other areas with equivalent enhanced operation and maintenance programs are inventoried and are current with inspections, and all failed systems are fixed.
ECB preferences	In written preferences expressed on May 24, 2011, five of 15 ECB members supported option 6. Four members supported option 5 and two others supported either option 5 or 6. Overall, 11 of 15 members supported either option 5 or 6. Three members did not indicate a preference and one member supported option 1.
Staff recommendation	Adopt option 5 – This option provides a clear target. It is ambitious, yet is achievable if adequate resources are applied to the problem.
Other items that might be included in a Leadership Council resolution	a. Reasonable timeframes for fixing failed systems (i.e., how long after inspection identifies a problem will a system be fixed?) need to be specified by local health jurisdictions and Department of Health b. Consider adjustments to target established in June 2011 based on analyses and decisions related to the effectiveness of OSS operation and maintenance programs and the need protect resources beyond designated marine recovery areas. c. Develop a robust system of indicators and strategies to effectively address and reduce harms from OSS

Table 14. Shoreline armoring

A functioning, resilient ecosystem requires:	• Dynamic shorelines maintained by coastal processes such as shoreline erosion and ecological exchange between terrestrial and aquatic systems.
This measure provides an indication of:	• Extent of armoring of marine shorelines. <u>Progress toward ecosystem recovery goals</u> • ***A healthy Puget Sound where*** *freshwater,* ***estuary, nearshore****, marine, and upland* ***habitats are protected, restored, and sustained*** • ***A quality of human life that is sustained by a functioning Puget Sound ecosystem***
Current conditions:	• Approximately 27% of Puget Sound's marine shoreline (666 miles) is currently armored. Extent of armoring continues to grow in recent years at a rate of about 1 mile per year from 2005-2010 (new + replacement – removals).
Bottom line of Science Panel member's review:	• "The shoreline armoring target document lays out target options that are consistent with our current understanding of the 'armoring problem.'...I do not believe that the uncertainties prohibit setting technically sound targets… [consider] use of targets related to the successful implementation of a viable No Net Loss regulation used in conjunction with a target based on armoring extent."
Biophysical constraints that affect what might be achieved by 2020:	• Rising sea-level and shifts in precipitation and runoff patterns may alter coastal erosion processes.
Socio-economic conditions that affect what might be achieved by 2020:	• Shoreline armoring is used to protect interests in shoreline properties. • The extent of shoreline armoring has increased over the past six years with recent placements concentrated in a few counties. • Population growth and development of shoreline properties is likely to result in continued armoring
Decisions on target setting might also consider:	• Target set for eelgrass • The degradation and impairment of function of drift cells – the fundamental unit of analysis of coastal erosion-transport-accretion processes – has been assessed in the change analysis of the Puget Sound Nearshore Ecosystem Restoration Program (PSNERP). • Armoring of shorelines is currently monitored and tracked by WDFW's database of hydraulic project approvals.
Options for 2020 targets	1. From 2011 to 2020, the annual amount of new armoring in Puget Sound is declining, but the total amount of new armoring is greater than the total amount of armoring removed (total miles added > total miles removed) 2. From 2011 to 2020, the total amount of new armoring in Puget Sound is equal to the amount removed during this period (total miles added = total miles removed) 3. From 2011 to 2020, the total amount of new armoring in Puget Sound is less than the amount removed (total miles added < total miles removed) 4. From 2011 to 2020, the total amount of new armoring in Puget Sound is less than the amount removed (total miles added < total miles removed); 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

ECB preferences	In written preferences expressed on May 25, 2011, 12 of 14 ECB members supported option 4. One members supported option 1 and one member supported another option.
Staff recommendation	Adopt option 4 – We recommend that the Leadership Council make a strong statement about the need to avoid new armoring at feeder bluffs to protect the supply of sediment to Puget Sound beach systems. The recommendation coincides with broad ECB support for option 4.
Other items that might be included in a Leadership Council resolution	a. Decisions about removing existing armoring and allowing the placement of new armoring should be sensitive to economic interests in shoreline properties and activities. b. Conduct assessments to project the extent of drift cell improvements needed for a functioning, resilient ecosystem and to support increases in Sound-wide extent of eelgrass. c. Develop a robust system of indicators and strategies to effectively address interests in beach systems and pressures on the ecosystem from other types of shoreline alteration.

Table 15. Wild Chinook salmon

A functioning, resilient ecosystem requires:	• A spatially and genetically diverse collection of viable Chinook salmon populations.
This measure provides an indication of:	• The status of this evolutionarily significant unit, currently listed as threatened under the federal Endangered Species Act. To achieve 95 to 99% probability that Puget Sound Chinook salmon can persist on their own for 100 years would require an abundance of 60,580 to 271,640 wild Puget Sound Chinook salmon, depending on the productivity of the Chinook populations. <u>Progress toward ecosystem recovery goals</u> • ***Healthy and sustaining populations of native species in Puget Sound, including a robust food web***
Current conditions:	• Abundance data back to 1986 indicate an overall decline over the last 25 years. • On average about 55,000 Puget Sound Chinook return for each year combined across harvest, spawning, or capture for hatchery brood stock
Bottom line of Science Panel member's review:	• "The Chinook indicator briefing paper is generally well done, building on the strong foundation of recovery planning work associated with ESA listing of Puget Sound Chionook."
Biophysical constraints that affect what might be achieved by 2020:	• Chinook salmon may respond to actions that directly affect their survival (e.g., improving passage, restricting harvest) over decades or less. Responses to other actions (e.g., improving hatchery practices, improving habitat quality) may take much longer. • Spatial distribution of populations is a key ecological attribute of Chinook salmon viability and the recovery plan suggests that at least 2 populations in each of five biogeographic regions should reach their recovery goals for Puget Sound Chinook to achieve a low risk of extinction.
Socio-economic conditions that affect what might be achieved by 2020:	• Level of effort in implementing habitat, harvest, and hatchery contributions to salmon recovery. • Effectiveness of regulatory and non-regulatory efforts to protect Chinook salmon habitat.
Decisions on target setting might also consider:	• Targets set for land use/land cover, benthic invertebrate communities in small streams, freshwater water quality, marine water quality, estuaries, eelgrass, floodplains, low summer flows, and Pacific herring • The Recovery Implementation Technical Team (RITT), which provides scientific advice to support salmon recovery in the region, notes that "it is highly unlikely that we will be able to detect a statistically significant change in abundance by 2020. This is due to the life history of salmon, and the complex responses of salmon to different changes in the ecosystem, and the uncertainty and lag between when actions are implemented and the response to those actions."

Options for 2020 targets	1. Through 2020, maintain current levels of abundance. 2. By 2020, demonstrate a statistically significant increase in wild Chinook salmon returning to Puget Sound. Preliminary statistical modeling indicates that a 40-45% increase over current levels (at least 22,000 more returning fish) would be needed for an improvement to be detectable in 2020. 3. By 2020, demonstrate increases of 45,000 to 50,000 wild Chinook salmon returning to Puget Sound, consistent with a linear trajectory toward achieving recovery planning ranges in 2050.
ECB preferences	In written preferences expressed on May 25, 2011, nine of 15 ECB members supported option 3. Four members supported option 2. One member each supported another option and expressed no preference.
Salmon recovery council preference	At its May 26, 2011 meeting, the Salmon Recovery Council voiced support for option 2 – with reference to reversing the decline and observing an increase in abundance
Staff recommendation	Adopt option 1– this recommendation is consistent with the RITT's suggestion that options 2 and 3 are "highly unlikely."
Other items that might be included in a Leadership Council resolution	a. Develop a robust system of indicators and strategies to effectively address all aspects of Puget Sound Chinook population viability, including population productivity, spatial distribution, and diversity.

Table 16. Southern resident killer whales

A functioning, resilient ecosystem requires:	• A viable population of southern resident killer whales
This measure provides an indication of:	• The status of this population segment, currently listed as endangered under the federal Endangered Species Act. ESA protections will no longer be needed if the population grows at an annual rate of 2.3% over a 28-year period, if population characteristics are indicative of a stable or increasing population, and if threats to the population segment have been addressed. <u>Progress toward ecosystem recovery goals</u> • ***Healthy and sustaining populations of native species in Puget Sound, including a robust food web***
Current conditions:	• The 2010 end of year census identifies 86 southern resident killer whales. The population has grown slowly in recent years with an annual growth rate of about 0.66%.
Bottom line of Science Panel member's review:	• "Sufficient scientific information exists for setting targets for the Southern Resident Killer Whale indicator. … The current reproductive capacity of the SRKW population would probably not support a 2.3% growth rate, even under ideal conditions so a 2.3% growth rate should be the upper limit of a target for growth."
Biophysical constraints that affect what might be achieved by 2020:	• Although this population segment currently includes 25 females of reproductive age, only 17 or 18 are reproductively active. At a 5-year calving interval, a population with 17 or 18 reproductively active females will produce 3-4 calves per year. Accounting for calf mortality and other mortality in the population, a 2.3% annual growth rate does not appear to be achievable in the near-term.
Socio-economic conditions that affect what might be achieved by 2020:	• Levels of ocean harvest and hatchery production of Chinook salmon from Puget Sound and Georgia Basin rivers affect the availability of prey for southern resident killer whales • Level of effort to address the threats to southern resident killer whale recovery might affect the rate of population recovery
Decisions on target setting might also consider:	• Targets set for Chinook salmon, toxics in fish, herring, eelgrass, etc.
Options for 2020 targets	1. Demonstrate progress toward biological criteria for downlisting southern resident killer whales by achieving 2.3% annual average growth rate for some period of years ending in 2020. At most, this might mean a 2020 end of census of 108 individuals based on 2.3% growth rate from 2010 to 2020. 2. By 2020, achieve an end of year census of southern resident killer whales of 95 individuals, which would represent a 1.0% annual average growth rate from 2010 to 2020. 3. By 2020, achieve an end of year census of southern resident killer whales of 92 individuals, which would represent a 0.66% annual average growth rate from 2010 to 2020.
ECB preferences	In written preferences expressed on May 25, 2011, five of 13 ECB members supported option 1 and four members supported option 2. Another four members supported none of the options.

Staff recommendation	Adopt option 3 and clarify that the expectation is to continue the slow, recent growth through 2020 and see improved growth rates (and reproductive capacity) in later years – this recommendation reflects the limited current reproductive capacity of the population and the anticipated time needed to recruit additional reproductive-age females.
Other items that might be included in a Leadership Council resolution	a. Develop a robust system of indicators and strategies to effectively address southern resident killer whale recovery and reduction in threats to recovery.

Table 17. Pacific herring

A functioning, resilient ecosystem requires:	• Herring to satisfy predators' consumption requirements, meet bait and other fishery needs, and assure sufficient herring for successful spawning and recruitment.
This measure provides an indication of:	• Biomass of herring in each genetic stock <u>Progress toward ecosystem recovery goals</u> • ***Healthy and sustaining populations of native species in Puget Sound, including a robust food web***
Current conditions:	• Overall, herring spawning abundance has declined in Puget Sound since the 1970s and the condition is depressed. Much of the decline is attributed to the decrease of the Cherry Point stock.
Bottom line of Science Panel member's review:	• "Calculating targets based upon a stock specific basis, is the best approach with modification. In addition to calculating targets based on stocks, there should also be goals set for age structure and stock productivity. A collapse in age structure is an indicator that the population is not doing well, even if the biomass is stable."
Biophysical constraints that affect what might be achieved by 2020:	• Food web modeling suggests that predators in central Puget Sound need 8,170 mt of juvenile and 2,540 mt of adult herring annually. • Age composition of Cherry Point and other herring stocks has been skewed to younger ages over time; this shift may reduce reproductive capacity and impair the capacity of the population to recover.
Socio-economic conditions that affect what might be achieved by 2020:	• Human population growth and associated land development may reduce the amount or quality of spawning habitat for herring. • Management of herring commercial harvest
Decisions on target setting might also consider:	• Targets set for shoreline armoring and eelgrass
Options for 2020 targets	1. By 2020, maintain 90% of the mean of annual cumulative estimated herring spawning biomass from 1986-2010 indicated by a. 2,520 tons for Cherry Point stock b. 710 tons for Squaxin Pass stock c. 10,876 tons for all other stocks combined 2. By 2020, maintain 100% of the mean of annual cumulative estimated herring spawning biomass from 1986-2010 indicated by a. 2,800 tons for Cherry Point stock b. 789 tons for Squaxin Pass stock c. 12,084 tons for all other stocks combined 3. By 2020, achieve biomass targets based on 25% of the unfished biomass for each genetic stock unit. (Specific targets not yet available) 4. By 2020, achieve biomass targets based on alternative thresholds for fishery and ecosystem needs. (Specific targets not yet available)

ECB preferences	In written preferences expressed on May 25, 2011, nine of 13 ECB members supported option 2. Two members supported option 1. One member each supported option 4 and another option.
Staff recommendation	Adopt option 2 – this recommendation is consistent with the preference expressed by the ECB and is the best available to address the Science Panel reviewers' suggestion
Other items that might be included in a Leadership Council resolution	a. Develop a robust system of indicators, monitoring, and strategies to effectively address all aspects of Pacific herring population viability, food web support, and provisioning for fisheries. b. Develop herring biomass thresholds based on biomass required for herring viability, fishery needs, and/or ecosystem needs

Table 18. Upland birds

A functioning, resilient ecosystem requires:	• Viable populations and communities of birds associated with the diversity of Puget Sound terrestrial ecological systems
This measure provides an indication of:	• Population size of marbled murrelets. The Recovery Plan for Marbled Murrelets under the Endangered Species Act (U.S. Fish and Wildlife Service 1997) calls for 'stabilizing the population size at or near current levels' suggesting that this population size is "acceptable." <u>Progress toward ecosystem recovery goals</u> • ***Healthy and sustaining populations of native species in Puget Sound, including a robust food web***
Current conditions:	• At-sea densities of marbled murrelets in this region have declined from 2001-2010 at an annual rate of 7.34%
Bottom line of Science Panel member's review:	• "The paper does a good job of characterizing the challenges with recovering the species but does not explicitly address which target level is achievable for a given effort. Data suggest that there will be a considerable lag in marbled murrelet recovery pending the re-growth of old-growth forest."
Biophysical constraints that affect what might be achieved by 2020:	• Spend most of their lives in the marine environment where they forage in near-shore areas and consume a diversity of prey species, including small fish and invertebrates. • Murrelet nesting habitat use is positively associated with the presence and abundance of mature and old-growth forests, large core areas of old-growth, low amounts of edge habitat, reduced habitat fragmentation, and proximity to the marine environment. The presence of platforms (large branches or deformities) used for nesting is the most important characteristic of their nesting habitat • A climate-induced increase in fire frequency in forests used by nesting murrelets would reduce the amount of late-succession and old-growth forests used as nesting habitat by murrelets and increase forest fragmentation, which could also result in increased nest predation rates
Socio-economic conditions that affect what might be achieved by 2020:	• Land development fragments habitat, increases predation, and reduces forest habitat extent. • Human activities in forests with marbled murrelet nesting habitat increases avian predation
Decisions on target setting might also consider:	• Ongoing development of a breeding bird indicator to supplement or replace the marbled murrelet indicator on the Partnership's Dashboard of Ecosystem Indicators • Targets set for land cover/land use and land development • A numeric target for Option 2 is not yet available, it might be available in 1-2 months or might require original analysis • Additional analysis is needed to evaluate whether Options 3 and 4 are achievable given known murrelet survival and fecundity rates.

Options for 2020 targets	1. Achieve a stable or increasing marbled murrelet population size for the 10-year period from 2011-2020. 2. By 2020, marbled murrelet populations demonstrate rates of increase consistent with predicted habitat improvements. 3. By 2020, recover marbled murrelet population size to 2001 levels: 8,936 individuals with 95% CL of 5,536 to 12,583 individuals. 4. By 2020, recover marbled murrelets to population size that is 15 percent above 2001 levels: 10,276 individuals (assumes ~15% above 2001 levels is a fair estimate of 1997 levels based on 4%/year decline)
ECB preferences	In written preferences expressed on May 25, 2011, seven of 14 ECB members supported option 4. Three members supported option 2. Two members each supported option 3 and supported none of the options.
Staff recommendation	Adopt option 1 – this recommendation is the best that can be expected for 2020 given the 7.4% annual declines seen from 2001-2010. This recommendation is contrary to the preferences expressed by ECB members, none of whom supported this option.
Other items that might be included in a Leadership Council resolution	a. Develop a robust system of indicators, monitoring, and strategies to effectively address all aspects of terrestrial birds and their habitat needs.

Source Materials

Land Development

- Land Development – Setting Targets for Pressure Reductions Technical Memorandum; J Leckrone Lee, D Peters, K Pierce, S Stanley, and K Stiles; March 25, 2011 DRAFT
- Land Development -- Addendum to Technical Memorandum (May 11, 2011)

Land Use/Land Cover

- Conversion of forested to developed cover in non-federal ownerships (Land-use/Land-cover) -- Setting Targets for Dashboard Indicators Briefsheet; KB Pierce, Jr.; March 25, 2011 DRAFT
- Land use/land cover -- Addendum to Brief Sheet (May 12, 2011)

Benthic Invertebrate Communities in Small Streams (originally titled Runoff from the Built Environment)

- Runoff from the Built Environment – Setting Targets for Pressure Reductions Technical Memorandum; B Wulkan; March 23, 2011 DRAFT
- Runoff from the built environment – Revised addendum to Technical Memorandum (May 16, 2011)

On-site Sewage Systems and Dissolved Oxygen in Marine Waters (originally titled Wastewater)

- Wastewater and On-Site Sewage Systems – Setting Targets for Pressure Reductions Technical Memorandum; D Fagergren; April 7, 2011
- Wastewater and onsite sewage systems – Revised pressure reduction objectives (May 11, 2011)

Toxics in Fish

- Toxics in fish – Setting Targets for Dashboard Indicators Briefsheet; JE West; May 31, 2011 DRAFT

Marine Sediment Quality (originally titled Toxics in Sediment)

- Toxics in sediments – Setting Targets for Dashboard Indicators Briefsheet; M Dutch, E Long S Weakland, V Partridge, and K Welch; March 23, 2011 DRAFT
- Toxics in sediments – Amendment following target setting workshop; M Dutch (May 6, 2011)
- Revised target options for toxics in sediments (May 17, 2011)

Freshwater Water Quality

- Freshwater water quality index – Setting Targets for Dashboard Indicators Briefsheet; D Hallock; March 23, 2011 DRAFT
- Freshwater water quality index – target summary (May 16, 2011)

Marine Water Quality

- Marine water quality composite index – Setting Targets for Dashboard Indicators Briefsheet; C Krembs; May 10, 2011 REVISION

Swimming Beaches

- Swimming beaches – Setting Targets for Dashboard Indicators Briefsheet; J Bennett; March 23, 2011 DRAFT

River Mouth Estuaries (originally titled nearshore restoration and shoreline alteration)

- Setting Targets for Estuaries, Nearshore Restoration, and Shoreline Alteration; Technical Memorandum; J Mulvihill-Kuntz, M Schneidler, K Currens, and K Stiles; May 16, 2011 REVISED DRAFT
- Footnote (May 20, 2011)

Floodplains

- Floodplains technical memo (April 17, 2011)
- Floodplains addendum – target options (May 13, 2011)
- Floodplain target recommendations (May 16, 2011)

Shoreline Armoring

- Shoreline armoring – Setting Targets for Dashboard Indicators Briefsheet; R Carman, K Taylor, and H Shipman; May 18, 2011 REVISION

Low Summer Stream Flow (originally titled Water Availability)

- Water availability Setting Targets for Dashboard Indicators Briefsheet; P Pickett.; March 25, 2011 DRAFT

Recreational Fishing Permits

- Recreational fishing license sales – Setting Targets for Dashboard Indicators Briefsheet; E Kraig; March 22, 2011 DRAFT

Southern Resident Killer Whales (Orcas)

- Southern resident orcas – Setting Targets for Dashboard Indicators Briefsheet, S Redman, May 23, 2011 Revision

Chinook Salmon Abundance

- Wild Chinook salmon abundance – Setting Targets for Dashboard Indicators Briefsheet; K Currens; May 5, 2011 REVISION

Pacific Herring

- Pacific herring spawning biomass – Setting Targets for Dashboard Indicators Briefsheet; K Stick and W Palsson; May 10, 2011 REVISION

Upland Birds

- Terrestrial birds – Setting Targets for Dashboard Indicators Briefsheet; S Pearson; May 3, 2011 REVISION

Funding

- Funding for Puget Sound – Setting Targets for Dashboard Indicators Briefsheet; J Cahill; March 22, 2011 DRAFT

Action Agenda Implementation

- Action Agenda engagement -- Setting Targets for Dashboard Indicators Briefsheet; K Boyd, M Daily, A Mitchell, and M Neuman; March 22, 2011 DRAFT

General

- Summary of April 14 Target Setting Workshop
- Summary of April 18 Target Setting Workshop
- Summary of April 19 Target Setting Workshop
- Summary of May 12 Target Setting Workshop
- Summary of May 13 Target Setting Workshop
- Compilation of Science Panel members' reviews of target setting technical materials
- Compilation of written comments on Partnership target setting through June 6, 2011