

Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) Strategic Science Review Panel 3-5 June 2008 Meeting

Summary Recommendations

The Strategic Science Review Panel (SSRP) convened for its first meeting in Seattle in June 2008. The Panel addressed five broad questions provided by the Project Management Team. The Panel's Recommendations are summarized here.

Problem Identification

- Articulate problems with the Puget Sound nearshore clearly and relate these problems directly to valued ecosystem components or other socially important functions, services, or goods.
- Use information from other ecosystems to support scientific justification of the problems and to identify local data gaps.
- Include future human population pressures (projected settlement and land use patterns) and institutional and management challenges explicitly in the problem definition.

Program Vision

- Engage stakeholders as soon as possible in developing a common vision, possibly including activities similar to the *Multi Vision Integration to Action* exercise.

Scientific Foundation

- Incorporate socio-economic factors into conceptual models to illustrate ways that changes in the system will impact people as well as ecosystem functions, goods and services.
- Integrate the current conceptual modeling approaches and include other non-nearshore limiting or confounding factors to show how the elements of the system work together now and in the future.
- Conduct local case studies on rates of shoreform change, possibly involving graduate student researchers, to better understand how quickly the system is expected to change, and why.

Incorporation of Best-Available Science

- Expand social science expertise on PSNERP teams. Specifically, include an expert in decision analysis to support application of program tools to the restoration strategy, in recognition of the need to systematically analyze tradeoffs amongst competing objectives.
- Develop and implement as soon as possible a structured process of stakeholder involvement led by experts in public engagement on technical issues. A pilot project with select stakeholders would provide guidance on how to reach intended outcomes.
- Explore critical uncertainties through pilot restoration experiments and incorporate results into project planning, using replication when possible.

Gaps in Logic or Process

- Address uncertainties associated with the likelihood of implementing restoration actions regarding not only scientific factors, but also societal factors (laws, regulations, attitudes, beliefs, values).
- Conduct a complete example of the envisioned PSNERP process in a pilot area once the Vision has been developed in order to convincingly demonstrate the logic and feasibility of the programmatic approach.
- Address potential uncertainties associated with climate change impacts to social and nearshore systems in both conceptual models and restoration strategy options.
- Consider developing a simplified shoreline scorecard (based on multivariate modeling approach) that has no more than 5 grades.

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Report

The Strategic Science Review Panel (SSRP) convened for its first meeting in Seattle in June 2008. The meeting included presentations and discussions with Project Managers and members of the Nearshore Science Team (NST), closed sessions for discussion amongst the SSRP, a field trip to representative sites in southern Puget Sound, and a verbal report of the Panel's preliminary findings and recommendations. All members of the SSRP were present for the meeting (see listing in Attachment 1). The objectives of the meeting were to:

- Develop Panel understanding of Puget Sound system and PSNERP.
- Review and comment on scientific foundation documents as adequate for a systematic needs assessment.

The agenda for the meeting is included as Attachment 2. Prior to the meeting the Panel held one conference call for organizational purposes and received extensive background materials on PSNERP and the Puget Sound system (listed in Attachment 3). The second meeting of the SSRP is tentatively scheduled for late Fall 2008.

The Panel was asked to consider the following five questions:

1. *Have we sufficiently defined the problem with, or risk to, Puget Sound nearshore ecosystems that explains for the need and our approach to comprehensive restoration/preservation?*
2. *Is our vision for this program clearly articulated and understandable?*
 - *If not, what don't you understand?*
 - *What changes can we make to improve?*
3. *From the standpoint of your scientific discipline, what is missing from the scientific foundation of this program that could be addressed in the near-term?*
4. *Based on your experience with large-scale ecosystem restoration programs, do you have any concerns (or any compliments!) about the way we are trying to incorporate the best science?*
5. *Are there any gaps in the products we are generating, or the logic of the process, that you think may impede our ability to complete our study?*
 - *What can we change or alter in the steps we have yet to complete?*
 - *When and how should we increase our ability to achieve interdisciplinary synthesis and integration?*

This report summarizes the Panel's responses to these questions, as well as some additional comments on PSNERP, and provides recommendations for consideration by the PSNERP Executive Committee.

PROBLEM IDENTIFICATION

The Panel finds that the fundamental problem(s) facing the Puget Sound nearshore now and in the future had not been sufficiently defined and justified. This is a matter of considerable concern as communicating these problems to decision-makers and the public will be essential to the Program's success. The Panel is surprised that many Puget Sound residents believe that the Puget Sound ecosystem is in good condition¹ thus providing a real challenge for the program in garnering widespread support. The development of a clearer statement of the problem will help with this crucial outreach.

PSNERP does an excellent job of showing how the character of nearshore lands and intertidal areas has been changed by human activities. However, it is not readily apparent *why* those changes represent a problem(s) that scientists or stakeholders should be concerned about, (i.e. which ecosystem processes and/or valued ecosystem components (VECs) have been affected, and to what degree?). It is possible that linkages between nearshore change and ecosystem degradation have not been directly studied or are incompletely understood. However, if such linkages have been identified outside of Puget Sound the NST should use such information to support PSNERP. If the purpose of the Feasibility Study is '*to evaluate significant ecosystem degradation in the Puget Sound Basin*' then it must be clear to all that there indeed is significant ecosystem degradation. The nearshore problem could be defined in technical terms such as reduced rearing habitat for various groups of fish, limited food availability to upper trophic levels, or in terms of lost shellfish beds, and /or increased shoreline erosion, but the Panel asserts it is important that the problem statement(s) be *directly linked to* nearshore features, goods, or services of importance to a range of stakeholder groups. Effective translation of technical ecosystem problems has been achieved in many areas using a Report Card approach².

The change analysis currently underway seems to represent the NST's approach to problem definition by quantifying the scale of alteration to the nearshore. The analysis is ambitious and when completed will provide an important foundation for restoration planning. However, because the analysis documents change between two points in time more than a century apart it cannot be used to estimate the current trajectory of change. The Panel suggests that including at least an additional data point – possibly in the early 1980s - would capture the rapid rise in human population and the role of major environmental regulations allowing the analysis to better demonstrate the activities which have contributed to the degradation. These data would help communicate the need for action. Given that the Feasibility Study must address future conditions, additional temporal data would better inform planning (by showing past vs ongoing patterns of alteration), even if the problem statement is best defined in terms of current system conditions. An example might be the trends in number of shellfish beds closed to harvesting because of bacterial contamination from sewage or leaky septic tanks.

¹ Puget Sound Partnership public opinion research available at:
http://www.psparchives.com/our_work/education/education_research.htm

² For example: http://www.psp.wa.gov/downloads/SOS07/2007_stateofthesound_fulldoc.pdf;
<http://www.bay.org/Scorecard/2005.Bay.Index.Scorecard.pdf>; <http://www.umces.edu/2007bay.html>;
http://www.shim.bc.ca/atlasess/fbc/ss3/Front_Page.html

The Panel notes that all structural change identified in the Puget Sound nearshore is categorized negatively by the term “impairment”. The Panel challenges this assumption of exclusively negative impact both in terms of the ecosystem and also the human system. Could a geomorphic change or the elimination of a shoreform altogether ever produce an ecological benefit? Or, perhaps more likely, a socio-economic benefit? The change analysis documents that the creation of various forms of shoreline infrastructure (e.g. ports, docks, railroads, roads, protected private property and parks) has eliminated certain habitats, and then infers losses of various ecosystem goods and services. While this is generally a reasonable approach, it appears to ignore the fact that while many ecological goods and services were lost, other services of value to people were created (e.g. transportation, secure housing, recreation). PSNERP should emphasize the need for balance amongst these competing uses of shoreline environments, so that **all** services can be sustained over the long term (ecological, economic, and social). The Panel contends that some of the solutions to ecosystem degradation likely lie with improved institutional or management structures. This makes it even more important that nearshore ecosystem problems are linked more directly with societal needs.

Recommendation(s):

- Articulate the problem with the Puget Sound nearshore – as indicated by identified symptoms that people not familiar with the science of local ecosystems can understand – clearly and relate these problems directly to VECs or other socially important functions, services, or goods.
- Utilize information from other ecosystems to support scientific justification of the problems and to identify local data gaps.
- Include future human population pressures (projected settlement and land use patterns) and institutional and management challenges explicitly in the problem definition.

Additional suggestions:

- Extend the change analysis to include more than two time points at least in selected areas, to better demonstrate patterns of change over time.
- Provide a more balanced presentation in the change analysis by acknowledging that losses in ecological goods and services were accompanied by gains in economic and social services.
- Utilize a simple report card approach to communicate problems with the nearshore ecosystem.

PROGRAM VISION

As with problem identification, the Panel asserts that the future vision driving the project could and should be better defined and articulated. There seem to be many – possibly even competing – visions for how PSNERP will improve the Puget Sound nearshore in the future. The Panel notes that the strongest sense of vision came from the NST who generally defined the vision to be process-based, large-scale nearshore restoration. The Panel asserts that this is a worthy goal (or vision) in term of approaching the problem, but does *not* necessarily represent the common vision of various stakeholders around the Sound. A well articulated vision for PSNERP will be

necessary to guide decisions on what level of restoration is necessary, how to measure and define success, and how to prioritize actions.

The Panel finds that the modified conceptual models and the current level of development of the change analysis provide a sound basis for PSNERP to develop a vision to guide restoration planning. A major challenge for PSNERP will be to clearly and understandably communicate to partners and the public the complex nature of both the problem and of the potential programmatic solutions. The public workshops held in summer 2008 were likely a major contribution to this communication. The Panel notes that in some other large-scale remediation or restoration efforts, the vision driving program actions was identified and developed by stakeholder groups³ and problems have been identified when the vision was not developed by stakeholders⁴. Such processes must also engage scientists and engineers to assure that visions are technically achievable and address the problems at hand. At this stage in its development, PSNERP should engage a group of stakeholders to begin development of a vision of a restored nearshore ecosystem. The ‘*Multi Vision Integration to Action*’ exercise recently undertaken by the PSNERP team appears to the Panel to be a promising approach to stimulating such thinking about the future state of the system.

Recommendation(s):

- Engage stakeholders early in developing a common vision, possibly including activities similar to the *Multi Vision Integration to Action* exercise.

Additional suggestions:

- Develop program vision with stakeholders using change analysis to illustrate nearshore change over time.
- Redesign the Level 2 and Level 3 conceptual model graphics to be more accessible to the public and inform the visioning process.

SOUNDNESS OF SCIENTIFIC FOUNDATION

The Panel is impressed with the process-based approach of PSNERP, the focus on ecosystem resilience, and the use of ecosystem functions, goods and services (EFG&S) in planning. The Panel acknowledges the large amount of Puget Sound-specific data being used to support planning. Due to the complexity of the approach and the diverse character of the nearshore system, the Panel sees a real challenge in translating scientific products for the public and a need for technically-informed public outreach support to serve the project.

The Conceptual Model framework developed by the NST is impressive. It could provide an improved foundation for PSNERP planning and communication if the model format was expanded to include more supporting information. This could be achieved using narrative and

³ Remedial Action Plans for the Great Lakes: <http://www.ec.gc.ca/raps-pas/default.asp?lang=En&n=A290294A-1>;
Water Use Plans for Hydroelectric Facilities in British Columbia:
<http://www.bchydro.com/environment/wateruse/wateruse1775.html>;

Bay Delta Public Advisory Committee: <http://calwater.ca.gov/calfed/oversight/BDPAC/index.html>

⁴ Reed (2006) – see Attachement 4 for full citations of documents and reports referenced in text and footnotes.

modification of diagrams to consider the relative importance, certainty and predictability on model linkages. Such approaches have been used in both California⁵ and Louisiana. Alternatively, Level 4 diagrams could specifically identify hypotheses underlying the linkages between boxes, an approach used in Impact Hypothesis Diagrams or Hypotheses of Effect⁶.

The Panel notes the importance of linking ecological and human factors as PSNERP pursues its future work. If PSNERP uses EFG&S⁷, conceptual models should include human values and changes in human well being as well as changes in the ecosystem. Presently the Conceptual Modeling approach focuses on the dynamics of the natural system. For use in planning and communication in PSNERP, the Panel asserts that it is important to also incorporate social or economic aspects of the system, both in terms of drivers and outcomes. For instance, a reduction in shoreline armoring might increase sediment availability for the ecosystem but will also result in increased erosion of property. Changes in incentives and regulations could have an enormous effect on the levels of various stressors, and are therefore a key driver of future ecosystem changes.

An important element of the scientific foundation of PSNERP that the Panel suggests needs strengthening is a clear documentation of the linkage between shoreline development actions (a major component of nearshore change) and VEC health in the context of other environmental stressors in Puget Sound (such as toxic contamination and climate change). Such a review of the environmental consequences of shoreline modifications in the broader context of other 20th century changes could result in a paper in a scholarly journal, further contributing to a credible scientific foundation for PSNERP. The Panel identifies the need to better relate the different types of conceptual models used in the program (e.g., Levels 3 and 4 and VEC conceptual models). Scientific linkages from process-based restoration actions to VECs need to be made explicit where they exist, understanding that in some cases, direct linkages may not exist. The Panel suggests using data from outside the Puget Sound area to help support these linkages where information from within the system is not available.

The Panel is concerned that the change analysis is based on two time points and encouraged the NST to better resolve the changes by incorporating additional analyses from the 20th Century. The Panel questions the utility of the 9-point rating system used in the change analysis, noting that the system makes it difficult to evaluate the restoration benefits in the mid-ranges where restoration actions would likely focus. How does valuing change as a 4 or 5 assist prioritization decisions? The Panel is concerned that this rating system could give a false sense of precision to those using it in the Strategic Needs Assessment. It may be helpful to consider the *sequence* of restoration actions in addition to (or instead of) their relative priority (e.g. restore within the next 10 years, next 20 years, or next 30 years).

The scientific foundation documents provided to the Panel do not include a thorough discussion of factors such as sea-level rise, the Pacific Decadal Oscillation, or other oceanographic processes which can influence both nearshore dynamics and nearshore biota which have pelagic

⁵<http://www.delta.dfg.ca.gov/erpdeltaplan/docs/Framework%20for%20the%20Development%20of%20DRERIP%20Ecosystem%20Conceptual%20Models%20053105.pdf>

⁶ Jones et al. (2006).

⁷ as defined by the Millennium Ecosystem Assessment

larvae or key life history stages in the ocean, e.g., via changes in sea surface temperature. The Panel is concerned that these factors could confound or mask future restoration results. The Panel also wonders about the underlying variability in the character of the nearshore system. How stable are these landforms over time, can change in erosion rates be measured, and how much do they vary locally? Understanding natural trajectories of change will be crucial to applying the change analysis for restoration planning. One way to address this is by conducting local studies of shoreform change and investigating the ecological implications of those changes.

Recommendation(s):

- Incorporate socio-economic factors into conceptual models to illustrate ways that changes in the system will impact people as well as EFG&S.
- Integrate the current conceptual modeling approaches and include other non-nearshore limiting or confounding factors to show how the elements of the system work together now and in the future.
- Conduct local case studies on rates of shoreform change, possibly involving graduate student researchers, to better understand how quickly the system is expected to change, and why.

Additional suggestions:

- Better articulate the link between process-based restoration and VECs where direct links exist.
- Expand the Conceptual Model to include regulatory, institutional, and other socio-economic factors.
- Include additional time periods in the change analysis, e.g., 1980's, to better identify current trajectories of change

INCORPORATION OF BEST AVAILABLE SCIENCE

The Panel is impressed with the use of the multivariate analytical approach in the Change Analysis and finds the tool useful – albeit difficult to understand, which could present a challenge with outreach. Also, the Panel considers the change analysis innovative and creative and believes it will serve the program's future needs.

The Panel remains unsure how the Conceptual Models and the Change Analysis will be used to evaluate restoration approaches, to compare restoration alternatives, or changes in EFG&S. The Panel again notes the need to involve stakeholders and weigh socio-economic objectives and to develop a mechanism to weigh tradeoffs related to achieving ecosystem function versus social objectives. In the Panel's experience with other restoration efforts, this methodology should be thought through early so that scientific products can be tailored or modified to inform the engagement. Many different approaches have been used in other areas⁸. The Panel suggests a

⁸ For example, see:

Water Use Planning Guidelines for British Columbia <http://www.obwb.ca/fileadmin/docs/wup.pdf>;

USACE Louisiana Coastal Protection and Restoration Study

(<http://lacpr.usace.army.mil/Report/Draft%20Appendices/Risk%20Informed%20Decision%20Framework%20Appendix.pdf>)

pilot group of 20-25 stakeholders could be asked to develop objectives. These objectives could then form the basis of performance measures and tools to relate objectives to future scenarios. Because of its strong leadership, Pierce County could be used to spearhead this effort. However, moving forward in this area requires that additional expertise in decision analysis⁹, structured facilitation, and/or stakeholder engagement be added to the planning team. Public input must be obtained in a structured manner to effectively inform difficult prioritization decisions ahead about restoration options.

How PSNERP will incorporate monitoring and adaptive management is of great interest to the Panel, especially considering the need to align grass roots restoration efforts with the top-down USACE restoration objectives of PSNERP. Management experiments, the Panel asserts, will be critical in the near-term to resolve key uncertainties and should include a small number of intensively monitored shoreline reaches. The development of the Adaptive Management framework for PSNERP is a critical future step. The framework needs to build on the shoreline classification as strata within which restoration action ‘replicates’ and reference sites could be monitored. On a small scale, the Panel is encouraged to see the Before-After-Control-Impact design of the monitoring work funded by the local municipality at Seahurst Park in Burien.

Recommendation(s):

- Expand social science expertise on PSNERP teams. Specifically, include an expert in decision analysis to support application of program tools to the restoration strategy, in recognition of the need to systematically analyze tradeoffs amongst competing objectives.
- Develop and implement as soon as possible a structured process of stakeholder involvement led by experts in public engagement on technical issues. A pilot project with select stakeholders would provide guidance on how to reach intended outcomes.
- Explore critical uncertainties through pilot restoration experiments and incorporate results into project planning, using replication when possible.

Additional suggestions:

- Improve understanding of variability with intensively monitored shoreline reaches tied to management experiments.

GAPS IN LOGIC OR PROCESS

The Panel notes a need to consider the (socially-determined) probability of a restoration action actually occurring in order to capture how society is likely to respond to current and future restoration actions and environmental degradation. This should be considered as part of the Future Risk Assessment work. The Panel contends that this understanding of likely societal acceptance will also help secure political support and long-term funding, and help the program identify socially-acceptable tradeoffs between the nearshore environment and society or property owners.

⁹ Hammond et al. (1999), Gregory and Keeney (1994).

The Panel suggests more interaction and formal links between the NST and the Implementation Team to avoid misunderstandings and meet PSNERP's timeline. This will be especially important as NST's Change Analysis is used in the Strategic Needs Assessment. The Implementation Team's practical questions will force the NST to apply their excellent principles, ideas and tools to hard decisions on restoration priorities. The Panel also notes the need for early thinking about prioritization and sequencing to develop a restoration plan that makes the best use of limited money, time, or other constraints, and that meets the public's expectations. The Panel understands that the team has not developed these approaches yet but urges consideration of the methods and approaches needed throughout entire planning process as soon as possible.

As noted under *Soundness of Scientific Foundation*, the Panel reinforces that factors associated with climate change and spatial and temporal variability must be incorporated into the project.

Recommendation(s):

- Address uncertainties associated with the likelihood of implementing restoration actions regarding not only scientific factors, but also societal factors (laws, regulations, attitudes, beliefs, values).
- Conduct a complete example of the envisioned PSNERP process in a pilot area once the Vision has been developed to convincingly demonstrate the logic and feasibility of the programmatic approach.
- Address potential uncertainty associated with climate change impacts to social and nearshore systems in both conceptual models and restoration strategy options.
- Consider developing a simplified shoreline scorecard (based on multivariate modeling approach) that has no more than 5 grades.

Additional suggestions:

- Improve formal connections between the NST and the Implementation Team.

OTHER POINTS

The Panel commends PSNERP team members for their dedication to this complex planning effort. PSNERP is fortunate to have such experienced and credentialed scientists working on the NST, and the Panel is impressed with the quality and amount of work products produced to date. The established peer-review process is commendable and its application throughout the planning process, not just on the final feasibility report, will serve the program well. The Panel encourages the NST to seek publication of some of their work, especially the change analysis, in the scholarly literature. This will both assist other restoration efforts still seeking approaches to analyse complex landscape changes, and provide broader recognition of the scientific foundation of PSNERP.

Communicating and co-ordinating with the many restoration-oriented efforts in Puget Sound is essential to provide clear messages to the public, to avoid duplication and effectively leverage all available sources of funding for restoration planning and implementation. The Panel encourages PSNERP Project Managers to ensure other efforts are aware of the science being developed through PSNERP, and allow its use by other parties and interests as appropriate.

ATTACHMENT 1

MEMBERS OF THE STRATEGIC SCIENCE REVIEW PANEL

Maggi Kelly. Faculty Director for the Geospatial Imaging & Informatics Facility, College of Natural Resources, University of California, Berkeley

Colin Levings. Scientist Emeritus Canada Department of Fisheries and Oceans and Adjunct Professor, Institute for Resources, Environment, and Sustainability, University of British Columbia

David Marmorek. President of ESSA Technologies Ltd, and Adjunct Professor, School of Resource and Environmental Management, Simon Fraser University

Susan Peterson. Teal Partners, Rochester, MA.

Denise Reed. Professor, Department of Earth and Environmental Sciences, University of New Orleans.

John Wells. Professor of Marine Geology, Director of the Virginia Institute of Marine Science and Dean of the School of Marine Science at the College of William and Mary.

ATTACHMENT 2

<p>NEARSHORE STRATEGIC SCIENCE REVIEW PANEL Meeting 1 Agenda</p> <p style="text-align: center;">June 3 – 5, 2008 Generally, 8:30 a.m. to 5 p.m.</p> <p><u>University of Washington Campus and Field Trip Locations</u></p>				
<p>Objectives:</p> <ol style="list-style-type: none"> 1. Develop Panel understanding of Puget Sound system and PSNERP restoration program 2. Review and comment on scientific foundation documents as adequate for systematic needs assessment. 				
<p>Materials:</p> <ul style="list-style-type: none"> • laptop and memory stick • copy of agenda • PSNERP GI Background document 				
Time	Topic	Process	Who	Background Documents
<p>Day One – UW Campus, Ocean Science Bldg. Dean’s Conf. Room</p>				
8:30	Intro	Welcome & Introductions		
8:45		Review agenda and logistics for field trip		Agenda
9:00	Program Overview	Puget Sound Nearshore Ecosystem Restoration Project <ul style="list-style-type: none"> • Mission and purpose • Relationship with and distinction from other restoration initiatives in Puget Sound • Roles and responsibilities • Timelines • Funding • Guiding Principles 	Hargrave Tanner Others?	PSNERP GI Background
10:00		➤ Discussion: Where is PSNERP science heading and how does the Strategic Science Review Panel fit into this process?		
10:30	BREAK		All	
10:45	Background on Puget Sound nearshore ecosystem structure	Focus on the Puget Sound nearshore ecosystem structure (structured by topic areas) <ul style="list-style-type: none"> • Nearshore Classification (geomorphic typology) • Valued Ecosystem Components 	Shipman Dethier	Typology doc 2007-07 VEC
12:00	LUNCH		All	

1:00	PS Ecosystem (cont'd)	<ul style="list-style-type: none"> Relationship of nearshore ecosystem structure to processes and function: Nearshore Conceptual Model "Process Unit" approach and the organization of geospatial data 	Simenstad Burke	2006-03 CM
2:30	BREAK	<i>By this time, panelists need to have a good understanding of the system and how it works and how PSNERP NST has developed a systematic approach to categorizing ecosystem structure, process and function</i>	All	
2:45		<ul style="list-style-type: none"> ➤ Discussion: Q&A between Panel and NST on science background <ul style="list-style-type: none"> ○ Guiding principles ○ Conceptual basis ○ Systematic approach to organizing data on nearshore ecosystems ○ Utility for restoration and preservation ➤ 	SSRP and NST	
3:45	BREAK			
4:00	SSRP Closed Session	Review and discussion of background materials	SSRP	
Day Two – Field Trip				
Objective: Familiarize panel with on-the-ground examples of needs, opportunities and constraints for ecosystem restoration in Puget Sound. To include beach-bluff and delatic systems if possible.				
		Sites To Be Announced, to include sites where restoration actions have been completed and one or more "typical" nearshore ecosystem examples.		
Day Three – UW Campus Ocean Science Bldg. Dean's Conf. Room				
8:30	Intro	Welcome, introductions, and review agenda (it may be revised by this point)		
8:45	Field Trip Review	Address issues and questions arising from the field trip		
9:30	PSNERP Technical Approach	Change Analysis <ul style="list-style-type: none"> Approach, strategy and assumptions Data development and derivates Change detection 	Burke Simenstad	PowerPoint presentation
10:30	BREAK		All	
10:45	Incorporating science (cont'd)	Change Analysis <ul style="list-style-type: none"> Data analysis and results Interpretation 	Simenstad	PowerPoint presentation

11:30		➤ Discussion: Q&A between Panel and NST on technical approach	SSRP and NST	
12:00	LUNCH		All	
1:00	Closed Session	Strategic Science Review Panel discussion and development of preliminary findings	SSRP	
4:00	Report Out	SSRP reports out to PSNERP	SSRP and NST	
5:00	Adjourn		All	

ATTACHMENT 3

LIST OF READING SUPPLIED TO THE PANEL PRIOR TO THE JUNE MEETING

Technical Documents

- 2008-01 A Geomorphic Classification of Puget Sound Nearshore Landforms
2006-05 Nearshore Birds in Puget Sound
2006-06 Juvenile Pacific Salmon and the Nearshore Ecosystem of Puget Sound
2007-01 Orcas in Puget Sound
2007-02 Marine Riparian Vegetation Communities of Puget Sound
2007-03 Marine Forage Fishes in Puget Sound
2007-04 Beaches and Bluffs of Puget Sound and the Northern Straits
2007-05 Kelp and Eelgrass in Puget Sound
2007-06 Great Blue Herons in Puget Sound
2007-07 Valuing Puget Sound's Valued Ecosystem Components
2006-01 Coastal Habitats in Puget Sound: A Research Plan in Support of the Puget Sound
Nearshore Partnership
2006-02 The Geomorphology of Puget Sound Beaches
2006-03 Conceptual Model for Assessing Restoration of Puget Sound Nearshore Ecosystems
2004-01 Application of "Best Available Science" in Ecosystem Restoration: Lessons Learned
from Large-Scale Restoration Efforts in the USA
2004-02 Guidance for Protection and Restoration of the Nearshore Ecosystems of Puget Sound
2004-03 Guiding Restoration Principles
Historical Reconstruction, Classification and Change Analysis of Puget Sound Tidal Marshes
2005-01 Historic Characterization of WRIA9 Shoreline Landforms

Reprints

- Attrill, M. J., D. T. Bilton, A. A. Rowden, S. D. Rundle, and R. M. Thomas. 1999. The impact of encroachment and bankside development on the habitat complexity and supralittoral invertebrate communities of the Thames Estuary foreshore. *Aquat. Ecol. Mar. Freshwat. Ecosys.* 9:237-247.
- Bell, S. S., M. S. Fonseca, and L. B. Motten. 1997. Linking restoration and landscape ecology. *Restor. Ecol.* 5:318-323
- Bortleson, G. C., M. J. Chrzastowski, and A. K. Helgeson. 1980. Historical changes of shoreline and wetland at eleven major deltas in the Puget Sound Region, Washington. *US Geol. Surv., Hydrologic Invest. Atlas, HA-617.* Denver, Colorado.
- Burns, R. 1985. *The Shape & Form of Puget Sound.* Washington Sea Grant Publ., Univ. Wash., Seattle, Washington. 100 pp
- de Groot, R.S., M.A. Wilson and R.M.J. Boumans. 2002. A typology for the classification, description and valuation of ecosystem functions, goods and services. *Ecol. Econ.* 41:393-408.
- Dethier, M.N. 1990. *A Marine and Estuarine Habitat Classification System for Washington State.* Natural Heritage Program, Washington Depart. Nat. Res., Olympia, WA. 60 pp.

- Dowty, P., B. Reeves, H. Berry, S. Wyllie-Echeverria, T.F. Mumford Jr., A. P. Sewell, P. Milos, and R. Wright. 2005. Puget Sound Submerged Vegetation Monitoring Project 2003-2004 Monitoring Report. Wash. Dept., Nat. Res., Nearshore Habitat Prog., Olympia, WA.
- Ehrenfeld, J. G., and L. A. Toth. 1997. Restoration ecology and the ecosystem perspective. *Restor. Ecol.* 5:307-317.
- Finlayson, D.P. 2006. The geomorphology of Puget Sound beaches. Ph.D. dissertation. Univ. Wash. Seattle. 216 p.
- Finlayson, D.P., and H. Shipman. 2003. Puget Sound drift cells: The importance of waves and wave climate. *Puget Sound Notes* 47:1-4.
- Gaeckle, J., P. Dowty, B. Reeves, H. Berry, S. Wyllie-Echeverria, T. Mumford Jr. 2007. Puget Sound Submerged Vegetation Monitoring Project 2005 Monitoring Report. Wash. Dept. Nat. Res., Nearshore Habitat Prog., Olympia, WA:
- Halpern, B.S., S. Walbridge, K.A. Selkoe, C.V. Kappel, F. Micheli, C. D'Agrosa, J.F. Bruno, K.S. Casey, C. Ebert, H.E. Fox, R. Fujita, D. Heinemann, H.S. Lenihan, E.M.P. Madin, M.T. Perry, E.R. Selig, M. Spalding, R. Steneck, and R. Watson. 2008. A global map of human impact on marine ecosystems. *Science* 319:948-952.
- Hood, W. G. 2004. Indirect environmental effects of dikes on estuarine tidal channels: thinking outside of the dike for habitat restoration and monitoring. *Estuaries* 27:273-282.
- Jacobsen, E.E., and M.L. Schwartz. 1981. The use of geomorphic indicators to determine the direction of net shore-drift. *Shore Beach* 49:8-42.
- Jay, D. A., and C. A. Simenstad. 1996. Downstream effects of water withdrawal in a small, West Coast river basin: erosion and deposition on the Skokomish River delta. *Estuaries* 19:501-517.
- Kozloff, E. 1973. Seashore life b of Puget Sound, the Strait of Georgia, and the San Juan Archipelago. Univ. Wash. Press, Seattle, 282 pp.
- Limieux, J.P., J.S. Brennan, M. Farrell, C.D. Levings and D. Myers. 2004. Proceedings of the DFO/PSAT Sponsored Marine Riparian Experts Workshop, Tsawwassen, BC, February 17-18, 2004. Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 2680, viii + 83p.
- Miles, J.R., Russell, P.E., and Huntley, D.A., 2001. Field measurements of sediment dynamics in front of a seawall. *J. Coastal Res.* 17:195-206.
- Macdonald, K., D. Simpson, B. Paulson, J. Cox, and J. Gendron. 1994. Shoreline armoring effects on physical coastal processes in Puget Sound, Washington. Coastal erosion management studies, Vol. 5. Report 94-78, Shorelands Coast. Zone Mgmt. Prog., Wash. Dept. Ecol., Olympia, WA
- Nightingale, B. and C. A. Simenstad. 2001. Overwater structures: Marine Issues (White Paper). Washington State Department of Transportation Report number WA-RD 508.1 Prepared for Washington State Transportation Center, University of Washington, Seattle, Washington. 133 pp plus appendices.
- Pollis, G.A. and S.D. Hurd. 1996. Linking marine and terrestrial food webs: Allochthonous input from the ocean supports high secondary productivity on small islands and coastal land communities. *Am. Nat.* 147:396-423.
- Rice, C.A. 2006. Efforts of shoreline modification on a northern Puget Sound beach: microclimate and embryo mortality in surf smelt (*Hypomesus pretiosus*). *Estuaries & Coasts* 29: 63-71

- Romanuk, T. N. and C. D. Levings. 2003. Associations between arthropods and the supralittoral ecotone: dependence of aquatic arid terrestrial taxa on riparian vegetation. *Environ. Entomol.* 32:1343-1353
- Romanuk, T.N., and C.D. Levings. 2006. Relationships between fish and supralittoral vegetation in nearshore marine habitats. *Aquatic Conserv: Mar. Freshw. Ecosyst.* 16: 115–132.
- Short, F.T. and S. Wyllie-Echeverria. 1996. Natural and human-induced disturbance of seagrasses. *Environ. Conserv.* 23:17-27.
- Shipman, H. 2004. Coastal bluffs and sea cliffs on Puget Sound, Washington. Pp. 81-94 in M.A. Hampton and G.B. Griggs (eds.). *Formation, Evolution, and Stability of Coastal Cliffs—Status and Trends*. Prof. Paper 1693; US Geol. Survey, Wash., D.C.
- Simenstad, C. A., W. G. Hood, R. M. Thom, D. A. Levy, and D. L. Bottom. 2000. Landscape structure and scale constraints on restoring estuarine wetlands for Pacific Coast juvenile fishes. Pp. 597-630 in M. P. Weinstein and D. A. Kreeger (eds.), *Concepts and Controversies in Tidal Marsh Ecology*. Kluwer Acad. Publ., Dordrecht, the Netherlands.
- Simenstad, C. A., C. Tanner, J. Cordell, C. Crandell and J. White. 2005. Challenges of habitat restoration in a heavily urbanized estuary: Evaluating the investment. *J. Coast. Res.*40: 6-23
- Simenstad, C. A., D. Reed, and M. Ford. 2006. When is restoration not? Incorporating landscape-scale processes to restore self-sustaining ecosystems in coastal wetland restoration. *Ecol. Engineer.* 26: 27-39
- Sobocinski, K. L. 2003. The impact of shoreline armoring on upper beach fauna of central Puget Sound. M.S. Thesis, School Aquat. Fish. Sci., Univ. Wash., Seattle, WA.
- Thom, R. M. 1987. The biological importance of Pacific Northwest estuaries. *Northwest Environ. J.* 3:21-42.
- Thom, R., D. Shreffler, and K. Macdonald. 1994. Shoreline armoring effects on coastal ecology and biological resources in Puget Sound, Washington: Coastal Erosion Management Studies. Washington Dept. of Ecol. 7: Pub. No. 94-80.
- Thom, R.N., G.W. Williams, and H.L. Diefenderfer. 2005. Balancing the need to develop coastal areas with the desire for an ecologically functioning coastal environment: is net ecosystem improvement possible? *Restor. Ecol.* 13: 193-203.
- Vitousek, P.M., H.A. Mooney, J. Lubchenco, and J.M. Melillo. 1997. Human Domination of Earth's Ecosystems. *Science* 277:494-499

ATTACHMENT 4.

LITERATURE CITED

- Hammond, J., H. Raiffa, and R. Keeney. 1999. *Smart Choices*. Harvard University Press. 244 pp.
- Gregory, R. and R. Keeney. 1994. Creating policy alternatives using stakeholder values. *Management Science* 40(8):1035-1048
- Jones, M.L., R.G. Randall, W. Dunlop, J. Imhof, G. Lacroix and N.J.R. Ward. 1996. Assessing the ecological effects of habitat change: moving beyond productive capacity. *Can. J. Fish. Aquat. Sci.* 53 (Suppl. 1): 446-457.
- Reed, D. J. 2006. Seeing the Future of the Louisiana Coast. Pages 45-47 in: G. Arnold (ed.) 'After the Storm: Restoration of America's Gulf Coast Wetlands'. Special Report of the National Wetlands Newsletter. Environmental Law Institute, Washington DC.