King County Comments on PSP Freshwater Resources Topic Forum Draft Discussion Paper

May 6, 2008

Here are comments from King County on the Puget Sound Partnership's (PSP) Water Quantity (Freshwater Resources) topic forum draft discussion paper. These are organized in three sections, from the general to the particular. The first section provides high level answers to key questions from the PSP and for the county; the second section offers the county's general concerns on the topic as presented in the paper; and the last section provides specific notes on gaps, inaccuracies, or particular points of concern. Wherever possible and appropriate, we have included references to back our comments. Thanks for considering our comments as you revise the paper and move it into the integration phase.

PSP Request for comments on water quantity paper

(1) Inform us of additional literature or research that will deepen our understanding of water quantity issues in the Puget Sound region. The recommendations that come out of this process MUST be supported by science/data.

- We have provided several references in the county's comments to studies that should be useful.

(2) Help identify gaps in our memos.

- To further support the urgency to address water quantity needs for both people and fish, we suggest you emphasize what NOAA Fisheries called for in its Final Supplement to the Shared Strategy's Puget Sound Salmon Recovery Plan, i.e., "*an urgent and inescapable need to ensure sufficient instream flows to recover Puget Sound Chinook salmon*." (See page 9-10 on instream flows, www.nwr.**noaa**.gov/**Salmon**-**Recovery**-**Plan**ning/**Recovery**-Domains/**Puget**-**Sound**/upload/PS-**Supplement**.pdf)
- To fully describe the freshwater resource picture, your study should account for (beyond alluding to them in other topic papers) the water quantity effects of:
  - Flood management
  - Stormwater management
  - Effluent management (via use of reclaimed water as a nonpotable supply)
- Be sure to address timing and seasonality of flows and spatial and geographic distribution as well as quantity of flows.
- Update the citation of the State Salmon Recovery Act from 2496 to RCW 77.85.

(3) Make sure we have identified the important tools to deal with threats to water quantity.

- A major threat that is not well articulated is the absence of any single, coherent water resource management strategy for the Puget Sound region. Such a strategy needs to be developed, either at the state or regional level, to make the rest of the proposed actions integrated and meaningful.

- The memo identifies a number of tools and strategies, most of which the state has the authority to implement now. The memo should discuss why those tools and strategies are not already being used, particularly at the state agency level (e.g., is it a resource issue? Priority issue?)
- The memo uses the word "effective" to describe some strategies, without stating how that strategy is effective, or what criteria are being used.
- It will be very important to develop a set of measures, and an accountability approach, around the items included on the action agenda.

(4) Identify solutions that have worked elsewhere (if they have documented effectiveness monitoring).

- King County has some data regarding Chinook population increases on the White River subsequent to increases in stream flows there.
- There are a number of national studies showing the effectiveness of metering in achieving water conservation.

County Questions for Review

Is the paper thorough, accurate, and telling the truth? Are the conclusions grounded in fact?

- In general, the paper was very readable and well organized**.** It does a good job of framing some of the key issues, challenges, and data gaps related to water resources in Puget Sound. However, it is unduly repetitive – the unique content could have been contained in a document less than half the size.
- Our current knowledge is limited related to the effects of water quantity and production of salmonids. However, we do know that every part of the hydrograph is important for native species, and understanding the tradeoffs made in accommodating high and low flow regimes is severely lacking. The initial discussion of memo of the "normative flow" regime recognizes this.
- It appears that this document is focused on the last bullet item on the second page of Science Question 1 – water supply. There is little mention of flood control and the effects of flood control on habitat-forming processes and aquatic biota. In combination with flood control facilities, dams have a significant influence on native species in almost every watershed within Puget Sound. No mention is made of the effects of flood control on flow and/or aquatic biota. This paper could instead present a holistic picture of how humans alter historic flow patterns including land cover change, water supply/demand, wastewater treatment/reuse, and flood control. These pressures on aquatic ecosystems are all driven by the numbers and distribution of humans on the landscape. Policy decisions regarding land use, water supply/demand, flood control, and wastewater treatment/reuse should be made considering how all of these issues are interconnected and how they affect aquatic resources. For an example of a more holistic framework for looking at water quantity issues, see the Water Quantity Provisional Indicators Freshwater Quantity Conceptual Model developed by the Puget Sound Partnership's Provisional Indicators Technical Work Group. A more holistic

ecosystem-based approach is alluded to on page 31 (under Ecosystem Considerations) in response to Policy Question 1.

- It also appears that protection of fish in relationship to water supply is a central focus of the draft document. This is perhaps understandable given the concern for threatened and endangered salmonids in this region, but the paper would benefit from a broader perspective on the aquatic biota that need to be protected and restored in Puget Sound and its rivers, lakes, streams, and wetlands.
- The final policy question (or "Logical Conclusions") regarding recommendations for action includes recommendations for understanding the influence of freshwater flows on Puget Sound nearshore and estuarine habitat and circulation (p. 42). This seems to be the first mention of these issues in the paper. This is an important issue as well and deserves more attention in the response to the Science questions. As a starting point, one might look at the Water Quantity Provisional Indicators Marine Circulation Conceptual Model developed by the Puget Sound Partnership's Provisional Indicators Technical Work Group. The U.S. Department of Commerce (2007) reference cited in the draft also provides some information on this topic.

Does the paper lay out the major threats, as they pertain to Puget Sound and King County Action Areas, succinctly?

- To first address this question, it would be helpful to better define what is meant by "water quantity threats". In the context of the draft document, this seems to almost exclusively refer to threats to meeting water supply needs of a presumed unavoidably growing population. In that context, the current document seems to do an adequate job of characterizing what measures are perceived "threats" to securing additional water for human needs (i.e., requirements to protect aquatic biota). However, the Action Agenda would be better served if the focus was turned toward looking at current and projected future human water needs as a pressure on aquatic resources that has implications for aquatic and riparian species, habitat, and water quality. This approach would necessarily broaden the scope of the document (and turn the focus away from a utility-centric approach) and require incorporation of additional information and findings.
- The paper addresses water supply, but doesn't sufficiently address the detrimental impacts of high flow rates of stormwater from urban impervious area. It also recommends desalinization as one solution to address decreasing freshwater supplies; however, not enough is known yet to allay concerns regarding potential harm to saltwater ecosystems (nor other issues associated with desalinization, including high energy costs and associated potential increases in greenhouse gas emissions). We need to be careful not to cure one problem by creating a larger one elsewhere in the system.

Does the paper propose solutions and the key factors influencing their implementation feasibility? Are the solutions likely to be effective? If not, why?

- See responses to questions above. Reclaimed water appears to be the most major omission within the narrower context of the draft document, although it receives attention in the response to Policy Question 2. Water reuse could have a sizable impact on water supply and should be addressed in this paper for different reasons that

covered in the Water Quality paper (where it is not really addressed at all as a potential source of supply). It could provide a significant source of new water supply needs. Low Impact Development (especially rainwater harvesting) receives no attention either, primarily due to the stormwater issue being addressed in the Water Quality Topic Forum (where its water quantity elements are not addressed). Flood control and implications are completely missing until it is mentioned as Strategy 3b on page 43. Non-potable uses are only mentioned in response to Policy Question 2, and then it is limited to use of reclaimed water to satisfy non-potable needs. No mention is made of water losses due to leakage, inefficiency, or issues surrounding irrigation or industrial uses.

Are there other existing programs and models that are not covered as possible solutions that we can share? If so, what do we know about their effectiveness?

- The strategies proposed in response to Policy Question 2 (or Logical Conclusions?) seem to be comprehensive and appropriately characterized. These strategies appear to go beyond the stated and implied scope of the previous sections and begin to address some of the elements that are missing from the draft (e.g., flood control, land use/cover, stormwater management, integrated water resource assessments).
- King County's Vashon Maury Island Water Resources Evaluation has modeled the contribution of groundwater to Puget Sound from VMI. The technique used on VMI could be adapted to other rural areas to gain a better understanding of the magnitude of total groundwater contributions to the Puget Sound. The VMI WRE information can be accessed on the web at: http://dnr.metrokc.gov/wlr/WQ/vashon-island/
- Under A.3 on page 46, it seems that after the first two bullets are completed, there may need to be an effort to address the other watersheds that haven't done modeling to estimate the impact of climate change on firm yield. The University of Washington Climate Impacts Group has done modeling for the Central Puget Sound (see www.govlink.org/regional-water-planning), and for the Columbia Basin. It could very well be the role of the State to ensure completion of similar work across the rest of the Puget Sound watersheds.
- In addition to the programs in San Juan County and the City of Seattle, the Department of Ecology has done a study on the potential benefits of rainwater harvest in the Barker Creek Watershed of Kitsap County. Doug Wood at the Northwest Regional Office DWOO461@ECY.WA.GOV can provide details on the study and conclusions.

Where criteria for prioritizing actions are proposed, are they appropriate and sufficient? Are there other criteria to consider? Where they are applied to suggested actions, do the results of their application make sense?

- Criteria for prioritizing actions are fairly general. The metrics are too vague. They cover the topics well, but are not specific to fully understand how they would translate into indicators. A list of hypotheses, followed by a sampling plan identifying specific metrics would be more useful in understanding if the correct measures are being used.

- There are a number of proposed actions that could be implemented now, without further study (e.g., metering, compliance, exempt wells, reclaimed water). That would seem to be a likely criterion for making some initial investments

What are possible implications to county departments and divisions (cost and resource impacts, and on lines of business)?

- The draft contains a fairly exhaustive list of measures, but many are not specific enough to translate into real indicators and the reason for some are unclear based on background information presented in the responses to the previous questions (e.g., water temperature, impervious surface cover). Baseline monitoring ("hydrology" and "fish surveys") and "flow/biota relationships" are identified as one of the most important things to start immediately, but no other details are provided. At a minimum, other biota in addition to fish should be included in any biological monitoring effort.
- A comprehensive monitoring program of surface water flows in streams and rivers, coupled with accounting of surface and groundwater withdrawals and the use and fates (consumption, disposal to ground or receiving waters) would be a good start. Comprehensive studies that would hopefully identify ecologically important flow components of stream, rivers, and wetlands would be another key component that could be developed alongside adaptive management actions to restore and maintain more natural flow regimes (and to a some extent water quality improvements along with them) for the benefit of aquatic biota. Monitoring the response of aquatic biota to these management actions would be a central component of these studies.
- The memo should perhaps recognize the federal budget reductions that are causing USGS to eliminate gaging stations. In addition, the Governor recently vetoed a budget proviso of slightly more than $200,000 that would have begun the process of creating a statewide groundwater monitoring and assessment program—something that will be needed for fully understanding the water picture of the Puget Sound.

General Comments

- This paper addresses <u>freshwater quantity</u>, which is not the same as freshwater resources. Since the goal is to ensure adequate water quantity for humans and ecosystem needs, why not stick with the original title?
- As stated in the answers to the county's review questions above, there is little to no discussion of <u>flood management or stormwater</u> as a water quantity issue. Any discussion of water quantity issues is not complete without these topics. References to discussions in other topic areas (water quality) are misleading, in that the water quantity aspects of these topics are not addressed in that topic paper. However, the discussion on the ecological benefits of maintaining a natural flow regime (including large floods) should be complemented with a statement on the benefits existing flood control measures provide.
- Similar concern about lack of discussion of <u>reclaimed water</u>, and reference to water quality topic paper, where water quantity aspects are not discussed. Reclaimed water

is a potential source of water that can provide environmental benefits and allow us to better manage our water resources.

  - PSP should focus the discussion of reclaimed water on value. This would allow for continued consideration and discussion of important costing, pricing, and customer impacts to water purveyors – but within the context of the gain to the region by the production and use of reclaimed water.
  - Future discussion of reclaimed water uses needs to include those uses where the end uses of reclaimed water are not likely to have a set of "paying customers" (e.g., stream flow augmentation, groundwater recharge, wetlands enhancement, and wetlands restoration).
  - Discussion of reclaimed water should also include discussion of past two years' legislation, December 2007 Ecology report to the Legislature, and current reclaimed water Advisory Committee work. King County has just completed a Feasibility Study that can provide useful information on this. See http://dnr.metrokc.gov/wtd/reuse/docs/FeasibilityStudy/index.htm .
  - We are also concerned about generating more support for reclaimed water in upper management of both Washington Departments of Ecology and Health, and the inability to date of Ecology to resolve its own internal policy conflicts between the water quality program and the water resources program on broader use of this potential resource.

- There is a lack of discussion of the role of the U.S. Army Corps of Engineers in management of major dams, Howard Hansen on the Green River, and Mud Mountain on the White. The fish kill on the White River a few years ago should be mentioned, which was caused when the Corps lowered the river rapidly for dam maintenance and left fish stranded. On the other hand, the White River has seen an increase in adult Chinook, likely in response to recently-increased flows.
- The report needs to clearly state that there is currently no water resource managment strategy at the state or regional level. The set of measures listed under Question 4 are, for the most part, already required or authorized under state law, and state agencies have simply not acted. Particularly noteworthy is the recommendation that Ecology require metering of 80% of the withdrawals in each basin, since they are already under court order to do that in fish-critical basins, after a lawsuit was filed against them for not following the law that requires them to meter (and the judge held that inadequate resources was not a sufficient defense).

Use of 'Adequacy' as a measure. Science Question 1 focuses on the status of freshwater quantity in Puget Sound. The first three sub-questions are phrased in terms of the 'adequacy' of flows to meet different objectives, such as protecting habitat function. The first question asks "Where in the Puget Sound Region are the amount, timing, and distribution of freshwater flows adequate?" The notion of adequacy makes little logical sense in discussing timing and distribution, but it does convey the idea that we need only meet some minimum, 'adequate' level of water resource condition. This is not just a semantic issue – by phrasing the status-of-the-resource in this way, we imply that there is a definition of adequacy that can be applied to any and all watersheds. In fact, not all watersheds (or aquifers for that matter) are created equal in terms of their role in supporting the functions and processes that shape the ecosystem and provide for

consumptive uses. In some cases, the goal should be absolutely minimal impairment of the amount, timing, and distribution from natural conditions, whereas in other watersheds it may be appropriate to apply a different benchmark for the level of impairment. There is no single definition of adequacy that would apply to all Puget Sound watersheds, and some likely merit higher hydrologic protection than others. For example, watersheds that still support numerous critical species, populations, and habitat types and have a fairly normal range of hydrologic functions and processes would rank high. More generally, the focus should be on understanding the scale of impairment and its implications rather than on finding some 'adequacy' threshold to apply. The discussion should explicitly note the need to provide flows designed to achieve "recovery" of listed species under the ESA.

Forests and Forestry. The paper omits any discussion of the importance of forests and forestry to water quantity. The Habitat/Land Use paper may include a discussion about forests and their value for ecosystem function, but it is also important to discuss the role of forestry practices and seral stage in the hydrology of a basin. Mature forests differ from regenerating forests in their ability to store water which is critical to sustaining late-season base flows and to moderating high flows. In mid-elevation rain-on-snow zones, one of the most quantitatively significant predictors of runoff is surface wind speed, which is dramatically affected by the presence or absence of mature, contiguous forest cover (U.S. Army Corps of Engineers. 1998. Engineering and Design. Runoff from Snowmelt. Manual No. 1110-2-1406). It is not just about seral stage (i.e., harvest), but also the effects of forest road networks on high flows in particular. We know a lot about the run-off side as it is integrated into models like DHSVM (Distributed Hydrology Soil Vegetation Model).

Industrial/Commercial use. The statistics regarding current levels of water use and the projections due to population growth do not include any discussion of industrial/ commercial use, their likely trends over time, or efforts/incentives for conservation. In the most populated portions of Puget Sound, domestic use is by far the largest category of water consumption – in King County it is roughly 15 times as high as industrial use (Lane 2004, cited in paper), but statewide the rates are essentially equal for the two categories. Please provide statistics and discussion regarding this important category of water consumption, and how it varies across the Puget Sound landscape.

FERC process as a tool. Throughout the document, the FERC hydroelectric relicensing process is invoked as a successful tool for achieving flow objectives in regulated rivers. The process is certainly better than nothing, and in some cases has led to better outcomes than might be achieved otherwise. However, the document oversells the process and outcomes. For example, the Lewis River Swift No. 1 project in southwest Washington is used as an example of a 'successful' process that led to improved flows. This is true to a degree, but improved compared to what? Since the project was completed 50 years ago, it has completely dewatered a significant stretch of the river, except for unintentional seepage through the earthen dam and massive flows during spill conditions. The reach historically featured mean low flows in the 700-800 cfs range; the negotiated settlement provides seasonal flow releases of less than 100 cfs. The point here is not to say that the FERC process does not have value, but the outcomes depend significantly on project

configuration (e.g., mainstem dam vs. off-channel diversion), capacity (i.e., how many megawatts), project purpose (e.g., power-peaking versus base load), ownership, suite of affected resources, and the willingness of state and federal agencies to push for meaningful flow improvements. The Lewis River project configuration is such that Swift No. 1 diverts all flow into a power canal that leads to the Swift No. 2 powerhouse and thus bypasses the so-called "Bypass Reach". All materials, including project configuration, historic flows, etc. can be found via FERC on-line under docket numbers P-935, P-2071, P-2111, P-2213. The negotiated flows (< 100 cfs) can be found in the Settlement Agreement. The pre-dam hydrology for that location is based on USGS gage 14218000 LEWIS RIVER NEAR COUGAR, WA, which shows mean September flows of 859 cfs. There is no post-dam gage yet, but the documents clearly state that flow is only via seepage, except for when the power canal failed catastrophically in 2001.

Given that FERC licenses are issued for very lengthy periods, putting a fixed amount of water for flows into the FERC license, and not examining the sufficiency of that flow regime periodically for effectiveness, is problematic. For some FERC-licensed facilities, the flows established in 20 or 30 years ago may look, in retrospect, to be inadequate in an ESA-recovery era. The memo should consider including references to FERC licenses and a renewal schedule, and identify advocacy by the state during those renewals as a strategy to remedy inadequacies under existing FERC license conditions.

The two goals/drivers of water quantity need to be identified in this paper, the region's quality of life (i.e., out of stream water supply needs) and the retention/restoration of natural conditions in the regions water bodies. These are often competing demands for water, but both needs should be identified and addressed in the paper.

The impacts of stormwater runoff on water quantity are significant and need to be addressed in this paper. The removal of water by human use is well addressed but the discussion of the replenishment and a primary source of freshwater (stormwater) is significantly missing. There is little discussion of the impacts of peak flows immediately after storm events. These result in the alteration of the geomorphology of stream habitat; changing the profile of the streams to broad, shallow channels with accreted substrate, eliminating habitat for many species. There is little discussion of the change in the natural hydrology over the year because of the increase in impervious surface, and the channelization of stormwater to local surface water bodies, which increase flows in the winter and reduce instream flows in the summer. The year-round flow regime needs to be discussed in greater detail in this paper. One issue that was not included in the paper is the discussion of directing stormwater to ground as a treatment BMP. This subject is addressed through the NPDES programs and the Underground Injection Control (UIC) regulations. This is a significant water quantity pathway that was barely discussed.

Another issue underwritten is the critical need for habitat as a storage structure. Much of the wetlands in the region serve a critical function in the storage of water within the region, acting as a sponge and buffer during high flow events and a water source during dry periods. The impacts of loss of this habitat, both freshwater and marine, are underrepresented in this paper.

Specific Comments

Here are more site-specific comments. Also attached is a track-changes version of the pdf file provided by one reviewer.

Science Question 1

1. The concept of flood control seems to be omitted from this paper. Flood control via levees increases velocity, narrows channels, and reduces floodplain connectedness. Flood control via dams shaves peak flows and decreases floodplain connectivity. It is surprising that it is not even mentioned as a data gap in this status paper. How much of each river is channelized? How have flood events changed from historic times?
2. King County's regional water supply planning process should be highlighted in section C, but it is not referenced. This work covers water demand for a large fraction of current and future population in the Puget Sound region.
3. Add greater emphasis to water demand for agriculture in this section. If it hasn't been compiled, then it is a major data gap.
4. Table S1-1. Vashon-Maury Island is in South-Central Puget Sound Action Area, and also in WRIA 15. There is a 2514 plan for Vashon-Maury Island that is not quite "official" but that is being implemented, unlike the 2514 plan for Kitasp that was shelved. A line should be added for this under South-Central action area.

- Table S1-1: Note that WRIAs 8 and 9 both have altered hydrology. The natural outflow for the Cedar River was the Black River that in turn flowed into the Green River. Now the Cedar River has been moved to flow into Lake Washington. In addition, a ship canal and locks now connect the fresh water of Lake Washington to the salt water of Puget Sound, but there is no natural estuary. The Duwamish River that flows from the Green River was dredged and straightened into the Duwamish Waterway. The severely altered hydrology of these two watersheds impacts the determination of normative flows.
- Table S1-1: Please add WRIAs 7 and 10 in the column titled King County Regional Water Planning. While the Tributary Streamflow Technical Committee addressed only WRIAs 8 and 9, the Climate Change Technical Committee covered WRIAs 7, 8, 9, and 10.
- Studies not mentioned: basin assessments by Ecology in mid-'90s; KC watershed assessments for Norm Flow Project; groundwater study for Auburn water rights applications; Soos Creek/Middle Green by WRIA 9; Samm River Corridor; Stilly EDT by Shared Strategy; exempt well data in Small Systems report; evaluation by TRT of water information in PS ESU watershed plans

Science Question 2

5. Only a few of the many different management approaches are discussed, but basically this section says that we don't know how effective any of them are.

For example, LID is not discussed as a flow management approach, but it definitely is. Use of reclaimed water is not discussed as an approach, but it definitely is.

6. In section C and D, there are two different kinds of effectiveness monitoring that we are talking about. First, how effective is each approach. This would require data on small scales about how different approaches can result in different flows. These data can then be extrapolated to calculate total impact across Puget Sound. Second, data for river and stream flows need to be measured and analyzed to see how the flows are changing over time. This way we can assess if they are getting "better" or "worse" over time.

- Ecology needs to provide an assessment of the value of instream flow setting by consensus in basins that are likely already over-appropriated. They also need to explain whether their rulemaking criteria conform to the salmon recovery objectives of the ESA, and how they know that. In other words, simply stating that a key element of the region's strategy is setting instream flows where none currently exist does not explain why the state's investment in this activity should be a priority, and what Ecology expects to gain from it.
- The Demand Strategies section needs to mention the Water Use Efficiency rule under the Municiapl Water Law, and how we will know what is working when utility annual performance reports start being sent to WA Department of Health in July 2008.
- Discussion of dam operation should mention negotiations with the Army Corps on Green River for instream flows, and the Corps' unilateral change in operations on Mud Mountain to reduce peak flows, which may change habitat forming processes.

<u>Policy Question 1</u>

7. Add levees and flood control to this section. The use of levees is a flow management policy to protect property and human safety in floodplains. However, there is a trade-off on flow and habitat that is worth noting.

- Lots of minor inaccuracies in this chapter -- for example, Ecology was authorized to establish minimum flows with water rights before 1987.
- Lots of statements re 'effective' existing strategies, but no definition or documentation.
- Most of the 'adequacy' discussion points out the failure by state agencies to do their jobs.

<u>Policy Question 2</u>

8. Rename section B from "What strategies are and are not working?" to "What strategies are improving freshwater flows and what strategies are not?" The reason for this is that there are some strategies that are very successful (such as old-fashioned stormwater conveyance in areas with lots of till preventing localized drainage issues, or levees preventing flooding but increasing water velocity and scouring) but do not improve freshwater flows.
9. Under strategy 1, we would recommend adding an action about implementing LID, or encouraging discharge to groundwater, of stormwater to the maximum extent possible.

10. Under strategy 1, add an action to encourage the setting back of levees from rivers to allow for more flow complexity and interaction between river channels and the floodplains.
11. Under strategy 1, add an action to encourage "unplumbing" of the water/ wastewater system, to have highly treated wastewater discharged back into the basin from which the water originated, as opposed to being discharged directly into Puget Sound.
12. Under stategy 2b and 2c, minimizing human uses of water to the extent practicable (conservation) is probably one of the most important things we can do in the next 12 years. These two items don't really state that as the objective.
13. Two main goals are to maximize water use efficiency, and restore natural hydrologic functions

High flows. The paper does not discuss high flows to a sufficient degree. As this topic paper is integrated with land-use and species/biodiversity topics, the role of high flows in sustaining ecosystem processes should be given a fuller treatment. This of course also relates to flood risk and the role of flood protection systems in exacerbating some of the problems associated with floods. Also, see comment above regarding forests and forestry.

Use cubic-feet-per-second (cfs) to link other rates to biologically meaningful rates. The paper tends to use "millions of gallons per day" (mgd) as the unit of choice for discussing demand in particular. It would be very useful to either provide a conversion table or simply the cfs equivalent in parentheses, and vice versa. For example, the projected need of an additional 136 mgd to serve the growing population in 2020 translates to 210 cfs, a value that can be readily compared to the flows in key watersheds (e.g., the lowest monthly mean flow in the Tolt River is only 179 cfs in the month of August).

S1.A. Changes in Watershed Hydrology, 3rd bullet (no page numbers provided in portions of document). Explain/clarify the statement "This results in channel conditions that are less favorable to native flora and fauna most of the year, and that require higher flows (than typical) to make them favorable during low flow periods."

S1.B. Data gaps. The paper mentions the work by Seiler to quantify the effects of scouring flows on smolt production (actually egg-to-fry survival). This is an important area of further study, but unfortunately this work has been frequently cited as applicable in seemingly all locations where salmon spawn, which may not be the case in areas where hydrology and channel form are in near-natural condition. Moreover, the study is often erroneously generalized to apply to basically any high flows during incubation. Seiler's work focused on the correlation between the single highest flow event and subsequent survival, as inferred from subsequent smolt estimates and adult returns. This is very different from other measures of high flow, such as mean flow during the winter season.

S2.A. Flow setting strategies. Define "DRIFT".

S2.A. Demand strategies. The paper lacks discussion of fee structure and incentives as a tool for reducing demand. An 'impact fee' on water use could be an effective tool for reducing demand while also providing a funding source to be directed at restoring habitat and other watershed conditions affected by hydrologic alteration. Currently, water use charges only account for conveyance, treatment, system maintenance etc., but not the impacts of the withdrawal. While the paper is not meant to provide explicit solutions, a discussion of current fee structure and potential options would be appropriate in the Strategy section.

S2.A. Dam operation strategies. See comment above re FERC relicensing. This section claims that reduced PSE withdrawals were a "primary factor" in significant increases in spring Chinook. The provided citation is simply a list of spreadsheets with fish-count information. Has the correlation and/or causation of flows to fish been measured statistically?

p.32. Enforcement. Expand on why enforcement is ineffective. Lack of funding?

p. 43. Strategy 4a. While plans for enforcement and compliance may be appropriately developed on the watershed scale, the State must take responsibility for defining plan requirements and for performing the enforcement function. If left to local level, enforcement will be unevenly applied and politically difficult locally.

p. 43. Strategy 4c. Please explain this 80% metering and reporting requirement. Is this meant to include exempt wells? It would be useful, for instance, for readers to know that the 80% figure is met in WRIA 8 by the metering of one utility—Seattle Public Utilities.

P. 9 - Major threats to freshwater supply - groundwater contamination has not been addressed; (if this is to be addressed in another paper please disregard). We have provided references for this in our comments on the Water Quality paper.

P. 18, item A, Par. 2, - No reference to any efforts to reduce groundwater contamination.

P. 21, Other Strategies - Rainwater harvest is being used in San Juan County and City of Seattle.

P. 25, item A, par. 1 and final - No reference to any efforts to reduce groundwater contamination.

P. 41, Item B, Supply side strategies should include rainwater harvest.

References:

Booth, D.B., J.R. Karr, S. Schauman, C.P. Konrad, S.A. Morley, M.G. Larson, and S.J. Burges. 2004. Reviving urban streams: Land use, hydrology, biology, and human behavior. *Journal of the American Water Resources Association* (JAWRA) 40:1351-1364.

Poff, N.L., and J.V. Ward. 1989. Implications of streamflow variability and predictability for lotic community structure: a regional analysis of streamflow patterns. *Canadian Journal of Fisheries and Aquatic Sciences*. 46:1805-1818.

For additional references, see King County Normative Flows Studies Project Literature Summary – Effects of Flow Alteration on Aquatic Ecosystems http://dnr.metrokc.gov/wlr/BASINS/flows/pdf/NFP-LitRev-Reference-Table.pdf

National Marine Fisheries Service Northwest Region. November 17, 2006. Final Supplement to the Shared Strategy's Puget Sound Chinook Salmon Recovery Plan. www.nwr.**noaa**.gov/**Salmon**-**Recovery**-**Plan**ning/**Recovery**-Domains/**Puget**-**Sound**/upload/PS-**Supplement**.pdf

Topic: Puget Sound Partnership Topic Forum Papers: Analysis of Data Management Needs

From: Stewart Toshach –NOAA/NWFSC

Data/Information Management Needs Identified in Puget Sound Partnership Topic Forum Papers and Suggestions for Further Work to Identify and Document Needs.

Introduction

I am providing this analysis for your consideration as I thought it would be useful to the Partnership as it decides how to proceed on data management.

In any science based decision making enterprise, such as that proposed for the recovery of the Puget Sound by 2020, it is critically important to identify, plan and provide for information management practices, services, tools and technologies.

Identification of actual data and information needs is an important step to be completed before investments are made in system changes or improvements.

The Puget Sound Partnership (PSP) recently published 7 separate Topic Forum papers for public discussion. Through some basic analysis the papers offer a 'window' into some of the data that could be needed for Puget Sound science and recovery decisions. The papers also reveal that more work is needed to define data/information management needs.

Analysis Method:

Each paper was searched for the use of common data or information management terminology as follows: "data management", information management", "data quality", "data gaps", "data inventory", "data" and,"database". Table I shows the number of 'hits' for the use of each term are shown in Table I.[1]

[1] This analysis has not been reviewed.

Then each of the 'hits' was reviewed for the context of the use of the term. Where the use of the term identified a possible data need such as at page 8 in the Human Health paper –"*Most of the data characterizing metals are from sediment sampling programs. There is less information characterizing metals in the water column*" the need was compiled in Table II. In addition a brief summary of the possible need was written, eg *"More data needed on metals in water column. Lack of Comprehensive data"*

Note that when a report stated, for example in the Risk Analysis paper at page 8, *"We briefly summarize methods and data sources for each ecosystem attribute below."*, this comment did not constitute a data or information management need so was not compiled into Table II.

Analysis Results:

While Table I shows some 387 references to common data management terms the great majority of these references are for generic uses of the terms and do not identify needed improvements to data/information quality, systems or gaps.

Table II shows approximately 60 information or data management needs. They identify a typical range of needs from data being inadequate to establish certainty to data not being collected at all to the need to specific data bases to the need to link data to management objectives or principles. Each of these is instructive but they do not define the extent of data or information management needs. In part this is because of the limited questions that were posed to the Authors of the Topic Forum Papers. No questions specifically asked authors to address data management or information management needs. In addition the authors were all asked to answer questions within their specialty or discipline. None were asked to identify needs or gaps with respect to our Puget Sound wide capability to integrate data across multiple disciplines. Therefore it could appear as if integrated cross-discipline data is not needed – which is unlikely to be the case. This is understandable for a couple of reasons. Few if any information specialists have participated as authors in the Topic Forums and the task of understanding how all of the Topics relate to each other is, in fact, a future topic. The Partnership may want to consider including data/information specialists in this upcoming discussion.

The results are instructive and helpful but they are insufficient for the purpose of designing, providing or locating data/information management practices, services, tools and technologies to meet Partnership science (or management) needs. Other methods such as focus groups, surveys and interviews are typically used by data/information management professionals to define data needs within and across disciplines. When put together these are called information needs assessments. In conventional data/information management practice these are considered to be a prerequisite before data/information management investment decisions are made.

In addition to local knowledge about specific Puget Sound Data/Information management needs there is a wealth of information from needs assessments prepared for other environmental recovery efforts that are similar in size and scale to the proposed Puget Sound recovery. These assessments and the lessons learned from deployment are interesting and instructive and could provide valuable information to the PSP as it decides what information and data management practices, services, tools and technologies are needed to support Puget Sound Recovery.

The Puget Sound Science Panel has a task at @ RCW 90.71.280 (1) b *"…to assist in developing an ecosystem level strategic program that: (i) addresses monitoring, modelling, data management and research…"*, and at @ RCW 90.71.290 *"…a strategic science program shall be developed by the [science] panel and may include recommendations regarding data collection and management to facilitate easy access and use by all participating agencies and the public..."*

As the Panel and the Leadership Council address data management action items for Puget Sound Recovery by 2020 the value of first completing a formal and detailed enterprise level information needs assessment might be considered before proceeding too far in addressing data management needs.

Again, this analysis and suggestions are offered only as information that may be useful to the Partnership.

Table 1: Number of References to Common Data Management Terms Used in PSP Topic Forum Papers

Data/Information Term	Human Health	Quality of Life	Species Biodiversity	Land Use, Habitat, Food Web	Water Quality	Water Quantity	Risk Analysis	
Data management	0	NA	0	0	0	0	0	0
Information management	0	NA	0	1	0	0	0	1
Data quality	0	NA	0	0	0	0	0	0
Data gaps	1	NA	0	0	1	12	0	14
Data inventory	1	NA	0	0	0	0	0	1
Data	26	NA	21	11	19	79	42	198
Information	24	NA	18	29	20	14	51	156

Database	2	NA	1	3	5	6	0	17
	54		40	44	45	111	93	387

Table 2: References to Data Needs from Topic Forum Text			
PAGE #	Topic Forum	Reference	Summary of Data Mgt Need
	Key: HH: Human Health, SB: Species and Biodiversity, LU&H: Land Use and Habitat, WQL: Water Quality, WQ Water Quantity, RA: Risk Assessment		
5	HH	Limited data on toxics in shellfish from Puget Sound have been collected and evaluated by the Washington State Department of Health (DOH).	More data on shellfish
7	HH	*C. What is the certainty about our understanding of these threats and their status?* The certainty of understanding relating to characterizing human health risks varies. Human health risk is dependent on chemical toxicity, pathogen virulence, and level of exposure. However, many years of monitoring data help to shape the understanding of these risks, and in some cases provide a reasonable certainty.	*More certainty from monitoring data*
8	HH	Metals Most of the data characterizing metals are from sediment sampling programs. There is less information characterizing metals in the water column. Limited site-specific data for metals indicate a potential human health risk from consumption of shellfish in urbanized bays and at hazardous waste sites. Levels of metals in shellfish outside of these sites indicate little risk, but comprehensive data are lacking.	More data needed on metals In water column. Lack of Comprehensive data
9	HH	Fish consumption rates More data about the historical use of resources across different populations would allow for a more accurate assessment of human health exposure for different communities and their cultural uses.	Data needed on historical use
10	HH	"Emerging" contaminants, pathogens, and biotoxins A host of chemicals are present in discharges to Puget Sound that have not yet been assessed for their risk to human health. These include pharmaceuticals and PFCs, amongst others. In addition, there are a number of pathogens that will require additional analysis to determine the risk they pose to human health. One example is *Vibrio parahaemolyticus*, for which there are data available regarding presence in water, shellfish, and plankton, but the synthesis of that information has not yet occurred.	Synthesis of data on contaminints pathogens and biotoxins

10	HH	Broad risk assessment for toxics in shellfish While a Puget Sound-wide risk assessment has been done for human health threats associated with the consumption of toxics in finfish[72], a similar risk assessment has not been conducted for shellfish. ……More data are available for metals in shellfish than other contaminants.	Data on shellfish contaminants
10	HH	Toxics and pathogens in crab Data are limited for toxics and pathogens in Puget Sound crab.	More toxic and pathogen data
10	HH	Toxics in additional species Information about toxics in other salmon species such as pink, chum, and sockeye is currently limited. This information is needed to confirm predicted low contaminant levels in these Puget Sound species. DOH work has characterized these as species likely to be consumed, but for which data are unavailable (DOH professional judgment). Lingcod, cabezon, and shrimp are additional species that are consumed, but with little characterization of contaminants.	More data on toxics in pink, chum and sockeye
10	HH	Cumulative impacts Little is known about the cumulative, additive, and synergistic impacts of exposure to multiple contaminants through multiple consumption pathways or direct contact over time. Traditional risk assessment should assume that exposure to multiple contaminants is additive with respect to overall risk when considering the same toxic endpoint (e.g., neurodevelopment). More specific information about interaction of toxics in the body would be helpful in validating this assumption.	Information on cumulative impacts of toxics in humans
10	HH	Toxics in the water column There is a lack of understanding about the presence and concentration of toxics in the water column. Information from PSAMP and NPDES monitoring is available, but it is either site-specific or does not address the specific toxics of concern. More complete information about toxics in the water column may lead to a better understanding of the human health risk from direct exposure, as well as the sources of contamination in fish and shellfish.	Improved data on toxics in water column
11	HH	Reference conditions While some site-specific data are available, the extent to which current conditions in Puget Sound meet or exceed reference conditions is not fully known.	Improved data on Puget Sound reference conditions

14	HH	*From a scientific standpoint, which management approaches have been documented to have the most effective response?* Several programs have been documented as effective in reducing threats to human health, within the limitations of effectiveness measurement. Washington State Mercury Chemical Action Plan based on reductions in mercury concentrations in the 2005-2006 biosolids data. Fish consumption advisories, based on awareness of advisories and on success of outreach efforts (including Washington Department of Fish and Wildlife pamphlet, website hits, and grocery store pilot project and evaluation). There are limited data that show these advisories are reducing human health risk. However, there is some indirect evidence of the programs' effectiveness in that species with lower contamination levels are increasingly preferred by consumers	*Data to show effectiveness of health advisories*
20	HH	A new European Community Regulation, referred to as the Registration, Evaluation, Authorization and Restriction of Chemical Substances (REACH), was established in 2007. This regulation requires that manufacturers and importers of chemical substances gather information about the properties of these substances to ensure their safe handling and register the information in a central database maintained by the European Chemical Agency. The agency will coordinate in-depth evaluation of chemicals that present a potential threat and maintain a public database for consumers and professionals to provide information on these chemicals.	A database for chemical substances affecting Puget Sound
22	HH	*What are the gaps between existing programs or plans and the identified needs?* There are both "general" gaps (such as geographic gaps in data collection) and "specific" gaps (such as lack of information on specific biotoxins) that limit the effectiveness of existing programs and plans.	*Data gaps in geographic extent of and specific biotoxins*
23	HH	What criteria should be considered for prioritizing actions to address threats to human health? A comprehensive inventory of data being collected would enhance the coordination of data collection and information between state and local agencies and Tribes.	Comprehensive inventory of data related to human health
24	HH	How will we know we are making progress on human health? We will know we are making progress on reducing threats to human health when…We have reduced the number and severity of data gaps.	Identify and reduce data gaps for human health

3	SB	Marine primary producers: Phytoplankton is the foundation of Puget Sound's pelagic food chain. Its distribution is highly variable, with maximum abundances in the summer. Long-term status and trends are not well known	Long term status and trends of phytoplankton are not well known
4	SB	Food web status Fundamental data are still needed on many basic food web elements, such as phytoplankton productivity. Indicators of marine and freshwater food web status could include predator-to-planktivore and other ratios.	Lacking fundamental data on basic food web elements
5	SB	Assessments of Puget Sound biodiversity are rare, with perhaps the most prominent being the Puget Sound Ecoregional Assessment prepared by The Nature Conservancy and partners. This work highlights areas of the Sound that are understood to both support significant biodiversity and to be vulnerable; due to limitations on data for marine biodiversity, this work focuses on upland areas.	Only limited marine biodiversity data
7	SB	*B. Main gaps in our understanding of threats* There is much we do not know about the forces that threaten species survival, or about how the interactions between natural and anthropogenic stressors affect populations and alter food webs and biodiversity.[57] We do not understand the cumulative effects of stressors and major drivers, the magnitude of impacts from individual stressors, or the relative importance of threats.[4] Perhaps the largest gap is in our understanding of the impacts of climate change on biodiversity and species. Current predictions incorporate our best estimates of future changes in the Northwest weather regime, based on global-scale models, combined with our understanding of the impacts of these changes on species and ecosystems. While new empirical data on climate change impacts continue to inform these projections, uncertainties in the data and model assumptions make it difficult to forecast effects precisely.	Data uncertainties limit predictions of impact of natural and anthropogenic stressors on ecosystem
13	SB	An additional benefit of harvest management is that required catch and population abundance data can be useful species-status information for purposes other than harvest management.	Harvest data can be used for other purposes
16	SB	*How is the effectiveness of management techniques measured and documented?* While a number of agencies and groups monitor species' abundance or health in the Puget Sound ecosystem, little of	PSAMP data not linked to management objectives or approaches

		this monitoring is done with the goal of informing modifications in management approaches.[49] For example, the Puget Sound Assessment and Monitoring Program (PSAMP) has been monitoring key indicators of water and sediment quality, nearshore habitat, shellfish beds, and the health of fish, seabirds, and marine mammals for almost 20 years. While PSAMP has provided a wealth of information on species health, abundance, diversity, and distribution, these data are not well-linked to management objectives or approaches.[50]	
16	SB	The Washington Department of Fish and Wildlife monitors a network of 18 marine reserves in Puget Sound for research purposes. Scuba divers estimate fish densities, measure individual fish, and identify and quantify lingcod nesting activity.[8] While these data do have relevance for the impacts of harvest on species, benefits for species or overall population management outside the reserves have not been demonstrated.	Limited data on impacts of harvest on populations outside of reserves
23	SB	*E. Plans or programs in place to address food web status and biodiversity in the Puget Sound region* • Establishing a Biodiversity Science Panel and a Biodiversity Data Partnership, as well as a Biodiversity Inventory to document all species in the state, and a Biodiversity Monitoring Plan to track the status of those species. The Nature Conservancy has found that Ecoregional Assessments provide a common information base, identify additional data needs, and help to build partnerships essential to conservation.	Biodiversity data partnership is needed to track status of species
34	SB	Build understanding of species, biodiversity, the food web, and the effectiveness of management actions: Conduct research to constrain and define the problem: what is the Puget Sound food web? This research should be designed to provide information about trends, patterns, and mechanisms of change in the food web, so that we can discriminate between natural and human-caused changes.	Need more information on trends, patterns
10	LU & H	Current Status of Puget Sound Threats and Habitat Structure Studies and monitoring of Puget Sound have measured certain aspects of habitat structure (e.g., eelgrass beds), human-induced threats (e.g., impervious surfaces), and ecosystem function (e.g., shorebird colonies). Rarely have ecosystem processes been addressed. Also, information that is Sound-wide tends to be limited in terms of data detail and accuracy, while localized information is often not consistent between different Puget Sound jurisdictions	Ecosystem process data limited in accuracy and detail. Local information inconsistent between jurisdictions
29	LU & H	Habitat Restoration and Mitigation	Project performance

		As these examples show, there is project performance monitoring information, both for habitat structure and resulting functions. However, scientific certainty about project results is difficult to attain as projects differ in what they examine, how they collect and data, and the time over which the project is studied.	difficult to measure – projects collect different data
40	LU & H	Monitoring and Adaptive Management to Ensure Ecosystem Health over Time Measuring our progress in restoring the health of Puget Sound with objective data and information from a comprehensive monitoring and adaptive management plan is critical to ensuring that our strategies are effective and ensuring that our actions are increasingly efficient in the context of reaching recovery goals.	Objective data and information is needed to measure progress
63	LU & H	*Science and Research Preliminary Recommendations* 1. Create a clear science framework and database from which to measure and act. 11. Establish a centralized and transparent approach to managing information, maps, studies, plans and data related to Puget Sound ecosystem and the Action Agenda. A centralized approach to information management would maximize transparency, accessibility and the sharing of information to improve our scientific knowledge about the Puget Sound ecosystem.	Need a science framework and database Need a centralized and transparent approach to managing maps, studies, plans and data. Improve sharing
5	WQL	Water Quality in Puget Sound Freshwater Systems …Overall trends in water quality for freshwater systems in Puget Sound are difficult to determine due to the lack of consistent data at the same sampling locations over long enough periods of time.	Overall trend analysis limited by lack of consistent date, sample locations and time periods
6	WQL	Sediment Quality The available scientific evidence, combined with the regulatory assessments conducted by Ecology under their Clean Water Act responsibilities, generally supports a conclusion that marine sediments in localized areas of Puget Sound are contaminated. However, there is greater variability in the data for freshwater sediments, making it difficult to conclude the status.	High variability for freshwater sediments prevents status assessment
10	WQL	Septic systems: There are approximately 472,000 septic systems in the Puget Sound basin, according to previous estimates by the Puget Sound Action Team. ……When systems are	Need data on geographic

		located near streams and marine waters, the leachate may be a significant source of nitrogen, and if they are improperly designed or maintained, they are a major source of pathogens. *[Authors and reviewers note more specific description with data on geographic concentrations and magnitude is needed.]*	concentration and magnitude of septic tank locations/impacts
13	WQL	*C. Gaps in knowledge* While new empirical data on climate change impacts continue to inform these projections, uncertainties in the data and model assumptions make it difficult to forecast effects precisely (Lawler and Mathias, 2007).	Climate data is uncertain
30	WQL	Mapping of interjurisdictional stormwater networks. Improved coordination and mapping of stormwater networks across jurisdictions is needed to reduce the potential for spills to travel across waterways through stormwater connections.	Need inter jurisdictional map of storm water networks
32	WQL	Source control To address the human and environmental concerns associated with chemical manufacturing and use, the European Union has moved forward with a regulatory program that requires cradle-to-grave understanding of chemicals prior to allowing their import or use within the European Union. Implementation of the regulation is in its early stages, but a part of the effort that may be of immediate use to the Partnership is the “REACH” database that is being assembled to assess relative risks and potential for source reduction of commonly used chemicals. The Partnership could begin by tracking the REACH database and bringing the available information to bear on decisions in the Puget Sound region.	Need to track chemical manufacturing and use with a REACH type database
	WQL	Improve understanding of the dynamics and levels of nutrients in Puget Sound. How increased nutrient levels affect the Puget Sound food web. In this case we lack both	Need monitoring info on phytoplankton and

		the basic monitoring information on the phytoplankton and zooplankton constituents of the food web and an understanding of the dynamics related to nutrient additions.	zooplankton as parts of food web
34	WQL	*How will we know when we're making progress?* The only way we will know that progress is being made to improve water quality in Puget Sound is to measure it against baseline conditions. There are limited water quality monitoring data available for all of the geographic regions of interest, so a carefully thought out water and sediment quality monitoring program should be established against which to compare future conditions in the fresh and marine water bodies of the Puget Sound basin. It is important to compile all of the existing data available, identify geographic or chemical constituent data gaps, and collect baseline data to fill the gaps.	Need an inproved water and sediment monitoring program to evaluate recovery progress. Need to compile existing data, id gaps and collect data to fill gaps
4	WQ	Data Gaps and Uncertainties To date, no regional summary exists of the adequacy of freshwater resources in the Puget Sound basin. Much of what we know about the adequacy of water resources in Puget Sound has been assessed at a watershed scale by WRIA (water resource inventory area) or more locally. There are 19 WRIAs within the Puget Sound basin (Figure S1-1). However, even with local information, a regional summary of ecological and human water needs is difficult due to: • The disparity in water quantity data and its varying geographic distribution, • Regional variation in climate and geology, • The temporal and geographic variability in the needs of different species, and • Institutional and political sensitivities associated with water use and instream flows. For example, the adequacy of groundwater to meet human needs can vary at a local level within a watershed, or even within an aquifer. Some wells may provide adequate supply while others within the same subwatershed may provide inadequate or saline water. Similarly, streamflows may be limiting for human water supply or aquatic species in some tributaries and not in others within a single watershed. Our understanding of whether low flows are adequate for individual aquatic species is further limited by incomplete knowledge of the complex relationship between flow and channel structure and function, offchannel wetland storage, and riparian condition. Full ecosystem function needs to be considered to determine whether flow is "adequate" for species' needs.	Need summary of freshwater resource adequacy and data. Local information does not approximate a regional summary
5	WQ	Current Adequacy of Freshwater Supply The 2004 State of Salmon Watersheds Report lists the Nooksack, Snohomish, Lake Washington, Green, White, Puyallup, Dungeness and Elwha as "water-critical basins" that are over-appropriated. The Stillaguamish and lower	No data to show impacts of appropriations on

		Skagit watersheds are listed as "low flow," and are noted to be experiencing signficiant pressure for increased water use and declining flows. However, data are not presented to document the impact of these flows on aquatic species.	water critical basins
5	WQ	Data Gaps and Uncertainties Major gaps in our understanding include: • Low-flow requirements for aquatic species are not well understood, and they are intricately linked to other elements of the ecosystem. For example, relationships between flow and the four Viable Salmon Population (VSP) parameters (abundance, productivity, spatial structure, and diversity) that are used to determine the relative health of salmonids have not been determined in the Puget Sound region (Shared Strategy, 2007). There is no regional assessment of the adequacy of flow variations for optimum habitat function, although some newer operational permits for FERC licenses and HCPs are considering high- and low-flow release prescriptions (Cushman Hydroelectric Project, Seattle Public Utilities Cedar River HCP). • Local data about the effects of flow alterations on native species are available. For example, local empirical data indicate the adverse effects of scouring floods and low spawning flows on smolt production (e.g., Seiler *et al.*, 2005). However, such information has not been quantified or extrapolated more regionally. • There are no known studies that address the potential adequacy of flows for aquatic habitat in the future. Threats such as increased groundwater and surface water withdrawals due to growth, associated land use impacts, and climate change may impair flows in watersheds where this is not currently an issue.	VSP parameters for Salmon not determined for Puget Sound region. Only local data is available for low flow impacts on native species. No studies (and data?) on adequacy of flows for aquatic habitat for future
6	WQ	Future Demand for Fresh Water Data Gaps and Uncertainties Major gaps in our understanding include: • There is no statewide program that compiles and reports water use information (Lane, 2004). Where watershed planning has occurred (under RCW 90.82), local communities have attempted to identify local problem areas for water supply and develop demand solutions. However, watershed planning under RCW 90.82 is not occurring in all watersheds in the Puget Sound region, nor are the data consistent between watersheds planning under the act, and so data on potential water supply shortfalls are not available consistently throughout the Sound. • Water system plans are numerous and not regionally compiled. Water supply management is typically addressed at the scale of a retail or wholesale service area of a water system through a water system plan.	No state wide water use information. Data inconsistent between watersheds No compilation of water system plans at

		The plan addresses population projections, demand forecasts, supply sources, and infrastructure requirements. There are over 2,300 Group A water systems (water systems with 15 or greater connections) that have prepared water system plans in the Puget Sound region (WDOH, 2008). The Washington State Department of Health is responsible for approving water system plan updates once every six years. However, they do not compile water system information at a regional scale. Comprehensive Irrigation District Management Plans address the adequacy of water supply for agriculture in the Dungeness and Skagit River watersheds. • Water rights provide an accounting of permitted water withdrawals. However, actual water withdrawals may differ from the water right, and illegal water use occurs. • Regional water supply planning is not occurring everywhere. In some areas such as central Puget Sound, regional water supply planning is comparing regional water demand with regional water availability (CPSWSF, in process). This has not occurred in other areas in Puget Sound. • Permit-exempt water use is not well accounted for. More current instream flow rules call for tracking future installation and use of permit-exempt wells. Reservations for new domestic and municipal supply have been established in those basins, and new uses are tracked through a reservation as a condition of the instream flow rule. Other watersheds that do not have instream flow rules, or have older flow rules, have no method of accounting for current or future permit-exempt water use.	a regional scale
8	WQ	Watershed Scale Assessments Numerous studies and planning processes have addressed aspects of freshwater supply needs, some focusing on species' needs and others including human water uses. Table S1-1 describes these assessments and indicates where these studies and planning processes have been conducted in the Puget Sound region and general outcomes by WRIA.Each has a different geographic coverage and uses different methodologies for identifying flow needs and inadequacies. Lack of inclusion of a watershed in a study or a planning process does not necessarily indicate that there are water availability issues in that geographic area.	Different geographic coverage and methodologies for identifying water flow needs
8	WQ	Water Quantity Data The collection and analysis of data on freshwater quantity, and the use of this information in planning, occurs on geographic scales ranging from individual point locations to coordinated regional monitoring. Surface water data are monitored through stream gages maintained by federal, provincial, state, and local agencies. These gages provide point data that are often used to infer flow conditions in some portion of the upstream area. Where data do not exist, it is possible to use models to create streamflow records based on rainfall, stream gage data, and runoff characteristics from a similar watershed. There is no statewide ambient groundwater monitoring program and	No statewide ambient water quality monitoring so lack of data. Monitoring not uniform

		generally, there is a lack of ambient groundwater monitoring data for Puget Sound. Where groundwater is monitored within Puget Sound, it is not monitored uniformly. Monitoring is primarily performed by local or state agencies. It typically is driven by site-specific needs and limited in scope to particular management objectives (e.g., nitrates, chlorides for seawater intrusion, or other contaminants of concern).	
9	WQ	*F. What is the certainty of our understanding?* As described in earlier sections of this report, there is little certainty regarding freshwater supply, or its adequacy for instream needs and out-of-stream beneficial uses at a regional level. In the Puget Sound region, most ecological assessments and studies have been broadly focused on habitat conditions and impacts to salmon species listed under the Endangered Species Act, and have not addressed water quantity and streamflow issues. As a result, the information regarding the extent and nature of streamflow issues is in most cases general in nature (Lombard and Sommers, 2004). The salmon limiting factors analysis (WSCC, 2005), which provides the most detailed statewide assessment, is a snapshot in time of habitat conditions. In those places where quantitative models and empirical data confirm conclusions, it is reasonable to hold them with confidence. However, given the disparity of data across the Puget Sound region, whether it is gage measurements of freshwater supplies or studies conducted to establish flow-biota relationships, it may not currently be possible to apply site-specific analysis to other areas in the region.	Disparity of data across the Puget Sound region means that site specific analysis cannot be applied across the region
9	WQ	*G. What are the main known gaps in our understanding?* Specific topics were detailed earlier in this report. In summary, the main gaps include: • Data that indicate groundwater levels, trends, and depletion on a regional scale; • Localized hydraulic continuity between surface water and groundwater; • A quantitative correlation between streamflow and fish productivity; • A quantitative understanding of geomorphology and fish needs during high flows; • Identification of flow impairments (both low and high flow problems) within the Puget Sound watershed (similar to the inventory of low flow impairments conducted by the King County Tributary Flow Committee (2006) in WRIAs 8 and 9); Regional understanding (survey) of water system plans and watershed plans: Where is current water supply inadequate to meet projected demand between now and 2020; • Evaluation of freshwater requirements for estuary health; and • The quantity of water used to meet consumptive needs.	Gaps in groundwater data levels trends and depletion. Data to support streamflow and productivity for fish. Data needed to relate geopmorp to fish needs at high flow. Low flow impairments. Water availability projections.
28	WQ	*Watershed Planning and Implementation*	Most WRIA's

		Watershed planning is voluntarily occurring in some watersheds in Washington State under RCW 90.82 (see Table S1-1). Where watershed planning has occurred, citizens, Tribes, local governments, and state agencies have worked together in WRIAs to develop watershed management plans that address the quantity of surface and groundwater. Local groups undertaking this type of planning have addressed water quantity issues in their plans, and some have also performed supplemental assessments of instream flows, water quality, storage, and fish habitat needs (Ecology, 2007a). Most plans address data gaps with actual projects to fill these gaps. Most of these WRIA groups are just beginning to implement the watershed plans they have developed; therefore the effectiveness of the plans is currently unknown and will likely vary over the region.	watershed plans identify data gaps – but effectiveness of plans is unknown and will likely vary over region
33	WQ	Review of a number of freshwater management plans[14] indicates a lack of coordination or integration among existing plans at the regional level. None of the planning programs to date have provided a consistent summary of current water use, projected future water use, current supply, and potential shortfalls in meeting projected demands or instream flow needs for the Puget Sound region at any scale (across all WRIAs, action areas, or other jurisdictional areas). This can be attributed to both programmatic inadequacies and to disparities in the scale at which different aspects of water quantity are addressed by programs in the Puget Sound region. Instream needs[15] are typically addressed at a subwatershed scale, not a WRIA scale. However, municipal water use is addressed at the even smaller scale of a water service area. Individual water users operate at the smallest scale, their own projects. Individual water use data for water systems in Puget Sound have not been summarized at a more regional level (Lane, 2004), nor have the data been correlated with watershed-scale instream needs or streamflow.	Freshwater mgt plans do not provide consistent summary of water use projected use supply and etc. Individual water use data has not been summarized at a regional level. Data has not been correlated to watershed instream needs or flow
42	WQ	Identify benchmarks for flow improvements and evaluate them. (Short-term) Analyze streamflow trends for all of the major tributaries to Puget Sound and compare to instream flows set by rule. Identify metrics that indicate the benefits of flow improvements. Quantify those benefits for individual species. Collect the data that will quantify the benefits of flow improvements for individual species.	Identify metrics and collect data to quantify benefits to individual species
42	WQ	Conduct a regionally consistent assessment of water use and future water needs, and availability. (Long-term) • Estimate the quantity of ground and surface water use and future water availability by watershed (WRIA) or regional management area (action area) in the Puget Sound region. Integrate findings about water needs with reclaimed-water planning and stormwater planning.	Develop a groundwater monitoring program database

		• Develop an integrated and regionally accessible groundwater monitoring program (including some targeted streamflow monitoring) and associated database.	
43	WQ	Model climate impacts uniformly in the ESU. (Long-term) Project the effects of a changing climate on streamflow over time by applying the model created by The Climate Impacts Group (CIG) at the University of Washington (Palmer, 2007) to all major watersheds in the Puget Sound region. Maintain a database of the information developed from the model that is available (through web access) to resource agencies and water suppliers. Update the assessments every 5 or 10 years to reflect new data and knowledge.	Maintain a database of information developed for the Climate impacts Group at UW.
43	WQ	Require metering and reporting for 80 percent of water use (by volume) in all watersheds. (Immediate) Begin with "fish critical" Puget Sound watersheds (Nooksack, Snohomish, Cedar/Sammamish, Duwamish/Green, Puyallup/White, Chambers/Clover, Quilcene/Snow, and Elwha/Dungeness). Create a web-enabled database for metering data.	Create a web-enabled database for data on metered water use in fish critical watersheds.
2	R A	This first iteration of the risk analysis is a mix of qualitative and quantitative information; as more data are amassed in the latter half of 2008 and into the future, increasingly quantitative analyses will be included in the risk analysis so that better estimates of the potential ecosystem response to threat mitigation are available to help inform decisions on priority actions.	More qualitative and quantitative information is needed
2	R A	We summarize status for several attributes of each ecosystem component, depending on the availability of information. Gaps in our understanding of status are noted for those attributes lacking information.	Details of data gaps – go to specific tables in Risk Analysis report
3	R A	For many attributes, information either is not available throughout the region or it has not been compiled and summarized. Such gaps in our understanding of ecosystem status are noted in subsequent tables to accurately reflect this source of uncertainty.	Data gaps are prevalent
7	R A	We aim to document several sources of uncertainty that should be kept in mind when interpreting the results of this risk assessment: (1) information is insufficient or lacking to	Data is insufficient or lacking

		describe the status of an attribute (e.g., in many cases, trends in condition or a reference condition for the attribute is not known, thus it is difficult to relate the current abundance to status	
9	R A	For those data that did not fit cleanly into Action Areas (e.g., county-based data may overlap with 2 or more Action Areas), some data manipulation was required, and this is noted in the corresponding summary tables.	To fit data, data manipulation is needed
8	R A	It is important to note that some of the data available are proxies or surrogate metrics for the attribute, and thus should be considered to be potential, rather than actual threats to ecosystem components. For example, one of the metrics summarized for the toxic pollution attribute is the number of permitted hazardous waste facilities by Washington Department of Ecology. This number is likely to be correlated with the risk of a hazardous chemical spill, but it is not a direct count of how many spills actually have occurred.	For some attributes only proxy data is available
10	R A	**Sources of uncertainty in threat/driver assessment** (1) Information does not exist or is insufficient for several potentially important threats/drivers, (2) metrics available to summarize spatial information are proxies or surrogates for a potential threat or driver, but are not a direct measure of that threat,	Data gaps contribute to uncertainty
11	R A	As for many other ecosystem components, there is little/no information on reference condition or trends in water quality attributes; making interpretation of its status difficult. In addition, different data sources can produce different indications of status (e.g., WA DOE 303d data and the PS Update), so further work is needed to reconcile the implications of different results from different sampling approaches and sources.	Little or no information for reference conditions for water quality

Data Gaps and Uncertainties

Major gaps in our understanding include:

• There is no statewide program that compiles and reports water use information (Lane, 2004). Where watershed planning has occurred (under RCW 90.82), local communities have attempted to identify local problem areas for water supply and develop demand solutions. However, watershed planning under RCW 90.82 is not occurring in all watersheds in the Puget Sound region, nor are the data consistent between watersheds planning under the act, and so data on potential water supply shortfalls are not available consistently throughout the Sound.

• Water system plans are numerous and not regionally compiled. Water supply management is typically addressed at the scale of a retail or wholesale service area of a water system through a water system plan. The plan addresses population projections, demand forecasts, supply sources, and infrastructure requirements. There are over 2,300 Group A water systems (Community and Non-community water systems with 15 or greater connections) identified within the Puget Sound watershed (WDOH, 2008). They represent 66% of the total number of Group A water systems in the State (4,193). Water systems over 1,000 connections, those expanding, and new water systems are required to submit water system plans for review and approval to the Washington State Department of Health. Water system plans are required to be updated once every six years. However, they do not compile water system information at a regional scale.

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p. 28

Water Conservation Programs

Conservation programs vary widely within the Puget Sound region. The City of Seattle employs an effective conservation program that could be used as a model in other areas. Ambitious customer conservation programs have been shown to be effective in reducing per capita water use, and peak summer season water use. There is little consistency in goals for water use efficiency over the Puget Sound region. Starting in 2008, provisions in the 2003 Municipal Water Law will require larger water systems to provide water use efficiency plans within a planning document. And all municipal water suppliers, the 2,300 in the Puget Sound watershed will be required to submit annual water efficiency performance reports on annual production, distribution system leakage and authorized consumption volumes. (WDOH, 2008). However, the goals will vary by water system, and the rule does not include specific targets for efficiencies.

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p. 45 and 6

2. Identify water needs or goals for people by watershed (WRIA) and promote demand management.

• Compile a regional summary (Puget Sound basin wide) of current water use (all sectors), projected water use, and water supply (consider climate change impacts).

• Develop goals for percent of non-potable water demand provided by reclaimed water.

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• Establish conservation targets – e.g., Puget Sound per capita water use factor.

• Establish purveyor conservation targets.

• Identify a target number of ASR and desalinization projects and equivalent streamflow savings.

• Determine the percent of water system plans that have adequate water supply to meet the 2020 threshold (projecting adequate supply through 2020).

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I'm concerned about what you want to measure bolded in yellow above. Maybe, it should be stated differently: Of the 1.4 million projected population increase for the Puget Sound area, how much of this number will be served by

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the larger expanding water systems, served by non-expanding Group A's(approximately 1,600), and by Group B water systems or exempt wells. And identify the number of water system plans showing they will not have enough water to serve the forecasted growth and identify the number of people this represents.

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Also, 2020 is actually pretty soon. Was this year chosen for a reason? Water systems prepare in their plans a look at 6 years and 20 years into their future.

From: Peter Beaulieu

Date: 05/08/2008

Comment: Dear Martha:
The enclosed will add nothing to your workload, but I thought might be of interest to your scribes if they try to build a narrative corresponding to the sequence of Puget Sound urbanization images you have for past, present and future decades.

• The Interim Regional Water and Sewerage Plan/or the Central Puget Sound Region was adopted by the Puget Sound Council Governmental Conference (PSGC) in August 1971. Its value to the Partnership lies in the (four-county) Regional Overview, and particularly in the summary profiles for six Puget Sound basin areas.

• The documentation in the basin profiles is drawn largely from the much more comprehensive Puget Sound and Adjacent Water Study completed in 1970 by two dozen federal and state agencies. This study provided vast detail in some twelve volumes. The abbreviated basin profiles in my transmittal to you put at least some actual numbers to the satellite maps you have for urbanization in 1970. As a point of curiosity, I am also copying you the 1971 PSGC review of the Puget Sound and Adjacent Waters Study.

And, as a point of institutional interest, there is a direct paralle1between the authority ofthe PSGC and the funding review function called for in the current ESSB 5372. Specifically, the spectrum of Great Society programs of the late 1960s included federal funding for water and sewer projects, through the new Department of Housing and Urban Development (DHUD). Under federal regulations (not state statutes) regional organizations like the PSGC were required to adopt a regional water and sewer plan, which was reviewed by DHUD who then "certified" the region for grants to local applicants. The PSGC had the authority under what was called the Circular A-95 process to pass judgment (I think in the fonn of recommendations) on these local water and sewer requests before the funding was actually approved by DHUD. All of which is to say that four decades ago there was a federal requirement for a regional water and sewerage big picture, and there was at least a rubber stamp leash on grants (perhaps more -one PSGC review contributed to the local dismantli ng of the agency in 1975). The Reagan revolution ofthe 1980s brought a dismantling of much federal grantsmanship, and by Executive Order turned the broad A-95 grant review process over to the respective states, where it died a slow and un-mourned death (direct Congressional revision of the underlying federal statutes was fraught with too many political dangers). Pardon this memory trip, but the parallel to ESSB 5372 merits notice.

Attachments: Interim Regional Water and Sewerage Plan for the Central

Puget Sound Region, Review of the Puget Sound and Adjacent Waters Study

From: Peter Beaulieu

Date: 05/19/2008

Comment: Dear Martha:
Enclosed are four sections from the programmatic environmental impact statement done for the original regional Vision 2020 plan adopted by the Puget Sound Council of Governments (replaced by the Puget Sound Regional Council) in 1990. (Water Resources: 4.1.10 and 5.1.10; and Ground Water/Surface Water/Puget Sound: 4.2.3 and 5.2.3).
These provide a brief but perhaps useful regional scale synthesis of water quality and water supply issues for the Puget Sound region and for the four-county urbanized core. This 1990 overview might help answer some of the questions posed during the Partnership's five recent listening sessions.
For example:
• In Edmonds, a request was made for quantitative approach to watershed analysis (Chris Kaufman, Cascade Conservancy?). Table 5.1.10-3 indicates in the right hand column the percent of annual flow in ten basins that was diverted (1990) for out-of-stream uses (varying from 81.3 percent in the Bremerton vicinity and 27.7 percent ofthe Hamma Hamma River, and 66.7 percent in the Cedar, to lesser amounts in the many other basins and 11.9 percent overall (an apples and oranges type aggregate).
• Information is bright-lined from significant research which might already be known to you: The Puget Sound Dredge Disposal Analysis (see Section 5.2.3, p. 285), and regional trends for a range of specific contaminants (Section 5.2.3, p. 286), and
• A few passing references to the probably still informative Environment 2010 (e.g., Section 5.2.3, p. 290, 291) produced by the Department of Ecology in 1990. The enclosure and these references are submitted and identified not in order to obligate a response at this point from the Partnership, but simply to help develop a possible narrative for the Partnership's work - which basinwide narrative might offer cross-sectional snapshots for previous (and future) decades such as 1990.

Attached: vision2020.pdf