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Puget Sound Partnership - Setting Targets for Puget Sound Recovery Revised Addendum to Technical Memorandum on Runoff from the Built Environment dated March 23, 2011

NOTE: This is a Revised Addendum incorporating feedback from participants at stakeholder workshop #2 held on May 12, 2011. Revisions consist of a new paragraph at the end of the introduction, edits to 2020 Objectives 1, and edits to the rationale of 2020 Objective 2. Document reviewers listed below reviewed the Addendum dated May 5, 2011 but not this Revised Addendum.

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1. Introduction

The Puget Sound Partnership (Partnership) held three stakeholder workshops in April 2011 to hear feedback on drafts of technical memoranda dated March 23, 2011, including a memorandum on *Runoff from the Built Environment* ("Runoff Tech Memo"). The Runoff Tech Memo was discussed at the workshop on April 18, 2011. Based on feedback at the workshop and additional analysis, Partnership staff developed this addendum to the Runoff Tech Memo to continue progress towards setting ecosystem recovery targets during 2011.

Ecologically-based objectives preferred
Participants at the April 18 workshop voiced strongest interest for the ecologically-based candidate objectives described in the Runoff Tech Memo and presented at the workshop. Participants voiced some confusion regarding the mix of objectives relating to ecological components, human health, and management (i.e., they felt this was "mixing apples and oranges"). Some participants suggested the Partnership sequence target setting to adopt ecological and human health-based targets first, followed sequentially by targets relating to management actions necessary to achieve the first two sets of targets. This would be consistent with the already-adopted dashboard indicators, all of which are ecologically or human-health-based. Developing another ecologically-based objective and target more closely aligned with stormwater runoff would also fill a perceived gap in the current set of dashboard indicators, as many feel the current list of dashboard indicators do not adequately address the adverse effects of stormwater runoff on the health of smaller stream systems.

Workshop participants were not receptive to the objective related to contact recreation and shellfish harvest affected by stormwater runoff. Participants felt the shellfish target already adopted by the Leadership Council adequately covered this objective. Participants also felt the wording of the objective, if moved forward for consideration, needed reworking.

B-IBI the first choice for ecological indicator

Workshop participants voiced strong support for the Benthic Index of Biological Integrity (B-IBI) in small streams as an ecological indicator. B-IBI measures the community structure of stream invertebrates. B-IBI is attractive for several reasons: 1) It relates directly to biological resources; 2) Data for B-IBI has already been compiled and synthesized; 3) Significant ongoing monitoring efforts are expected to continue; 4) B-IBI already has numeric scoring categories calibrated to Puget Sound lowland streams that can be used to track, and set objectives and targets for, a key component of ecosystem health; and 5) B-IBI is an integrative index that responds to multiple impacts of urbanization and stormwater runoff.

Flow in small streams, while an extremely important potential objective, needs more time and work to develop. Flow data needs to be compiled and synthesized. The definition of "more natural conditions" needs to be developed and, once developed, localized modeling is needed to develop hydrologic goals for the streams, with the added complication that different streams with different watershed attributes may express very different "natural" hydrologic metrics (Konrad and Booth, 2002). Researchers identify flow, riparian habitat extent and type, and water quality as factors affecting B-IBI scores; thus, a target relating to B-IBI would, to some extent, take flow into account (May, 1997; DeGasperi et al, 2009). Last, carrying out systematic flow monitoring is more expensive and time-consuming than B-IBI monitoring because of the need for equipment installation and sufficient time to develop a time-series of prevailing flow conditions (Bedient and Huber, 2002). A clear advantage of working towards a flow metric, however, would be the opportunity to track a critical driver of both physical and biological degradation in small streams, offering a more direct avenue for identifying well-directed corrective actions (Booth et al., 2004, Doyle et al., 2005).

The third ecologically-based candidate objective on pre-spawn mortality received some interest; however, participants noted the lack of clarity and understanding regarding the cause and effect relationship between stormwater runoff and observed mortality (i.e., what about stormwater runoff is causing the high mortality percentages?). Further, to assess pre-spawn mortality, multiple visits are required to observe fish while invertebrate sampling requires only one visit and can happen during a 3-month window.

Rural areas should be included

Participants also questioned focusing only on urban runoff, as rural runoff harms Puget Sound as well. If B-IBI was pursued as a candidate objective, participants urged the Partnership to consider tracking B-IBI Soundwide (i.e., in rural as well as in urban areas).

Target language for B-IBI should be re-examined

Workshop participants questioned the target language for B-IBI; specifically, what is the current baseline for B-IBI scores? How much of a stretch would the proposed targets be over existing conditions? The Science Panel, in their review of the Runoff Tech Memo, questioned the scientific basis for the phrasing of targets (i.e., what would meeting these options for targets mean to the recovery and ongoing health of Puget Sound? What is the scientific basis for the

choice of target options?). Also, some participants urged the Partnership to set long-term (beyond 2020) as well as shorter term (2020) goals.

Use of "2nd and 3rd order" streams should be re-examined
Some participants questioned what is meant by 2nd and 3rd order streams. Others suggested including 1st order streams as well. Still others questioned the use of the term "stream order," as this term is a function of the scale and type of map used to make the designation, and thus can vary considerably for a single stream segment. Some participants suggested using the term "Puget Sound lowland wadeable streams." The population of streams to which the targets apply would be defined in terms of *area* rather than stream order. Within that area, the focus would be on wadeable streams, as they are most affected by stormwater runoff.

B-IBI as a dashboard indicator
Several individuals participating in this effort have suggested adding B-IBI as an additional dashboard indicator. In addition to filling a perceived gap in the dashboard indicators, using B-IBI in this way acknowledges that stormwater runoff alone (flows and pollutants) does not determine B-IBI scores in small streams – stream riparian health also plays a role. Protection and restoration strategies, when developed, should address all these factors.

Based on feedback from workshop participants and additional analysis, Partnership staff propose to focus first on candidate objectives related to *ecological components*; specifically B-IBI in small streams. The remainder of this addendum describes options for establishing objectives and setting numeric targets for B-IBI in small streams. The following objectives are offered *as a package of objectives*, not as individual options. If adopted, these objectives would represent both shorter and longer-term goals for protecting a key ecological component of the Puget Sound ecosystem from threats from stormwater runoff and development. This, coupled with adopting targets for dashboard indicators related to water quality, toxics in sediment and fish, and human health would represent a robust suite of indicators and targets related to stormwater runoff.

This Revised Addendum contains the following changes, which were made based on feedback from participants at the stakeholder workshop #2 held on May 12, 2011:

1. The two lower ranges of numeric targets for 2020 Objective #1 were deleted. Rationale: The vast majority of workshop participants felt that 100% of "excellent" rated streams should be protected, and that the lower range of targets (75-80%) were unacceptable. A target of 90% was retained to reflect comments that: 1) in some rural areas it may be difficult or impossible to preserve 100% as urban growth areas expand into rural areas; and 2) targets need to be bold yet still achievable.
2. Additional text is added to 2020 Objective #2 reflecting participants' recommendation that 10 restored drainage areas be the target for 2020.

2. Results and Discussion

Long-term Objective (beyond 2020): Ensure biological health of lowland streams.

Objective: 60%, 70%, 80% or 90% of Puget Sound lowland stream drainage areas monitored have B-IBI scores of at least 35-38 (supportive of salmonids).

a. Description: This objective represents a long-term (beyond 2020) goal for the biological health of the wadeable lowland streams of Puget Sound's watersheds. Biological health is defined here as supporting the salmonids and invertebrates native to this region. A percentage of the lowland stream drainage areas monitored (60, 70, 80 or 90%) would have stable B-IBI scores of at least 35-38. Stream miles (rather than drainage area) could be measured, as per U.S. EPA guidance (Stoddard et al, 2005). Geographic scope would include all areas monitored, both within and outside urban growth areas (UGAs). Different targets for within and outside UGAs could be set, but as UGA boundaries change, potential issues of shifting baselines and continued degradation would need to be addressed. "Stream drainage area" should be used rather than 2nd and 3rd order streams, as the order of a stream is a function of scale and mapping rather than an intrinsic property of the channel (Dunne and Leopold, 1978). The U.S. EPA recommends using "stream miles" and state reporting follows this guidance (EPA, 2011).

b. Rationale for indicator and numeric targets: The Puget Sound lowland B-IBI is a ten-metric biological index that summarizes the numbers of species and individuals of key groups of macroinvertebrates found in Puget Sound streams (e.g., predators, mayflies and sensitive species). The index combines biological conditions to derive a score between 10 (poor condition) and 50 (excellent condition) that represents the general health of the stream (Karr, 1998, King County, 2009). The indicator was developed to supplement chemical monitoring and provide an indicator of the health of biota in freshwater stream systems. Benthic macroinvertebrates serve as valuable indicators of watershed health due to their limited mobility; use of streambeds for habitat; ease of collection; and response to changes in stormwater flows, water quality and habitat. Numerous researchers use B-IBI to assess the effects of urbanization on the biological health of Puget Sound lowland streams (Morley and Karr, 2002, May, 1998, Fore et al, 2001). Researchers use the index because a strong positive correlation exists between the extent of urbanization of a watershed (as indicated by impervious surface area and clearing of forests), stormwater runoff, and relative biological health of the receiving freshwater stream system (May, 1998, Booth et al, 2004). Researchers have found that alterations in flows, riparian habitat, and water quality all contribute to B-IBI scores (DeGasperi et al, 2009). Thus, strong scientific evidence exists, based on numerous studies in the region, for using B-IBI as an indicator of the effects of development and stormwater runoff on watershed health.

   The proposed numeric target of 35-38 is based on research by Dr. James Karr, one of the pioneers of using biological monitoring to gauge stream health and one of the developers of the Puget Sound lowland B-IBI. According to Karr and other researchers, a minimum B-IBI score of 35 is necessary to provide spawning and rearing habitat for diverse and healthy populations of salmonids native to Puget Sound streams (Karr et al, 2003). The range offered here accounts for a) variation in sampling scores, which are currently approximately +/- 4 points (King County, 2011; Fore, 2011 personal communication); and b) the Puget Sound lowland B-IBI scoring system, which rates streams as "good" when their score is 38-44 (King County, 2011).

   The choice of numeric targets (60-90%) represents policy choices that take into account many factors, including but not limited to financial resources available for implementing

protection and restoration measures, political will, and our ability to influence and change citizen behaviors that have direct and indirect effects on stream channels and riparian areas (Booth et al, 2004). The range is also indicative of significant scientific uncertainty regarding *how much of the total Puget Sound lowland drainage area needs to be protected, or restored, so that the mean scores within these areas achieve and maintain minimum B-IBI scores of 35-38.* In other words, how much of the region's lowland streams need this minimum score to sustain salmonids? Is it sufficient if 60% of the region's lowlands achieve this score? Would that represent a healthy, resilient ecosystem? Or do we need 80%? The author could not find scientific studies responding to this question.

c. Evaluation: There is ample scientific evidence that choosing the Puget Sound lowland B-IBI as an indicator would provide the region with an effective means of evaluating how well the region, as a whole, is protecting the biological health of small streams from stormwater runoff and development of riparian areas. This observation is supported by the Puget Sound Stormwater (Monitoring) Work Group, which has chosen B-IBI in small streams as one key indicator to monitor (Puget Sound Stormwater Work Group, 2010). The King County-led, multi-agency collaborative project to track and monitor B-IBI throughout the region collected more than 4000 samples from more than 1200 sites, providing sufficient data to establish a baseline in many stream drainages (King County, 2011). King County data shows that about 37% of sites have scores of 38 or better (rated "good" or "excellent"), with the remaining 63% rated "fair" or "poor" (King County, 2011). This suggests a fair amount of restoration work would be needed to reach targets in King County. One could query the database to establish similar baselines in other counties where data exists. Not surprisingly, the vast majority of higher scores found are in rural areas. Monitoring gaps exist in more rural counties, like Skagit, where stream stretches may have higher scores. To repeat the above key consideration, there appears to be scientific uncertainty (perhaps due only to lack of studies thus far) as to how many lowland stream drainage areas need to achieve a score of at least 35-38 in order to constitute a healthy, resilient Puget Sound lowland stream ecosystem.

d. Program and policy relevance: As stated in the Runoff Tech Memo, there are some policy implications for *new* development and far stronger implications for existing development. New developments of a minimum size within jurisdictions covered by National Pollutant Discharge Elimination System (NPDES) municipal stormwater permits are required to adhere to strict flow control and treatment requirements that are designed to protect the biological resources and structure of downstream stream channels (Ecology, 2005). These controls, coupled with new proposed requirements in the reissued permits to use the low impact development (LID) approach where feasible, should help maintain B-IBI scores in lowland streams (Ecology, 2011). However, new development requirements for flow control do not always apply to single family residences and much of the land area in Puget Sound is not covered by NPDES municipal permits (the phase II permit applies only to the urbanized portions of the counties). Therefore, smaller new development projects and new development in unpermitted areas of the Sound could continue to have negative effects on stream health.

There are significant policy implications for *existing* development, as noted in the Runoff Tech Memo. The majority of development in the region was built prior to the advent of

current level stormwater flow control and treatment standards. Unless already retrofitted, one can presume that these lands are discharging unmanaged or undermanaged runoff. Bringing all this development up to today's standards is a daunting proposition: A recent assessment estimated the cost to retrofit the impervious surfaces around Puget Sound at $3-15 billion (Parametrix, 2010). This estimate was for treatment only and did not take into account land acquisition costs (a significant cost driver in highly urbanized settings). In order to reach a goal of a high percentage of stream reaches or drainage areas achieving and maintaining a B-IBI score of 35-38 requires significant investments in upgrading older stormwater infrastructure. Improving the maintenance of existing (and new) infrastructure is also required, and will result in significant costs.

Regional considerations: Some areas of the Sound (e.g., San Juan islands and Whidbey Island) will not find this objective very relevant, as there are few stream basins in these regions. Therefore, it may be necessary to identify and develop an alternative objective suitable for the biological resources in these areas.

2020 Objective 1: Biologically richest lowland streams are preserved.

Objective: By 2020 90% or 100% of Puget Sound lowland stream drainage areas monitored with B-IBI scores of 42-46 or better retain these "excellent" scores.

a. Description: This objective represents a protection/preservation target for the remaining high quality small stream habitats. A very high percentage (90-100%) of these high-quality, high-functioning stream drainage areas (or stream miles, if that is what is measured) would be preserved by 2020. The intent is to protect these biologically rich and productive streams from adverse effects from development and stormwater runoff so they can continue to serve as productive habitat for salmonids and other aquatic species.

b. Rationale for indicator and targets: See discussion under "Long-term objective" for rationale for using B-IBI as an indicator. The target of 42-46 is based on the B-IBI scoring system, which establishes 5 ranges of scores, with "excellent" scores defined as 46-50, plus taking into account previously discussed variability in scores of approximately +/- 4 points (King County, 2011; Fore, 2011, personal communication). The range of numeric targets (90-100%) reflects 1) comments from participants at the April 12 and May 12 stakeholder workshops; and 2) policy choices, which include many factors, including but not limited to regional and local political will, available financial resources to implement protection measures, expansion of urban growth areas into rural areas, and willingness of landowners to comply with regulations and participate in programs. There appears to be a lack of scientific studies regarding how much of this excellent stream habitat needs to be preserved to constitute a healthy, resilient Puget Sound ecosystem.

c. Evaluation: As stated, the Puget Sound Stream Benthos database contains a significant number of data points and locations. This allows for a query of the number of stream stretches currently rated "excellent." Additional monitoring in other counties where data is limited would allow for an identification of stream stretches (or drainage areas) with mean scores of 42-46 or better. Once identified, these areas could be designated

for protection. As most of these stream drainages are expected to be located outside UGAs this would allow for in-fill of UGAs with projected regional population growth while still protecting the best remaining habitats within the region. In looking at King County's data, virtually all the "excellent" scores came from stream stretches located outside UGAs (King County, 2011; Fore, 2011 personal communication). Setting this goal is consistent with the Clean Water Act's anti-degradation goals (Davies and Jackson, 2006). Last, resource protection is typically far less expensive and technically difficult than natural resource restoration.

d. Program and policy relevance: Stream stretches with "excellent" scores of 42-46 or higher generally (or entirely) lie outside urbanized areas, areas not regulated under the NPDES municipal stormwater permit. Therefore, the level of control on new development could vary considerably in these unregulated areas, and, as a result, may or may not be sufficiently protective of these excellent quality streams. Many jurisdictions not covered by permit have not adopted current levels of stormwater controls, as defined as the Stormwater Management Manual for Western Washington (or a technically equivalent manual). For new development within some watersheds that drain to these high-quality areas, additional protective measures may be needed. As these areas appear to be virtually always in rural areas, and there is less existing development in rural areas than in urban areas, there is significantly less implications for policies regarding existing development.

2020 Objective 2: Biological health of degraded streams improves.

Objective: By 2020 mean B-IBI scores of 10, 20 or 30 Puget Sound lowland drainage areas improve from rating of "fair" (28 – 36) to "good" (35 - 38 or better).

a. Description: This objective represents a restoration target for a selected number of degraded stream drainage areas that possess potential for improvement. A targeted number of lowland drainage areas (10, 20 or 30) with B-IBI scores of "fair" (as per the Puget Sound lowland B-IBI rating system, King County, 2011) would be identified and restored to the next higher rating ("good", with a score of 35-38 or better). Alternatively, a certain percentage of stream drainages rated "fair" could be targeted for improvement to a point where they would be rated "good" (35-38 or better).

b. Rationale: See discussion under "Long-term objective" for rationale for using B-IBI as an indicator. In order to achieve a healthy, resilient Puget Sound freshwater ecosystem, protecting the remaining excellent stream drainages alone is not sufficient, some number (or percentage) of already degraded stream drainages need to be restored. A certain number of stream drainage areas or stream stretches (or a percentage of the total) would be restored to at least a point where they sustain spawning and rearing of salmonid species native to Puget Sound lowland streams and invertebrate communities. The B-IBI value that is associated with healthy salmonid populations has been estimated at 35, a value in the middle of the range considered "good" (King County, 2011 and Karr et al, 2003). The range of number of stream drainages improved (10, 20 or 30) reflects policy judgments regarding how quickly such restoration can take place. Such choices must take into account desire and willingness to act boldly, available financial resources to plan for and carry out projects, state and local political will, and willingness of citizens

and landowners to participate in such an effort. Participants at the May 12, 2011 stakeholder workshop #2 voiced their support for 10 stream drainage areas restored by 2020 as the most attractive choice for target. Rationale: Workshop participants reiterated the high costs of restoring stream drainages: restoring 10 stream drainages could cost hundreds of millions of dollars. The size of drainage areas that could be considered varies broadly. There are very roughly 350-400 drainage areas in the region ranging in size from 4-30 square miles (Simmonds, 2011 personal communication). Choosing to improve scores of some number of small drainage areas would constitute progress towards restoring the region's small stream ecosystems. As expensive investments to improve stormwater flows, quality of stormwater runoff, and riparian habitat might all needed to be made in order to improve B-IBI scores, choosing a number of restoration sites and projects should not be taken lightly – such restoration activities can be costly.

c. Evaluation: Restoration of a percentage of degraded freshwater ecosystems, coupled with other restoration efforts in watersheds and efforts to preserve the best remaining freshwater habitat, is a logical, defensible process. The Puget Sound stream benthos database provides a viable framework with a significant number of data points with which to establish a baseline and begin to identify stream drainage areas (or stream stretches if preferred) for potential improvement. The Stormwater Work Group's recommendation to use B-IBI as an indicator in future monitoring is highly likely to result in additional monitoring of B-IBI in the coming years. Some initial assessments would be needed to prioritize among the many stream drainages with "fair" scores to determine a subset that have the greatest potential for improvement. The Watershed Characterization study, which is identifying geographic areas for preservation, restoration, and future development, should be used in these assessments (Ecology, 2011) as well as available local data. The choice of whether to identify a number of drainage areas for improvement or a percentage of the total for improvement is largely a matter of choice; each have their pros and cons.

d. Program and policy relevance: See the discussion under the long-term goal (beyond 2020) – much of the program and policy relevance for new and existing development for this objective should be similar. Like salmonids, benthic invertebrate communities thrive under natural patterns of water flow, healthy riparian corridors, absence of chemical contaminants, and abundant availability of food. Restoration goals can be designed to address these factors and progress can be tracked using B-IBI (Karr, 1998; Booth et al, 2004; DeGasperi et al, 2009).

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