Monitoring for Adaptive Management: Status and Trends of Aquatic and Riparian Habitats in the Lake Washington/Cedar/ Sammamish Watershed (WRIA 8)

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King County

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Executive Summary

To inform salmon recovery efforts, King County conducted field surveys of wadeable salmon streams from 2010-2013 to assess habitat conditions in the Lake Washington/ Cedar/Sammamish Water Resource Inventory Area 8 (WRIA 8) watershed. The purposes of the project were to: (1) characterize conditions in small salmon streams using a spatially balanced, statistically rigorous sampling approach; (2) investigate relationships between landscape, hydrologic, biological and habitat metrics; (3) inform adaptive management actions recommended by the WRIA 8 Chinook Salmon Conservation Plan; and (4) communicate findings, methods, and analytical approaches to local and regional forums. This type of comprehensive multi-year effort at the watershed scale is seldom seen in the U.S. and has not yet been attempted elsewhere in the Puget Sound region.

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Watershed Context

The WRIA 8 watershed, encompassing Lake Washington and its tributaries in the central Puget Sound region, contains some of the most urbanized areas in Washington state. Despite this, salmon and trout are still found in urban streams, some of which are migratory routes for regionally important salmon runs. Conservation and recovery actions in the watershed are guided by the 2005 WRIA 8 Chinook Salmon Conservation Plan (hereafter the WRIA 8 Plan). Most Chinook salmon spawning and rearing occurs outside Urban Growth Area (UGA) boundaries where water quality is generally good and aquatic habitat conditions are considered excellent.

Findings

The data collected in this study provide important baseline information on the status and trends of wadeable salmon streams in the WRIA 8 watershed, as well as perspectives on the relationships between land cover, hydrology, habitat, and biological community response.

- Stream biological conditions (as measured by the Benthic Index of Biotic Integrity or B-IBI) ranged from very poor in heavily urbanized areas to very good in rural, forested areas.
- Stream habitat conditions considered important for salmon (wood volume and water temperature) were found to be predominantly not supportive for salmon use even in rural areas. Wood volume was consistently below levels needed to support properly functioning habitat conditions and water temperatures frequently exceeded state standards.
- Generally, four years is not a sufficient length of time to see trends in stream resources. However, we did see a statistically significant upward trend (improvement) in the Benthic Index of Biotic Integrity (B-IBI) in the watershed between 2010 and 2013. There was no corresponding improvement in habitat condition in those streams during those years. Comparison to a larger WRIA 8 and 9

dataset with many more years of data suggests that the increase in B-IBI scores, while real, is likely due to natural variability.

- The spatially-balanced data we collected are of sufficient precision to reliably test for trends in the sampled streams over time. We identified a short list of metrics representing important indicators of stream habitat conditions important to salmon (wood volume, pool area, sediment composition, canopy cover, and B-IBI) that are repeatable and precise.
- Our analyses indicated that for most of the metrics we measured, it will take an annual monitoring program 10 to 20 years to reliably detect a significant change (3 percent per year) in the status of the most relevant metrics. Currently no such program exists.
- Our study corroborated most other research on relationships between land cover stressors and benthic macroinvertebrate community response as measured by B-IBI. Urbanization and population density best explained the observed variance in B-IBI scores – low levels of urbanization and human population density coincide with highest B-IBI scores and high levels of urbanization and population density coincide with lowest B-IBI scores.
- Our study also provided the first test of the utility of a Fish Index of Biotic Integrity (F-IBI) developed especially for Puget Sound lowland streams. Our results indicate that the Puget Sound lowland F-IBI (although initially calibrated and validated with data collected primarily from King County streams) is confounded by contributing upstream basin area and/or stream size. Further research will be needed to identify a F-IBI that is comparable to the B-IBI, which is not confounded by natural landscape features.

Adaptive Management

As part of the 2005 Chinook recovery planning process, the watershed was organized into priority areas or "tiers" based primarily on Chinook use. Certain salmon recovery priority areas appear to be at risk of degradation in the short term. These areas include streams located inside the UGA boundaries where development and infill is occurring and forest cover is diminishing. Findings within the context of these recovery planning tiers follow:

- Tier 1 areas include primary spawning habitat as well as migratory and rearing corridors for Chinook salmon. Management strategies for Tier 1 areas involve the preservation of existing high quality habitat, and restoration where needed. Our surveys confirm that the majority of Tier 1 areas are of relatively higher quality than Tier 2 or Tier 3 sites. B-IBI and pool area were generally higher in Tier 1 areas. However, wood and temperature metrics were low in all tiers.
- Tier 2 areas contain streams with occasional Chinook use, and are important for preserving the overall spatial structure of Chinook in the watershed. Some Tier 2 areas include streams located completely inside the UGA boundaries. Tier 2 streams inside the UGA are at the most risk of degradation in the short term. It is likely that

the most high-functioning Tier 2 area within UGA boundaries (i.e., North Creek) will degrade further without focused efforts.

- Tier 3 areas are the most urbanized areas of the watershed, and have little or no use by Chinook salmon. These streams are generally in poor condition by most metrics. Strategies for Tier 3 areas focus on protecting or improving water quality or decreasing the effects of high flows from stormwater runoff. Current strategies are likely insufficient to support the long-term occurrence of coho salmon in these urban streams.

Adaptive Management Recommendations

- **Re-evaluate the tier strategy based on new information in this report and other sources.** Consider updating the watershed evaluation first performed for the (2005) WRIA 8 Chinook Salmon Conservation Plan. The information presented in this report and from other recent sources (e.g., land cover change and Chinook escapement reports) can be used to re-assess and update the classification framework.
- **Re-examine management strategies in light of the information on habitat quality in this report.** Strategies for Tier 1 and Tier 3 areas appear to appropriately match conditions in those areas. However, Tier 2 areas include some streams inside the UGA boundaries where development and infill is occurring, and forest cover is diminishing. Because Tier 2 areas inside the UGA appear to be at the most risk of degradation in the short term, additional management actions may be warranted.
- **Reclassify some areas based on information acquired since 2005.** The upper Cedar River and its tributaries above Landsburg Dam were classified as Tier 2 in the original WRIA 8 Plan because there was insufficient information on Chinook use above the dam. Data acquired since then confirms that this area has become a core area for Chinook and should be re-classified as Tier 1. Other areas, where watershed function and/or Chinook use has declined, may require reclassification to a lower level or increased efforts to support Chinook use.
- **Request regional support to develop condition thresholds for biologically relevant metrics that are specific to Puget Sound lowland streams.** Thresholds based on reference conditions are needed to classify or categorize metrics into poor, fair, or good condition; or supporting/non-supporting properly functioning habitat condition. In this study, we could only identify thresholds for B-IBI, F-IBI, wood volume and summer maximum stream temperatures. Additional work is needed by the region to establish condition thresholds for other biologically relevant metrics that are specific to Puget Sound lowland streams.
- **Implement a monitoring strategy for the future.** The information in this report provides baseline information collected in a spatially balanced and probabilistic sampling framework using appropriate methods with quantified precision. It provides estimates of precision that indicate it would take an annual monitoring effort about two decades to confidently detect a significant (3 percent) annual change.

Conclusions

One of the key elements of a relevant status and trends monitoring program is that it is sustained over a long period of time. It is hoped that the information presented in this study provides a solid foundation for the development of a well-designed and sustainable long term WRIA 8 status and trends monitoring program. A small number of habitat and biological community metrics with high precision and repeatability, sampled annually, using a proven framework, regional data repositories and established analytical tools, benefits not only the watershed but the region as well.

More broadly, future habitat status and trends monitoring that capitalizes on converging regional and local needs for multiple purposes (water quality permitting, salmon recovery, stormwater, etc.) could contribute substantially to a consistent and reliable long-term set of decision-making tools.