Executive Summary

The Green/Duwamish River watershed provides habitat for wildlife, birds and fish, including three fish species listed as "threatened" under the Endangered Species Act: Puget Sound Chinook, Puget Sound Steelhead, and Bull Trout. The Green/Duwamish River watershed includes the land surrounding the Green River and the Duwamish River, as well as the land surrounding all of the tributaries that drain to the Green/Duwamish River, including the Black River, Springbrook Creek, Mill Creek, Soos Creek, Jenkins Creek, Covington Creek, Newaukum Creek, and Crisp Creek.

The downstream area of the watershed, known as the Lower Duwamish Waterway (LDW), is now largely an engineered channel. Decades of industrial activity in the lower watershed have contaminated portions of the groundwater, soil and sediment with a variety of pollutants. Remediation of contaminated groundwater, soil and sediment is being planned, is under-way, or has been completed at numerous locations along the LDW under Federal[1] and State[2] authorities. A large-scale Superfund in-waterway cleanup, involving sediment dredging, capping and other remediation techniques, will occur over the next ten years in the lower five-miles of the watershed.

In contrast to the site-specific focus of state and federal clean-up programs, the Clean Water Act (CWA) looks broadly at the cumulative water quality effect of pollutants in impaired watersheds. This CWA requirement is implemented through a series of steps, beginning with development of state water quality standards. Water quality standards establish the "uses" of a waterbody, and commonly include fishing, shellfish harvesting, swimming and the ability to support aquatic life. Each state adopts criteria to protect the designated uses. CWA Section 303(d) requires that states identify those waterbodies where the water quality criteria (and therefore the "uses") aren't being met. This list of impaired waters is referred to as the 303(d) list.

Ecology has identified impairments in the water column, fish tissue and sediment in the Green/Duwamish watershed. While the in-waterway cleanup and source control efforts will substantially improve the quality of LDW sediments and surface water, and reduce the seafood consumption risk by about 90%, it is likely that some Clean Water Act-based impairments will remain following the LDW cleanup. Both EPA and Ecology recognize the need for a scientific approach that can predict short and long-term improvements in water and sediment quality, and can subsequently predict the level of contamination in fish tissue over time, as different cleanup and restoration scenarios are implemented.

[1] Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or Superfund), Resource Conservation and Recovery Act (RCRA) and Toxic Substances Control Act (TSCA)
[2] Model Toxics Control Act (MTCA) and Sediment Management Standards (SMS)

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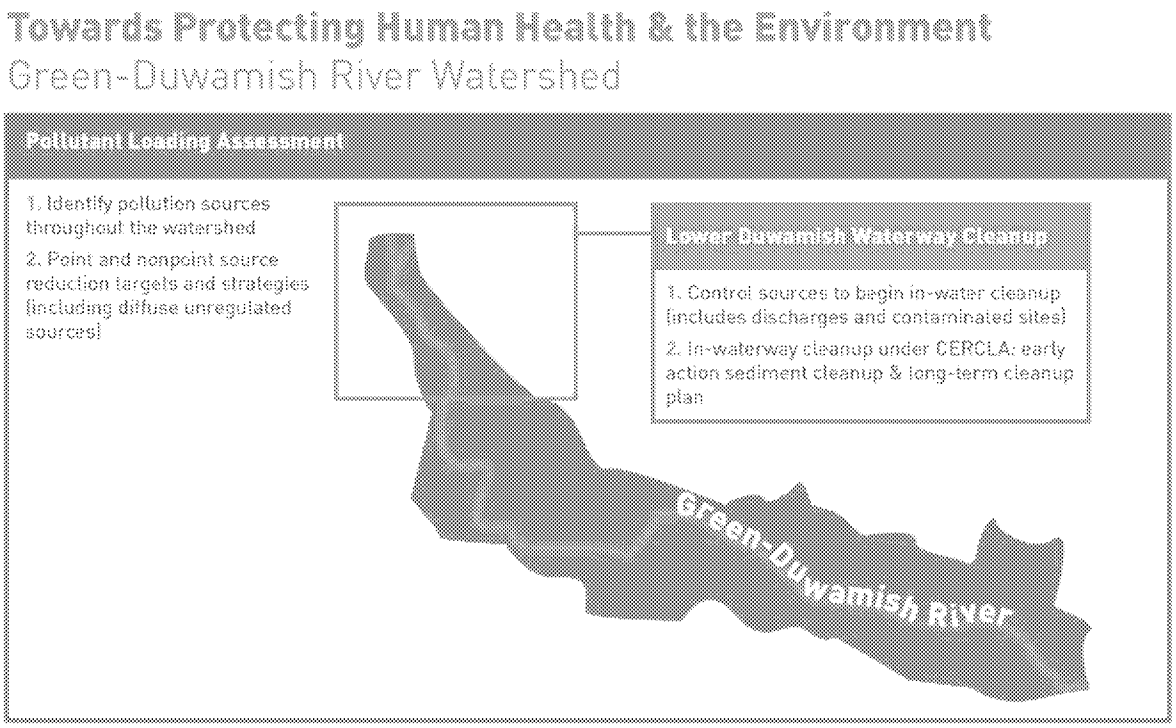

Figure 1: The Clean Water Act-based Pollutant Loading Assessment and LDW cleanup activities are complimentary efforts aimed at a common goal: Protecting Human Health and the Environment

As illustrated in Figure 1, State and federal efforts to clean up historical contamination and to restore water quality in the Green/Duwamish watershed are complimentary efforts aimed at a common goal: protecting human health and the environment. Remediation of contaminated sediments, soil and groundwater in the LDW will help restore water quality, while reduction of pollutant loading throughout the watershed will help protect sediment quality and aquatic habitat in the LDW. Ultimately, successfully integrating state and federal efforts to improve both water and sediment quality will make the most progress toward attaining designated uses, including reducing the bioaccumulation of toxics in the food chain.

The purpose of this report is to outline a proposed comprehensive and quantitative geographically-based pollutant loading assessment (PLA) tool for the Green/Duwamish River watershed, the essential elements of which are described below. A considerable amount of monitoring, modeling, cleanup and restoration work has already been done by local governments, interested parties and regulatory agencies (e.g., Ecology, 2012b; AECOM, 2012a). This report identifies these previous and ongoing efforts, and is designed to incorporate these efforts into a proposal for future work in a way that best represents the complex dynamics of the Green/Duwamish River watershed.

The proposed PLA tool can be used to integrate current and ongoing cleanup and source control efforts in the watershed, with the ultimate goal of protecting human health and the environment throughout the watershed. The PLA tool is designed to assist governments, businesses, and residents with each of the following needs:

- Understand the pollutant loading associated with the uncontrolled release of chemical pollution from diffuse sources throughout the watershed.
- Compare different pollutant reduction alternatives to allow for more informed decision-making.

- Predict the resulting short and long term improvements in fish tissue, water column and sediment quality throughout the watershed.
- Minimize recontamination of post cleanup sediments and improve the effectiveness of natural recovery.
- Support adaptive management over time in response to measured progress in meeting water quality targets.

The proposed tool consists of a linked watershed/receiving water/food web modeling system that will accurately reflect the hydrology, hydrodynamics, and source loadings to the Green/Duwamish River watershed. The recommended models include the LSPC-MDAS[3] watershed model; the Environmental Fluid Dynamics Code (EFDC) receiving-water model, and the Arnot and Gobas and DYMBAM food-web models. The PLA tool will also represent, in a scientifically rigorous manner, sediment transport, resuspension and sedimentation, as well as the dominant processes affecting the transformations and transport of toxic pollutants throughout the watershed, including dissolved and particulate phases of pollutants.

There are three important distinctions between the recommended technical approach and previous approaches developed for the LDW: 1) given that ongoing sources of pollution are located throughout the watershed, a broad geographic scale is a necessary expansion to previous technical analyses, 2) the recommended model framework includes contaminant transport and transformation processes, and an expanded suite of pollutants, and 3) the recommended model framework has the ability to model and predict water quality.

Development of the PLA tool will benefit from the involvement of tribal governments, federal, state and local governmental agencies, as well as area businesses and other interested parties. Available water quality data are currently inadequate to calibrate and validate pollutants in the watershed and receiving water models. Despite this data gap, EPA and Ecology believe initial modeling efforts can start soon (e.g. during the period of additional data collection and/or compilation). Ecology expects development of the PLA to begin in the fall of 2014, and expects that completion of the modeling tool will take several years due to the complexity of the natural processes in the watershed and the wide range of interested parties.

[3] Loading Simulation Program- C++ (LSPC)-Mining Data Analysis System (MDAS) (LSPC-MDAS)

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