

## Research Proposal

### Model Selection for Watershed Scale Temporal Water Storage

**Problem Title.** Which models or modeling techniques can be used or modified to simulate temporal water storage (to mitigate for flow alterations) on watershed scales?

**Problem Statement.** Stormwater flow control in urbanized areas can be either very expensive or not feasible due to land costs, built-out conditions, steep slopes, and other factors. Flow controls also tend to be more difficult to locate next to highways because water storage is land intensive. In-stream flows can be managed on many spatial scales however. It is possible on a technical level to mitigate increased stormwater runoff volumes, rates, and durations by modifying flow storage, routing, retention, and detention. This can be achieved by either altering land use or by providing flow controls for existing impervious areas. By mitigating flow impacts away from the highway right-of-way, it also may be possible to provide additional environmental benefits, such as restoring riparian and wetland areas for fish and wildlife habitat. If off-site mitigation for flow impacts can be demonstrated via modeling to replicate the functions of wet detention ponds as well as provide habitat benefits, it would increase the net environmental value of WSDOT's environmental investments and would promote project delivery by creating more "fish friendly" projects that would be more acceptable to federal services involved in ESA implementation.

Many rivers and lakes have such large background flows and volumes such that the small incremental increases in flow volumes from transportation projects are not measurable or are not environmentally significant. WSDOT projects have been delayed in the past because of technically unjustified accusations that small incremental increases in impervious area would impact baseline river hydrology. A prime example is a highway project near Pasco that was delayed by consultations with federal services because of the impervious signature by a light pole footing discharging to the Columbia River. What is needed is a consistent modeling methodology to determine whether flow impacts derived from the impervious footprints of a project or groups of projects.

Associated questions that could be addressed by this proposal:

- Which modeling techniques should be used to determine which large rivers and lakes can be exempted from flow controls?
- How can it be demonstrated or modeled that a particular change in land use/land cover (such as expanding highways) has no measurable effect (not likely to adversely affect) on receiving waters?

**Literature Search.** This is apparently a relatively new field of study.

**Research Methods.** WSDOT has engaged Ecology with a proposal to mitigate flow impacts of SR 405 North Renton to I-90 lane expansions using a watershed approach. Part of the project

will involve looking for off-site flow control opportunities and developing methodologies for using the MGSFlood or WWHM continuous, HSPF-based hydrology models to predict the impacts of highway expansions and the mitigation(s) used to abate those impacts. This process should continue and be refined for use in other projects.

Inter-Fluve, Inc. has initiated a study, related to the development of an Eastern Washington stormwater guidance, to determine stream-specific flow control standards to prevent geomorphic instability and ecologic disturbance. Watershed-based zoning was introduced, based on a concept developed by Tom Schueler of the Center for Watershed Protection in Maryland (Schueler, T. 1994. The Importance of Imperviousness. Watershed Protection Techniques, Vol. 1, No. 3. Center for Watershed Protection. <http://www.cwp.org/>). Watershed-based zoning classifies streams based on impervious cover in the contributing watersheds and prescribes stream protection methods, including flow controls that are based on the classification. Project size should also be considered as criteria for exemptions, since many projects have very small impervious area impacts. This approach should be proposed in Washington in the future.

**Partnering Opportunities.** Excellent in Washington State. A method for exempting streams in Eastern Washington based on exempting 5<sup>th</sup> order (and higher) streams from flow controls has been proposed. Ecology and WSDOT has initiated attempts to modify that approach for use in Western Washington.

**Estimate of Costs and Research Duration.** Estimated costs have not been developed, but are expected to be between \$50,000 and \$100,000.

**Urgency, Payoff Potential, and Implementation.** Results could substantially reduce costs related to stormwater management facilities.

### **Research Proposer**

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### **Research Monitor (to be assigned, as needed, by the research program administrator)**

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