Appendix Q

Whipple Creek Watershed-Scale Stormwater Plan Report

Analysis of Watershed Prioritization for Stormwater Retrofits

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Background

Recently, the Washington Department of Commerce released a guidance document titled *Building Cities in the Rain – Watershed Prioritization for Stormwater Retrofits*. The aim is to most effectively deploy scarce resources to protect and restore receiving waters for stormwater runoff by prioritizing areas for stormwater retrofitting. The guidance relies heavily on companion guidance by Ecology for elaborate GIS-based watershed characterization and the newer stormwater control transfer program that promotes placing restorative stormwater controls where there is the greatest benefit.

Purpose

This analysis will prioritize Whipple Creek subareas for protection, restoration or development based on hydrologic modeling, water quality modeling and areas of special interest such as salmon bearing stream reaches. The hope is that this analysis will supplement the permit-driven goal of a long-term plan to restore designated uses by identifying areas where restoration should be a near-term priority.

Methodology

This project and analysis is based on the approach presented in the Washington Department of Commerce *Building Cities in the Rain – Watershed Prioritization for Stormwater Retrofits* (September 2016).

The prioritization uses two factors, importance of the subarea resource and level of resource degradation to assign management strategies. Management strategies or approaches are Protection (keep it good), Restoration (make it better) and Development (keeping it from getting worse as development occurs). The procedure allows for more than one management strategy in an area, for example development and restoration in a developing urban area.

Under the NPDES permit stormwater planning requirement to restore designated uses, the goal is clearly restoration and protection, leaving development as an interim watershed state that will someday require restoration.

The calibrated HSPF hydrology model for current conditions in Whipple creek integrates many of the watershed characteristics defined in the GIS-based analysis of the Building Cities in the Rain guidance. The use of a calibrated model removes the need to estimate past hydrology using GIS data.

Hydrologic data can indicate importance by simply noting the discharge rates at base flow conditions. Higher base flow provides better salmon habitat. The flashiness metric TQmean correlates very well with the BIBI score in Clark County streams similar to Whipple Creek. The TQmean therefore provides a good indicator of stream habitat quality based on hydrology.

Along with the calibrated hydrology model, the project uses a calibrated water quality model to estimate historical water quality conditions for five key indicators: temperature, total suspended solids

(TSS), dissolved copper (Cu), dissolved zinc (Zn) and fecal coliform (bacteria). Use of the calibrated water quality model also negates the need for an elaborate GIS model to estimate water quality conditions.

Areas of special concern are considered outside of the modeling analysis. The most significant areas for special concern are those stream reaches that have known or potential salmon presence, and those areas where gravel substrate is present. These factors describing potential salmon habitat will tend to correlate with the hydrologic metrics indicating higher historic importance.

Presenting Results

Results can be presented in absolute terms such as BIBI based on modeled TQmean, or can be ranked and split into groups such as high, medium and low. The figure below is from Ecology watershed guidance and describes the process of binning and displaying results. Once subareas are assigned a metric or a category for protection, restoration or development, these features can be easily mapped using GIS and subbasin or reach maps.

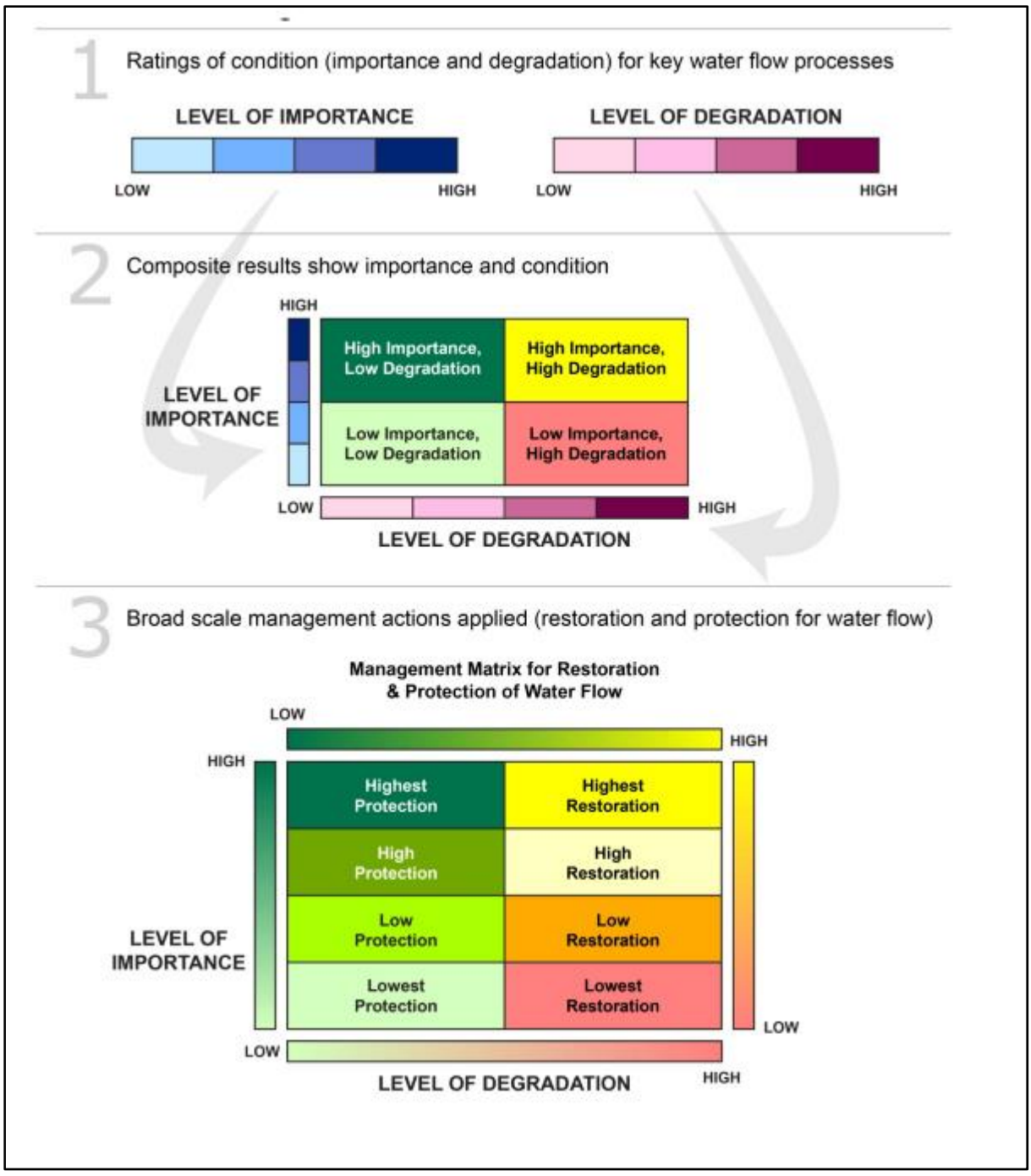

Figure 1: Figure from Ecology Watershed Characterization Guidance

Hydrologic Importance and Degradation by Subarea

The Hydrologic Importance and Degradation of a subarea is determined by how much influence it has on watershed processes. For Whipple Creek, there are two conditions to consider in a simple analysis:

- Hydrologic Importance of a subarea based on historic flows

- Hydrologic Degradation of a subarea based on current hydrology compared to historic.

Hydrologic Importance

Metrics describing **Hydrologic Importance** of historic forested land cover are modeled using the historic predeveloped model which could include metrics such as:

- Base flow (wet and dry season) per unit area to compare to other subareas
- Base flow (wet and dry season) in absolute terms to compare too current conditions
- TQmean to rank importance of subareas historically

Current hydrologic conditions could also be used to establish hydrologic importance considering the reality of watershed conditions.

Hydrologic Degradation (Current Condition)

Metrics describing **Hydrologic Degradation at current conditions** of a subarea are modeled using calibrated HSPF existing conditions model. The integrates a wide array of watershed processes not readily described by a GIS analysis. Hydrologic degradation should be quantified as a deviation from the historical hydrologic condition. For example, the difference in TQmean between historic forest and the current condition would be greatest where streams are most degraded.

Hydrologic Degradation (Comprehensive Plan Condition)

Hydrologic Degradation due to future development of a subarea is modeled using calibrated HSPF model and model inputs that simulate added urbanization built to stormwater standards of the 2015 Clark County Stormwater Manual. The results could be used to show areas where restoration projects are needed to simply maintain the current hydrology.

Water Quality Baseline and Degradation

Water Quality Baseline and Degradation analysis can use the HSPF water quality model to define historic and current water quality, and therefore the amount of degradation from historic conditions. Water quality is somewhat different from hydrology in that there are clear state criteria for water quality based on concentrations of Zn, Cu, and bacteria. Temperature has a more complex standard based on daily maximum temperatures. Total suspended solids do not have criteria in state standards but are a widely used surrogate for pollutants in runoff, as a simple way to measure pollutant impacts due to human activities.

Baseline Historic Water Quality

Modeling water quality for the historic forest condition creates a model-derived baseline defining water quality conditions before settlers arrived. Whether such conditions existed in the area is an open question. The modeled historic water quality may, or may not pass state water quality criteria, but are the best estimate for historic water quality using the calibrated water quality model.

Water Quality Degraded Conditions

The calibrated existing condition model defines current water quality metrics to describe the degree of degradation compared to historic forested condition. Modeled water quality data is used for the comparison instead of actual field data. The difference between current conditions and historic conditions show the level of degradation. The comparison will be for simple metrics such as annual load/unit area or mean concentrations.

Special Areas of Protection and Restoration

Whipple Creek plan scope Task 2 describes areas of special concern. Areas inhabited by salmon and areas contributing flow to salmon-bearing reaches are the highest priority. Areas where gravel stream bed may support salmon spawning are limited to parts of the main channel and Tributary. These areas may be identified as priorities for restoration and/or preservation using specific projects such as channel restoration or flood plain reconnection.

Priority stream reaches could also indicate the greatest need for upstream water quality projects in degraded areas. Whipple Creek is unusual in that the most degraded areas are headwaters along the I-5 corridor and the most important habitat will likely be downstream rural reaches. This means that to protect or restore higher priority reaches, hydrology and water quality restoration may be required up stream in lower priority subareas.