Patterns of Urban Land Treatment and Correlations to Temperature in Puget Sound Waters

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Introduction

Water quality in area lakes, rivers and Puget Sound is influenced by: groundwater inputs and baseflows, stream volume and surface area, riparian vegetation, infiltration rates, climate, seasonal changes, precipitation, snow pack and disturbances. Aquatic life in this region has evolved to respond to specific temperatures, dissolved oxygen levels, nutrient content, and turbidity. In particular, salmon and trout species require a cold water fishery, with low turbidity and high dissolved oxygen levels. Both natural and anthropogenic factors affect the capacity of aquatic systems to maintain these conditions.

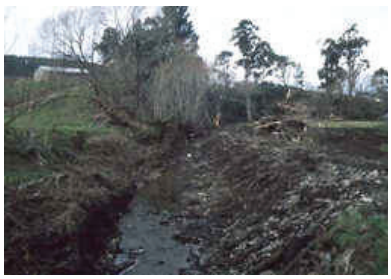
Impacts

Natural factors, such as ambient air temperature, stream flow rate, depth and volume of water, solar heating (which itself is a function of latitude, time of year, and time of day), how much shade is available to block the sun, and influence of adjacent groundwater affect temperature. Natural disturbances, such as flooding, landslides, avalanches and earthquakes, can impact also water quality. However, human caused disturbances, ranging from localized activity to broader global trends, play a greater role in changes in water quality, specifically temperature, in the lower reaches of Puget Sound watersheds. Activities that have contributed to elevated water temperatures include:

- removal of vital riparian and lacustrine vegetation
- impervious surfaces affect runoff and peak flows, prevents infiltration and-heats stormwater
- decrease of stream and river flows due to climate change, decreased snow-pack and growing demands on water supplies for drinking water, industry, irrigation, and recreation
- water impoundment and withdrawals
- augmentation of sediment load due to erosion of stream banks from disturbed riparian areas
- input of point and non-point source pollution and nutrients

Global Predictions

Research exploring impacts of climate change predict large-scale changes in precipitation and temperature patterns in the Pacific Northwest. In the next 50 years, models suggest that Puget Sound will see the air temperatures increase 2 to 10 degrees F, ocean levels rise two to three feet, precipitation increase in the form of rain in winter, decrease of precipitation and widespread drought during summers, and dramatic reduction in glaciers and snowpack. Degradation of wildlife populations, decline in human health, economic declines are the consequences of decrease water quality.



Terrestrial Treatments to Address Water Temperature

Traditional methods to address stormwater runoff have entailed: storm water detention ponds, stream bank reinforcement and armoring, and created wetlands. However, some of these methods are less effective than others. Impounded water--such as in detention and retention ponds, as well as reservoirs--is prone to high water temperatures, mosquito populations, and sedimentation. More recent explorations have entailed scientific modeling to understand temperature variations. The Temperature Urban Runoff Model (TURM), developed in Wisconsin to predict the impacts of proposed development sites, draws correlation between parcel size, impervious surface and stream baseflow. Recent engineering solutions in urbanized areas utilize gabion

As the percentage of impervious area of a parcel increases, more of the total runoff from the parcel comes from the heated runoff contributed by the impervious surfaces. Therefore, as percentage impervious area increases, the temperature of the water runoff from the parcel increases and the temperature of the stream that the runoff enters increases as well. (Dorava et al, p. 89)

weirs to capture larger sediment and filter smaller particles and stone channels to direct water underground (Dorava, Joseph M. et al, p. 85)

In addition to preservation and restoration, other alternative methods to increase onsite retention of storm and sewer water, filtering and infiltration include using constructed wetlands, bioretention and sand filters, notable examples being projects such as SeaStreets and Living Machine. In addition, other terrestrial interventions might include dense urban forests to increase interception of precipitation

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