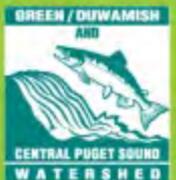


Green/Duwamish and Central Puget Sound (WRIA 9) Chinook Salmon Recovery

Effects of climate change, contaminants, and stormwater on Chinook salmon recovery

*Doug Osterman, WRIA 9
Salmon Recovery Manager*



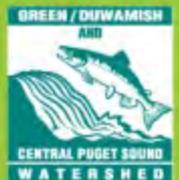


Green/Duwamish and Central Puget Sound Watershed

- 664 square miles
- 720,000 people
- 100 miles of Puget Sound marine shoreline
- 1 county and 16 cities
- Diverse land uses:
 - forestry (47%)
 - residential (36%)
 - industrial/commercial (9%)
 - agriculture (5%)
 - parks (3%)



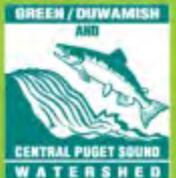
Water Resource Inventory Area 9 “WRIA 9”



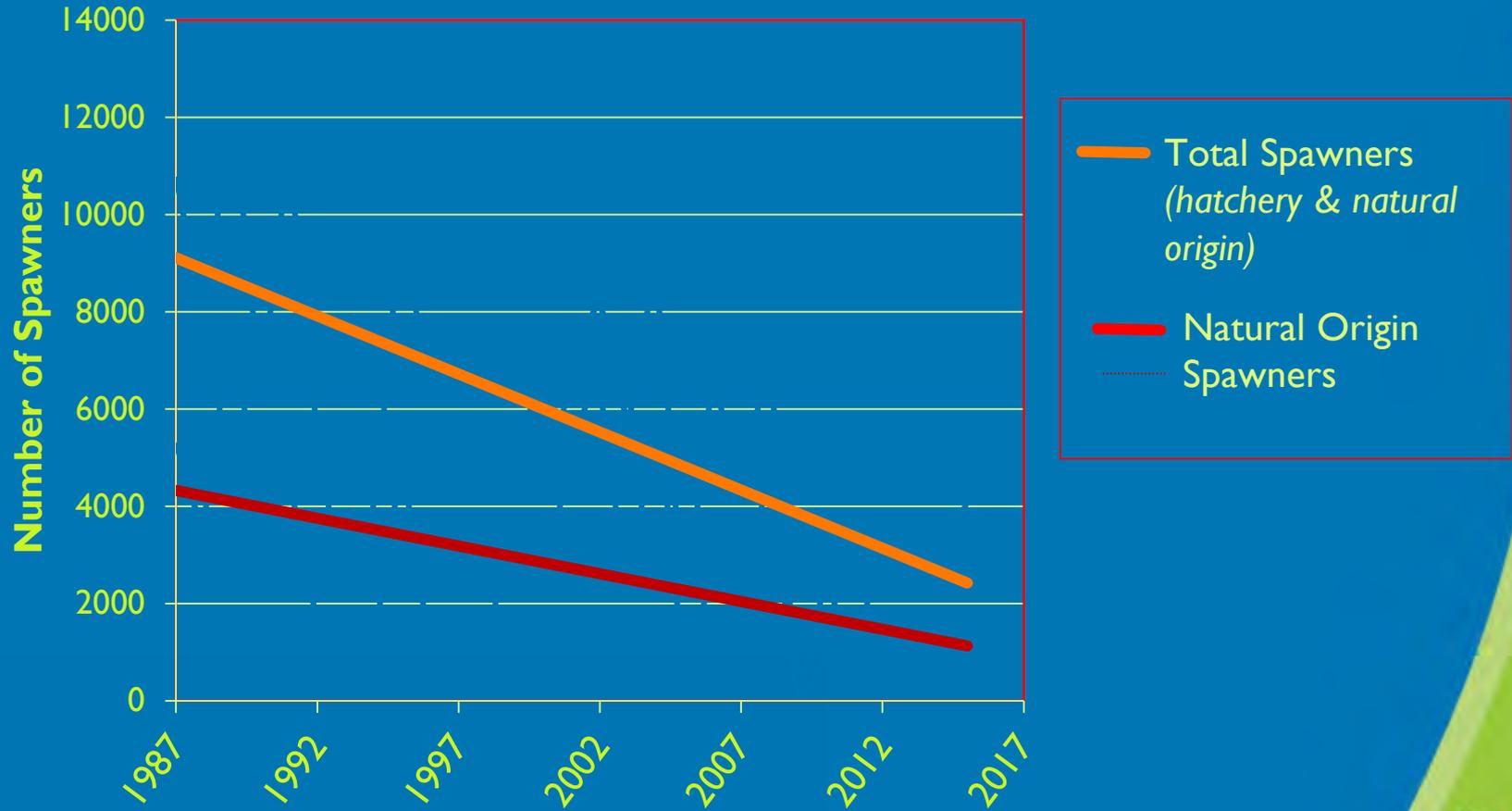
A River of Green, 1970s

Someone should steadily be asking: *Is this the way we want it to be, now and in the future?*

The ultimate condition of the Green River Basin should be the result of informed and farsighted public decisions.



Green River Chinook Abundance



Climate Change Impacts: Quad Strikes



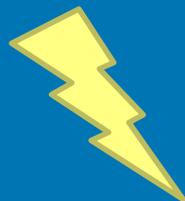
Increased water temperatures



Decreased low flows



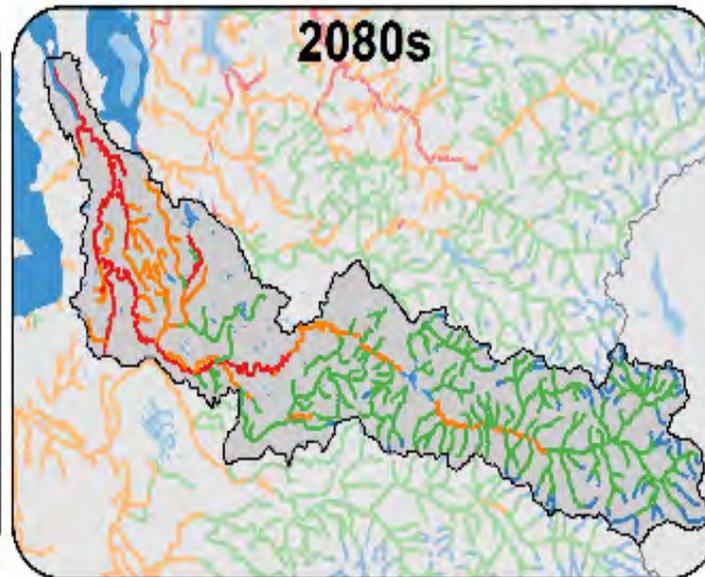
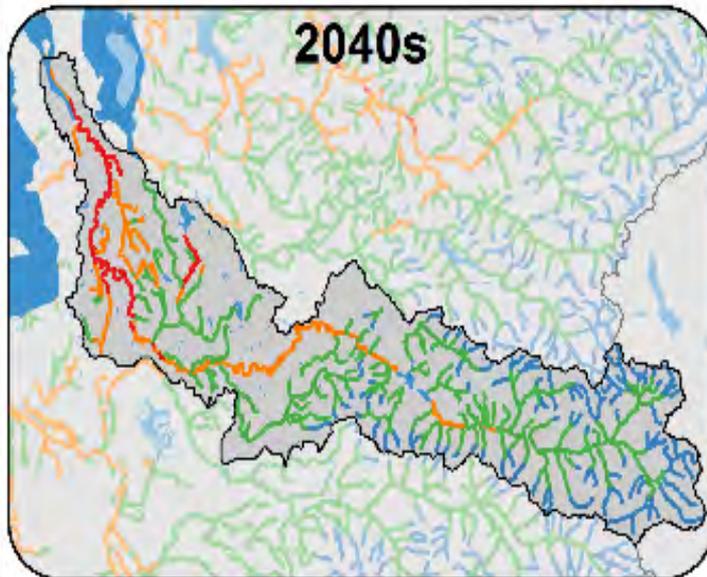
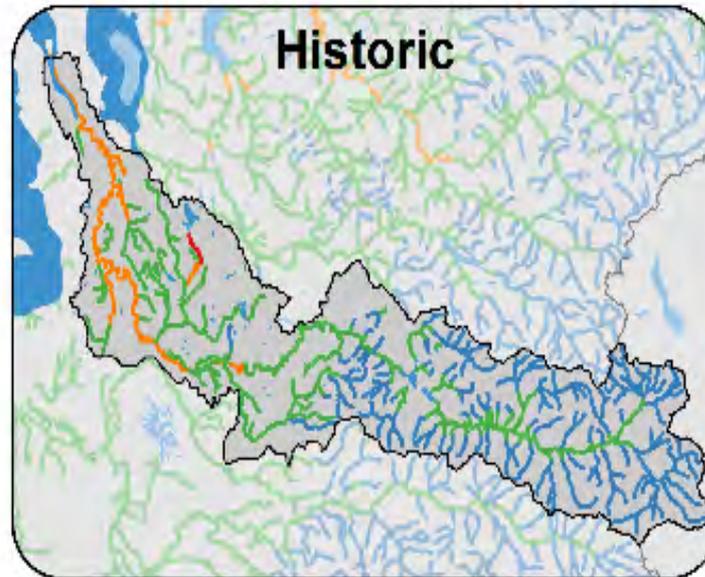
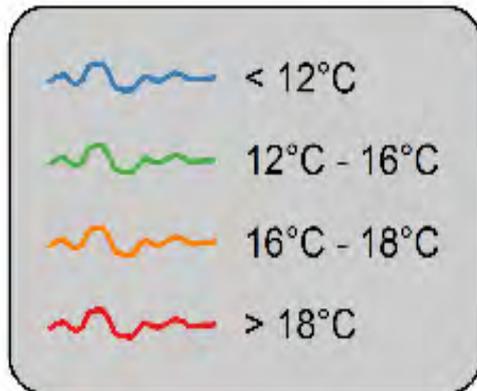
Increased winter floods



Loss of spring snow melt



Stream Temperatures



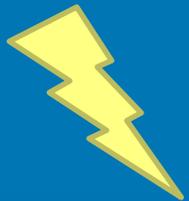
Contaminant Impacts: Quad Strikes



Reduced Chinook return rates to Duwamish Estuary



Documented immunosuppression



Highest known risks in Duwamish River from PCBs



PCBs accumulating, may cause health effects



Chemical Contaminant Toxicity

Metals (copper, lead, zinc)



Ion imbalance

Neurological, reproductive, immune system effects

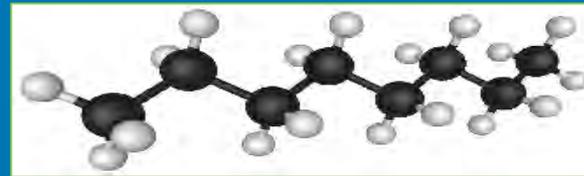
Organic chemicals (PCBs, petroleum hydrocarbons)

Reproductive/developmental effects

Reduced growth

Organ damage

Endocrine system impairment



Stormwater Impacts: Toxic Tri Strikes



Multiple symptoms of toxicity in fish (behavior, lethality, cardiovascular)

Acute lethality primarily affects coho, however sublethal toxicity (cardiovascular toxicity) may be more widespread

Contaminants responsible for acute mortality and sublethal toxicity may differ



Street Sweeping



Bioswales



Check Dams

Stormwater Controls and Retrofits



Cisterns



Ponds



Pervious Pavement



Rain Gardens



Green Roofs

- Conserve water**
 - Efficient faucets, toilets, clothes washers and showers.
 - Fix leaks. Cutting back on the water we use is good for the environment and salmon, and you'll save money.
- Use natural yard care**
 - Build healthy soil with mulch.
 - Leave grass clippings on the lawn.
 - Wait to mow your lawn. Think twice before using pesticides, the native plants.
- Take care of your car**
 - Wash your car on your lawn instead of the driveway. Better yet, take it to a carwash. It's a lot better for your car and recycle more oil. Clean up spilled anti-freeze.
- Use proper disposal**
 - Dispose of unneeded household, paints, cleaners, and other chemicals at hazardous waste collection sites. Do not pour down the household drain or storm drain.
- Preserve your shorelines**
 - Leave your shoreland, dunes, and Puget Sound shoreline vegetation in place. Encourage native plants, shrubs, rocks, and provide insects that feed the fish.

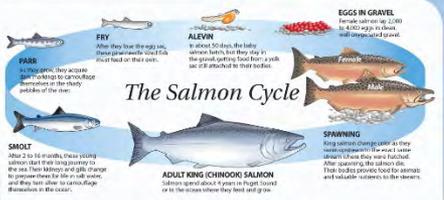


Habitat Plan for the Green/Duwamish and Central Puget Sound Watershed

www.govlink.org/watersheds/

Making Our Watershed FIT FOR FISHING

Chinook salmon were listed as "threatened" in 1999 under the federal Endangered Species Act. In 2005, local governments, environmental groups, businesses, and state and federal agencies completed a science-based Habitat Plan for protecting and restoring local salmon habitat. This watershed plan was folded into the Puget Sound Salmon Recovery Plan approved in 2007. The goal of these plans is to make Puget Sound healthier for people and fish.



- Remove invasive weeds**
 - Remove or control non-native invasive species such as blackberry, knotweed, and ivy that obstruct river flow.
- Plant a tree**
 - Plant native trees and shrubs to improve the ecosystem for fish, wildlife, and birds.

HISTORIC RIVERS

The Green Duwamish Watershed was 1,040 square miles in 1906 when four river basins drained into Elliott Bay. Today it is reduced to 400 square miles. The Cedar River now flows into Lake Washington. The White River was diverted south in 1906 by a logjam. Glaciers made this permanent by constructing a levee. The Duwamish River was straightened, reducing its length from 12 to 11 miles. Flooding was reduced by the construction of the Howard Hanson Dam and a series of levees. These made land in the valley much more attractive for development.

Our Watershed: Problems and solutions

- 12,000 BC** Ice age ends and the Puget Sound glacier retreats.
- Thousands of years before present** Indian peoples thrive on the stream and other resources of the watershed.
- 1851** First settlers arrive in Duwamish estuary area.
- 1866** Population of valley starts to grow in earnest.
- 1870s** Major railroads build.
- 1880-1910** Major logging occurs.
- 1888** Northern Pacific Railroad constructs road way line through the watershed.
- 1889** Washington general land office.
- 1895** Duwamish Falls Waterway construction begins.
- 1900** Extensive logging on Vashon Island.
- 1902** Green River Hatchery completed.
- 1906** Major flooding in rivers during fall and winter legions forces major levee work.
- 1909** Harbor Island, at the time the world's largest artificial island, is completed.
- 1911** The White River is completely diverted to Puget Sound to reduce flooding problems.
- 1913** City of Tacoma completes its Harbor water diversion dam on the upper Green River.
- 1916** Lake Washington Ship Canal completed, Cedar River diverted to Lake Washington. Most of Black River dries up.
- 1917** Dredging fills most Duwamish intertidal areas and the East West Waterways are finished.
- 1919** Private levee construction begins all along the Green/Duwamish river in preventing flooding.
- 1954** Seattle and King County development plan accomplishes the Howard Hanson Dam, a series of levees, and many fill areas.
- 1963** Howard Hanson Dam is completed. Major floods are eliminated.
- 1990** Habitat of State Growth Management Act is promulgated. Smaller, smaller growth.
- 1999** Federal listing of Chinook salmon and hull rule is set. Significant species protection language.
- 2007** Puget Sound Salmon Recovery Plan approved.
- 2015** Significant habitat improvements accomplished. First 10 years of Habitat Plan.
- 2055** Watershed is healthy for fish and for people.

GOAL: IMPROVE HABITAT PRODUCTIVITY AND INCREASE SALMON NUMBERS, DIVERSITY AND DISTRIBUTION

UPPER GREEN

- RIPARIAN HABITAT:** The less we interfere with the riparian zone the better the salmon will do.
- Healthy riparian habitat:** Plants and structure salmon need. Remove or control non-native invasive species such as blackberry, knotweed, and ivy that obstruct river flow.
- Poor riparian habitat:** Lack of native trees and shrubs allows the water to burn and erode non-riparian areas like lawns and lawns.
- Urbanization from streets:** Runoff from streets carries pollutants into the river.
- Leaves:** Recreate more natural and greater stream banks by setting back levees.
- Washbasins and Industry:** Use natural riparian care and avoid "quick release" fertilizers, pesticides, and plant native trees and shrubs.
- Gravel for spawning:** Replacing old culverts with box culverts will help open up stream habitat.
- Replacement:** Road box culverts, gravel flow pipe culverts, and water diversion ditches.
- New Fish Passage Tower:** Maintain healthy riparian habitat, remove obstructions, improve stream structure, and provide habitat for fish.
- Older culverts are difficult for fish to swim through and can allow cut, causing sedimentation.**

MIDDLE GREEN

- Maintain Dams and Fish:** At river mile 10, the Tacoma Hydroelectric Dam creates a barrier to salmon. The dam is being replaced with a fish passage structure. The dam is being replaced with a fish passage structure.
- The Problem with Levees:** Levee banks prevent natural and greater stream banks by setting back levees.
- Control storm water resources to maintain water quality and avoid contamination of estuaries.**
- Factory waste causes mercury level pollution in the Duwamish today. Most pollution today comes from stormwater runoff.**
- Restore shallow water habitat, where young fish feed, shelter, and adapt to salt water.**
- Restore estuaries:** Restore shallow water habitat, where young fish feed, shelter, and adapt to salt water.

LOWER GREEN

- Duwamish Estuary Subwatershed:**
 - Reduce sediment loading to the estuary by installing riparian habitat and stream bank stabilization.
 - Protect and restore water quality through point and non-point pollution reduction.
 - Reduce sediment loading to the estuary by installing riparian habitat and stream bank stabilization.
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- Middle Green River Subwatershed:**
 - Protect and restore side channels, off-channel wetlands, tributary mouths, and pools that provide shelter and habitat complexity for young salmon.
 - Reduce sediment loading to the estuary by installing riparian habitat and stream bank stabilization.
 - Reduce sediment loading to the estuary by installing riparian habitat and stream bank stabilization.
- Lower Green River Subwatershed:**
 - Protect and restore side channels, off-channel wetlands, tributary mouths, and pools that provide shelter and habitat complexity for young salmon.
 - Reduce sediment loading to the estuary by installing riparian habitat and stream bank stabilization.
 - Reduce sediment loading to the estuary by installing riparian habitat and stream bank stabilization.

NEARSHORE

- Marine Nearshore Subwatershed:**
 - Protect and restore riparian habitat, and riparian habitat.
 - Protect and restore riparian habitat, and riparian habitat.
 - Protect and restore riparian habitat, and riparian habitat.

Upper Green River Subwatershed

- Remove or control non-native invasive species such as blackberry, knotweed, and ivy that obstruct river flow.
- Protect and restore riparian habitat along the Green River watershed and major tributaries and riparian habitat.
- Reduce sediment loading to the estuary by installing riparian habitat and stream bank stabilization.
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IN ALL AREAS

- Protect and restore riparian habitat along the Green River watershed and major tributaries and riparian habitat.
- Reduce sediment loading to the estuary by installing riparian habitat and stream bank stabilization.
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Middle Green River Subwatershed

- Protect and restore side channels, off-channel wetlands, tributary mouths, and pools that provide shelter and habitat complexity for young salmon.
- Reduce sediment loading to the estuary by installing riparian habitat and stream bank stabilization.
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Lower Green River Subwatershed

- Protect and restore side channels, off-channel wetlands, tributary mouths, and pools that provide shelter and habitat complexity for young salmon.
- Reduce sediment loading to the estuary by installing riparian habitat and stream bank stabilization.
- Reduce sediment loading to the estuary by installing riparian habitat and stream bank stabilization.

What's a Watershed?

A watershed is the area of land that drains into a river or stream. The watershed boundary is the line that separates one watershed from another. The watershed boundary is the line that separates one watershed from another.

Green Duwamish and Central Puget Sound Watershed

Area: 1,040 square miles (1906) / 400 square miles (2007)

Length of Green Duwamish River: 10.5 miles

Length of Puget Sound: 100 miles

Annual value of recreation goods and services: \$1.2 billion

- Water Resource Inventory Area 9**
- Subwatershed boundary**
- City boundary**
- Salmon hatchery**
- Urban growth area line**
- Levee**
- Contamination:** Highest concentrations of mercury, PCBs, PHAs, and phthalate contamination.
- Restoration projects:** Proposed projects include reconnecting side channels, creating shallow water and marsh habitats, planting native trees, setting back levees, adding gravel for spawning, culvert removal, removal of bulkheads, and restoring pocket estuaries.

- Protect Puget Sound beaches and bluffs**
 - Use soft armoring rather than hard bulkheads to protect property. Preserve areas that overhang the beach. Move rocks gently rather than excavating and leave driftwood in place.
- Consume wisely**
 - Buy products that have the best ratings on water quality in their manufacturing, use, and disposal.
- Get involved**
 - Volunteer to steward restoration projects by planting trees and collecting invasive weeds.