
SALMON HABITAT PLAN:
Making our Watershed Fit for a King

Green/Duwamish and Central Puget Sound Watershed (WRIA 9)

August 2005

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0209 W9SteeringCom.ai LP

August 10, 2005

Dear WRIA 9 Watershed Forum Members:

On behalf of the citizen-stakeholder Steering Committee for the Green/Duwamish and Central Puget Sound (WRIA 9) Watershed, we are pleased to present the *Salmon Habitat Plan: Making Our Watershed Fit for a King* to the WRIA 9 Forum of local governments. This plan reflects thousands of hours of work since 2000 by the Forum, Steering Committee, and supporting working groups and committees. It demonstrates the positive results of our inclusive partnership to help improve our watershed's health for people and salmon. Moreover, this plan presents a road map, based on sound scientific evidence and the collaborative efforts of many, for our watershed's contribution to turning around the salmon decline in Puget Sound.



Our local wild Chinook salmon runs were listed as "threatened" under the federal Endangered Species Act (ESA) in 1999 and are clearly in danger. This fact suggests that the underlying ecosystem that supports these remarkable fish also is in jeopardy. It is up to all of us to recover this important resource for ourselves, for our children, and for our children's children and to make our watershed truly "fit for a King."

The attached *Salmon Habitat Plan* reflects many hours of deliberation by the Steering Committee in response to public comment received on the draft Salmon Habitat Plan between March 10 and April 25, 2005. Numerous policies and actions have been revised, cost estimates have been refined, and a more detailed implementation strategy has been developed. The Steering Committee also adopted a watershed-wide prioritization policy that forms the basis for implementing projects.

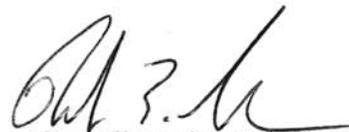
This *Salmon Habitat Plan* is based on a strong scientific foundation. Using this foundation, we have developed an ecological approach that offers solutions in the form of landscape-level and site-specific actions that can be implemented by local governments, business, community groups, and private property owners.

For any other questions or information needs regarding the Salmon Habitat Plan, contact either Gordon Thomson, WRIA 9 Habitat Plan Manager, gordon.thomson@metrokc.gov, 206-296-8013, or Dennis Clark, Public Outreach Coordinator, dennis.clark@metrokc.gov, 206-296-1909, toll free 1-800-325-6165, TTY 711.

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Financial support provided by signers of Watershed Planning Interlocal Agreement for WRIA 9 including: Algona, Auburn, Black Diamond, Burien, Covington, Des Moines, Enumclaw, Federal Way, Kent, King County, Maple Valley, Normandy Park, Renton, SeaTac, Seattle, Tacoma, Tukwila

Now remember this, the recovery plan must be a living document. While we must commit to work to make progress, we recognize that the plans will change as firmer answers become available.

To prove or disprove the science undergirding the plan, we must monitor our results, test our hypotheses and adaptively manage the changes necessary to meet new data requirements or test new hypotheses. Our knowledge of what to do is not perfect and we should not demand perfection of our plan.

We need not await perfection before we decide to act. We know enough to make a huge difference if we proceed on our current knowledge.

William Ruckelshaus
Keynote speech excerpt
Shared Strategies Summit
January 26-27, 2005

DOCUMENT ROADMAP: QUICK GUIDE TO THE SALMON HABITAT PLAN



See how the document is organized

- This matrix and the Table of Contents



See how the Salmon Habitat Plan addresses harvest and hatchery practices in WRIA 9

- Chapter 1: Executive Summary (Section 1.11)



Read an overview of the main points of the Salmon Habitat Plan, and how the Plan addresses Bull Trout and other species

- Chapter 1: Executive Summary (Section 1.12)
- Also see Volume II: Appendix K for a comparison between the recommendations in this Plan and those of the U.S. Fish and Wildlife Service that will benefit Bull Trout



Understand what the Salmon Habitat Plan is and is not

- Chapter 2: Introduction



Understand the WRIA 9 Salmon habitat conservation planning process

- Chapter 2: Introduction



Learn what is being done now to protect and restore salmon habitat

- Chapter 2: Introduction Other related information: Near Term Action Agenda, May 2002 at:
<http://dnr.metrokc.gov/WRIAs/9/NTAA.htm>



Learn the characteristics of the WRIA 9 Watershed, causes of salmon decline

- Chapter 3: Impacts on Salmonid Habitat in WRIA 9: History, Factors of Decline, and Policy Recommendations
- See the *WRIA 9 Habitat Limiting Factors and Reconnaissance Assessment* available at:
<http://dnr.metrokc.gov/WRIAs/9/Recon.htm>
- For saltwater habitat information, see the *State of the Nearshore Ecosystem: WRIAs 8 and 9* available at:
<http://dnr.metrokc.gov/wlr/Watersheds/puget/nearshore/sonr.htm>



Learn about the science behind the actions

- Chapter 4: Scientific Foundation Other related information: Strategic Assessment at:
<http://dnr.metrokc.gov/WRIAs/9/index.htm>

DOCUMENT ROADMAP: QUICK GUIDE TO THE SALMON HABITAT PLAN



Learn about the ecosystem synthesis approach used in the Plan.

- Chapter 4: Scientific Foundation



Learn about the specific management strategies that lead to each action

- Chapter 5: Habitat Management Strategies
- Other related information: Functional Linkages Reports (Phase 1 and 2) at: <http://dnr.metrokc.gov/WRIAs/9/StratAssess.htm>



Learn how ecological economics can be used to determine the value of the WRIA 9 ecosystems:

- Chapter 6: Ecological Economics Foundation



Find out what actions are recommended Watershed-wide for all local governments and other partners

- Chapter 7: Proposed Actions and Policies to Achieve a Viable Salmonid Population



Find out what actions are recommended for the specific part of the watershed where you live, work, or play

- Chapter 7: Proposed Actions and Policies to Achieve a Viable Salmonid Population



Learn how flexible this plan is and how we can respond to changes in the future.

- Chapter 8: Implementation Strategy and
- Chapter 9: Adaptive Management and Monitoring
- Other related information: Shared Strategies Summit Platform statements at: <http://www.sharedsalmonstrategy.org/summit/index.htm>



Understand how the actions can be implemented and where the money may come from

- Chapter 8: Implementation Plan



See who participated in the development of the Habitat Plan

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Photos

Unless otherwise noted, all photos courtesy of King County Department of Natural Resources and Parks.

ABBREVIATIONS AND ACRONYMS

BNSF Railway	Burlington Northern Santa Fe (Railway)	NOAA Fisheries	National Oceanic and Atmospheric Administration Fisheries
cfs	cubic feet per second	NOR	natural origin recruit
CY	cubic yards	NPDES	National Pollution Discharge Elimination System
DSA	distinct spawning aggregation	Plan	WRIA 9 Salmon Habitat Plan
ERP	Green/Duwamish Ecosystem Restoration Project	RCW	Revised Code of Washington
ESA	Endangered Species Act	RM	river mile(s)
ESU	Evolutionarily Significant Unit	SAV	submerged aquatic vegetation
Forum	Forum of Local Governments	SRFB	Washington State Salmon Recovery Funding Board
GIS	Geographic Information System	TMDL	Total Maximum Daily Load
Habitat Plan	WRIA 9 Salmon Habitat Plan	TRT	Puget Sound Technical Recovery Team
HOR	hatchery origin recruit	VSP	Viable Salmonid Population
ILA	Interlocal Agreement	WAC	Washington Administrative Code
KCD	King Conservation District	WLRD	Water and Land Resources Division
LWD	large woody debris	WRIA	Water Resource Inventory Area
MRV	marine riparian vegetation		

GLOSSARY OF TERMS

303 (d) list: Lists of all water bodies with impaired water quality in the United States as required by the Clean Water Act of 1973.

abundance: A measure of the size of the population or numbers of fish at each life stage. One of four viable salmonid population (VSP) parameters.

action: The process of doing something to achieve an aim. In this Plan, actions include both projects and programs. In this Plan, the term actions does not include policies.

adaptive management: A dynamic planning and implementation process that involves applying scientific principles, methods, and tools to improve management activities incrementally, as decision makers learn from experience and as better information and analytical tools become available. Adaptive management involves periodic modifications of planning and management strategies – and sometimes goals, objectives, and benchmarks – in recognition of the fact that the future cannot be predicted perfectly. Adaptive management requires deliberate, careful monitoring and analysis of the results of past actions and application of those results to current decisions.

alevin: Larval salmonid that has hatched but has not fully absorbed its yolk sac and generally has not yet emerged from the spawning gravel.

alluvial: Deposited by running water.

anadromous: Pertaining to fish that spend a part of their life cycle in the ocean and return to freshwater streams to spawn.

anthropogenic: Resulting from the influence of human beings on nature

bank armoring: The artificial application of various materials to protect streambanks from erosion by running water. Also, the formation of an erosion-resistant layer of relatively large particles on the surface of a streambank.

bar: Ridge-like accumulation of sand, gravel, or other alluvial material formed in the channel, along the banks, or at the mouth of a stream where a decrease in water velocity induced deposition. Also, a structure (of

alluvial material, bedrock, or other material) that obstructs flow and induces deposition.

basin: The area of land that drains water, sediment, and dissolved materials to a common point along a stream channel. Synonym for watershed.

buffer: An area of intact vegetation maintained between human activities and a particular natural feature, such as a stream. The buffer reduces potential negative impacts by providing an area around the feature that is unaffected by this activity.

channel migration: The area within the floodplain where a stream or river has been and will be susceptible to channel erosion and/or channel occupation.

channelization: Straightening the meanders of a river; often accompanied by placing riprap or concrete along stream banks to fix the stream in its new channel.

confluence: The junction or union of two or more streams; a body of water produced by the union of several streams.

conservation hypothesis: A “best estimate” of how improvements in habitat conditions and processes will lead to improvements in the four salmon parameters critical to viability.

conspecific: Of or belonging to the same species.

current use assessment program: A program designed to preserve open space/natural areas by providing tax incentives to encourage landowners to keep their open space-type properties in “current use.” Specifically, it seeks to prevent the loss of open space due by taxing land at the lower tax rates associated with agricultural or undeveloped uses (see also Public Benefit Rating System).

distinct spawning aggregations: A group of conspecific fish gathered for the purpose of spawning, with fish densities or numbers significantly higher than those found in the area of aggregation during the non-reproductive periods. Resident spawning aggregations draw individuals from a relatively small and local area, whereas in transient spawning aggregations individuals must travel days or weeks to reach the aggregation site.

diversity: Differences within and among populations in genetic and behavioral traits. One of four viable salmonid population (VSP) parameters.

drainage area: Total land area draining to any point in a stream, as measured on a map, aerial photograph, or other horizontal, two-dimensional projection.

Ecological Synthesis Approach: A practical approach of understanding a population within an ecosystem based on empirical observations of how salmon currently use habitats in the overall watershed in the context of current versus historical habitat conditions.

ecosystem: A biological community of interacting organisms and their physical environment.

ecosystem management: Management that integrates ecological relationships with sociopolitical values toward the general goal of protecting or returning ecosystem integrity over the long term.

Ecosystem Restoration Project/Study: In the 1990s, the US Army Corps of Engineers, in partnership with King County, the cities of the watershed, the Muckleshoot and Suquamish Tribes, state agencies, and local interests conducted the Green/Duwamish Ecosystem Restoration Study to identify steps needed to restore the ecosystem of the watershed. The resulting list of 45 projects is called the Green/Duwamish Ecosystem Restoration Project. Implementation of the first projects began in the early 2000s.

Endangered Species Act (ESA): A 1973 Act of Congress that mandated that endangered and threatened species of fish, wildlife, and plants be protected and restored.

escapement: The number of fish that have survived all causes of mortality and will comprise the spawning populations.

estuary, estuarine: Semi-enclosed body of water that has free connection with the open sea, and within which seawater is measurably diluted by fresh river water. Typically provides a greater number of ecological niches than either freshwater or marine ecosystems.

evolutionary significant unit (ESU): A population (or group of populations) that is reproductively isolated from other conspecific population units, and represent an important component in the evolutionary legacy of

the species. Chinook salmon in Puget Sound are considered one ESU by NOAA Fisheries.

fecundity: The average number of eggs produced by a female salmon.

fingerling: A salmon that migrated from the river to the estuary or ocean in its first year of life. Its total age equals its marine age.

fishmix: The proper mix of substrate (gravel) sizes in the marine nearshore that forage fish can spawn in.

floodplain: Lowland areas that are periodically inundated by the lateral overflow of streams or rivers.

fry: Life stage of trout and salmon between full absorption of the yolk sac and a somewhat arbitrary defined fingerling or parr stage, which generally is reached by the end of the first summer.

functional linkages: The qualitative and quantitative relationships between habitat quantity and quality and the four viable salmonid population (VSP) parameters of abundance, productivity, diversity, and spatial structure.

hatchery origin recruits (HOR): Describes all fish that are not of natural origin.

hyperosmotic: Having an osmotic pressure higher than that of the environment. For example, a fish in fresh water is *hyperosmotic* to its environment (and hence tends to lose salts and be flooded by water).

impervious surface: An impermeable ground coverage or surface, such as a paved road, roof, sidewalk, or structure, that alters the natural flow and quality of water.

interlocal agreement (ILA): An agreement between two or more governments or other partners defining shared tasks or responsibilities. This Plan was developed under the terms of an interlocal agreement signed by all WRIA 9 local governments and the City of Tacoma.

large woody debris (LWD): Large woody material that intrudes into a stream channel. Large pieces of wood are an important part of the structural diversity of streams. The term usually refers to pieces at least 20 inches (51cm) in diameter.

levee: A long, narrow embankment usually built to protect land from flooding. If built of concrete or masonry, the structure is usually referred to as a flood wall. Levees and floodwalls confine streamflow within a specified area to prevent flooding. The term “dike” is used to describe an embankment that blocks an area on a reservoir or lake rim that is lower than the top of the dam.

life history: The description of a species’ entire life cycle including rearing, feeding, migratory, and breeding behaviors.

life history stage: The distinct periods in the life of a salmonid. Typically, each life stage is associated with particular habitat needs. Life history stages vary among salmonids. For Chinook, life stages are egg, alevin, fry, smolt, ocean phase (immature), and adult.

life history trajectory: Classification of salmonid rearing based on estimated body length and approximate residence time within rearing habitats. Expression of life history trajectories depends on genetic diversity (the propensity of juveniles rear in a given habitat) and environmental conditions (the existence of habitats necessary for a given trajectory). Five life history trajectories have been identified for Green/Duwamish River Chinook: marine-direct fry, estuarine reared fry, lower river-reared fry, marine-direct late migrant, and yearling.

limiting factor: Single factor that limits a system or population from reaching its highest potential in terms of viable salmonid population parameters.

logjam: Large accumulations of debris partially or completely blocking the stream channel, creating major obstructions to flow.

marine riparian vegetation: See “riparian.”

Mean Lower Low Water: The average height of the lower low waters over a 19 year period (a tidal datum).

meander: The snake-like appearance of the reach of a stream. More specifically, a stream reach is said to be meandering if its length is 1.5 times (or more) the length of the valley through which it passes.

natural origin recruit (NOR): A fish that has spent essentially all of its life-cycle in the wild and whose parents spawned in the wild.

necessary future conditions: An hypothesized set of Chinook population and habitat goals and targets considered necessary to produce desired changes in viable salmonid population (VSP) parameters. In WRIA 9, necessary future conditions are expected to be refined over time as understanding improves regarding the relationships between habitat quantity and quality and salmonid population response.

osmoregulation: Control of the volume and composition of body fluids.

oxbow: A looping river bend or meander cut off from the main flow by a new channel. A crescent-shaped lake formed by the detachment of a river bend from the main channel.

parr: Young trout or salmon actively feeding in freshwater; usually refers to young anadromous salmonids before they migrate to salt water.

patch: A sub-unit of a landscape that exhibits consistent or homogenous properties that are different from the surrounding area. In a riverine system, for example, a patch may refer to a gravel riffle or to a pool. It may also refer to a pool:riffle unit that is separated from other such units by other types of patches. In meta-population work, a patch is often considered the smallest unit of the landscape relevant to population dynamics.

photic zone: The zone in a water body (lake or ocean) extending from the surface to the depth at which photosynthesis cannot occur due to insufficient light.

phragmites: A tall wetland grass also known as common reed. There are both native and non-native strains of this plant in Washington. Due to its aggressive tendencies and impact to waterways, the non-native strain was added to the State Noxious Weed List as a Class C noxious weed in 2003.

piling groups: Groups of pilings, usually vertical wooden poles from historical piers or buildings.

policy: As used in this Plan, a “policy” refers to high-level guidance related to either goals or methods of achieving those goals. In this Plan, policies are most likely recommended for local governments and may address land use regulations, land use incentives, stormwater management, stewardship/public education, and internal government practices.

pool tailout: The downstream end of a pool where the bed surface gradually rises and the water depth decreases. It may vary in length but usually occurs immediately upstream of a riffle.

productivity: A measure of how well the population is “performing” in its habitat, or the growth rate of the population. One of four viable salmonid population (VSP) parameters.

program or programmatic action: As used in this Plan, a “program” refers to a body of work requiring staffing and/or funding. For example, a program to provide incentives to private property owners who voluntarily protect habitat could include determining incentives, publicizing them, and awarding them to the property owners. In this Plan, programs focus on weed control, stewardship/public education, internal government practices, and other governmental efforts to protect and restore salmon habitat either directly or in cooperation with individuals, groups, businesses, and other governments.

project: As used in this Plan, a “project” refers to on-the-ground efforts to protect, restore, rehabilitate, or substitute habitat or the processes that create habitat. Habitat protection projects typically consist of the acquisition of specific habitat through fee-simple purchase or purchase of a conservation easement. Restoration, rehabilitation, or substitution projects consist of improvements to instream, riparian, or upland habitat through planting of native vegetation, control of weeds, installation of large woody debris, setting back or breaching levees, removal of bulkheads, excavating shallow water habitat, gravel supplementation, and other physical changes that expand the quantity of habitat or improve its quality.

protection: The maintenance of ecosystem form and function together with the attendant processes necessary for creation and maintenance of the ecosystem. This may also imply management of the ecosystem (or of external influences) to maintain natural characteristics and function.

Public Benefit Rating System: A program in King County that provides incentives to encourage landowners to voluntarily conserve and protect land resources, open space, and timber. In return for preserving and managing resources, the land is assessed at a value consistent with its “current use” rather than the “highest and best” and as much as 90% for the portion of the land participating in the program (also see current use assessment program).

recruitment: The influx of new members into a population by reproduction or immigration.

refugia (plural; refugium – singular): Geographic locations where a species or population has persisted during changed or adverse conditions such as glaciation. Also, a collection or mosaic of habitat units that supports a persistent population during normal environmental perturbations. Refugia occur at scales from tens to thousands of square miles.

rehabilitation: To return to working order or to put back into good condition. In this case, not all characteristics and functions of an ecosystem will be recovered but improvements can be made that approximate some undisturbed forms and functions. Continual human intervention will likely be required because restoration of the underlying ecosystem processes has not occurred. (National Research Council, 1992)

restoration: To return an ecosystem to a close approximation of its condition prior to disturbance; the re-establishment of pre-disturbance aquatic functions and related physical, chemical, and biological characteristics. This requires attention to rebuilding the entire ecosystem with attention to all functions and characteristics, an objective that may, in practice, be quite difficult to achieve. (National Research Council, 1992)

revetment: A facing of stone, broken rock, or other material placed on a streambank to minimize erosion by running water.

riffle: Shallow section of a stream or river with rapid current and a surface broken by gravel, rubble (cobble), or boulders.

riparian: Type of transition zone between aquatic habitats and upland areas. Typically, lush vegetation along a stream, river, or Puget Sound shoreline (marine riparian vegetation).

run size: The total number of adult salmon returning in a given year. Consists of all fish including those harvested, those taken as broodstock for hatcheries, and those escaping to spawn in the wild.

salmonid: Of or relating to fish of the family Salmonidae, including salmon, trout, chars, whitefish, ciscoes, and grayling. In general usage, the term most often refers to salmon, trout, and char.

seep: An area of groundwater flow to the land surface or surface water.

setback: The repositioning of a levee or other structure away from the edge of the river or stream. Setback levees allow habitat to develop between the levee and the river or stream.

Shared Strategy for Puget Sound: A collaborative effort to protect and restore salmon runs across Puget Sound. Shared Strategy has engaged local citizens, tribes, technical experts and policy makers to create a Chinook salmon recovery plan for Puget Sound. Shared Strategy is the venue where the WRIA 9 Salmon Habitat Plan will be integrated with other habitat, hatchery, and harvest plans through the Puget Sound Salmon Recovery Plan.

smolt: Juvenile salmon that are in the process of making the necessary physiological changes for transition from freshwater to saltwater. This is usually the time the young salmon migrate out of the river into the estuary, although they may continue the smoltification process in freshwater after having reached the estuaries.

soft armoring: The protection of streambanks or shorelines through techniques that utilize living and nonliving plants instead of rock revetments and concrete bulkheads. These techniques are considered to have higher value for fisheries, wildlife, water quality, and aesthetic appeal.

spatial structure: Both the geographic distribution of fish in a watershed and the physical processes that lead to that distribution. One of four viable salmonid population (VSP) parameters.

stray: An individual that breeds in a population other than that of its parents.

stray rate: The proportion of a population that consists of strays.

substitution: The replacement of ecosystem form and functions with new features that are not supported by natural processes. Substitutions require constant intervention to maintain the desired functions.

Total Maximum Daily Loads (TMDLs): The quantity of a pollutant that can be assimilated by a water body and still meet water quality objectives. The initials TMDL also refer to the final Water Cleanup Plan document

that outlines how this quantity was determined and describes the process used to determine the quantity.

trajectory: See “life history trajectory.”

transition zone: A location where freshwater from a river and saltwater from the marine salt wedge mix, creating brackish conditions. It is also often is where the river widens, stream velocities decrease, and estuarine mudflats begin to appear. Habitat associated with the transition zone is particularly important for juvenile Chinook and chum smolts making the transition to salt water. The transition zone moves upstream and downstream in response to the combination of stream flow and tidal elevations and thus varies over a 24 hour period and seasonally.

upland: Land areas not immediately adjacent to a water body. All land exclusive of riparian zones and surface freshwater. Uplands are connected to streams through sheet flow on undeveloped or cleared lands and through stormwater sewers and road drainage systems.

viable salmonid population: A population that is naturally self-sustaining and not dependent upon artificial propagation.

viable salmonid population (VSP) parameters: The parameters critical to a viable salmonid population: abundance, productivity, diversity in terms of genetics and life history, and spatial structure. See separate definitions for abundance, productivity, diversity, and spatial structure.

Water Resource Inventory Area (WRIA): Geographic areas usually corresponding to major watersheds. Washington State is divided into 62 WRIsAs for water management purposes. The Green/Duwamish Watershed and the small stream drainages from Seattle’s Elliott Bay to Federal Way make up WRIA 9. For salmon habitat planning purposes only, Vashon/Maury Island is included in WRIA 9.

watershed: A basin-shaped area that drains to a central point where it enters a larger river, lake, or the ocean. A watershed includes freshwater ground water and surface waters as well as the marine waters of Puget Sound. Although technically made up of multiple watersheds or basin, the area in Water Resource Inventory Area 9 is often simply referred to as the Green/Duwamish and Central Puget Sound Watershed. Synonym for basin.