Stormwater Management and Recovery of Puget Sound Chinook Salmon

A Report Submitted to

Smith and Lowney

by

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February 2, 2006

Notice of Intent to Sue -
Attachment 9

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February 2, 2006

Mr. Richard Smith
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2317 East John Street
Seattle, WA 98112

Dear Mr. Smith:

Enclosed please find Steward and Associates' report, "Stormwater Management and Recovery of Puget Sound Chinook Salmon," authored by myself and John Lombard, Senior Policy Analyst at Steward and Associates.

Our report documents the inadequacy of current approaches to stormwater management with respect to their potential to adversely affect chinook salmon. Current runoff control standards and practices are likely to preclude the possibility of recovering chinook salmon in all basins with substantial development. Stormwater from cleared and developed areas has such profound effects on hydrology—and therefore also on the structural and functional aspects of stream channels—that it can overwhelm other efforts to conserve and restore salmon habitat, such as critical area buffers or restoration projects. The water quality of receiving streams can be impaired by stormwater to the point that salmon are killed outright. Stormwater also causes sub-lethal effects that harm the ability of salmon to reproduce or make them more susceptible to death by other direct causes, such as disease or predation.

We base our conclusions on the scientific literature cited in our report, and on our professional experience, which in my case includes more than 25 years in fisheries management, serving clients that include federal and state agencies, Indian tribes, universities, private firms, and environmental groups from throughout the region. I received my M.S. in Fishery Science from the University of Washington in 1983 and my B.S. in Wildlife Science, Aquatic Option, from the University of Montana in 1978, graduating Summa cum laude. My firm, Steward and Associates, provides technical assistance to a wide variety of clients in analyzing environmental impacts, complying with governmental regulations, and resolving conflicts involving fisheries and aquatic resources, with emphasis on water management, watershed analysis, habitat restoration, and fisheries research and management.

In 2000, I was appointed by the National Marine Fisheries Service to serve as a scientific advisor to federal and state agencies engaged in the recovery of threatened and endangered salmon and steelhead in the Willamette and Lower Columbia Rivers. I also serve on the Greater Lake Washington Watershed Steering Committee and Technical Committee for Chinook salmon recovery, and as technical advisor to the Bonneville Power Administration on matters of implementation and compliance with habitat provisions set forth in the current Biological

Opinion for Federal Columbia River Power System. I have worked extensively with the Lower Columbia River Fish Recovery Board, supervising watershed assessment work in support of salmon recovery planning in 5 counties in southwest Washington. I specialize in the habitat and migratory requirements of juvenile salmonids and have broad expertise in freshwater ecology and fisheries management. I am frequently solicited to provide expert opinion and help resolve conflicts involving fisheries and aquatic resources, including surface water management, watershed impacts, salmon hatchery impacts, salmon smolt passage survival and behavior, and monitoring and evaluation techniques.

Mr. Lombard assists our clients with review of environmental regulations, policies and programs, particularly as they affect salmon. He has helped four cities update their critical area regulations, including development of comprehensive new regulations for the Cities of Oak Harbor and Roslyn. He also managed our development of an Endangered Species Act Strategy for the City of Snohomish, which included both a detailed evaluation of habitat and water quality throughout the City's Urban Growth Area and a comprehensive review of City regulations, programs and capital projects that might affect salmon. The Strategy serves as an integrated approach for the City's compliance not just with the Endangered Species Act but also the Clean Water Act, Growth Management Act, Shoreline Management Act and other environmental laws. Mr. Lombard is the author of Salmon, Owls, Orcas and Us: A Practical Conservation Strategy for the Puget Sound Region, to be published this fall by the American Fisheries Society and the University of Washington Press. His book includes a detailed evaluation of the major laws that affect the region's ability to conserve its natural heritage in the face of long-term population growth, including the Clean Water Act and related stormwater programs.

Further background on Mr. Lombard's and my qualifications may be found in our curricula vitae, which are appended to this report.

Thank you for the opportunity to assist your review of how stormwater issues relate to the recovery and health of Puget Sound Chinook salmon populations. Please do not hesitate to contact me if you have any questions or concerns regarding our report.

Sincerely,

Cleveland R. Steward III

Cleve Steward
Principal and Senior Scientist

Enclosure

cc: John Lombard – Steward and Associates

Table of Contents

Stormwater Management and Recovery of Puget Sound Chinook Salmon

I. Introduction

This report summarizes how National Pollutant Discharge Elimination System ("NPDES") permit-authorized stormwater discharges affect Puget Sound chinook salmon, which was listed as a threatened species in 1999 under the Endangered Species Act. NPDES permits include municipal stormwater permits, construction stormwater permits, permits for stormwater discharges associated with industrial activities, and permits for numerous other types of activities, including sand and gravel operations, boatyards, and aquatic pesticide applications. The United States Environmental Protection Agency ("EPA") has delegated regulatory authority over NPDES permits to the Washington Department of Ecology ("Ecology"), as allowed under the federal Clean Water Act. As discussed in this report, stormwater discharges regulated through the NPDES permit program have serious and widespread hydrologic, toxicologic and water quality impacts that adversely affect chinook salmon and their habitat.

"Degradation and loss of freshwater and estuarine habitat" throughout the Puget Sound area was one of the primary reasons NOAA Fisheries decided to list Puget Sound Chinook salmon as "threatened" under the Endangered Species Act (NOAA 1999). In addition, NOAA Fisheries stated in its listing decision, "recent studies suggest that effects of pollutants on early life history stages of Chinook salmon also contribute to the stress on fish" in the Puget Sound area (NOAA 1999). As discussed in this report, later studies confirmed and amplified these concerns.

Because they are anadromous, chinook salmon occupy a wide variety of freshwater and marine habitats over the course of their lives. Puget Sound chinook are referred to as "ocean-type" because they migrate to the ocean earlier, typically within one to three months after emergence, than do stream-type fish, which reside for up to a year in freshwater before migrating. Since they are smaller at time of saltwater entry, ocean-type chinook salmon spend an extended period of time within estuaries and nearshore areas, where they acclimate and grow while preparing for their ocean migratory stage (Pacific Fisheries Management Council 1999).

Although variations in juvenile migration and adult run timing exist, all Puget Sound Chinook possess similar freshwater ecological requirements: cool, clean water, adequate flow, appropriate spawning substrate, sufficient food, riparian vegetation, shelter from predators, and safe passage conditions. Stormwater runoff that is subject to regulation through the NPDES permit program is a major source of pollutants affecting chinook salmon in freshwater, estuarine and nearshore areas (Richter undated). It also frequently alters the hydrology of streams to the point that habitat is degraded and chinook survival and behavior are significantly impaired. Stormwater management, therefore, is crucial to the long-term persistence and recovery of Puget Sound Chinook salmon.

Ecology's Stormwater Management Manual for Western Washington (WDOE 2005a) is the primary authorized guidance regarding how stormwater should be managed to facilitate salmon recovery in the Puget Sound region. NPDES permits generally require implementation of the Manual or its equivalent. Yet, far from leading to improved stream conditions, the Manual is insufficient to prevent conditions from getting worse for salmon as surrounding areas develop. As the Manual itself acknowledges, its focus on engineered solutions and Best Management Practices "cannot replicate the natural hydrologic functions of the natural watershed that existed before development, nor can [these approaches] remove sufficient pollutants to replicate the water quality of pre-development conditions." These natural functions and processes create and maintain the habitat required by Chinook salmon for their long-term survival. To foster these conditions, the Manual advocates retaining as much natural soils and land cover in a drainage basin as possible, together with low-impact approaches to development. But it does not mandate these approaches. Moreover, NPDES permits provide significant exceptions to even the inadequate standards the Manual does require. Together, the weaknesses of the Manual and NPDES permits as currently written preclude the possibility of long-term salmon recovery in the Puget Sound region.

II. The Hydrologic Effects of Stormwater

Puget Sound streams, and the salmon and other life forms they support, evolved over time in relation to their surrounding landscape. Historically, this region was heavily forested almost everywhere except for high mountains above treeline and the prairies found in south Puget Sound and the rain shadow of the Olympic Mountains. These vast tracts of forests, consisting mainly of western hemlock, Douglas fir, western redcedar and diverse understories of plants, had a profoundly moderating influence on stream flows, for two fundamental reasons. First, vegetation kept approximately half of all precipitation from ever reaching streams or aquifers (Beyerlein 2000). Much of the water that fell was collected on the surface of plants and returned to the air by evaporation. Plants also drew water through their roots from the soil, some of which was released back into the atmosphere via transpiration. Second, over thousands of years, leaf and litter fall accumulated in a thick, spongy layer of forest "duff", which trapped water that was either released back into the atmosphere via evapotranspiration or was forced by gravity downward into the groundwater and underlying aquifers. Plants and soils were so efficient at trapping water that in all but the greatest storms, there was essentially no surface runoff in the forest (Booth 1991).

Prairies, especially in south Puget Sound, typically occurred on porous glacial outwash soils, and so had little surface runoff from rain and snow. Streams and other waterbodies in prairie and forested areas were replenished by subsurface flows at rates determined by local topography and geology.

All this changed dramatically with Euro-American development, which has generally cleared forests and the top layer of soils, replacing them with hard surfaces such as rooftops and roads. Rain falling on these impervious surfaces is conveyed by gutters, pipes and ditches to receiving waterbodies in matters of minutes or hours rather than days, weeks or months. Even nominally pervious surfaces such as lawns and pasture cannot halve the volume of precipitation as forests do. Moreover, lawns often become nearly as impervious as roads and rooftops because the soils beneath them get compacted or the forest duff has been stripped away before they have been installed (Beyerlein 2000, Booth 1991).

Research on streams in the lowland areas of Puget Sound, where most development in the region has taken place, has found that stormwater from development can cause profound biological damage just from how it changes downstream hydrology, independent of and in addition to damage it may cause through increased pollution (Booth 1991; May et al, 1997; Booth et al 2001). This is especially true for areas that are not heavily urbanized, which generally provide the best habitat for salmon. Changes in hydrology include both more and higher peak flows. Many storms that formerly had minimal effect on stream flows under forested conditions now cause flows to increase to flood proportions in urbanized watersheds. Major floods now occur much more frequently, with devastating consequences (Booth et al 2001; Booth, Hartley and Jackson 2002). In addition, by reducing the amount of precipitation that is stored and gradually released from surface waters and aquifers, impervious surfaces reduce stream baseflows during periods of little or no precipitation.

These flow changes profoundly affect the physical structure of streams, as well as the life within and around them. Physical effects include destabilizing both streambeds and stream banks, as regular high flows erode banks and transport gravel and fine sediment downstream (Booth, 1991; May et al 1997). Stream channels either cut down through softer materials, eliminating connections with riparian and floodplain areas, or they spread out across harder materials (such as gravel, cobble or bedrock), aggravating problems with reduced baseflows. Woody debris, which is crucial to the creation and maintenance of habitats that salmon and other species need, is often cleared from streams in developed areas out of concerns for flooding or public safety. Wood that is removed or transported downstream by high flows is often not replenished because of extensive clearing of riparian areas in developed areas. Sediment eroded by higher flows tends to fill and eliminate pool habitats and bury spawning gravels. All of these changes harm salmon by reducing the quality and quantity of habitats they use for rearing, spawning, and protection from predators and threatening conditions, such as the high and turbid flows that now occur much more frequently. The changes also reduce the quality and quantity of habitats used by insects that are the preferred food of salmon.

A clear and consistent inverse relationship between the biological health of lowland streams and the percentage of impervious surface present has been found for Puget Sound drainages (Booth et al 2001).[1] Scientists now recognize that biological health begins to

[1] Biological health is typically measured by the Benthic Index of Biotic Integrity (B-IBI), developed by University of Washington Professor Jim Karr, which is based on the number and diversity of invertebrates collected from the stream bed at a given site. Though the index does not use salmon directly, it is a useful measure for the quality of salmon habitat, both because salmon prey on many of the invertebrates used in the

decline at very low levels of development. There is substantial variation in the biological health of streams at low to moderate levels of impervious surface (below approximately 30% of the drainage basin). At these lower levels of urbanization, other factors beside the amount of impervious surface can have significant effects on biological health, including the size and integrity of riparian areas and the amount of forest and wetland area in the basin. At higher levels of urbanization, alterations in hydrology and water quality appear to be great enough that other factors tend to make only modest differences in biological health (Booth et al 2001).

NOAA Fisheries recognized the importance of stormwater runoff in the "4(d) rule" it issued to govern take of Chinook and other salmonids listed as threatened under the Endangered Species Act:

> Changes in hydrological processes associated with the effects of MRCI (Municipal, Residential, Commercial and Industrial) development typically result in a flow regime that is more episodic and generates higher peak flows, faster runoff, and reduced base flows during periods without precipitation. Peak flows and base flows are both ecologically significant. Peak flows are primary agents of instream and riparian habitat change during storm events. Base flows sustain aquatic life during dry portions of the year. Other hydrological characteristics are also significant in the design of stormwater systems, for example, the need for water velocities suitable for juvenile salmonids.
>
> Stormwater management programs associated with MRCI development activities should avoid impairing water quality and quantity. Such programs should preserve or move stream flow patterns (hydrographs) closer to historic hydrologic conditions (e.g., peak flows, base flows, durations, volumes, and velocities) that maintain properly functioning habitat conditions. This can be accomplished by guiding land-use practices at the watershed scale in order to reduce impervious surfaces, maintain forest cover, and retain natural soils. These conditions will, in turn, maintain essential habitat processes such as natural water infiltration rates, transpiration rates, stormwater run-off rates, sediment filtering, and provide hydrographic conditions that sustain aquatic life. (NOAA 2000)

III. Water Pollutants and Stormwater

In addition to the hydrologic effects just discussed, stormwater can also have dramatic impacts on water quality that harm salmon. Polluted stormwater from urban and agricultural areas is now by far the most common reason why waterbodies across the

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index and because the community of invertebrates, being relatively stationary, reflects conditions at that site over time, not just at the time of collection.

country are not meeting water quality criteria under the Clean Water Act (EPA 2005). The types and quantities of pollutants present in stormwater vary with land use and pollutant sources. Most urban pollutants come from industrial and commercial areas, roads and freeways and higher density residential areas. Single-family residential areas can contribute significant amounts of pollutants as well, especially when viewed across an entire drainage basin. Motor vehicles are a major pollutant source, contributing oils, greases, hydrocarbons and toxic metals (Richter undated).

A. Conventional Pollutants

The term "conventional pollutants" refers to water quality parameters that are frequently monitored, such as temperature, pH, dissolved oxygen and turbidity. It also refers to particulate matter suspended in water that can be seen by the naked eye. Especially in urban and suburban areas, stormwater is frequently polluted in all these respects.

Streams in developed areas tend to be warmer than similar streams in undeveloped areas for a variety of reasons, including reduced inflows of cool groundwater because of reduced infiltration; reduced riparian shade from current and past clearing; and the warming of stormwater in detention ponds and water quality treatment facilities or from running across exposed surfaces such as parking lots and street gutters.

Unnaturally high water temperatures in discharges are a "pollutant" under the Clean Water Act and are a particularly significant problem for salmon (WDOE 2002). In 2003, the Washington Department of Ecology proposed modifying water quality criteria for temperature in the state, primarily to protect salmon and bull trout (which were listed as threatened under the Endangered Species Act six months after Chinook, and which require especially cold water for many of their life stages, having evolved to spawn and rear in high mountain streams; WDOE 2003a). Sufficiently high water temperature can kill salmon and bull trout outright; it also can seriously stress them, making them more susceptible to death by other causes, such as disease or predation (WDOE 2002, 2003b). EPA has still not approved the new temperature criteria, which (despite weaknesses in some areas) are significantly stricter than Ecology's current criteria. The latter remain in effect until EPA has approved a change.

Urban streams are also often turbid due to the erosion and entrainment of soil and organic particles from streambanks, riparian areas, roads, construction sites and other disturbed areas. Many toxic pollutants in urban stormwater – heavy metals in particular, as discussed below – are commonly adsorbed to fine sediment particles, such as silt and clay, which have high surface-to-volume ratios. This is also true for nutrients such as nitrates and phosphates, which can often be traced to chemical fertilizers applied to lawns and landscaping. Excessive nutrients can stimulate algal growth; when algae decomposes, it can deplete oxygen levels in streams and lakes, killing fish (Richter undated).

B. Toxic Pollutants

Toxic pollutants commonly found in urban runoff include trace metals such as lead, copper, zinc and organic compounds including oils, grease, phthalates, chlorinated hydrocarbons and pesticides (Richter undated; Parametrix 2002). Copper, lead and zinc were detected in more than 90% of stormwater samples taken for EPA's National Urban Runoff Program (NURP) in the early 1980s (EPA 1983). Sources of toxics include the breakdown of metal products, vehicle fuels and fluids, vehicle wear, industrial processes, and the use of industrial and household chemicals.

The Washington State Department of Ecology's Puget Sound Ambient Monitoring Program has found that levels of polycyclic aromatic hydrocarbons (PAHs) have been increasing in Puget Sound sediments since the late 1980s (Dutch *et al.* 2005). They had been declining from a peak in the mid-1940s through the 1960s, paralleling the shift in the use of coal to oil or natural gas for home heating, improvements in industrial emissions controls, and increases in the efficiency of power plants. The more recent increase is most likely due to stormwater from urban and suburban development and vehicle traffic – a trend that extends much further back but which was originally masked by the decreases from other sources (Dutch et al 2005).

Trace metals and organic compounds may be highly toxic to aquatic organisms and can bioaccumulate in fish and shellfish (Richter undated). Water quality criteria under the Clean Water Act are generally set for lethal effects on widely distributed target organisms. They may or may not represent lethal standards for salmon (Scholz et al 2004, Scholz and Collier 2003). Moreover, they do not account for repeated exposures or sublethal effects of pollutants, nor do they account for the synergistic or antagonistic effects of combined pollutants (Parametrix 2002). There are also many chemicals, particularly synthetic organic compounds (including many pesticides), that do not have established water quality standards and are typically not sampled in water quality testing (D. Lester, personal communication, August 26, 2003).

A series of studies by NOAA Fisheries scientists has documented how pollutants in urban waterways can harm juvenile Chinook salmon (Arkoosh *et al.* 2001). These studies appear to be those referred to in the listing decision for Puget Sound Chinook (NOAA 1999). In one study, juvenile Chinook were exposed to contaminants commonly found in road runoff at concentrations similar to those found in the Hylebos Waterway of Commencement Bay,. The researchers then exposed the fish to the bacterial pathogen *Vibrio anguillarum* at a concentration that would not normally kill fish rapidly. The fish exposed to chemical contaminants and the bacterial pathogen died at approximately twice the rate of a control group only exposed to the pathogen. Summarizing the results of this and previous studies, the scientists noted:

> [A]lthough juvenile Chinook salmon are only briefly exposed to contaminants in an urban estuary as they migrate to sea, immune altering events may be persistent, and a consequent increase in disease susceptibility in chemically exposed juvenile salmon may extend into their early ocean life. Recruitment of fish to the adult stages is thought to be dependent on variables acting on the

fish during the first year of life. Therefore, an increase in mortality rates within salmon populations from disease could potentially not only affect juvenile salmonids but also influence recruitment to adult stages.

IV. Ecology's 2005 Stormwater Manual

The updated Stormwater Management Manual for Western Washington, published in 2005 by Ecology (WDOE 2005a), provides guidance intended to ensure that new development and redevelopment comply with water quality standards and protect the beneficial uses of receiving waters. Nearly 1,000 pages across five volumes, the 2005 Stormwater Manual has no regulatory authority of its own, but attains regulatory authority as local governments and others are required to incorporate its environmental protection measures in their NPDES permits. The Manual is generally, as Ecology says, a "one-size-fits-all...generic, default" approach to stormwater management. Ecology encourages basin-specific approaches, which could typically better protect stream resources at similar or lower costs for compliance. However, Ecology currently recognizes only one such basin study (for Des Moines Creek, in King County) and few others are currently planned.

A. One-Size-Fits-All Approach

In June 2003, the Independent Science Panel of the Governor's Salmon Recovery Office reviewed an earlier version of the Stormwater Manual issued in 2001 (ISP 2003). While the panel cited the Manual as "one of the most comprehensive in the United States and...impressive in its scope, coverage and quality," it also raised a number of critical concerns. Most fundamentally, it warned against the Manual's one-size-fits-all approach, finding that the actual benefit from applying the Manual's requirements would vary based on a large number of factors, including the size and location of a proposed development, the amount and location of existing development in the basin, the basin's soils and precipitation patterns, the size of substrate downstream (e.g., sand erodes at much lower flows than large cobble), background sediment inputs, riparian condition, and the amount and quality of woody debris downstream. Ecology more clearly acknowledged these issues in its 2005 Manual and accompanying discussion papers, stating, "The use of a generic approach is a policy choice borne out of risk management, and limited budgets" (WDOE 2005b). The generic approach ensures that in many cases the Manual would be insufficient to meet its own goals even if it were universally applied, including small developments below thresholds for the Manual and retroactive application to existing development.

B. Stormwater Pollution Control Measures

The 2001 and 2005 versions of the Stormwater Manual contain similar guidance for preventing pollution during and after construction, treating stormwater runoff to remove pollutants, and detaining, infiltrating and releasing stormwater to simulate pre-development runoff patterns. The Independent Science Panel was critical of Ecology's approach to managing stormwater quality (ISP 2003). It questioned, for example, whether some of the Manual's Best Management Practices (BMPs) for stormwater quality, such as oil/water separators, would actually provide as much treatment as the manual indicates. More ominously, it warned:

> Uncertainties in the present state of knowledge regarding the effects of pollutants in stormwater on salmon suggests this goal [of preventing direct kill of fish] will not be attained in the near term. Some of the direct and indirect effects of single toxicants have been studied, but combined effects of all toxicants in stormwater cannot be predicted accurately and this continues a risky situation. Information needed to design adequate guidelines is generally lacking, especially for the effects of interacting pollutants, and is not likely to be available in the foreseeable future (ISP 2003).

The ISP recommended incorporating research on these issues into a wider monitoring and adaptive management framework. It also recommended a stronger emphasis on pollution prevention, relative to treatment, than the Manual offers (ISP 2003).

Other stormwater experts have raised concerns that the Manual's goal for water quality treatment is based on the percent of pollutants removed from annual runoff. This will not necessarily address water quality problems when they are most acute, which is typically after storms in late summer, when pollutant concentrations in streams are higher because base flows are low and pollutants in runoff may have built up in source areas (e.g., streets) over long periods of little rain (Minton and Blosser 2000). At the same time of year, fish are generally more susceptible to harm from pollutants because higher water temperatures increase their stress levels and metabolism.

C. Engineered Facilities

Ecology readily acknowledges many of the weaknesses in the Manual identified by the Science Panel, particularly those relating to a one-size-fits-all approach and to the limits of what can be accomplished without addressing land use and site development standards:

> The engineered stormwater conveyance, treatment and detention systems advocated by this and other stormwater manuals can reduce the impacts of development to water quality and hydrology. But they cannot replicate the natural hydrologic functions of the natural watershed that existed before development, nor can they remove sufficient pollutants to replicate the water quality of pre-development conditions. Ecology understands that despite the application of appropriate practices and technologies identified in this manual, some degradation of urban and suburban receiving waters will continue, and some beneficial uses will continue to be impaired or lost to new development. This is because land development, as practiced today, is incompatible with the achievement of sustainable ecosystems. Unless development methods are adopted that cause significantly less disruption of the hydrologic cycle, the cycle of new development followed by beneficial use impairments will continue. (WDOE 2005a, Volume I, p.1-25)

Citing May et al (1997) on these issues, the Manual advocates retaining 65 to 75% of the natural soils and land cover in a drainage basin, together with low-impact approaches to development, such as permeable pavement, green roofs, reduced road widths and site designs that use natural topography and vegetation to manage stormwater. The Manual does not mandate these approaches, but the 2005 update provides incentives for them, by suggesting how to represent them in stormwater models to estimate their benefit in reducing runoff (see Appendix C, Volume III, WDOE 2005a). As the Manual says, "The lower estimates should translate into smaller [and therefore less expensive] stormwater treatment and flow control facilities. In certain cases, use of various techniques can result in the elimination of those facilities."

D. Changes from 2001 Stormwater Manual

Besides improving incentives for low-impact development, all of the other major changes WDOE made to the 2005 Stormwater Manual *reduced* standards from the 2001 version. Most significantly, the updated Manual introduced a proposal to lower the flow control standard in highly urbanized drainage basins (with at least 40% total impervious surface area for the last 20 years; see WDOE 2004). The Science Panel had noted that streams in such areas would likely have had their channels transformed by the dramatic changes in flow patterns, so that "protecting channels as they exist...cannot be expected to restore salmon." Ecology proposed that the flow control standard for new development and redevelopment in such basins should be based on the existing site condition—i.e., not making things worse—rather than the historic (pre-Euro-American) condition. This abandoned the goal of the 2001 Manual to improve conditions for salmon in these streams.

In another modification of the "one-size-fits-all" approach, Ecology dramatically increased the number of surface waters where direct discharges would be exempt from any flow control requirements, mostly adding large lakes and large rivers (Appendix E, Volume I, WDOE 2005a). Ecology's rationale, which generally is reasonable, is that the incremental benefit of detaining stormwater in these cases may be small (typically the case in lakes) or even counterproductive (as can be the case for lower rivers, because detaining flows low in such systems may actually increase downstream flooding problems by augmenting high flows from far upstream, which may take many hours or days to reach lower reaches).

Ecology also proposed to restrict its requirement for enhanced water quality treatment for arterials and highways based on multiple factors, including traffic volume, whether the roads are inside or outside urban growth management areas, and the size of receiving waters in rural areas (since large streams would have greater capacity to dilute pollutant concentrations; see WDOE 2005b).

E. Federal Agency Concerns about Weakening of Manual

NOAA Fisheries and the U.S. Fish and Wildlife Service raised concerns about all of these changes in a December 2004 comment letter (NOAA and USFWS 2004). In addition, they asked that Low-Impact Development approaches be required, not just encouraged, in a variety of circumstances and they echoed the Science Panel's call for more emphasis on stormwater pollution prevention, because BMPs for removing stormwater pollutants are not reliable. In their discussion of the Stormwater Manual's flow control standards, the agencies cited the case of North Creek, in the North Lake Washington area, which has total impervious surface greater than 40% but continues to support Chinook salmon, and which is undergoing significant erosion in parts of its basin that are still rapidly developing. They argued that the lower standard was inappropriate for urbanized basins that still support listed species, and expressed concern that establishing flow control standards based only on impervious surface levels was a significant disincentive to basin-level planning, which might justify increased protections. The agencies were further concerned that the lower flow control standard would reduce opportunities for low-impact development, which they argued should be encouraged through additional flow control credits.

The federal service agencies were concerned that Ecology's generic criteria for exempting lower river reaches from flow control requirements were insensitive to important issues relating to geomorphic setting, sediment load, substrate characteristics, the presence of listed species, and the effects of dikes, levees and other streambank hardening and channelization on flows and biological resources in downstream areas. They were again concerned by the loss of opportunities and incentives for low-impact development, particularly in areas with shallow groundwater and hyporheic flows that are likely in substantial interaction with river flows. They argued for the importance of basin-level studies to take all of these issues into account.

The agencies argued that enhanced water quality treatment should apply to <u>all</u> roads, because even roads with low traffic volumes can have stormwater discharges that violate water quality standards frequently and severely, and because the standards themselves often do not protect listed species, for the reasons discussed by the Science Panel (2003).

The Science Panel, NOAA Fisheries, the U.S. Fish and Wildlife Service and Ecology itself agree that basin-level studies can provide a better technical basis for stormwater requirements than the Manual in essentially any given location, by taking into account unique aspects of hydrology, geology, stream and riparian characteristics, land uses, target species and other factors. All of those parties also would generally agree that low-impact approaches to land use and site design can address crucial issues regarding the environmental impacts of development that the Manual, with its focus on engineered methods to reduce or mitigate the impacts of development, cannot address.

V. NPDES Permits and Stormwater

A. Municipal Stormwater Discharges

As noted above, Ecology's Stormwater Manual has no regulatory authority of its own. Its standards attain regulatory authority to the extent that they are incorporated in NPDES permits for stormwater discharge that are administered by Ecology. NPDES permits, when issued to local governments, condition several activities regulated by those governments, including when the Stormwater Manual must be followed in setting requirements placed on development.

NPDES municipal stormwater permits are being issued in two phases, following the structure provided for by EPA policy. Phase I is for urbanized jurisdictions whose populations numbered 100,000 or more in the 1990 census, and for several categories of industrial and construction activity. Puget Sound-area governments in Phase I include King, Snohomish and Pierce counties, the cities of Seattle and Tacoma, and the Washington Department of Transportation for its roads and facilities within these areas. Although NPDES permits are issued for terms limited to five years, renewals have been allowed to languish, so that these Phase I governments continue to operate under the original permits issued in 1995. The terms for renewal of Phase I permits are currently being developed. Draft terms were issued by Ecology (2005c) on May 16, 2005, and are discussed below.

Phase II NPDES stormwater permits will cover so-called small municipal separate storm sewer systems, which include local governments meeting federal regulatory thresholds for population within areas classified as "urban." These parties have not been subject to NPDES stormwater permits in the past, though cities and counties have been required (subject to the availability of resources) to comply with the Puget Sound Water Quality Management Plan, first issued by the State in 1987 and updated five times since then (PSAT 2000). The Puget Sound Plan has referenced Ecology's stormwater manuals as they have evolved over the years, but the State has never attempted to enforce use of the latest manual. Terms for Phase II NPDES permits are also being developed, with a preliminary draft issued on May 16, 2005. These, too, are discussed below (WDOE 2005d).

The Clean Water Act and associated regulations issued by the EPA set different requirements for Phase I and Phase II jurisdictions (EPA 1990, 1999). Phase I jurisdictions have a more extensive set of programmatic requirements for local stormwater management, including capital programs, maintenance of stormwater facilities, monitoring and basin planning. Both Phase I and II jurisdictions are required to have programs for (1) public education, outreach and involvement; (2) detection and elimination of illicit discharges to stormwater systems; (3) pollution prevention; (4) control of construction site runoff; and (5) control of post-construction runoff. This report focuses only on the last two programs, both of which are addressed by Ecology's Stormwater Manual.

Ecology has proposed that renewed Phase I NPDES permits require use of standards and BMPs recommended in the updated Stormwater Manual or alternatives that provide equal or better protection (WDOE 2005c). Most significantly, the Manual's stormwater detention and water quality treatment requirements apply when a new development would add 5,000 square feet or more of new impervious surface, or convert ¾ acres or more of native vegetation to lawn or landscaped areas (similar requirements apply to redevelopment, if it adds more than 50% to the assessed value of the existing site improvements).

The proposed Phase II permits would raise this threshold for both new development and redevelopment, so the Manual's detention and water quality treatment requirements would apply only when one or more acre of land is disturbed (or will be disturbed, if the project is phased; see WDOE 2005d). This is a very significant exception, given that local researchers have found that the cumulative impact of not regulating developments under a half-acre is severe enough to negate the benefits sought from regulating larger developments (Booth and Jackson 1997).

Discharges of stormwater from municipal separate storm sewer systems authorized by these NPDES permits are likely to harm threatened Puget Sound Chinook by allowing streamflows in developing areas to depart even more from the normal range of water quality and hydrologic conditions (e.g., magnitude, frequency and duration of peak and base flows) needed to maintain properly functioning habitat and support recovery of the species. Total volume of storm flows would increase, as would the frequency and size of peak flows, while base flows would decrease. Higher storm flows would further degrade in-stream habitat (particularly during the stages of spawning, incubation and early rearing of fry for Chinook) while lower base flows would reduce the quantity and quality of habitat (particularly during adult migration and late juvenile rearing and migration for Chinook). Water pollution would worsen in developing areas, while existing problems with the sublethal and combined effects of pollutants (particularly toxics and high temperatures) would remain in already developed areas, affecting both juvenile and adult Chinook.

In Ecology's own words, "some degradation of urban and suburban receiving waters will continue and some beneficial uses will continue to be impaired or lost to new development" under the NPDES permits as currently proposed (all the more so in Phase II jurisdictions, where thresholds for applying the Manual's requirements are relaxed). As Ecology acknowledges, the only choice that could possibly reverse these trends is to require low impact development strategies, but the Manual stops short of doing so.

B. Construction Activities

Ecology has also recently updated requirements for the NPDES permit it issues for construction sites (WDOE 2005e). The most significant change extends coverage to construction sites as small as one acre, compared to the minimum of five acres in the permit issued in 2000. This change was mandated as part of EPA's Phase II NPDES regulations (EPA 1999). All construction sites will be required to select Best Management Practices (BMPs) to stabilize soils and reduce erosion and discharge of sediments from their sites during construction, as described in Volume II of Ecology's Stormwater Manual (WDOE 2005a). However, in the Independent Science Panel's review of the Manual, it noted that BMPs can vary significantly in effectiveness (ISP 2003). The Panel recommended timing construction activities to minimize site disturbance and other measures to prevent turbid runoff at its source, "along with a few relatively robust controls (such as wet sediment ponds that are properly sized and mulching for soil protection at the earliest opportunity)." (ISP 2003) The permit allows more discretion regarding BMPs, but would include significant monitoring and inspection requirements.

The BMP's for construction activity focus almost exclusively on minimizing erosion and the discharge of sediments, including alkaline sediments from cement-related materials, and phosphorus, a nutrient that occurs naturally in soils but at high concentrations can cause excessive algal growth and lower dissolved oxygen levels in receiving waters. The Stormwater Manual recognizes that runoff from construction sites can also be contaminated by oil, grease and other petroleum products, but proposes no specific standards to address them. The Manual does not discuss other potential pollutants from construction sites, such as phthalates, pesticides, metals and other toxics, nor does it discuss the potential for discharges to violate water quality standards for temperature. It also does not recognize that alkaline runoff is a significant danger from freshly laid concrete, not just from accidental spills and tool washing (Minton and Benedict 1999).

Stormwater discharges from construction sites authorized by NPDES permits issued by Ecology are likely to harm threatened Puget Sound Chinook by contributing fine sediments that bury spawning gravels and suffocate incubating eggs, alkaline sediments that alter the pH of receiving waters, phosphorus that degrades water quality, metals and toxics with both lethal and sub-lethal effects on salmon, and warm water that violates both existing and proposed water quality standards for temperature. While any one of these pollutants is capable of causing significant impacts, they are especially harmful in combination, which is probably the most typical case. The best strategies to avoid or minimize their impacts would emphasize pollution prevention; numeric limits on pollutant discharges, based on the needs of receiving waters; requirements for vigorous monitoring; treatment of turbid, alkaline or otherwise polluted runoff where necessary; and extension of protective measures to construction sites less than one acre in size.

C. Industrial Activities

In January 2005, Ecology updated its requirements for the general NPDES stormwater permit it issues for industrial activities. The permit covers a range of businesses that may pose special concerns for stormwater pollution, including oil refineries, mineral extraction and processing, hazardous waste facilities, landfills, air transport facilities, sewage treatment plants and rubber and plastic manufacturers. The permit calls for BMPs to control pollutants at their source, but also allows stormwater discharges of a variety of pollutants, ranging from total suspended solids and pH to ammonia, toxic metals and a host of industrial chemicals. As shown in Table 1 below, performance standards are two or more times the "benchmark" levels set by EPA as "target" concentrations for pollution prevention measures in its 1995 Federal Register notice for NPDES industrial permits. The most common source of these benchmarks is EPA's National Water Quality Criteria, though EPA also used other sources. Above the criteria, pollutants commonly could cause acute effects on aquatic life, including mortality, in a short period of time (EPA 1995).

The "Action Level" in the NPDES permit, above which a permittee must take a variety of actions to bring stormwater discharges back below the standard, is frequently high enough that there is little incentive for most companies to choose any but the least expensive BMPs (G. Minton, personal communication, December 21, 2005). BMPs may be selected from Ecology's Stormwater Manual, the NOAA Fisheries-approved Regional Road Maintenance ESA Program Guidelines (King County 2005), or they may be uniquely

Table 1. NPDES performance standards and target concentrations for water quality criteria.

Parameter	NPDES Permit "Action Level"	EPA Benchmark
Total Copper	149 μg/L	64 μg/L
Total Lead	159 μg/L	82 μg/L*
Total Zinc	372 μg/L	65 μg/L*
Oil and Grease	30 mg/L	15 mg/L
Biochemical Oxygen Demand	60 mg/L	30 mg/L
Ammonia	38 mg/L	19/mg/L*
Nitrate + Nitrite Nitrogen	1.36 mg/L	0.68 mg/L
Total Phosphorus	4.0 mg/L	2.0 mg/L

* From EPA Water Quality Criteria

tailored to site conditions, if demonstrated to meet water quality standards and other state and federal requirements.

Stormwater discharges authorized by general industrial NPDES permits issued by Ecology are likely to harm threatened Puget Sound Chinook by contributing sediments and toxic chemicals with both lethal and sub-lethal effects on salmon. Toxic chemicals are particularly harmful in combination, which is probably the most common case for industrial stormwater discharges.

D. Other Activities Covered by NPDES permits

Ecology also issues NPDES stormwater permits for a variety of other specific activities, including boatyards (permit issued November 2, 2005), sand and gravel operations (revised permit to be issued in 2006, following an appeal and settlement), concentrated animal feeding operations (permit to be issued in 2006) and aquatic pesticide control and eradication (target issuance date of March 2006). Similar to the general industrial NPDES stormwater permits, these permits include required BMPs to control pollutants at their source and limits on pollutant discharges, but with more industry-specific detail.

The boatyard permit identifies copper as "the most prevalent metal found in boatyard wastewaters," and on that basis treats copper as "a prime indicator metal in determining if an individual boatyard has properly instituted BMPs to control metal discharges" (WDOE 2005g). It sets even higher discharge standards for copper than the general industrial permit, however: 384 μg/L for discharges to rivers and 229 μg/L for discharges to marine waters, compared to 149 µg/L for the general industrial permit and 64 µg/L for EPA's benchmark.

Although the final terms for some of these industry- or activity-specific NPDES permits issued by Ecology are still to be determined, the high standards for copper in the boatyard permit raise concern that these permits, like the general industrial NPDES permit, will prove likely to harm threatened Puget Sound Chinook by contributing toxic chemicals with both lethal and sub-lethal effects on salmon. These chemicals will pose particular dangers when acting in combination.

VI. Low-Impact Development

Given that Ecology itself acknowledges that the BMPs and standards specified in its Stormwater Manual, even if universally applied, are insufficient to prevent the continued degradation of Puget Sound streams, a different approach needs to be taken if chinook salmon are to recover. As Ecology notes in its Manual, researchers and regulators have focused on ways that natural land cover and soils can be preserved or restored to maximize evapotranspiration and infiltration, thereby minimizing surface runoff during storms and increasing groundwater levels to support base streamflows during dry periods. Together with different construction methods and materials such as pervious pavement or "green roofs" (which use vegetation to reduce and clean stormwater runoff), these approaches have been grouped under a general heading of "Low Impact Development" (LID; see, for example, PSAT 2005).

The Stormwater Manual notes that preserving 65% to 75% of land cover and soils in a natural state in urban or suburban watersheds requires

> a dramatic reduction...in the amount of impervious surfaces and artificially landscaped areas to accommodate our preferred housing, play, and work environments, and most significantly, our transportation choices. Surfaces created to provide "car habitat" comprise the greatest portion of impervious areas in land development. Therefore, to make appreciable progress in reducing impervious surfaces in a watershed, we must reduce the density of our road systems, alter our road construction standards, reduce surface parking, and rely more on transportation systems that do not require such extensive impervious surfaces (rail, bicycles, walking). (WDOE 2005a)

Even with its current dense network of roads, the City of Seattle has become a national leader in demonstrating the potential for "Natural Drainage Systems" and the City's "Street Edge Alternatives (SEA Streets) Project" to dramatically reduce stormwater runoff (SPU 2005a). Two years of monitoring have found that SEA Streets demonstration projects have eliminated 98% of the stormwater runoff from a two-year storm. By essentially eliminating surface runoff for all but the very largest storms, SEA Streets necessarily has kept stormwater pollutants out of streams, and has also increased infiltration to support baseflows. The City is currently exploring how a system of SEA Streets in the drainage area of a small stream can affect its hydrology and water quality (SPU 2005b).

Though most experimentation with LID in the Puget Sound area so far has been with government projects, there have been a few private residential low impact developments, and McPhee Street Medical Center in Olympia recently opened as probably the first commercial development in the region to employ low impact approaches on a comprehensive basis (T. Holz, personal communication, October 5, 2005). When local stormwater permits begin offering the incentives for LID included in the Stormwater Manual, there likely will be more such private developments. Many of the tools used in LID are not new. Village Homes in Davis, California, constructed in the early 1970s, is cited as an early example, and many European cities began experimenting with LID techniques in the early 1980s. Prince George's County, Maryland, has been a leader in the use of LID since the late 1980s (PSAT 2005).

A "Technical Guidance Manual" for LID issued by the Puget Sound Action Team argues that the target of 65% coverage for mature native vegetation may be achievable even in medium and high-density settings "by applying multifamily, cottage, or condominium type development." Where less forest protection is possible, the Technical Manual suggests that pre-development hydrologic conditions may be approximated on soils with low infiltration rates when using the full suite of LID practices and 40 to 50% open space protection (CH2M Hill 2001).

NOAA Fisheries and the U.S. Fish and Wildlife Service have urged that Ecology modify its Manual to *require* at least some elements of LID as widely as possible (NOAA Fisheries and U.S. Fish and Wildlife Service 2004). In the guidance that NOAA Fisheries has issued for making determinations of effects on listed salmon during ESA Section 7 consultations, it included requirements for LID in its "model terms and conditions" for actions it would approve (NOAA 2003). These terms included minimizing alteration of natural soils and vegetation and demonstrating that a wide range of LID practices identified were incorporated into the project or providing a written rationale why they were not. Recommendations included infiltrating stormwater to the maximum extent possible, installing permeable pavement for load-bearing surfaces, and using engineered stormwater BMPs only "after landscape approaches have been incorporated into the project, and project effects remain" (NOAA 2003).

Anything less than widespread implementation of LID is unlikely to provide for salmon recovery.

VII. Stormwater Management and Salmon Recovery

Ecology's Stormwater Manual and the NPDES permits based on it would allow continued – and in many cases accelerated – degradation of receiving waters. This would preclude the recovery of Puget Sound chinook salmon for the following reasons:

- The Stormwater Manual's engineered approach to managing stormwater from new development and redevelopment allows hydrologic conditions and associated ecological processes to continue to deviate even more from the historic template to which salmon are adapted, and which NOAA Fisheries uses as a guide to support recovery of listed species.

- The minimum thresholds in NPDES permits for applying even the Manual's insufficient approaches would allow cumulative impacts from small developments to negate benefits from regulating large developments, particularly in Phase II municipalities and for smaller construction sites.
- The water quality criteria used in the Manual and NPDES permits do not take into account the synergistic or antagonistic effects of combined pollutants, which can have both lethal and sub-lethal effects on salmon that go well beyond the harm from individual pollutants.
- The freedom given in NPDES permits to select BMPs from the Manual places insufficient emphasis on preventing pollution at its source or using the robust controls most likely to minimize polluted stormwater discharges.
- The Manual and NPDES permits do not require the low-impact approaches to development that Ecology itself acknowledges are the only possible means to provide for salmon recovery as the region continues to grow.

In places, Ecology's Manual is remarkably frank about these weaknesses. If we are to recover threatened salmon in our region, those who evaluate and use the Manual must heed Ecology's notices and advocate for stronger measures than those in the proposed requirements.

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Appendix A: Authors' Curricula Vitae

Cleveland R. Steward III

Principal Scientist and Owner, Steward and Associates

Steward and Associates principal and lead scientist Cleve Steward is a fisheries scientist and consultant with over 25 years experience and education in salmon and trout ecology and management, both as a government employee and as a consultant. His firm – Steward and Associates – provides technical assistance in analyzing environmental impacts, complying with governmental regulations, and resolving conflicts involving fisheries and aquatic resources, with emphasis on water management, watershed analysis, habitat restoration, and fisheries research and management.

Mr. Steward has extensive experience in the fisheries management field and has undertaken numerous projects for federal and state agencies, Indian tribes, universities, private firms, and environmental groups from throughout the region. He is a recognized authority on the habitat and migratory requirements of juvenile salmonids and has broad expertise in freshwater ecology and fisheries management. He is frequently solicited to provide expert opinion and help resolve conflicts involving fisheries and aquatic resources, including surface water management, watershed impacts, salmon hatchery impacts, salmon smolt passage survival and behavior, and monitoring and evaluation techniques.

Mr. Steward serves in a variety of roles providing technical analysis and policy guidance on salmon recovery, delisting criteria, limiting factors, and habitat restoration measures. He was appointed by the National Marine Fisheries Service to serve as a scientific advisor to federal and state agencies engaged in the recovery of threatened and endangered salmon and steelhead in the Willamette and Lower Columbia Rivers. He is currently serving on the Greater Lake Washington Watershed Steering Committee and Technical Committee for Chinook salmon recovery, and as technical advisor to Bonneville Power Administration on matters of implementation and compliance with habitat provisions set forth in the current Biological Opinion for Federal Columbia River Power System. Mr. Steward has also worked extensively with the Lower Columbia River Fish Recovery Board, supervising watershed assessment work in support of salmon recovery planning in 5 counties in southwest Washington.

Education

Master of Science, 1983:
University of Washington, Seattle, WA
Degree Emphasis: Fishery Science

Bachelor of Science, Summa cum laude, 1978:
University of Montana, Missoula,
Degree Emphasis: Wildlife, Aquatic Option

Professional Organizations

American Fisheries Society
American Water Resources Association

Professional Experience

Steward and Associates, Snohomish, WA.
Principal, 1992- present

Owner and lead consultant in a firm that specializes in fisheries management, ESA recovery and compliance planning, biological assessments, research design and implementation, Columbia River and Puget Sound fisheries issues, dam-related impacts and relicensing, dispute resolution, and programmatic review for public agencies, Indian tribes, and non-profit conservation groups. Clients include the Bonneville Power Administration, National Marine Fisheries Service, U.S. Fish and Wildlife Service, U.S. Geological Survey, Northwest Power Planning Council, various Indian tribes (Nez Perce, Yakama, Cowlitz, Quilcute, and Skokomish) Seattle Aquarium, Seattle Public Utilities, University of Washington, Boeing, Save Our Wild Salmon, Trout Unlimited, American Rivers, URS, various law and engineering firms, and others. Responsible for several contracts; author of key publications.

In 2000, Mr. Steward was appointed by the National Marine Fisheries Service to serve as a scientific advisor to federal and state agencies engaged in the recovery of threatened and endangered salmon and steelhead in the Willamette and Lower Columbia Rivers. Mr. Steward also serves on the Greater Lake Washington Watershed Steering Committee and Technical Committee. Under contract with the Lower Columbia River Fish Recovery Board, Mr. Steward supervises watershed assessment work to support salmon recovery planning in 5 counties in southwest Washington. He also serves as technical advisor to Bonneville Power Administration on matters of implementation and compliance with habitat provisions set forth in the current Biological Opinion for Federal Columbia River Power System.

Sustainable Fisheries Foundation, Snohomish, WA
Executive Director, 1994- Present

Co-founded an international (U.S. and Canada) 501(c)(3) research and education foundation in 1994 to promote a balanced approach to fisheries resource management and use, so that Pacific salmon and trout populations remain viable, productive, and accessible to future generations. The SFF works closely with other non-governmental and scientific organizations on a number of salmon-related initiatives, most notably the development of a Sustainable Fisheries Strategy for West Coast Salmon and Trout Populations; the Timber, Fish and Wildlife process in Washington State; and the King County Watershed Resource Inventory Area (WRIA) 8 (Greater Lake Washington Watershed) Conservation Plan.

As Director of the SFF, Mr. Steward provides scientific oversight and represents the interests of the environmental community in salmon recovery planning and watershed assessment and management processes. He sits on the WRIA 8 Steering Committee and the King County Technical Advisory Committee to direct Limiting Factors Analysis and Conservation Plan development for WRIA's 7, 8, and 9.

For his efforts on behalf of salmon conservation, Mr. Steward was named co-recipient of the President's 1997 Conservation Award, presented by the American Fisheries Society.

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John Lombard

Senior Policy Analyst, Steward and Associates

John Lombard is a senior policy analyst with more than 13 years experience in watershed management, basin planning, development regulations, intergovernmental coordination and endangered species policy. He currently manages our work advising clients on issues relating to salmon recovery, watershed planning and compliance with the Endangered Species Act, Growth Management Act and other state and federal regulations. From 1996 to 2000, Mr. Lombard was King County's coordinator for salmon recovery planning in the Lake Washington watershed, which involved working with all 28 cities, both counties, federal and state agencies, tribal governments and community, business and environmental groups in the 700-square-mile planning area. His book, Salmon, Owls, Orcas and Us: Deciding a Future for the Puget Sound Region, will be published by the American Fisheries Society in Spring 2006. It develops a practical strategy for the region to protect and restore its major ecosystems in the face of continued population growth.

Recently, Mr. Lombard has been managing the firm's contracts advising local governments with updates of their critical area regulations. He also managed our contract to develop an Endangered Species Act Strategy for the City of Snohomish, which serves as a comprehensive strategy for the City to prioritize its resources to meet its environmental goals and comply with federal and state environmental laws, including the Clean Water Act, the Growth Management Act and the Shoreline Management Act, in addition to the Endangered Species Act.

Selected Projects

- **Endangered Species Act Strategy, City of Snohomish:** Led development of a strategy integrating compliance with the ESA, Clean Water Act, Growth Management Act and Shoreline Management Act across all major City activities, with emphasis on development regulations and habitat restoration projects. Included mapping and classifying all streams and wetlands and evaluating stream and riparian habitat throughout the City's Urban Growth Area.
- **Critical Area Updates, Cities of Bothell, Oak Harbor and Snohomish:** Manages con-tracts to provide best available science and suggested code language for updates of critical area regulations mandated by the Growth Management Act.
- **WRIA 8 Salmon Conservation Planning Liaison, Cities of Bothell and Woodinville:** Represent Bothell and Woodinville on technical and other committees developing a conservation plan for salmon listed under the ESA in the Greater Lake Washington watershed.
- **Central Puget Sound Low Flow Survey, Washington Department of Fish and Wildlife:** Lead author of report identifying streams with low flow problems from the Stillaguamish River to the Chambers-Clover Creek basin, including suspected causes and recommendations for a strategic approach to improve conditions for salmon.

Education

Bachelor of Arts with honors, 1983
Washington University, St. Louis,
Majored in Politics, Philosophy and Economics; Phi Beta Kappa

Organizations

American Fisheries Society
Society for Conservation Biology

Professional Background

King County Department of Natural Resources
Senior Policy Analyst, Director's Office, 2000–2001

Oversaw development of Action Plan for the Sammamish River, which connects Lake Sammamish and Lake Washington. Advised King County water supply planners on issues related to salmon and watershed planning. Assisted development of King County Executive's Air Quality Initiative, to reduce emission of greenhouse gases and pollutants from county operations and facilities.

King County Department of Natural Resources (KCDNR)
Lake Washington Watershed Coordinator, 1996-2000

Led coalition of 30 local governments, public/private Steering Committee, scientists and interested citizens developing salmon recovery plan for the 700-square-mile Greater Lake Washington watershed. Created partnership of 20 local governments and Corps of Engineers to construct $2.4 million project at Ballard Locks to improve passage for juvenile salmon. Facilitated technical, citizen and government prioritization of $10 million of habitat projects in Lake Washington watershed for submittal to the Salmon Recovery Funding Board. Managed team of eight responsible for acquiring more than 1,500 acres of prime salmon habitat, identifying and prioritizing factors limiting salmon recovery in watershed, and managing and coordinating more than $2 million of research.

Metropolitan King County Council
Legislative Analyst, 1992-1996

Lead staff to King County Council on utility issues. Responsible for adoption of plans guiding land use and capital expenditures to protect salmon, improve water quality and reduce flood hazards in four stream basins covering 150 square miles. Led revision of policies governing water and sewer utilities in 1994 comprehensive plan. Annually reviewed $100-200 million budgets for Health and Public Works departments.

St. Louis Mayor's Office, St. Louis, MO
Administrative Assistant to the Mayor, 1985-1990

Developed policy, wrote speeches and served as community liaison for Mayor of St. Louis. Staffed Tax Reform Commission, which revised the city's entire system of business taxes and fees. Oversaw development of Hope House, one of largest transitional housing programs for homeless families in the country.

Publications

Lombard, J. Salmon, Owls, Orcas and Us: Deciding a Future for the Puget Sound Region, to be published by the American Fisheries Society, Bethesda, MD, by early 2006.

Lombard, J. "The Two Keys to Success: A Landscape Approach and Making Economics Work for Conservation", chapter in The Salmon 2100 Project: Alternative Futures for Pacific Salmon, to be published by the American Fisheries Society, Bethesda, MD, January 2006.

Lombard, J. 2002. "The Politics of Salmon Recovery in Lake Washington", chapter in Restoration of Puget Sound Rivers, edited by D. Montgomery, D. Booth, S. Bolton and L. Wall, University of Washington Press: Seattle.

Lombard, J. 2000. "A Different World" (on the potential consequences of listing Puget Sound Chinook salmon under the Endangered Species Act), The Seattle Times, D1, November 19, 2000.