5. Water Quality and Habitat Protection Resources

The purpose of this chapter is to provide a list of resources that local communities can use when updating their zoning code and comprehensive plan to protect and enhance water quality and aquatic habitat.

This chapter includes:

- A description of the eight tools of watershed protection
- Internet resources for watershed planning and water quality and habitat protection
- Educational fact sheets for use when updating the zoning code and/or comprehensive plan

5.1 The Eight Tools of Watershed Protection

The "Eight Tools of Watershed Protection" section describes a comprehensive approach to developing an urban water quality management plan. The challenge for local officials in Oregon is to coordinate between comprehensive planning efforts and the watershed planning efforts recommended by the Center for Watershed Protection.

The Center for Watershed Protection's *Rapid Watershed Planning Handbook* includes the following information about the eight tools that should be used to protect a stream within a community. This material is taken directly from the Handbook.

1. **Watershed Planning** is perhaps the most important because it involves decisions on the amount and location of development and impervious cover, and choices about appropriate land use management techniques.
2. **Land Conservation** involves choices about the types of land that should be conserved to protect a subwatershed.
3. **Aquatic Buffers** include choices on how to maintain integrity of streams, shorelines, and wetlands, and provide protection from disturbance.
4. **Better Site Design** seeks to design individual development projects with less impervious cover which will reduce impacts to local streams.
5. **Erosion and Sediment Control** deals with the clearing and grading stages in the development cycle, when runoff can carry high quantities of sediment into nearby waterways.
6. **Stormwater Best Management Practices** involves choices regarding how, when, and where to provide stormwater management within a subwatershed, and which combination of best management practices can best meet subwatershed and watershed objectives.
7. **Non-stormwater Discharges** involves controlling discharges from wastewater disposal systems and illicit connections to stormwater systems, and reducing pollution from household and industrial products.
8. **Watershed Stewardship Programs** involves careful choices about how to promote private and public stewardship to sustain watershed management.

This guidebook covers tools 1 through 6 in chapter 4. Tools 7 and 8 are touched on in this chapter. The good housekeeping ordinance is meant to help reduce pollution from household activities. The fact sheets found in this chapter assist in the public education effort needed to begin an effective watershed stewardship program.

5.2 Internet Resources

The following list includes a number of Internet resources containing a wide variety of information, from slide shows to checklists. A brief description of each site's content is included with the web address.

Oregon Association of Clean Water Agencies
http://www.oracwa.org/
The Oregon Association of Clean Water Agencies, ACWA, is an organization of local government agencies working to maintain and enhance the quality of lakes, rivers and streams in Oregon. They manage treatment of human and industrial wastes and the runoff of polluting waters.

This site includes a useful manual on the Endangered Species Act (ESA). Chapter 7 of the manual includes a checklist to diagnose stormwater issues. This checklist can be a valuable tool for determining possible zoning code and/or comprehensive plan changes to address the ESA and water quality.

Another valuable resource found at this site is a Municipal Stormwater Toolbox for Maintenance Practices found at www.oracwa.org/Pages/toolbox.htm. The toolbox provides quick and easy guidance for maintenance staff about ways to integrate water quality-friendly practices into routine everyday maintenance practices.

Oregon Department of Environmental Quality
http://www.deq.state.or.us/
Web site for DEQ includes information on water quality rules and regulations and a list of all water quality limited streams [the 303(d) list].

Oregon Department of Land Conservation and Development
http://www.lcd.state.or.us/
Includes information on the state land use planning program, including links to the state land use goals and implementing administrative rules.

The Oregon Department of Fish and Wildlife
http://www.dfw.state.or.us
Web site for ODF&W includes information on stream flow restoration priorities, habitat policy and policy changes and links to the Bull Trout program.

The Oregon Plan for Salmon and Watersheds
http://www.oregon-plan.org/
The goal of the Oregon Plan is to restore populations and fisheries to productive and sustainable levels that will provide substantial environmental, cultural, and economic benefits. The site includes information on salmon restoration efforts and watershed health.

Environmental Protection Agency - Nonpoint Source Pollution
http://www.epa.gov/owow/NPS/
Includes information on education, EPA programs, outreach and funding opportunities. Also includes links to other EPA web sites such as the NPDES Stormwater Phase I and II Program and the Drinking Water Protection Program.

National Marine Fisheries – Northwest Region
http://www.nwr.noaa.gov/
Latest information on endangered species listings, including 4(d) rules and *A Citizen's Guide to the 4(d) Rule For Threatened Salmon and Steelhead on the West Coast*, an excellent primer on the 4(d) rule.

US Fish and Wildlife Service
http://endangered.fws.gov
Direct link to the Endangered Species Program of USF&W.

Watershed Professionals Network
http://www.watershednet.com/
Watershed Professionals Network is an association of natural resource consultants in the Pacific Northwest. The web site includes a copy Oregon Watershed Enhancement Board's *Oregon Watershed Assessment Manual* (1999).

Nonpoint Education for Municipal Officials
http://www.lib.uconn.edu/CANR/ces/nemo/
NEMO is a University of Connecticut Cooperative Extension System project using innovative techniques to teach local officials about the sources and impacts of nonpoint source (NPS) pollution, how different land uses affect water quality, and what towns can do to protect water quality.

A slideshow explaining the land use and water quality connection is available for download for free at the site.

Terrene Institute
http://www.terrene.org/index.htm
Established in 1990 as a not-for-profit, nonadvocacy organization, the Terrene Institute works with business, government, academia and citizens to protect our environment and conserve our natural resources. Education and public outreach comprise the cornerstones of the Terrene Institute, which assembles the best minds and expertise to provide accurate information – and presents this information in attractive, understandable, usable formats.

Terrene has established a reputation for offering balanced, credible information in ways that inspire learning, the hallmark of excellence in communication.

This site provides a nonpoint source projects database, and extensive links to other water quality sites.

Center for Urban Water Resources Management at the University of Washington
http://depts.washington.edu/~cuwrm/
The Center for Urban Water Resources Management is an interdisciplinary research center at the University of Washington, whose mission is to develop new and more effective ways for managing the consequences of land development on the Pacific Northwest's water resources through applied research.

Center for Watershed Protection
http://www.cwp.org/
Founded in 1992, the Center for Watershed Protection works with local, state, and federal governmental agencies, environmental consulting firms, watershed organizations, and the general public to provide objective and scientifically sound information on effective techniques to protect and restore urban watersheds.

This site includes a zoning code worksheet to rate local development code for water quality provisions.

5.3 Fact Sheets Explaining Nonpoint Source Pollution and Water Quality

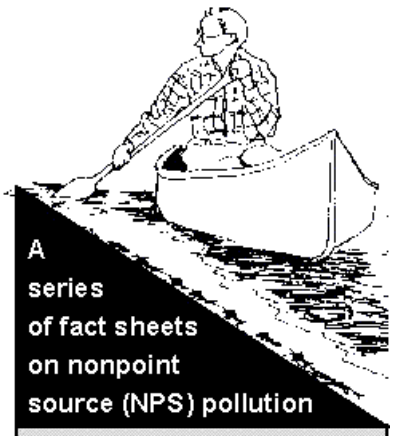
The following fact sheets are provided to assist with education efforts, when revising zoning codes and comprehensive plans to protect and enhance water quality. The fact sheets are included as text, so they can be altered and printed to fit a community's needs. The fact sheets cover the following topics:

- Nonpoint Source Pollution: The Nation's Largest Water Quality Problem
- Opportunities for Public Involvement in Nonpoint Source Control
- Managing Urban Runoff
- Managing Nonpoint Source Pollution from Households

The fact sheets were developed by the Environmental Protection Agency, and are part of a larger series of fact sheets.

Nonpoint Source Pollution: The Nation's Largest Water Quality Problem

Why is there still water that's too dirty for swimming, fishing or drinking? Why are native species of plants and animals disappearing from many rivers, lakes, and coastal waters?



Three Leading Sources of Water Quality Impairment

Rank	Rivers	Lakes	Estuaries
1	Agriculture	Agriculture	Urban runoff
2	Municipal point sources	Municipal point sources	Municipal point sources
3	Stream/ habitat changes	Urban runoff	Agriculture

Source: Water National Quality Inventory, 1994

NPS pollution occurs when water runs over land or through the ground, picks up pollutants, and deposits them in surface waters or introduces them into groundwater .

The United States has made tremendous advances in the past 25 years to clean up the aquatic environment by controlling pollution from industries and sewage treatment plants. Unfortunately, we did not do enough to control pollution from diffuse, or nonpoint, sources. Today, nonpoint source (NPS) pollution remains the Nation's largest source of water quality problems. It's the main reason that approximately 40 percent of our surveyed rivers, lakes, and estuaries are not clean enough to meet basic uses such as fishing or swimming.

NPS pollution occurs when rainfall, snowmelt, or irrigation runs over land or through the ground, picks up pollutants, and deposits them into rivers, lakes, and coastal waters or introduces them into ground water. Imagine the path taken by a drop of rain from the time it hits the ground to when it reaches a river, ground water, or the ocean. Any pollutant it picks up on its journey can become part of the NPS problem. NPS pollution also includes adverse changes to the vegetation, shape, and flow of streams and other aquatic systems.

NPS pollution is widespread because it can occur any time activities disturb the land or water. Agriculture, forestry, grazing, septic systems, recreational boating, urban runoff, construction, physical changes to stream channels, and habitat degradation are potential sources of NPS pollution. Careless or uninformed household management also contributes to NPS pollution problems.

The latest National Water Quality Inventory indicates that agriculture is the leading contributor to water quality impairments, degrading 60 percent of the impaired river miles and half of the impaired lake acreage surveyed by states, territories, and tribes. Runoff from urban areas is the largest source of water quality impairments to surveyed estuaries (areas near the coast where seawater mixes with freshwater).

The most common NPS pollutants are sediment and nutrients. These wash into water bodies from agricultural land, small and medium-sized animal feeding operations, construction sites, and other areas of disturbance. Other common NPS pollutants include pesticides, pathogens (bacteria and viruses), salts, oil, grease, toxic chemicals, and heavy metals. Beach closures, destroyed habitat, unsafe drinking water, fish kills, and many other severe environmental and human health problems result from NPS pollutants. The pollutants also ruin the beauty of healthy, clean water habitats. Each year the United States spends millions of dollars to restore and protect the areas damaged by NPS pollutants.

Progress

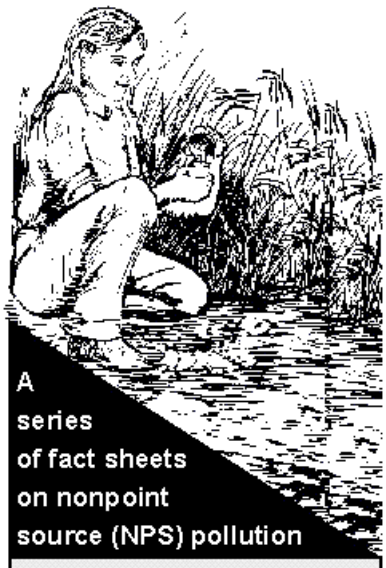
During the last 10 years, our country has made significant headway in addressing NPS pollution. At the federal level, recent NPS control programs include the Nonpoint Source Management Program established by the 1987 Clean Water Act Amendments, and the Coastal Nonpoint Pollution Program established by the 1990 Coastal Zone Act Reauthorization Amendments. Other recent federal programs, as well as state, territorial, tribal and local programs also tackle NPS problems.

In addition, public and private groups have developed and used pollution prevention and pollution reduction initiatives and NPS pollution controls, known as management measures, to clean up our water efficiently. Water quality monitoring and environmental education activities supported by government agencies, tribes, industry, volunteer groups, and schools have provided information about NPS pollution and have helped to determine the effectiveness of management techniques.

Also, use of the watershed approach has helped communities address water quality problems caused by NPS pollution. The watershed approach looks at not only a water body but also the entire area that drains into it. This allows communities to focus resources on a watersheds most serious environmental problems – which, in many instances, are caused by NPS pollution.

Just as important, more citizens are practicing water conservation and participating in stream walks, beach cleanups, and other environmental activities sponsored by community-based organizations. By helping out in such efforts, citizens address the Nation's largest water quality problem, and ensure that even more of our rivers, lakes, and coastal waters become safe for swimming, fishing, drinking, and aquatic life.

Opportunities for Public Involvement in Nonpoint Source Control



Did you know that volunteers often collect information on the health of water-ways and the extent of NPS pollution?

NPS pollution occurs when water runs over land or through the ground, picks up pollutants, and deposits them in surface waters or introduces them into groundwater.

Over the last 25 years, communities have played an important role in addressing nonpoint source (NPS) pollution, the Nation's leading source of water quality problems. When coordinated with federal, state, and local environmental programs and initiatives, community-based NPS control efforts can be highly successful. To learn about and help control NPS pollution, contact the community-based organizations and environmental agencies in your area. These groups often have information about how citizens can get involved in the following types of NPS control activities.

Volunteer Monitoring

Local groups organize volunteers of all skill levels to gather water quality data. This information can help government agencies understand the magnitude of NPS pollution. More than 500 active volunteer monitoring groups currently operate throughout the United States. Monitoring groups may also have information about other NPS pollution projects, such as beach cleanups, stream walks, and restoration activities.

Ecological Restoration

Ecological restoration provides opportunities for the public to help out with a wide variety of projects, such as tree planting and bank stabilization in both urban and rural areas. Restoration efforts focus on degraded waters or habitats that have significant economic or ecological value.

Educational Activities

Teachers can integrate NPS pollution curricula into their classroom activities. The U.S. Environmental Protection Agency (EPA), federal and state agencies, private groups, and nonprofit organizations offer teachers a wide variety of materials. Students can start on an NPS control project in the primary grades and carry their work through to the intermediate and secondary levels.

Water Conservation

Using technologies that limit water use in the bathroom, kitchen, laundry room, lawn, driveway, and garden can reduce the demand on existing water supplies and limit the amount of water runoff. More than 40 states now have some type of water conservation program to help citizens and businesses implement conservation practices. Government

agencies, utilities, and hardware stores have information about different products that help households conserve water.

Household Management

Learning to limit NPS pollution at the household level can reduce the overall impacts of NPS pollution on water quality. Households, for example, can irrigate during cooler hours of the day, limit fertilizer applications to lawns and gardens, and properly store chemicals to reduce runoff and keep runoff clean. Chemicals and oil should not be poured into sewers, where they can result in major water quality problems. Pet wastes, a significant source of nutrient contamination, should be disposed of properly. Households can also replace impervious surfaces with more porous materials.

Public Meetings and Hearings

Decisions made during public hearings on stormwater permitting and town planning can determine a community's capability to manage NPS pollution over the long term. Laws or regulations may require federal, state, or local agencies to hold public hearings when permits are issued or when town plans are formed. Notices about hearings often appear in the newspaper or in government office buildings.

Community Organizations

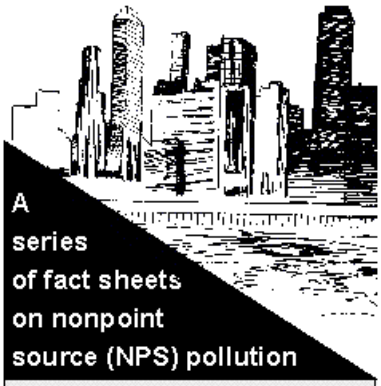
Many communities have formed groups to protect local natural resources. These community-based groups provide citizens with information about upcoming environmental events in their watershed, such as ecological restoration, volunteer monitoring, and public meetings. Watershed-level associations are particularly effective at addressing a wide range of NPS pollution problems.

Environmental Information on the Internet

Citizens can obtain a tremendous amount of environmental data and educational material with a computer linked to the World Wide Web. EPA's site (http://www.epa.gov) on the World Wide Web provides up-to-date information on Agency activities and enables citizens to find out about air and water quality data in specific communities.

Managing Urban Runoff

The most recent National Water Quality Inventory reports that runoff from urban areas is the leading source of impairments to surveyed estuaries and the third largest source of water quality impairments to surveyed lakes. In addition, population and development trends indicate that by 2010 more than half of the Nation will live in coastal towns and cities. Runoff from these rapidly growing urban areas will continue to degrade coastal waters.



Did you know that because of impervious surfaces such as pavement and rooftops, a typical city block generates 9 times more runoff than a woodland area of the same size?

NPS pollution occurs when water runs over land or through the ground, picks up pollutants, and deposits them in surface waters or introduces them into groundwater.

To protect surface water and ground water quality, urban development and household activities must be guided by plans that limit runoff and reduce pollutant loadings. To this end, communities can address urban water quality problems on both a local and watershed level and garner the institutional support to help address urban runoff problems.

How Urban Areas Affect Runoff

Increased Runoff. The porous and varied terrain of natural landscapes like forests, wetlands, and grasslands trap rainwater and snowmelt and allow it to slowly filter into the ground. Runoff tends to reach receiving waters gradually. In contrast, nonporous urban landscapes like roads, bridges, parking lots, and buildings don't let runoff slowly percolate into the ground. Water remains above the surface, accumulates, and runs off in large amounts.

Cities install storm sewer systems that quickly channel this runoff from roads and other impervious surfaces. Runoff gathers speed once it enters the storm sewer system. When it leaves the system and empties into a stream, large volumes of quickly flowing runoff erode streambanks, damage streamside vegetation, and widen stream channels. In turn, this will result in lower water depths during non-storm periods, higher than normal water levels during wet weather periods, increased sediment loads, and higher water temperatures. Native fish and other aquatic life cannot survive in urban streams severely impacted by urban runoff.

Increased Pollutant Loads. Urbanization also increases the variety and amount of pollutants transported to receiving waters. Sediment from development and new construction; oil, grease, and toxic chemicals from automobiles; nutrients and pesticides from turf management and gardening; viruses and bacteria from failing septic systems; road salts; and heavy metals are examples of pollutants generated in urban areas. Sediments and solids constitute the largest volume of pollutant loads to receiving waters in urban areas.

When runoff enters storm drains, it carries many of these pollutants with it. In older cities, this polluted runoff is often released directly into the water without any treatment. Increased pollutant loads can harm fish and wildlife populations, kill native vegetation, foul drinking water supplies, and make recreational areas unsafe.

Point and Nonpoint Distinctions

There are two different types of laws that help control urban runoff: one focusing on urban point sources and the other focusing on urban nonpoint sources. Urban point source pollution is addressed by the National Pollution Discharge Elimination System permit program of the Clean Water Act, which regulates stormwater discharges. Urban nonpoint source pollution is covered by nonpoint source management programs developed by states, territories, and tribes under the Clean Water Act. In states and territories with coastal zones, programs to protect coastal waters from nonpoint source pollution also are required by section 6217 of the Coastal Zone Act Reauthorization Amendments.

Measures to Manage Urban Runoff

Plans for New Development. New developments should attempt to maintain the volume of runoff at predevelopment levels by using structural controls and pollution prevention strategies. Plans for the management of runoff, sediment, toxics, and nutrients can establish guidelines to help achieve both goals. Management plans are designed to protect sensitive ecological areas, minimize land disturbances, and retain natural drainage and vegetation.

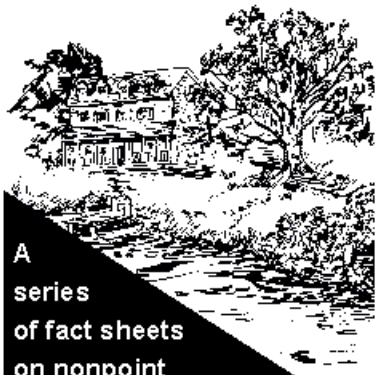
Plans for Existing Development. Controlling runoff from existing urban areas tends to be relatively expensive compared to managing runoff from new developments. However, existing urban areas can target their urban runoff control projects to make them more economical. Runoff management plans for existing areas can first identify priority pollutant reduction opportunities, then protect natural areas that help control runoff, and finally begin ecological restoration and retrofit activities to clean up degraded water bodies. Citizens can help prioritize the clean-up strategies, volunteer to become involved with restoration efforts, and help protect ecologically valuable areas.

Plans for Onsite Disposal Systems. The control of nutrient and pathogen loadings to surface waters can begin with the proper design, installation, and operation of onsite disposal systems (OSDSs). These septic systems should be situated away from open waters and sensitive resources such as wetlands and floodplains. They should also be inspected, pumped out, and repaired at regular time intervals. Household maintenance of septic systems can play a large role in preventing excessive system discharges.

Public Education. Schools can conduct education projects that teach students how to prevent pollution and keep water clean. In addition, educational outreach can target specific enterprises, such as service stations, that have opportunities to control runoff onsite. Many communities have implemented storm drain stenciling programs that discourage people from dumping trash directly into storm sewer systems.

Managing Nonpoint Source Pollution from Households

The well-known stories about environmental problems tend to focus on big, recognizable targets such as smoking industrial facilities, leaking toxic waste dumps, and messy oil spills. As a result, people often forget about water pollution caused by smaller nonpoint sources – especially pollution at the household level.



Did you know that homes with xeriscape landscapes use natural contours and native plants to conserve water, limit runoff, and reduce chemical use?

NPS pollution occurs when water runs over land or through the ground, picks up pollutants, and deposits them in surface waters or introduces them into groundwater.

However, nonpoint source (NPS) pollution is the Nation's leading source of water quality degradation. Although individual homes might contribute only minor amounts of NPS pollution, the combined effect of an entire neighborhood can be serious. These include eutrophication, sedimentation, and contamination with unwanted pollutants.

To prevent and control NPS pollution, households can learn about the causes of such pollution and take the appropriate (and often money-saving) steps to limit runoff and make sure runoff stays clean.

Limit Paved Surfaces

Urban and suburban landscapes are covered by paved surfaces like sidewalks, parking lots, roads, and driveways. They prevent water from percolating down into the ground, cause runoff to accumulate, and funnel into storm drains at high speeds. When quickly flowing runoff empties into receiving waters, it can severely erode streambanks. Paved surfaces also transfer heat to runoff, thereby increasing the temperature of receiving waters. Native species of fish and other aquatic life cannot survive in these warmer waters.

To limit NPS pollution from paved surfaces households can substitute alternatives to areas traditionally covered by nonporous surfaces. Grasses and natural ground cover, for example, can be attractive and practical substitutes for asphalt driveways, walkways, and patios. Some homes effectively incorporate a system of natural grasses, trees, and mulch to limit continuous impervious surface area. Wooden decks, gravel or brick paths, and rock gardens keep the natural ground cover intact and allow rainwater to slowly seep into the ground.

Landscape With Nature

Altering the natural contours of yards during landscaping and planting with non-native plants that need fertilizer and extra water can increase the potential for higher runoff volumes, increase erosion, and introduce chemicals into the path of runoff. In contrast,

xeriscape landscaping provides households with a framework that can dramatically reduce the potential for NPS pollution.

Xeriscape incorporates many environmental factors into landscape design – soil type, use of native plants, practical turf areas, proper irrigation, mulches, and appropriate maintenance schedules. By using native plants that are well-suited to a regions climate and pests, xeriscape drastically reduces the need for irrigation and chemical applications. Less irrigation results in less runoff, while less chemical application keeps runoff clean.

Proper Septic System Management

Malfunctioning or overflowing septic systems release bacteria and nutrients into the water cycle, contaminating nearby lakes, streams, and estuaries, and ground water. Septic systems must be built in the right place. Trampling ground above the system compacts soil and can cause the systems pipes to collapse. Also, septic systems should be located away from trees because tree roots can crack pipes or obstruct the flow of wastewater through drain lines. Proper septic system management is also important, and a system should be inspected and emptied every 3 to 5 years.

By maintaining water fixtures and by purchasing water-efficient showerheads, faucets, and toilets, households can limit wastewater levels, reducing the likelihood of septic system overflow. Most water conservation technologies provide long-term economic and environmental benefits.

Proper Chemical Use, Storage, and Disposal

Household cleaners, grease, oil, plastics, and some food or paper products should not be flushed down drains or washed down the street. Over time chemicals can corrode septic system pipes and might not be completely removed during the filtration process. Chemicals poured down the drain can also interfere with the chemical and biological breakdown of the wastes in the septic tank.

On household lawns and gardens, homeowners can try natural alternatives to chemical fertilizers and pesticides and apply no more than the recommended amounts. Natural predators like insects and bats, composting, and use of native plants can reduce or entirely negate the need for chemicals. Xeriscape can limit chemical applications to lawns and gardens.

If chemicals are needed around the home, they should be stored properly to prevent leaks and access by children. Most cities have designated sites for the proper disposal of used chemicals.

Model Fact Sheet on the Effects of Urban Development on Salmon and Trout
The following fact sheet can be tailored to explain the impacts of the listing of salmon and trout under the Endangered Species Act in your community and what can be done to mitigate activities that have a negative impact on these fish. This fact sheet also describes many of the model ordinances in this guidebook that are recommended for adoption. This fact sheet was developed by the City of Portland.

Urban Development
Its Effects on Salmon and Trout

In March 1998 the National Marine Fisheries Service (NMFS) listed lower [Columbia River steelhead (list other species as needed)] as a threatened species. The listing includes the [Willamette River and its tributaries below Willamette Falls (list the applicable waterbodies)]. In March 1999, NMFS listed [Chinook salmon] as a threatened species. In response, the [jurisdiction] is evaluating how all its activities and development regulations affect salmon and trout. The [jurisdiction] is also identifying how to avoid, minimize, or mitigate activities that have a negative impact on these fish.

Three Primary Impacts
Salmon and trout are very sensitive to any change in the stream environment and urban development can alter their habitat. Development activities can pollute water, degrade instream and riparian habitat, and alter the natural flow of rivers and streams.

Erosion
Erosion can put excessive amounts of sediment into rivers and streams, and can be lethal to salmon and trout. Both species need gravel and rocks to spawn and rear young. Erosion caused by construction introduces fine sediments that clog the spaces between rocks and gravel in streams, buries the eggs salmon and trout lay in these spaces, and prevents flowing water and oxygen from reaching the eggs and newly hatched fish.

Sedimentation can also fill in pools, which are an important part of fish habitat. Salmon and trout use pools for rearing and spawning, as resting areas during migration, and as a refuge to avoid temperature and flow extremes. Sediments in water can damage gills and decrease visibility, which can hamper the fish's ability to find food. Sediments also can carry and store toxic pollutants and nutrients that can poison habitat.

[jurisdiction] is developing a new system to track and respond to erosion problems. The [jurisdiction] is rewriting its erosion control regulations [and design manual] to improve construction site erosion control and stormwater management. And [jurisdiction] is exploring methods of improving enforcement of erosion control standards and responding to complaints more effectively.

Impervious Surfaces
Parking lots, roofs, roads, and other hard surfaces prevent water from soaking into the ground. As impervious surfaces increase, so do the volume and velocity of stormwater

runoff into rivers and streams. Increased volume and velocity cause more erosion and sedimentation, and disturbance to spawning and resting areas.

In undeveloped areas, stormwater can soak into the ground, allowing soil and vegetation to filter out some pollution. In urban areas, the dirt, oil, chemicals, and other pollutants that collect on roads and other hard surfaces wash directly into streams without the benefit of any natural treatment. Impervious surfaces "short circuit" natural watershed cleansing processes.

Research shows that when the percentage of impervious surfaces in a watershed exceeds 10 to 15 percent, streams degrade markedly. The diversity of fish and the aquatic insects they eat begins to decline. Sensitive species, such as salmon and trout, may be replaced by fish species that are more tolerant of degraded streams.

Good stormwater management can partially offset the impact of impervious surfaces. The amount of impervious surface in some Portland area watersheds far exceeds 15 percent. But damage to our rivers and streams can be reduced by restoring riparian vegetation, capturing and treating stormwater runoff, and controlling erosion. [Jurisdiction] is [developing an improved stormwater design manual] and strengthening stormwater drainage regulations to reduce stormwater impacts on rivers and streams.

Removal of Riparian Vegetation

The abundance of trees and shrubs that grow alongside stream banks may be the most important key to healthy salmon and trout habitat. Removing this riparian vegetation increases water temperatures, destabilizes stream banks, destroys fish habitat, degrades water quality, and diminishes the food supply.

Clearing away streamside trees and shrubs eliminates shade that cools the water. Water temperatures above 59 degrees Fahrenheit can harm salmon and trout by:

- Increasing physical stress,
- Decreasing their ability to compete for food and avoid predators,
- Decreasing oxygen levels in the water while increasing oxygen demand,
- Increasing the toxicity of many contaminants,
- Decreasing rearing habitat.

Water temperatures above 68 degrees Fahrenheit can be lethal to salmon and trout. High stream temperatures may allow carp, suckers, sunfish, and other temperature tolerant species to dominate at the expense of salmon and trout.

Riparian trees and branches regularly fall into streams. This large woody debris is extremely important to salmon and trout survival. It provides cover, protection from predators, resting areas, and important habitat for aquatic insects and small fish that salmon and trout eat. Debris dams help form pool areas that are essential to fish habitat.

[Jurisdiction] recognizes the importance of streamed trees and shrubs and the [jurisdiction] has environmental zoning regulations designed to protect riparian vegetation. Development

standards limit the number of trees that can be removed from sensitive areas, require replacement of trees illegally removed, and require new development to be set back from stream banks. [Jurisdiction] is reviewing these regulations and standards with an eye toward strengthening protection of salmon and trout.

What Developers Can Do

[Jurisdiction] can grow, and development can occur, without destroying salmon and trout habitat in the process. Development that minimizes impacts on fish habitat will help the recovery process. Some things developers can do to help preserve salmon and trout habitat are:

- Use state-of-the-art erosion control.
- Cover bare soil at the construction sites with gravel or straw.
- Don't disturb soil during the rainy season.
- Plant native plants, using compost as a soil amendment instead of fertilizing.
- Remove weeds manually rather than using herbicides
- Reduce the amount of impervious surface in new developments by using porous paving blocks or grass blocks where appropriate.
- Direct roof runoff to landscaped areas, detention ponds, or grassy swells.
- Plant native trees at the construction site.

Questions?

Call the [jurisdiction] at [xx-xxx-xxxx]

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