Upper Humptulips River Temperature Total Maximum Daily Load

Detailed Implementation Plan

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Detailed Implementation Plan

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List of Acronyms

A&TM	Access and Travel Management Plan
ACS	Aquatic Conservation Strategy
BMP	Best Management Practice
CCWF	Centennial Clean Water Fund
CMZ	Channel Migration Zone
CRP	Conservation Reserve Program
CREP	Conservation Reserve Enhancement Program
CWA	Clean Water Act
DIP	Detailed Implementation Plan
DNR	Department of Natural Resources
EPA	United States Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ESHB	Executive Summary House Bill
FEIS	Final Supplemental Environmental Impact Statement
FFR	Forest and Fish Report
FRP	Forest Practices Rules
FREP	Forest Riparian Easement Program
GCU	Geomorphic Channel Unit
GHC	Grays Harbor County
GHCD	Grays Harbor Conservation District
GIS	Geographic Information System
HCP	Habitat Conservation Plan
LRMP	Olympic National Forest Land and Resource Management Plan
LWD	Large Woody Debris
MOA	Memorandum of Agreement
NFS	National Forest System
NPDES	National Pollution Discharge Elimination System
NRCS	Natural Resource Conservation Service
NWFP	Northwest Forest Plan
ONF	Olympic National Forest
RCW	Revised Code of Washington
RMAP	Road Maintenance and Abandonment Plan
ROD	Record of Decision
SMA	Shoreline Management Act
TMDL	Total Maximum Daily Load
USFWS	United States Fish and Wildlife Service
USFS	United States Forest Service
WAC	Washington Administrative Code
WAU	Watershed Administrative Unit
WQRP	Water Quality Restoration Plan
WRIA	Water Resource Inventory Area
WRP	Wetland Reserve Program

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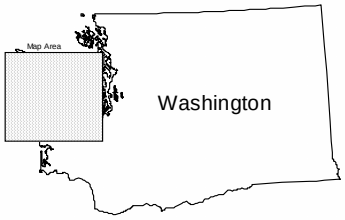

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Upper Humptulips River Vicinity Map

Plotted: 8:37 AM, May 8, 2001; pcuhns.apr

Introduction

Section 303(d) of the 1972 Clean Water Act (CWA) as amended requires the identification and placement of water bodies (rivers, streams, and lakes) on the 303(d) list for those waters that do not meet state water quality standards. Water quality limited water bodies must be identified by the United States Environmental Protection Agency (EPA) or by the state agency delegated this authority by EPA. In the state of Washington, EPA has delegated this responsibility to the Washington State Department of Ecology (Ecology). Ecology updates the 303(d) list every two years.

Section 303 of the Clean Water Act mandates that Total Maximum Daily Loads (TMDLs) be developed for the parameter(s) causing beneficial use impairment for all 303(d) listed waters. A TMDL is the waste load allocation for point sources of pollution and the load allocation for nonpoint sources of pollution, including natural background levels, in addition to a margin of safely to allow for uncertainty. The TMDL defines the amount of pollutant that can be present in the water body without exceeding water quality standards and impairing beneficial uses. However, these assessments do not necessarily prescribe specifically what must be done to meet the allocated loads.

In Washington State, Ecology is the responsible agency for establishing TMDLs. In addition, a lawsuit on behalf of Northwest Environmental Advocates and Northwest Environmental Defense Center requires Ecology to complete TMDLs for all the impaired water bodies identified on the 1996 303(d) List by 2013. A water body within the Upper Humptulips River is among more than 650 water bodies in Washington State included in that requirement.

Ecology conducted a TMDL study of the Upper Humptulips River and some of its tributaries during 2000 and 2001. The TMDL study, along with input from responsible government agencies, forest landowners, and local residents, formed the basis for the Upper Humptulips River Watershed Temperature Total Maximum Daily Load (Water Cleanup Plan) Submittal Report (Peredney et al. 2001). EPA approved this Submittal Report in June 2001.

The developers of the TMDL relied heavily on the (Draft) East/West Fork Humptulips Watershed Analysis as a scientific basis (Rayonier et al.1999). Individuals representing several government agencies and private landowners conducted the watershed analysis in 1998 and 1999. Team members included individuals from the following organizations: Rayonier Timberlands Operating Company; United States Forest Service (USFS)-Olympic National Forest (ONF); U.S. Environmental Protection Agency - Region 10; United States Fish and Wildlife Service (USFWS)– Pacific Region (Western Washington Fish and Wildlife Office); Washington State Department of Ecology - Southwest Region; Washington State Department of Natural Resources (DNR)– Olympic Region; Columbia Pacific RC&D; and Quinault Indian Nation (observer). Core team members including representatives from the Ecology, EPA, ONF and Rayonier coordinated watershed analysis products to assure information obtained from this effort would provide the framework for TMDL development. The watershed analysis condition assessment and

logic tracking provides a basis for developing sound management strategies to restore watershed health, including restoration of water quality.

The next step in the TMDL process is development of a detailed plan that outlines the framework for achieving water quality standards, monitoring plans, measures of success, and reasonable assurances. This document is the Detailed Implementation Plan (DIP) for the Upper Humptulips River. It is based on the findings of the (Draft) East/West Humptulips Watershed Analysis (Rayonier et al. 1999), the Upper Humptulips River Watershed Temperature Total Maximum Daily Load (Water Cleanup Plan) Submittal Report (Peredney et al, 2001), referred to in this document as "the TMDL", and the Upper Humptulips River Watershed Temperature Total Maximum Daily Load Study Technical Report (Cleland et al, 2001). It has been developed using input from Ecology, EPA, Olympic National Forest, Chehalis Basin Partnerships Water Quality Committee, Rayonier, and public involvement. The website for documents related to the Upper Humptulips TMDL (Submittal Report, Technical Report; and Detailed Implementation Plan) can be found at the following website:
http://www.ecy.wa.gov/biblio/0310042.html.

The DIP emphasizes current management direction set for federal and state and private forestlands as the fundamental approach to protecting aquatic resources and beneficial uses, and improving water quality conditions. The Olympic National Forest (ONF) manages National Forest System (NFS) lands within the Upper Humptulips according to direction set forth in the 1994 Record of Decision (ROD) for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (USDA and USDI 1994a), also known as the Northwest Forest Plan (NWFP). This plan amends the Olympic Land and Resource Management Plan (LRMP) (USDA 1990). Land allocations and standards and guidelines within the ROD are set to take an ecosystem management approach aimed at maintaining healthy forest ecosystems that support habitat for populations of native species, including riparian areas and waters. The Aquatic Conservation Strategy (ACS) is a major component of the ROD, a strategy designed to maintain and restore the ecological health and aquatic ecosystems at the watershed or landscape scale to protect habitat for fish and other riparian dependent species and resources.

The Washington Forest Practice Rules (FPR) is the regulatory tool for Clean Water Act compliance of forest management activity in Washington State. The FPR pertain to state, county, and private landowners.

The Upper Humptulips River Watershed TMDL has shown that land management under the NWFP and FPR should lead us on a trajectory towards the effectiveness shade targets. Adaptive management will be used to introduce more stringent compliance measures to meet this goal if monitoring determines that conditions are not proceeding in a positive direction.

The Olympic National Forest recognizes the Upper Humptulips River Detailed Implementation is the Water Quality Restoration Plan (WQRP) for NFS lands. Guidance for development of WQRPs is provided in the document entitled Forest Service and

Bureau of Land Management Protocol for Addressing Clean Water Act Section 303(d) Listed Waters (USDA and USDI 1999). The purpose and protocol outlined for WQRP development parallels the purpose and protocol for development of the DIP. Given this, both ONF and Ecology recognized that efficiency in combined efforts in development of the DIP.

Background

The Upper Humptilips analysis area lies in the southwestern portion of the Olympic Peninsula and is roughly 130 square miles. It encompasses the drainage area within the Humptulips River watershed upstream from the State Highway 101 Bridge. The area includes the entire area of the East Fork Humptulips and West Fork Humptulips Watershed Administrative Units (WAUs) and a portion of the Humptulips – Stevens Creek WAU. The USFS manages approximately 65 percent of this land base, with state, county and private ownership accounting for the remaining 35 percent. Rayonier Timberlands Operating Company is the largest private industrial landowner. Map 1 in Appendix D displays land ownership within the Upper Humptulips River.

Water quality information collected in the Upper Humptulips analysis area indicates that excessive summer water temperature may reduce the quality of rearing habitat for coho salmon as well as for steelhead and cutthroat trout. Primary watershed disturbance activities that contribute to surface water temperature increases include forest management within riparian areas, timber harvest in sensitive areas outside the riparian zone, and road construction and maintenance. The description that follows provides information on characterization and watershed disturbances due to human activities that have occurred since the early 1900s. This information is taken from various modules within the (Draft) East/West Fork Humptulips Watershed Analysis document (Rayonier et al. 1999).

Both the East Fork and West Fork Humptulips rivers flow in a general southwesterly direction converging to form the Humptulips River, which flows into Grays Harbor, a Pacific Ocean inlet. Elevations within the upper Humptulips watershed range from roughly 200 feet to 4,500 feet. Ridgetops in the upper watersheds commonly extend over 2,500 feet. The headwaters of both the East and West Humptulips River system initiate in the steep Olympic Mountains and flow into gradually broadening glaciated river valleys. The watershed precipitation averages 150 inches overall and over 200 inches annually in the uppermost elevations.

The bedrock geology of the upper Humptulips is almost entirely composed of the Crescent Formation and the related Blue Mountain Unit (Tabor and Cady 1978). Several times during the Pleistocene, alpine glaciers have developed in the headwaters of the upper Humptulips watershed. (Long 1975). The bedrock and glacial activity of the past have affected the watershed's current sediment budget. Typical of other watersheds on the Olympic Peninsula, the upper Humptulips sediment budget is dominated by inputs from mass wasting and creep processes, with surface erosion contributing a much smaller portion of the total. Compared to the other Olympic Peninsula rivers which have episodic sediment supply, the upper Humptulips has a chronic sediment supply. This is primarily a result of evacuation of glacial valley fill during peak flow events undercutting stream channel inner gorges and terrace edges.

Mass wasting processes in response to forest management appear to increase the chronic sediment supply and may also increase the small episodic peaks that are

triggered by large storm events. Placement of excess fill, concentration of road drainage, and loss of root strength are the key management related triggers of mass wasting. Road erosion increases the chronic component of the sediment regime and is also increasing the fine to coarse sediment ratio.

Riparian vegetation in the East/West Humptulips Watershed has been impacted by human activity since the early 1900s. Timber harvest, splash dams, and railroad and truck road building have affected all but the headwater areas of the watershed.

Early logging, from the turn of the century to the 1930s, was concentrated near the mainstem channels and the larger tributaries. The only method of log transport during that period was splash damming, which occurred on both mainstems and on a few of the larger tributaries. There were approximately 17 dams constructed within the analysis area. Some of these dams exceeded 40 feet in height and 200 feet in width. For example, the West Fork Splash Dam #3 was approximately 48 feet tall (Van Syckle 1980). Multiple splash, roll and pond dams were used on the mainstems, as well as some of the major tributaries, to create sufficient water to splash and to store logs. Often, a series of dams were splashed in sequence. That is, the upper dam was splashed first. Then, as the artificial freshet of water arrived at the next downstream dam, it was splashed, and so on down the river system. Many times the whole river system was cleared of logs in a series of splashes. Log driving or splashing, lasted approximately 30 years. The time came when the trees were too far from the streams and rivers to allow use of the waterways as a means to transport logs.

Railroad logging reached its peak in the 1930s to the 1940s. Railroads were built in the lower watershed, south of the National Forest boundary. Many of the railroad grades were later converted to truck road mainlines. The Donkey Creek, Newberry Creek, O'Brien Creek, and East Humptulips roads are all converted railroad grades.

Most of the remaining private lands had been harvested by 1960. Prior to the mid-1970s, no riparian buffers were required and riparian areas were harvested up to the edge of the stream channel unless the trees were unmerchantable or it was impractical to reach them. Due to the early harvest history in the East/West Humptulips Watershed, most current stands are continuous second-growth forest up to the edge of the stream channel, and many of these stands are now large enough to be harvested a second time. A second rotation of harvest is currently occurring on private lands in the lower watershed. Due to current forest practice requirements, these new harvest units do have riparian buffers along fish-bearing streams.

Timber harvesting first occurred on federal lands in 1906 but increased during the 1950s through the 1980s. It was most extensive during the 1960s and 1970s. Truck roads were built along the break between the steeper, upper hillslopes and the gentler lower hillslopes. The harvesting occurred primarily between the roads and the valley bottoms in both the East and West forks. Harvesting was also heavy in the Chester Creek drainage.

Some minimal riparian protection was required during this period, but most riparian areas adjacent to harvest units experienced some disturbance. Logging contracts during the 1960s and 1970s did provide for some protection of stream channels, for example, by including culvert and log suspension requirements and by prohibiting ground equipment from arbitrary crossings. After 1973, logging contracts required that trees be directionally felled away from protected stream channels. Early logging contracts also required the removal of some logging slash from streams. This was not performed on a large scale but likely resulted in some large woody debris (LWD) being removed from stream channels.

Even when riparian buffers were required, the larger conifers were often harvested and the residual vegetation was subject to damage from equipment and logging operations. The end result was that these buffers, though providing some degree of riparian protection, were often lacking in the large conifer suitable for LWD recruitment, shade, and habitat.

The Olympic National Forest and Resource Management Plan (LRMP) (Forest Service 1990) expanded the protection of riparian areas. The plan extended buffer widths to 200 feet from each side of channels and waterbodies. Although harvesting was still allowed in these areas, no clearcutting was allowed within 100 feet of Class 1 and 2 streams. It was also required that a 60 percent canopy cover be left along fish-bearing streams, and minimal disturbance by logging systems and roads was advised. Slash burning was usually avoided.

Since modification of northwest forest plans by the Record of Decision (ROD) in 1994 (Forest Service and BLM 1994a), no commercial harvest has occurred on federal lands in the watershed. Further protection of riparian areas by inclusion in Riparian Reserves, establishment of new land allocations, and adoption of the new Standards and Guidelines contained in the ROD will undoubtedly slow the human-caused effects on riparian areas in the federal ownership in the watershed.

Data within the (Draft) East/West Humptulips River Watershed Analysis Riparian Module indicates that within the lower portions of the watershed, plant association groups that once supported large conifers, especially Sitka spruce, Douglas-fir, and western red cedar, now contain high percentages of small conifer and hardwoods. Although hardwoods have always been a component of the riparian areas along the mainstems and larger tributaries, the present composition shows a greater ratio of hardwoods to conifers and younger successional stages. Over the entire watershed, 20 percent of the riparian areas within 100 feet of the stream channel have small conifer or hardwood stands. By applying Riparian Reserve widths to federal lands and overlaying these areas with successional stages, 48 percent of the riparian areas are in early to middle stages.

Overview

Thermal influx can be linked to source areas and actions needed to address processes that influence water temperature, specifically riparian vegetation management to increase shade. Load allocations for the Upper Humptulips TMDL are derived using effective shade. Operational assurance that the DIP will be faithfully carried out relies fundamentally on implementation of current management direction set forth on federal and state and private lands. The Record of Decision for the Northwest Forest Plan provides direction for forest practices on National Forest System lands. The Washington Forest Practice Rules are the regulatory tool for Clean Water Act compliance of forest management activity in Washington State. The FPR pertain to state, county, and private landowners. The Upper Humptulips River Temperature TMDL has shown that management according to the NWFP and FPR should lead us on a trajectory towards the effectiveness shade targets. If trees are planted in 2003, temperatures should be expected to meet standards by the year 2053.

The Approach

This Detailed Implementation Plan addresses the pollutant heat as a major determinant of water quality that affects aquatic life. This factor varies naturally in its characteristics across the landscape as a function of geology, topography and climate as well as over time. The influence of this pollutant on water quality can also be significantly affected by changes associated with land use. The DIP is designed to address impairments due to surface water temperature increases for the water quality-limited segment located on the Humptulips at Highway 101. In addition, it sets load allocation limits to protect other streams within the Upper Humptulips watershed area from becoming water quality limited. This includes temperature exceedences detected in 1998 at the locations on 9 water bodies not included on the 303(d) List.

The TMDL provides the framework and targets for long-term monitoring and implementation activities. However, it does not include the details for what to do or the mechanisms that will ensure that water quality improvements will occur. This document summarizes the strategy and elements that should ensure effective actions to meet the established targets as well as to maintain compliance with water quality and temperature standards.

Temperature violations occur in late summer. However, the causes for elevated temperatures in forested environments are systemic conditions. These include past and current deficiencies in riparian conditions, road management and accelerated erosion and mass wasting from management activities. These are conditions that result from a variety of management actions taken throughout the years and across the landscape.

The TMDL temperature analysis has been adopted by the federal and agencies as the analytical basis for validating the effectiveness of the riparian management prescriptions in the Upper Humptulips area and for guiding monitoring efforts and subsequent adaptive

management. The load allocations from this TMDL were derived using effective shade. Thermal influx can be linked to source areas and, thus to actions (specifically riparian management) needed to address processes which influence water temperature. The TMDL relies on this document to articulate the management activities, broad environmental outcomes, monitoring requirements, and the adaptive management process.

Pollution Sources

The TMDL is established for the pollutant, heat (incoming solar radiation). Temperature exceedances in summer months are a result of too much solar radiation directly affecting the water bodies. This factor varies naturally in its characteristics across the landscape (as a function of geology, topography and climate) as well as over time. The influence of this pollutant on water quality can also be significantly affected by human caused changes associated with land use. Increasing effective shade will decrease the solar radiation (heat) being delivered to stream systems.

Washington State water quality standards are published pursuant to Chapter 90.48 of the Revised Code of Washington (RCW) and are located in the Washington Administrative Code (WAC) Chapter 173-201A (WDOE 1992). According to the WAC, all waters within the Upper Humptulips are classified as Class A or AA waters. All waters on National Forest System lands are considered Class AA. All other waters are considered Class A. According to the WAC, the following water quality criteria apply:

Class A waters:

> *Temperature shall not exceed 18.0℃ (freshwater) or 16.0℃ (marine water) due to human activities. When natural conditions exceed 18.0℃ (freshwater) or 16.0℃ (marine water), no temperature increases will be allowed which will raise the receiving water temperature greater than 0.3℃…Incremental temperature increases resulting from nonpoint source activities shall not exceed 2.8℃.*
>
> [*WAC 173-201A-030(2)(c)(iv)]*

Class AA waters:

> *Temperature shall not exceed 16.0℃ (freshwater) or 13.0℃ (marine water) due to human activities. When natural conditions exceed 16.0℃ (freshwater) or 13.0℃ (marine water), no temperature increases will be allowed which will raise the receiving water temperature greater than 0.3℃…Incremental temperature increases resulting from nonpoint source activities shall not exceed 2.8℃.*
>
> [*WAC 173-201A-030(1)(c)(iv)]*

When natural conditions exceed the numeric criteria for temperature, the following criteria apply:

> *Whenever the natural conditions of said water are of a lower quality than the assigned criteria, the natural conditions shall constitute the water quality criteria.*
>
> [*WAC 173-201A-070(2)]*

The TMDL was designed to address impairments identified in the 1996 303(d) List due to surface water temperature increases on one water quality-limited segment of the Humptulips River located at the State Highway 101 Bridge. The 1998 303(d) List also includes this segment. In addition to this segment, the TMDL sets allocation limits to protect over 300 additional miles of drainage network that drain into the Humptulips upstream from State Highway 101 Bridge from becoming water quality-limited. Temperature data collected in 1998 for the (Draft) East/West Humptulips Watershed Analysis detected exceedances at ten locations on 9 water bodies. These exceedances were not submitted for 303(d) listing given that the TMDL was being developed concurrently with the watershed analysis. Table 1 provides information on locations where these exceedences occurred. Map 3 in Appendix D displays the location of these (and other) temperature monitoring station locations.

Table 1. Upper Humptulips River - 1998 Stream Temperature Exceedances

Water body	Monitoring Site	Temp. °C	Standard °C
HUMPTULIPS RIVER @ 101 BRIDGE (WA22-1010) (NY74PY)	22A070 (ECY)	21.6	18
W.F. Humptulips above confluence	T3	23.2	18
E.F. Humptulips above confluence	T4	24.3	18
Furlough Creek	T8	18.2	18
Road.3610 Donkey Creek tributary	T11	18.7	16
Upper Donkey Creek wetland	T12	26.5	18
E.F. Humptulips @ Flatbottom Creek	T13	19.6	18
E.F. Humptulips @ R.M. 15	USFS1	17.9	16
W.F. Humptulips @ R.M. 41 below Rainbow Creek	USFS3	20.8	16
W.F. Humptulips@ R.M. 45.3	USFS6	20.4	16
E.F. Humptulips across the river from junction of Roads 2200 & 2206	USFS16	17.3	16

The primary designated beneficial use requiring protection within the Upper Humptulips is aquatic life. Native salmonid species include coho, chinook, chum, steelhead, coastal cutthroat trout, resident rainbow trout, mountain whitefish and the non-native Eastern brook trout.

Organizations Responsible for Pollution Reduction

This section provides information on organizations for implementation of the Upper Humptulips River Detailed Implementation Plan. The USFS manages approximately 65 percent of this land base, with state, county and private ownership accounting for the remaining 35 percent. Rayonier Timberlands Operating Company is the largest private industrial landowner.

Department of Ecology

Ecology has been delegated the authority under the federal Clean Water Act by the EPA to establish water quality standards, administer the Non Point Discharge Elimination System (NPDES) permitting program, and enforce water quality standards.

The Local Watershed Planning Program instituted under Executive Summary House Bill (ESHB) 2514 and the Salmon Recovery Program under ESHB 2496, have limited involvement in the Upper Humptulips watershed. The Local Watershed Planning Program under the direction of Ecology is tasked with establishing a procedure for controlling stream flow and has the option to deal with water quality issues. Increasing flow during critical periods has the potential of decreasing temperature. The Humptulips River is one of the water bodies administered by the Chehalis Watershed Planning group. They are currently studying the possibilities for flow restoration within the basin.

Federal Forest Land – (United States Forest Service)

The United States Forest Service is the Designated Management Agency for meeting federal Clean Water Act requirements on National Forest System lands within the state of Washington. This authority is set forth in the Memorandum of Agreement between the USDA Forest Service - Region 6 and the Washington State Department of Ecology for Meeting Responsibilities under federal and state water (USDA and WDOE 2000). As stated in this agreement, the Forest Service will ensure that all waters on NFS lands meet or exceed water quality laws and regulations and that activities on those lands are consistent with the level of protection of the Washington Administrative Code relevant to state and federal water quality requirements.

The Olympic National Forest will manage lands under its jurisdiction within the Upper Humptulips River according to direction set forth in pertinent management documents. The Olympic National Forest has been managed under the direction provided in the Olympic National Forest Land and Resource Management Plan since its implementation in 1990. The plan sets forth Forest-wide goals and objectives, Forest-wide standards and guidelines by program element, and a system of management areas, each with its own goals, objectives and standards and guidelines for management of the Forest. The 1994 Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl, also known as the Northwest Forest Plan, amends the Olympic LRMP. The ROD adopts Alternative 9 of

the Final Supplemental Environmental Impact Statement (FEIS) on Management of Habitat for Late-Successional and Old-Growth Species within the Range of the Northern Spotted Owl (USDA and USDI 1994b) as modified by the ROD and as amplified by the standards and guidelines attached to it.

The NWFP amends the Olympic LRMP by overlaying a system of land allocations with their accompanying standards and guidelines. The Olympic LRMP is still valid, but is amended to include the provisions of the NWFP. In general, where NWFP standards and guidelines are more stringent than the Olympic LRMP for specific resource areas, the NWFP standards and guidelines apply. Standards and guidelines and land allocations in the Forest plan not directly super-ceded will remain in effect. Map 2 in Appendix D displays Olympic National Forest land allocations.

The purpose and need for the NWFP standards and guidelines, as stated in the ROD is "to take an ecosystem management approach to forest management, with support from scientific evidence; meet the requirements of existing laws and regulations; maintain a healthy forest ecosystem with habitat that will support populations of native species (particularly those associated with late-successional and old-growth forests), including riparian areas and waters; and maintain a sustainable supply of timber and other forest products that will help maintain the stability of local and regional economies on a predictable long-term basis."

The Northwest Forest Plan describes the ecological principles for management of late-successional forests. Late-successional reserve areas are designated land allocations. The primary management objective for these lands is to protect and enhance conditions of late-successional forest ecosystems so that they can effectively serve as habitat for late-successional and old-growth related species. The purpose of the standards and guidelines set for the late-successional reserves is to maintain late-successional forest ecosystems, maintain natural ecosystem processes, accelerate development of young plantations into stands with late-successional and old-growth forest characteristics, and reduce the risk of severe impact from large-scale disturbances.

Adaptive Management Areas are landscape units designated within the Northwest Forest Plan to be managed to encourage development and testing of technical and social approaches to desired ecological, economic and other social objectives. The overall management objective for these areas is to learn how to manage on an ecosystem basis in terms of both technical and social challenges, and in a manner consistent with applicable laws.

The Aquatic Conservation Strategy is a major component of the Northwest Forest Plan. This strategy is designed to maintain and restore the ecological health and aquatic ecosystems at the watershed or landscape scale to protect habitat for fish and other riparian dependent species and resources. In general, watersheds that currently have the best habitat or those with the greatest potential for recovery are priority areas for increased protection and for restoration treatments. The conservation strategy aims to maintain the natural disturbance regime. Components of the Aquatic Conservation Strategy include:

1. Riparian Reserves: Lands along streams, and unstable and potentially unstable areas where special standards and guidelines direct land use. Riparian reserves are designed to maintain and restore the ecological health and aquatic ecosystems. Interim widths for Riparian Reserves are established based on ecological and geomorphic factors. Interim Riparian Reserves for federal lands are delineated as part of the watershed analysis process based on identification and evaluation of critical hillslope, riparian, and channel processes. Final Riparian Reserve boundaries are determined at the site-specific level during the appropriate National Environmental Policy Act analysis.
2. Key Watersheds: A system of refugia comprising watersheds crucial to at-risk fish species and stocks and provide high quality water. Key Watersheds are generally those watersheds with the best habitat or those with the greatest potential for recovery and are priority areas for increased protection and for restoration treatments. Activities to protect and restore aquatic habitat in Key Watersheds are a higher priority than similar activities in other watersheds.
3. Watershed Analysis: Procedures for conducting analysis that evaluates geomorphic and ecological processes operating in specific watersheds. This analysis should enable watershed planning that achieves Aquatic Conservation Strategy objectives. Watershed analysis provides the basis for monitoring and restoration programs and the foundation from which the Riparian Reserves can be delineated.
4. Watershed Restoration: a comprehensive, long-term program of watershed restoration to restore watershed health and aquatic ecosystems, including habitats supporting fish and other aquatic and riparian dependent organisms.

Federal Forest Land – (United States Forest Service) Specific Actions

Implementation of Record of Decision for the Northwest Forest Plan

The recovery of water quality conditions in the Upper Humptulips on NFS lands is dependent on implementation of the Olympic National Forest Land and Resource Management Plan as amended by the Northwest Forest Plan. Important to this recovery is implementation of the NWFP standards and guidelines to meet the Aquatic Conservation Strategy. According to this direction, activities aimed at protecting and restoring aquatic habitat within non-Key Watersheds are considered a lower priority than similar activities within watersheds designated as Key Watersheds. Therefore, implementation of restoration activities within the Upper Humptulips River, a non-Key Watershed, will be prioritized based on this direction.

Late-Successional Reserves aimed at protecting or enhancing late successional forest ecosystems account for approximately 98 percent of this land base. In addition, Riparian Reserves designed to maintain and restore the ecological health and aquatic ecosystems overlap all land allocations and cover nearly 60 percent of the area. Figure 1 shows the general character of the Upper Humptulips on the Olympic National Forest. Figure 2 represents Late-Successional Reserve land allocation.

"Passive" restoration of conditions within the Upper Humptulips watershed has occurred under NWFP direction and should lead towards recovery of riparian shade. Since 1994, the Forest has emphasized implementation of road maintenance, improvement or reduction with no timber stand harvest activities. Land allocations designated for this area under the NWFP provide considerable resource protection.

Figure 1. Upper Humptulips River - Olympic National Forest

Figure 2. Upper Humptulips River – Late-Successional Reserve

Road Management

Restoration of watershed health, including protection and enhancement of water quality, through management of the road system continues to be a primary focus on the Olympic National Forest. In line with this emphasis, the Forest recently updated its Access and Travel Management Plan. This plan is a strategic management tool considered useful in prioritizing road activities, including those within the Upper Humptulips. As a starting point for the A&TM update, the Forest conducted a forest-wide analysis of its road network that is a useful tool for development of restoration opportunities. Under this process, the Forest analyzed roads based on factors associated with aquatic and wildlife risks, need for access and potential future uses. This preliminary information is useful in determining

what roads pose the greatest potential risk to aquatic resources and what roads are good candidates for different types of road treatments. The analysis also provides information that is useful in prioritizing road-related work at a Forest-wide scale.

A significant outcome of the A&TM process is identification by the Olympic National Forest of roughly one-third of its 2200 miles of road network for decommissioning, a total of over 750 miles. This totals all roads proposed for decommissioning, including roads that are candidates for conversion to trails. Products relating to the Access and Travel Management Plan can be accessed at the following website address: http://www.fs.fed.us/r6/olympic/aboutonf/atm_web/atm_maps.htm

Within the Upper Humptulips River Watershed, the Olympic National Forest A&TM has identified about 93 of the 200 miles total Forest Service roads for decommissioning. Map 4 in Appendix D displays the road objective maintenance levels determined through the A&TM for the Upper Humptulips, which includes road proposed for decommissioning.

Restoration Opportunities Identified in Watershed Analysis

The Olympic National Forest will utilize restoration opportunities identified in the (Draft) East/West Fork Humptulips Watershed Analysis to help guide specific restoration activities. The section of the watershed analysis document entitled "Key Restoration Opportunities" tabulates several restoration opportunities such as: road treatments (stabilization, drainage, upgrade, and decommissioning, reduction of sediment production and delivery to the aquatic system); stand density control; snag development; forage seeding, planting, and fertilizing; reduction of road density; riparian silviculture; in-channel large woody debris placement; investigate development of log jams and off-channel habitat.

In development of restoration projects, the Olympic National Forest will also take into consideration recommendations within the Vegetation Assessment Module and the Riparian Modules of the watershed analysis. The Vegetation Assessment Module outlines restoration actions that would enhance vegetative processes and structures that have been compromised in comparison with historic levels due to forest management practices. The Riparian Module outlines several types of restoration actions that could be taken to improve riparian conditions. In addition, this module ranks sub-basins based on low large woody debris recruitment potential and below-target shade, information that is useful in prioritizing restoration activities.

Recent Restoration Activities

The Olympic National Forest has implemented restoration projects within the Upper Humptulips since the early 1990s. In the recent years since 1999, the Forest has implemented the following road-related restoration treatments: road drainage and/or stabilization at 12 sites; road decommissioning of 3 roads totaling around 5.4 miles; road drainage on 1 road totaling 0.4 miles, and; road drainage and stabilization on 3 roads totaling 4.1 miles. Work on these roads included re-vegetation treatments. Table 2 provides information on completed road-related restoration work.

In addition road restoration work, the ONF completed riparian planting along 0.4 stream miles, and in-channel placement of large woody debris within 0.9 miles of channel completed within the Chester Creek drainage. Figures 3a and 3b provide examples of recent restoration activities conducted within the Chester Creek drainage, a tributary to the West Fork Humptulips River. Map 5 in Appendix D shows locations for road-related restoration treatments completed in recent years following watershed analysis.

Figure 3a. Example of Recent Restoration Work – In-channel Placement of Large Woody Debris

Figure 3b. Example of Recent Restoration Work – Culvert Removal, Stream Crossing Restoration

Planned Restoration Activities

The Forest is underway with design and or implementation of the following types of road projects with emphasis given to protection of aquatic resources: construction of a bridge that includes fish passage and road decommissioning of 5.6 miles of road.

Table 2. Olympic National Forest - Completed and Planned Road–Related Restoration Work

Forest Service Road Number	BMP (miles)	EMP (miles)	Length (miles)	Road Treatment Type
Restoration Work Completed Since 1999				
2204000	15.7		0.1	Drainage
2204000	16.4		0.1	Drainage
2204000	16.6		0.1	Drainage
2204000	16.9		0.1	Drainage
2259000	3.0		0.1	Drainage
2206000	3.4		0.1	Drainage & Stabilization
2206000	4.3		0.1	Drainage & Stabilization
2206000	8.0		0.1	Drainage & Stabilization
2206000	8.1		0.1	Drainage & Stabilization
2281000	6.1		0.1	Drainage & Stabilization
2281000	5.1		0.1	Drainage & Stabilization
2220120	0.9	5	4.1	Decommission
2220023	0	0.2	0.2	Decommission
2204070	0	2.7	2.7	Drainage & Stabilization
2204072	0	0.9	0.9	Drainage & Stabilization
2204073	0	0.5	0.5	Drainage & Stabilization
2204076	0	0.4	0.4	Stabilization
2204079	0	1.1	1.1	Decommission
Restoration Work Planned in 2003				
2204000	3.5		0.1	Bridge, Fish Passage
2281480	0.0	5	5.0	Decommission
2281490	0.0	0.6	0.6	Decommission

Private, County, and State owned Forest Land

In 1999, various state and federal agencies, counties, some tribes and the timber industry entered into the Forests and Fish Report (FFR) (USFWS et al. 1999) to address impacts caused by forest harvesting activities on water quality and habitat for fish and six riparian-dependent amphibians. This agreement was contingent on the state adopting improved forest practice regulations as well as funding and implementing a monitoring and adaptive management program to demonstrate the effectiveness of the new rules in protecting water quality and fisheries habitat. Landowners also agreed to share water quality information with the other parties to the agreement.

Emergency forest practice regulations were adopted by the Washington Forest Practices Board and became effective March 20, 2000. These rules are representative of the FFR agreement. In May 2001, the Forest Practice Board adopted permanent rules implementing the "Forests and Fish Report" passed by the legislature in 2000. The Forest Practice Act (RCW 76.09, Forest Practice Rules WAC 222), Forest Practices Board Manual (WFPB 2002), and Forests and Fish Report can be found at the following Washington Department of Natural Resources website address: http://www.dnr.wa.gov/.

Negotiated "assurances" were provided to the timber industry under the agreement in exchange for their support of improved forest practice regulations. These assurances include: 1) development of TMDLs for 303(d) listed waterbodies impacted primarily or solely by forest practices may be delayed until the year 2009; 2) EPA and Ecology would not ask the Forest Practices Board to adopt any more stringent rules except through the adaptive management program set out in the FFR; and, 3) the FFR adaptive management process will be used for adjusting forest practices if necessary in order to meet load allocations of TMDLs produced for streams in mixed use watersheds.

Initial development of the Upper Humptulips TMDL predates the FFR. Therefore, Ecology proceeded with this TMDL to completion. Load allocations are included in the TMDL for forestlands in the Upper Humptulips in accordance with the section of the FPR entitled **"TMDLs produced prior to 2009 in mixed use watersheds"**. Also consistent with the FPR, implementation of the load allocations established in this TMDL for private and state forestlands will be accomplished per implementation of the revised forest practice regulations. The effectiveness of the FPRs will be measured through the adaptive management process and monitoring of streams in the watershed. FPR assurances are provided for forest harvesting activities conducted under regulations adopted pursuant to the FFR agreement.

The (Draft) East/West Humptulips Watershed Analysis documented several stream segments of the lower mainstems of both the East Fork Humptulips and West Fork Humptulips rivers, and on the lower tributaries of the East Fork Humptulips tributaries that have experienced recent harvesting. These riparian buffers were cut under the former forest practice regulations that allowed much smaller buffers. However, the current riparian buffer requirements for future harvests should ensure that the tree canopy along these stream segments will be wider. This increased riparian buffer will provide greater effective shade and thereby reduce the level of solar radiation being delivered to the associated water bodies. Figure 4 shows a graphical representation of riparian buffers.

Figure 4. Graphical Representation of Riparian Buffers

Private, County, and State-Owned Forest Land Specific Actions

Forest Practices Rules that guide riparian management in the Upper Humptulips will likely improve effective shade conditions. FRP riparian buffers requirements on large, fish-bearing waters are 105 to 128 feet wide, with an additional 20 trees per acre in the outer zones to provide abundant shade on low-gradient pool-riffle and terrace confined geomorphic channel unit (GCU) types. FFR buffers on small, fish-bearing streams such as the forced pool-riffle or smaller hillslope confined (GCU) type are 75 to 100 feet wide, with an additional 20 trees per acre in the outer zones. These buffers are providing these smaller GCU with all available shade.

Figure 5 shows an aerial photograph view of a timber unit within the Brittain Creek drainage that Rayonier recently harvested. Obviously, the floodplain migration geomorphic channel type is difficult to completely shade due to natural conditions, but some landowners have left the entire lower floodplain un-harvested.

Figure 5. Typical Timber Harvest Unit Under Current Forest Practices Rules

FPR buffers on perennial, non-fish-bearing streams such as many segments of terrace transition and babbling brook GCU types are protecting at least 50 percent of the total perennial length with 50-foot buffers. For example, Rayonier's recent harvest unit provided at least 50 percent protections to the perennial, non-fish-bearing streams. These 50-foot buffers experience some blow-down, but provide significant shade. In addition, these small streams become very well shaded within a few years of harvest by understory vegetation that establishes along the entire stream length, including under the riparian trees.

Unstable Slopes

Current Forest Practice Rules require considerable improvements to forest practices permitting processes with the goal of preventing forest practices from causing an increased rate of landslide-related sediment delivery. Improved topographic and geologic mapping will provide landowners and the DNR with more accurate tools to predict where landslides may occur. Detailed standards will be established to field-identify the most hazardous areas. Local slope stability issues will be identified through regional efforts following adoption of new rules**.** Resource professionals representing agencies, tribes, and landowners will be trained to recognize potentially unstable slopes and a team of geologists will map hazard areas and assist resource professionals in assessing slope stability issues.

Forest Roads

Current Forest Practice Rules require that all existing forest roads be improved and maintained to a higher standard to provide fish passage, prevent landslides, limit delivery

of sediment and surface runoff water to streams, and avoid capture or redirection of surface or groundwater. To accomplish this, landowners will be required to bring all of their forest roads into an approved maintenance plan within five years and to complete improvements within 15 years. The rules specify new road construction standards to meet water quality goals. Standards, priorities, and implementation guidelines recommended by the FFR are included in the Forest Practices Rules and the Forest Practices Board Manual.

The DNR administers and enforces the FPR, including Road Maintenance and Abandonment Plan (RMAP) regulations. Specific FPR require all large forest landowners to submit detailed RMAPs by the end of 2005. The work identified within these plans must be completed by 2015. Rayonier intends to complete an RMAP that includes all their ownership within the area covered by the TMDL by February 2004. Work completed under these RMAPs will generally improve water quality and may help reduce temperature by limiting sediment delivery from roads that cause channel aggradation.

Wetland Protection

Current FPR acknowledge that timber harvest in some forested wetlands may influence the interaction between the wetland and fish-habitat waters. There are recommendations for specific scientific studies to assess the impacts of harvesting in these wetlands. In addition, the FPR recommends improved mapping of wetlands and clarification of existing rules for wetland protection.

Other Provisions

Forests and Fish Report

The Forests and Fish Report contains agreement on adaptive management and a number of additional issues covering programmatic changes to forest practice regulation, assurances from regulatory agencies, and funding that are not directly addressed in this review. These issues are essential to the consensus reached by the authors of the FFR and are critical components of the overall system of forest practices regulation.

Shoreline Management Act

Grays Harbor County (GHC) administers the Shoreline Management Act (SMA) in Grays Harbor County. Forest practices conducted in areas subject to Washington State SMA are subject to both the Shoreline Management Act and to the Washington State Forest Practices Act. Under the Shoreline Management Act, timber cutting, alone, does not require a shoreline permit. However, road building, grading for landings or for major fire trails, and other kinds of activities commonly associated with forest practices may require a shoreline permit. To determine whether or not a shoreline permit will be required for a particular activity, the operator should contact the local planning department. Exemption from the requirement to obtain a permit does not equal exemption from the requirement to comply with the law. Whether a permit is required or not, all forest practices must comply with the SMA and with the local Shoreline Master Program.

Non-Forested Lands

On the few non-forested mixed-use lands several entities share an interest in seeing improvements in water quality, soil conservation, and habitat restoration. Voluntary cooperation is the main approach to manage these concerns. There are several funding sources available from the Grays Harbor Conservation District (GHCD) and Natural Resources Conservation Service (NRCS).

The GHCD, in cooperation with local farmers, has implemented several activities to mitigate the effects of land use on the water temperature in the Humptulips River. The GHCD funded 130 miles of riparian fencing to exclude livestock from the riparian area in order to conserve riparian vegetation and to reduce fecal contamination. They have also funded riparian revegetation efforts on the main stem and tributaries of the Humptulips River.

In 2001, the Humptulips River was added to the Conservation Restoration and Enhancement Program (CREP). The CREP program is a voluntary cost share program that encourages landowners to take lands out of crop production in exchange for financial support. The program supports improvement of riparian management targeted to increase riparian vegetation, improve bank stability, and restore and enhance habitat. Implementation of such management activities would contribute to meeting effectiveness shade targets. The GHCD intends to continue and expand these programs, dependent on funding.

Management Roles, Activities, and Schedules

Table 3 summarizes the agencies or organizations, their authority and responsibilities, likely funding sources, and status or schedule, for implementation of the Upper Humptulips River Detailed Implementation Plan.

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Table 3. Management Roles, Activities and Schedules

Agency/ Organization	**Authority/Responsibility**	**Funding**	**Status/schedule**
Department of Ecology	**Education** Report on Humptulips River TMDL implementation **Financial Assistance** Provide funding through 319 funds, Centennial Grants, and State Revolving Loan Funds. Host 5- and 10- year performance reviews Conduct TMDL Effectiveness Monitoring Participate in ESHB 2514 Planning **Enforcement** Enforce state Water Pollution Control Act (RCW 90.48)	Ecology	On going Annual funding On going
United States Forest Service – Olympic National Forest	**Administration** Continue to implement the Northwest Forest Plan and other requirements to work towards achieving load allocation targets in this TMDL. Implement Access and Travel Management Plan. Conduct monitoring.	USFS	On going On going On going
Grays Harbor County	**Administration** Responsible for SEPA, Shoreline permitting and flood ordinances.	GHC	On going
Grays Harbor Conservation District	**Administration** Participate in farm planning and provide technical assistance on BMPs. Install riparian livestock – exclusion fencing and riparian planting to increase effective shade. Support Conservation Reserve Enhancement Program (riparian protection). Maintain water quality monitoring	CCWF CCWF CREP	As requested As requested As requested As needed

Agency/ Organization	Authority/Responsibility	Funding	Status/schedule
	program.		
Department of Natural Resources	**Administration** Implement Forest Practice Rules to develop buffers in cooperation with private forest landowners to meet TMDL effective shade targets. **Enforcement** Administer and enforce FPR, including review and approval of RMAPs.	DNR	On going On going
Natural Resources Conservation Service	**Education** Provide technical assistance to GHCD. Participate in the Environmental Quality Incentive Program. Provides technical and financial assistance to landowners.	NRCS EQIP NRCS	As requested As requested On going
Quinault Tribe	**Education** Provide technical assistance.	Quinault Tribe	As needed

Performance Measures and Targets

TMDL developers used information about each channel class (e.g. estimated drainage area, estimated active channel width, range of flows, etc.) to determine effective shade targets. The channel classification system is used to assess stream reaches according to temperature groups. This approach leads to effective shade targets that recognize the variability in channel and riparian characteristics that occur across the landscape. As such, these targets reflect the range of active channel widths and riparian vegetation heights by Geomorphic Channel Unit (GCU) within the Upper Humptulips River.

Identification of the loading capacity is an important step in developing TMDLs. Shade intercepts the solar radiation and acts to cool the waters. The loading capacity provides a reference for calculating the amount of pollutant reduction needed to bring a water body into compliance with State water quality standards. By definition, a TMDL is the sum of the load allocations. An allocation is defined as the portion of a receiving waters' loading capacity that is assigned to a particular source. EPA defines the loading capacity as "the greatest amount of loading that a water can receive without violating water quality standards".

The Upper Humptulips River TMDL Submittal has shown that the Northwest Forest Plan and the Washington Forest Practice Rules should put us on a trajectory towards the effective shade targets. Appendix B includes direct excerpts from the TMDL Submittal Report. These extracts are considered useful in displaying information on channel types

and effective shade load allocations. Refer to the Submittal Report for the more complete details.

Measuring Progress Toward Goals

The Olympic National Forest considers this Upper Humptulips River DIP to be the Water Quality Restoration Plan for lands it administers in the Humptulips. The MOA between Ecology and USFS requires annual reporting by USFS to Ecology for WQRPs. Given this, both agencies can evaluate work conducted by the USFS under the Humptulips DIP as part of the annual reporting requirements of the MOA.

For private, county and state forestlands, the RMAPs are reviewed on an annual basis. The FFR riparian effective shade levels can be reviewed in coordination with review of new aerial photos. This should be performed in approximately 5- or 10- year intervals.

For volunteer cooperation on non-forested lands, the GHCD keep records of riparian restoration projects within Upper Humptulips. This information should be used to supplement the FFR information during the 5- or 10- year review.

Since 1999, Ecology and the Olympic National Forest have coordinated collection of stream temperature monitoring data within the Upper Humptulips River Watershed. Water temperature monitoring is designed to collect stream temperature information at strategic locations within the stream network in order to determine compliance with Washington State Water Quality Standards set for temperature. In addition, this information will be used to evaluate the influence of different channel types on stream temperatures. In 2004, Ecology and the ONF plan to analyze the stream temperature data that has been collected in the Upper Humptulips to determine what type and frequency of monitoring needs to occur in the future. This analysis will be conducted every five years.

Effectiveness Monitoring Approach

Department of Ecology

The purpose of effectiveness monitoring is to provide assurance that control measures put in place during TMDL implementation achieve the expected load reductions. Ecology is responsible for determining, through effectiveness monitoring, the status of water bodies subsequent to the development and implementation of each TMDL. The timing of this monitoring will be dependent upon the pollution parameters addressed in the TMDL, the period after which positive results should be identifiable, and the availability of resources. Effectiveness monitoring priorities will be selected by each regional office and verified through the annual scoping process.

In order to be thorough in accomplishing this task, monitoring personnel will follow a review sequence. The sequence will include consultations with the original TMDL

modeler to determine critical parts of the implementation plan and to verify critical locations. They will also contact the regional office TMDL coordinator to learn the results of implementation monitoring and the status of the TMDL implementation plan. Both monitoring and regional staff will make an effort to identify a local partnership to assist with the actual data collection. On completion of these steps, an examination of the resulting data will be made and a water quality status determination will be announced for the water body in an advisory memorandum followed by a technical report.

Part of the effectiveness monitoring will be to ensure we are getting closer to achieving the effective shade targets. The (Draft) East/West Humptulips River Watershed Analysis Riparian Module provides useful information about the current riparian age and species composition of the watershed. However the current information does not translate well into Geographic Information System (GIS) for incorporation into the heat budget analysis. The analysis tools that can derive the actual effective shade for comparison to the effective shade targets are presently being developed and perfected.

Federal Forest Land – (United States Forest Service)

Direction within the Olympic LRMP as amended by the NWFP provides the framework for monitoring implementation of restoration actions on lands administered by the Olympic National Forest. This direction emphasizes coordination and cooperation between various federal, state and local agencies, American Indian tribes and other interest groups.

The Olympic National Forest recognizes that it may take several years following implementation of restoration actions aimed at improvements to the aquatic system to meet the objectives of the action. In some cases, responses to improvements in aquatic ecosystems can be expected in 10 to 20 years. In other cases, it may take decades or possibly more than a century to see the effects restoration of the aquatic system. Monitoring conducted in the Upper Humptulips on NFS lands will reflect this recognition that it may take several years before responses by the natural system are observable or measurable.

The Olympic National Forest monitoring approach will include evaluation of short and long-term effectiveness of riparian restoration treatments. Water temperature monitoring is included as part the strategy and is designed to collect stream temperature information at strategic locations within the stream network in order to determine compliance with Washington State Water Quality Standards set for temperature. In addition, this information will be used to evaluate the influence of different channel types on stream temperatures. Forest temperature monitoring efforts will continue to be coordinated with Ecology and other interested groups.

<u>Recent Monitoring Efforts</u>
The Forest has conducted stream temperature monitoring at several locations within the Upper Humptulips watershed during the past five years. The Forest submitted summary data that included this stream monitoring information to Ecology for submission to the 2002 303(d) List. This submittal included stream temperature data collected within the

Upper Humptulips River for the years 1998 through 2002. The Forest also provided this stream temperature data to Ecology as part of the 2002 Annual MOA. Figure 6 provides photographs of two ONF stream monitoring stations within the Upper Humptulips River.

Figure 6. Photographs of Olympic National Forest Stream Temperature Monitoring Stations

In 2002, the Forest initiated data collection at selected sites within the Upper Humptulips to determine whether road restoration treatments designed to reduce sediment delivery to aquatic systems have been effective. The monitoring design involves multiple-year implementation and includes data collection prior to, immediately after, and one-year following, various treatments to roads. Data collection is still underway, and results will be documented in the monitoring report that is expected in 2004.

Private, County, and State owned Forest Land

The FFR riparian effective shade levels can be reviewed in coordination with review of new aerial photos. This could be performed in approximately 5- or 10-year intervals. The RMAPs are reviewed on an annual basis.

To gain further knowledge of the geomorphic channel types and to start effectiveness monitoring the Department of Ecology and the Olympic National Forest deployed temperature data loggers in many of the previous locations on private, state, and federal lands. They also gained better representation of several geomorphic channel types. The Grays Harbor Conservation District has been doing on going temperature work at the State Highway 101 Bridge and several places on the mainstem Humptulips River. This collaborative temperature monitoring (Ecology, ONF, Rayonier, and GHCD) should be repeated at 5-year intervals. The next comprehensive temperature study will be in 2008.

Non Forested Lands

For volunteer cooperation on non-forested lands, the GHCD keep records of riparian restoration projects within Upper Humptulips. This information could be used to supplement the FFR information during the 5- or 10- year review.

Adaptive Management

"Adaptive management" is often defined as the reliance on scientific methods to test the results of actions taken so that the management and related policy can be changed promptly and appropriately. Above all it requires clear focus on elements with the greatest uncertainties or risks.

Some TMDL analytical techniques are widely used and applied in evaluating source loading and determining impacts on waterbodies. However, for certain pollutants, such as heat and sediment, the methods used are newer or still in development. The selection of analysis techniques is based on scientific rationale coupled with interpretation of observed data. Without the benefit now of long-term experience and testing of the methods used to derive TMDLs, the potential for the estimates to require refinement is quite high. This uncertainty underscores the need for adaptive management. The selection of the margin of safety has clarified the implications for monitoring and implementation planning in refining the estimate if necessary.

The TMDL process accommodates the ability to track and ultimately refine assumptions within the implementation component. This TMDL plan allows for future changes in loading capacities and surrogate measures (allocations) in the event that scientifically valid reasons support alterations. It is important to recognize that there is continual study and progression of understanding of the original plan. Water quality parameters addressed in this TMDL (e.g. stream temperature, sediment, and riparian condition). The (Draft) East/West Humptulips Watershed Analysis and this DIP address future monitoring plans. In the event that data show that changes are warranted, these changes will be made.

Enforcement

The Water Pollution Control Act (chapter 90.48 RCW) provides broad authority to issue permits and regulations, and prohibits all unregulated discharges to water. The act clearly states that it is the policy of the state to maintain the highest possible standards to ensure the purity of all waters of the state and to require the use of all known, available, and reasonable means to prevent and control water pollution. The act defines waters of the state and pollution. The Department of Ecology is authorized under this act to control and prevent pollution, to make and enforce rules, including water quality standards. The act also designates Ecology as the state water pollution control agency for all the purposes of the federal Clean Water Act.

Reasonable Assurances

Federal Forest Lands

Operational assurance that the NWFP will be carried out, falls within several avenues. These are Olympic National Forest Land and Resource Management Plan, the Northwest Forest Plan and the Ecology/USFS MOA. These are some additional regulatory tools to ensure Clean Water Act compliance of forest management activity in Washington State. The Northwest Forest Plan is a federal directive designed to protect the range of the Northern Spotted owl. The Aquatic Conservation Strategy is a major component of the Northwest Forest Plan. This strategy is designed to maintain and restore the ecological health and aquatic ecosystems at the watershed or landscape scale to protect habitat for fish and other riparian dependent species and resources. The Olympic National Forest adheres to the agency responsibilities set forth in the Memorandum of Agreement between the USDA Forest Service, Region 6 and the Washington State Department of Ecology for meeting federal and state water quality regulations. These programs provide reasonable assurance for federal lands that is backed by federal mandate.

Private, County, and State owned Forested Lands

For state, county, and privately held forestlands, the FFR that is now contained within the Forest Practice Rules (WAC 222) holds precedence. Forest and Fish calls for monitoring and adaptive management to modify the watershed analysis prescriptions to State meet water quality standards (if needed).

In addition to complying with FPRs, Washington State trust lands managed by the DNR must comply with provisions of their federally approved Habitat Conservation Plan (HCP). This is a multi-species conservation strategy to provide habitat for animal species of concern and other unlisted animal species. The HCP covers strategies for the protection of fish species (listed salmon, steelhead, and native trout), amphibians, arthropods, mollusks, mammals, birds, mollusks, and reptiles.

Non-Forested Lands

For non-forested mixed-use lands several entities share an interest in seeing improvements in water quality, soil conservation, and habitat restoration. The Grays Harbor Conservation District, in cooperation with local ranchers, has conducted efforts in riparian management such as riparian fencing, riparian replanting, and fecal coliform water testing. The Humptulips River was added in 2001 to the Conservation Restoration and Enhancement Program (CREP). The CREP program is a voluntary cost share program that encourages landowners to take lands out of production in exchange for financial support. This programs aims to increase bank stability and to restore and enhance habitat. The Local Watershed Planning Program instituted under ESHB 2514 and the Salmon Recovery Program, ESHB 2496, also have limited involvement in the Humptulips watershed. The local watershed-planning program under the direction of the Department of Ecology is tasked with establishing a procedure for controlling stream flow. Increasing flow during critical periods has the potential of decreasing temperature.

The Humptulips River is one of the waterbodies administered by the Chehalis Watershed Planning group. They are currently studying the possibilities for flow restoration in the basin.

Funding Opportunities Available

Centennial/Salmon Recovery Fund/319 – These three funding sources are managed by Ecology through one combined application program. Funds are available to public entities as grants or low-interest loans. Grants require a 25 percent match. They may be used to provide education/outreach, technical assistance, for specific water quality projects, or as seed money to establish various kinds of water quality related programs or program components. Grant funds may not be used for capital improvements to private property. However riparian fencing, riparian revegetation, and alternative stock water are grant eligible.

Low-interest loans are available to public entities for all the above uses. They have also been used as "pass-through money" to provide low-interest loans to homeowners for septic system repair or agricultural best management practices. Loan money can be used for a wide range of improvements on private property, for instance.

Conservation Reserve Enhancement Program (CREP) – Provides incentives to restore and improve salmon and steelhead habitat on private land. This is a voluntary program to establish forested buffers along streams where streamside habitat is a significant limiting factor for salmonids. In addition to providing habitat, the buffers improve water quality and increase stream stability. Land enrolled in CREP is removed from production and grazing, under 10-15 year contracts. In return, landowners receive annual rental, incentive, maintenance and cost share payments. The annual payments can equal 100 percent of the weighted average soil rental rate (incentive is 110 percent in areas designated by Growth Management Act).

Conservation Reserve Program (CRP) – A voluntary program that offers annual rental payments, incentive payments for certain activities, and cost-share assistance to establish approved cover on eligible cropland. Assistance is available in an amount equal to not more than 50 percent of the participant's costs in establishing approved practices; contract duration between 10-15 years. The CRP is administered through the Grays Harbor Conservation District.

Emergency Watershed Protection – NRCS may purchase easements on floodplain lands and the right to conduct restoration activities, in exchange for limited future use by landowner.

Environmental Quality Incentives Program (EQIP) - This federally funded program would be administered by the NRCS. This program:

- Provides technical assistance, cost share payments and incentive payments to assist crop and livestock producers with environmental and conservation improvements on the farm.
- $5.8 billon over next 6 years (nationally).
- Allows 75 percent cost sharing but allows 90 percent if producer is a limited resource or beginning farmer or rancher.
- Distributes program funding 60 percent for livestock-related practices, 40 percent for cropland.
- Supports contracts that are 1 to 10 years in duration.
- Sets no annual payment limitation; sum not to exceed $450.000 per individual or entity.

Forestry Riparian Easement Program (FREP) – This voluntary program is administered through the DNR Small Forest Landowner Office. The easement program acknowledges the importance of small landowners and their contribution to protect wildlife habitat. The intent of the program is to help small forest landowners keep their land in forestry. The FREP partially compensates landowners for not cutting or removing qualifying timber under a 50-year easement. The landowner still owns the property and retains full access, but has "leased" the trees and their associated riparian function to the state. You may qualify for FREP if:

- You own land as an individual or as part of a partnership, corporation, or other nongovernmental legal entity.
- You: a.) own one parcel of more than 20 continuous acres, OR b.) You own a parcel of less than 20 acres as part of a total ownership of multiple parcels in Washington State that together total more than 80 acres.
- You have timber next to a river, stream, lake, pond or wetland that you plan to harvest in the near future.
- Historically, you have not harvested an average of more than 2 million board feet of timber each year from all of your ownerships.
- The state has access to the property by foot or vehicle.
- There are no hazardous substances

2514 Planning Unit for Water Resource Inventory Area (WRIA) 22 – Through this planning process, citizens and agencies are evaluating and making recommendations for the water resources in the Humptulips and Grays Harbor watersheds (which have an administrative designation as WRIA, 22). Funding is made available from time to time through the Washington legislature for different purposes, including some funds for water quality related projects.

Riparian Open Space Program – A voluntary program administered by the DNR to acquire (through purchase or donation) an interest in lands within unconfined avulsing channel migration zones (CMZs). DNR may acquire the fee interest of the CMZ land or a permanent conservation Easement over such lands.

Wetland Reserve Program (WRP) –A voluntary program to restore and protect wetlands on private property (including farmland that has become a wetland as a result of flooding). Landowners can receive financial incentives to enhance wetlands in exchange for retiring marginal agricultural land. Landowner limits future use of the land, but retains ownership, controls access, and may lease the land for undeveloped recreational activities and possibly other compatible uses.

Title II - The Secure Rural Schools and Community Self-Determination Act of 2000 allows 50 percent of all Title II project funds be used for road maintenance or abandonment, and for the restoration of streams and watersheds. The overarching intent of Title II is to foster local creativity and innovation with regard to the projects that participating counties and Resource Advisory Committees recommend. Projects are reviewed and ranked by the RAC. RAC must submit project proposals to the Secretary concerned not later than September 30 for fiscal year 2001 and each September 30 thereafter for each succeeding fiscal year through fiscal year 2006

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Appendix A

Public Involvement and Response

Public Involvement

The public comment period for the draft Detailed Implementation Plan was for 30 days commencing on May 19 and ending on June 18, 2003. Notification of the comment period was mailed out to approximately 200 people. Draft copies of the Upper Humptulips DIP were available at the Hoquiam Timberland Library (420 Seventh St.), the Humptulips Grocery, and the web at http://www.ecy.wa.gov/biblio/0310042.html.

The notification of the comment was mailed out in the form of a focus sheet. Below is a copy of the focus sheet that was mailed out to approximately 200 people to notify them of the comment period.

Focus on **Upper Humptulips River**

Southwest Regional Office - Water Quality Program

Ecology seeks comments on draft plan to reduce temperature in the Upper Humptulips River

The Washington Department of Ecology (Ecology) and partners have completed a draft of the Detailed Implementation Plan (DIP) that identifies strategies for reducing water temperatures and to protect and restore critical habitat in the Upper Humptulips River. The DIP was developed with input from private timberland managers, the Quinault Tribe, and state and federal agencies.

The plan addresses the Upper Humptulips River – from the 101 bridge to the headwaters in the Olympic National Forest. Since 65 percent of this watershed is owned and managed by the US Forest Service and the remaining 35 percent is primarily owned by private timber companies, these two entities are responsible for most of the actions needed to reduce temperature. These activities are already detailed in the Northwest Forest Plan and the Forest and Fish Agreement.

On the few non-forested mixed-use lands, several entities share an interest in seeing improvements in water quality, soil conservation, and habitat restoration. Voluntary cooperation is the main approach to manage these issues.

You are invited to comment. You may review the draft Detailed Implementation Plan at these locations:

- **Hoquiam Timberland Library, 420 Seventh St.**
- **Humptulips Grocery**
- **http:www.ecy.wa.gov/biblio/0310042.html**

Please send comments by June 18, 2003 to:

Craig Graber,
Department of Ecology, Water Quality
PO Box 47775, Olympia, WA 98504-7775 or email:
cgra461@ecy.wa.gov

Background

The Humptulips River Watershed has been actively managed by humans for over 100 years. Land use in the Upper Humptulips is predominantly silviculture, including commercial forest owned by Rayonier. Some valley bottomland in the extreme lower watershed consists of small farms.

The headwaters of the Humptulips River originate in the steep Olympic Mountains in the Olympic National Forest. The streams then flow into gradually broadening glaciated river valleys. Salmon, steelhead, and cutthroat trout are present in the Upper Humptulips watershed. Significant fish-bearing streams within the watershed include the East Fork Humptulips and West Forks Humptulips mainstems and key tributaries (Goforth Creek, Flatbottom Creek, Donkey Creek, and Chester Creek).

A partnership of private timberland managers, the Quinault Tribe, and state and federal agencies evaluated the condition of the East Fork and West Fork Humptulips River Watersheds. Water quality sampling indicates that temperatures in the river system exceed state water-quality standards. Although high water temperatures are the primary concern, sediment in the river and loss of spawning and rearing habitat are also of concern.

Ecology sets water quality standards to protect the beneficial uses, such as swimming, fishing, and fish and wildlife habitat, associated with surface waters of the state (lakes, rivers, wetlands, etc.). Increased temperatures can reduce the quality of habitat for salmon, steelhead, and trout. Typical causes of increased temperatures include roads, riparian vegetation removal, and channel widening as well as timber harvest in sensitive areas outside the riparian zone.

Water Cleanup Plan process

Federal law requires states to identify sources of pollution in waters that fall short of water quality standards, and to determine how much pollution needs to be reduced for the water body to remain healthy. Using the source and allocation information, Ecology and local landowners develop strategies for achieving the necessary reduction or elimination of pollution. The result is a water cleanup plan or Total Maximum Daily Load (TMDL). The next step is the Detailed Implementation Plan (DIP) which outlines specific actions and responsible parties.

For more information contact Craig Graber at 360-407-6299

If you require this publication in an alternate format, please contact the secretary at (360) 407-6404 (Voice) or (TTY) at 711 or 1-800-833-6388.

Response to comments on the draft Detailed Implementation Plan

The comments received during the comment period for the draft Upper Humptulips River Detailed Implementation Plan are paraphrased below.

James Plampin

Comment:

Mr. Plampin suggests that several surface mining operations and riparian harvests along the Humptulips River could contribute to higher water temperatures. He recommends that Ecology review the Grays Harbor County permits for mining on and in the Humptulips River. Mr. Plampin also recommends planting trees around the gravel pits to help reduce the temperature of the water.

Response:

Thanks for your suggestion. Washington State requires a permit to discharge wastewater to waters of the state. Since wastewater includes stormwater and waters of the state include groundwater as well as surface water, nearly all facilities require a discharge permit. The sand and gravel general National Pollution Discharge Elimination System (NPDES) permit provides permit coverage for discharges of process water, stormwater, and mine dewatering water associated with sand and gravel operations, rock quarries, and similar mining operations, including stockpiling of mined materials. Permit conditions require the permit holder to provide environmental protection through best management practices (BMPs) and wastewater treatment. BMPs are physical, structural, or managerial practices designed to prevent or reduce pollutants in the discharge. Temperature increases and decreases for process water, mine dewatering water, and stormwater are primarily a result of ambient air temperature and solar influences. Processing by the facilities covered under a sand and gravel general permit does not typically transfer significant thermal energy. Temperature decreases have not been identified as a significant environmental concern. There are more than 300 rivers in the state (including the Humptulips River) that are listed for water quality temperature excursions as a result of high temperatures. The temperature of water discharged to surface water during the warm weather months is therefore a concern. Surface discharges from sand and gravel pits, if they occur at all, are generally between November and April when temperature is not an issue. All rock quarries, gravel pits, spoil disposal areas and borrow pits used after January 1, 1975 shall be reclaimed within 2 years from the time the rock or gravel source is either exhausted or abandoned. At that time the owners are required reforest in accordance with chapter 222-34 WAC to the extent practical.

Under the current forest practice rules and the Northwest Forest Plan significantly larger riparian buffers are being left then occurred in the past. These buffers should allow us to achieve Washington state temperature water quality standards sometime in the future.

Appendix B

Technical Analysis for Determining Load Allocation

Technical Analysis for Determining Load Allocation

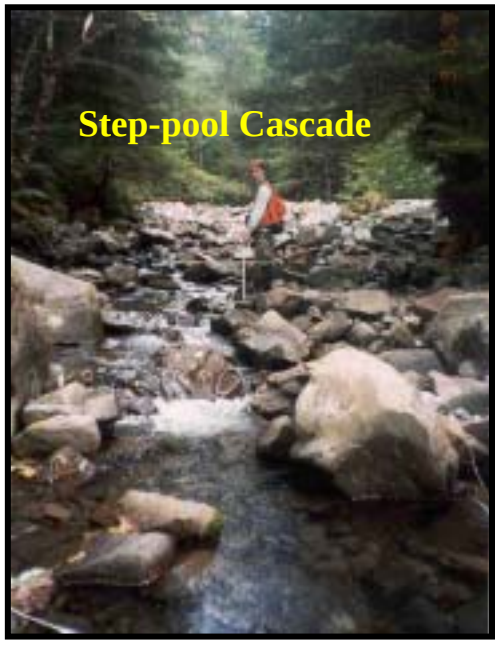
Information within this appendix provides information that is useful in understanding the technical analysis used in TMDL development to determine effective shade load allocations. This appendix includes photographs of the Geomorphic Channel Units and direct excerpts taken from the Upper Humptulips River Watershed Temperature TMDL Submittal Report. Information within the tables and figures taken from the Submittal Report have not been changed, they have simply been relabeled to conform with the formatting set of this document.

Temperature Groups

Temperature conditions in the analysis area are influenced by a variety of factors that include shade, groundwater flow, and channel morphology. The geomorphic channel units (GCUs), described in the Stream Channel Assessment of the Watershed Analysis Report *(Module E)*, have been used to classify segments based on channel morphology, geology, and location within the drainage system. The channel classification system can be used to group stream reaches by the dominant control(s) that affect water temperature. Figure B1 displays GCUs as grouped by source, transport and response reaches. Table B1 displays the channel types grouped based on these dominant temperature controls, and are grouped as source, transport, or response reaches. Map 3 in Appendix D displays the distribution of GCUs within the analysis area. Table B2 identifies seven groups and describes watershed process features that exert the greatest influence on water temperature in those channel classes.

Figure B1. Photographs of Geomorphic Channel Unit Types

Source Reaches



Transport Reaches

Response Reaches

Table B1. Groups Reflecting Dominant Process Affecting Water Temperature

Group	Features
	Source
Source reaches are defined in the Stream Channel Assessment as those channels that occur in sediment source areas or that contribute a significant source of sediment from bank erosion. These are small to medium sized, high gradient streams in the Watershed Analysis area.	
sd	*Slope Deposit.* This GCU includes steep gradient (> 8 percent) channels that occur adjacent to debris fans and deep-seated landslides. These channels function as sediment source and transport sites as a result of bank erosion and undercutting at the margin and toes of the fans and landslides. Large woody debris (LWD) helps to stabilize the channel and minimize bank erosion. Channel morphology is variable depending on the accumulation of sediment and LWD. Summer flows in these channels are likely derived from groundwater.
spc	*Step-pool / Cascade:* This GCU includes moderate to high gradient channels (4 percent to 20 percent) in moderately confined to confined valleys that occur in the upper portions of the drainage network. Channel morphology is characterized by step-pools and cascades formed by boulders, rocks, and LWD. LWD may form pools, especially in the lower-gradient channels, and create sediment storage sites behind log jams. Substrate is dominated by cobble, boulder, and bedrock.
	Transport
Transport reaches are defined in the Stream Channel Assessment as those channels that function as sediment transport zones. These range from small to large sized, mid-gradient streams in the Watershed Analysis area.	
tt	*Terrace Transition:* This GCU includes the moderate to high gradient (> 4 percent), confined channels that occur in a transition zone between the tops of glacial terraces and the valley floor. This GCU includes channels characterized by a series of steep cascades, chutes, or falls (some up to 50 feet high) that are usually formed in bedrock, but also occur on glacial outwash. The steep gradient zones may be interspersed with short, low-gradient pool / riffle zones where the channel flows across intermediate terraces. The large channels are eroded to the bedrock base level, but similar channels may continue to downcut and erode headward. The Terrace Transition classification was applied to all mixed steep and low gradient reaches that flow between the top of the highest terrace and the valley floor.

Group	Features
fpr	*Forced Pool / Riffle:* This GCU includes moderate gradient (2 percent to 4 percent), moderately confined channels that occur in the middle to upper portions of most tributaries and in the upper East Fork mainstem. Small pools formed by LWD or other obstructions are the dominant channel morphology. Flood plain development is limited along most of these segments by banks formed of consolidated material. Some channels, however, may have narrow, discontinuous flood plains. The substrate is dominated by cobble and gravel
brg	*Bedrock Gorge:* This GCU only occurs in the East and West Fork mainstems. It includes low-gradient (<2 percent) segments that are confined by steep bedrock walls, which rise 100 to 200 feet above the river bed. Rapids, glides, and trench pools formed by boulders and bedrock outcrops are the dominant channel features. Pools formed by LWD are rare, and LWD recruitment processes are limited. Most LWD in these channels is derived by fluvial transport from upstream. Retention of LWD is low because of high transport capacity in the confined channels.

Response

Response reaches are defined in the Stream Channel Assessment as channels that are sensitive to sediment or flow changes. These range from small to large sized, low gradient streams in the Watershed Analysis area. Table C-6 identifies those GCUs which are in this category, specifically riverine wetland (rw), babbling brook (bb), hillslope confined (hsc), terrace confined (tc), low gradient pool / riffle (lgpr), and floodplain migration (fpm).

bb	*Babbling Brook:* This GCU includes small (< 2.0 m bankfull width), unconfined and moderately-confined, low and moderate gradient (1 to 4 percent) brooks. They occur in small basins with low relief, most of which are located in the lower portion of the watershed. These segments would be classified in the low gradient pool / riffle GCU if they were larger, but babbling brook channels do not have enough flow and hydraulic power to form pools and riffles. Channel morphology is characterized by shallow glides with small pools that are occasionally formed around tree roots, shrubs, and wood debris. Substrate is dominated by sand, silt, and small gravel.
rw	*Riverine Wetland:* These areas are low gradient (<2%) streams within wetland valley bottoms. The channels are typically incised in fine organic and inorganic silt deposits. Stream flows are generally placid, low-velocity and the streams are frequently impounded by beaver dams.
hsc	*Hillslope Confined:* This GCU includes low gradient (< 2 percent) mainstem channels that are mostly confined by adjacent sideslopes. Glides and pools formed by boulders and rock outcrops are the dominant channel features. Short, wide riffles are present at the transitions between units, and the substrate is dominated by cobble and gravel. Some gravel patches occur in association with retention structures formed mostly by boulders and in some cases LWD. LWD recruitment processes are limited by the confined channel morphology, and pools formed by LWD are rare.

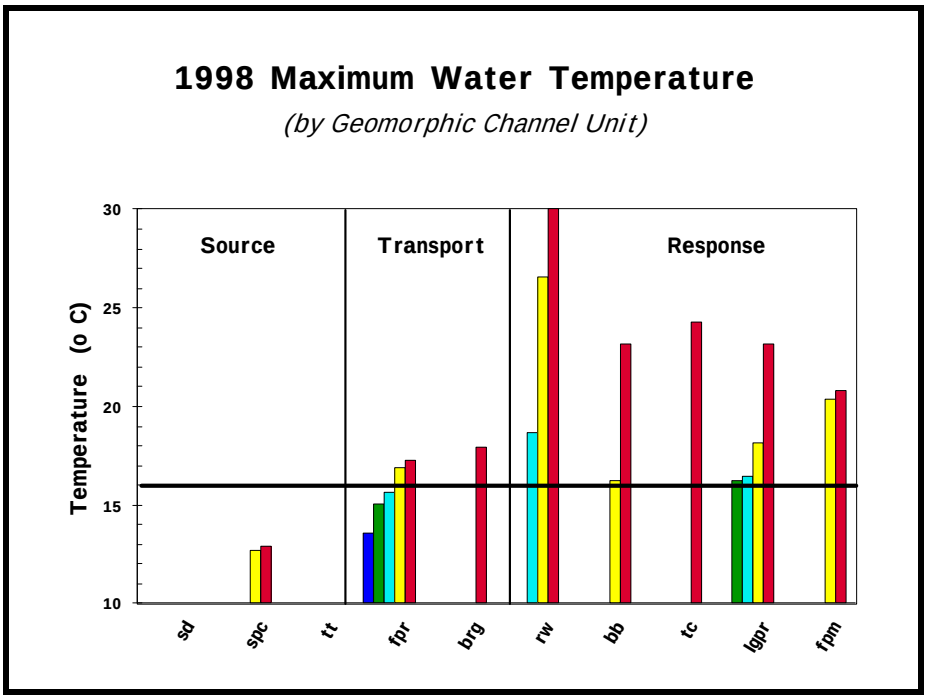
Group	Features
tc	*Terrace Confined:* This GCU includes the low gradient (< 2 percent) segments of the East and West Fork mainstems that are confined by glacial terraces. Steep walls composed of glacial deposits on one or both sides of the channel confine this GCU in a narrow valley. Pools and glides formed by lateral scour are the dominant channel morphology. Short riffles are present at the transitions between units, and the substrate is dominated by cobble and gravel. Undercutting of toe slopes by the river is a common source of sediment and LWD. LWD retention, however, is low because of the high transport capacity of this GCU.
lgpr	*Low-gradient Pool / Riffle:* This GCU includes the moderately confined, low-gradient (<2 percent) channels in the East and West Fork mainstems and in the larger tributaries. Channel morphology typically consists of alternating pool and riffle units with occasional glides. Pools are formed by channel meandering and in-channel scour elements (i.e. LWD and bedrock outcrops). The stream bed material is predominantly gravel. The channels have narrow, often discontinuous flood plains that are punctuated by bedrock outcrops. Channel morphology in the Low-gradient Pool / Riffle GCU is similar to that of the Flood Plain Migration GCU, in the mainstem, except the frequency and extent of channel movement are reduced, resulting in fewer flood plain features (e.g. side channels, sloughs, and ponds).
fpm	*Flood Plain Migration:* This GCU includes the wide, unconfined, low-gradient (< 2 percent, most < 1 percent) channels that occur only in the East and West Fork mainstems. This GCU has extensive gravel bars and low flood plain expanses that are formed by sediment deposition during floods. Channel migration in response to changes in sediment supply and inputs of LWD is a common process leading to the formation of overflow channels, side channels, sloughs, and ponds on the gravel bars and flood plain. Channel morphology in this GCU is typically alternating pool and riffle units with occasional glides. Pools are formed by channel meandering and by in-channel scour elements (i.e. LWD and bedrock outcrops). The stream bed material is predominantly gravel. Overflow channels and side channels on adjacent gravel bars are common. Sloughs and ponds within the current flood plain are rare. Oxbow ponds and wetlands formed by post-glacial channel migration occur on higher terraces.

Table B2. Groups for Identifying Targets to Address Water Temperature

Group	Features	GCU
Shade		
S-a	Small to medium sized pool riffle channels. Water temperature is driven by shade and low flows (poor water storage in these watersheds over glacial tills and shallow soils).	bb lgpr
S-b	Low gradient segments of the East and West Fork mainstems that are confined by adjacent sideslopes and glacial terraces. Channels of this group receive some topographic shading provided by confinement. Groundwater inputs are probable, but generally have limited influence on stream temperature. Heat advected from segments located upstream can also contribute to elevated water temperatures in these channels.	hsc tc
S-c	Large channels in the East and West Fork mainstems that are confined by steep bedrock walls that rise 100 to 200 feet above the river bed. These channel segments receive near topographic shade and the water is fast and deep. When elevated temperatures occur, it is typically through heat advected from segments located upstream.	brg
S-d	Small to medium sized forced pool riffle channels. These systems have moderate to low flows in summer with varying amounts of groundwater influence. Along the continuum, those with minimal groundwater influence are susceptible to elevated water temperatures with loss of shade. Those with significant amounts of groundwater influence are resistant to temperature changes.	fpr
Groundwater		
G-a	Small and medium sized moderate to high gradient confined channels. These are topographically shaded and are *"near"* the water source with substantial groundwater influence that shows as side seeps and springs. These systems are typically cool and are resistant to water temperature changes. Shade is a secondary influence, except during extreme low flow years.	sd spc tt
Channel Morphology		
C-a	Low gradient streams within wetland valley bottoms. Low velocity, placid flow sloughs are the dominant channel morphology. Beaver dams frequently create ponds in these channels and influence riparian vegetation composition. Low velocity and naturally open canopy cause this temperature group to rapidly respond to heat inputs.	rw
C-b	Medium to large channels affected by high sediment supply and multiple thread channels over at least some of their length. Temperatures in these systems are strongly influenced by channel pattern and open canopies. Current and past sediment supply, long residence times, and channel pattern make it unlikely that water temperatures here will change for decades.	fpm

In order to understand load allocations, a little background data is supplied to help in understanding how they were derived. The eleven channel classes allow refinement of assumptions used to develop effective shade targets. Development of effective shade targets is then based on a better description of site-specific conditions. In addition, actual data collected on streams in the Upper Humptulips watershed is used to validate anticipated responses. Figure B2 depicts information collected in 1998 from sites representative of each temperature group. Maximum observations between July 1 and August 31 are shown. This corresponds with the seasonal time frame when maximum water temperatures occur.

Figure B2. Annual Maximum Water Temperature by Channel Group

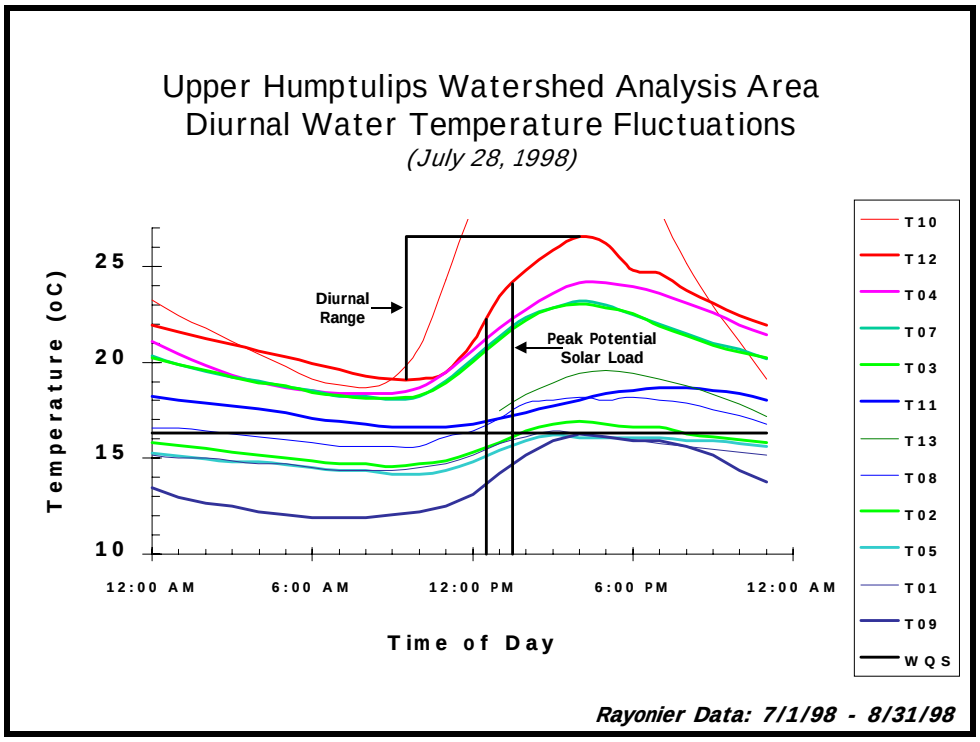


Peak Hourly Change

Development of loading capacities and allocations that focus on either maximum diurnal range or peak hourly water temperature increase is possible. An analysis can be constructed which evaluates solar radiation inputs and resultant water temperature change through a heat budget analysis. Figure B3 depicts the diurnal variation of the temperature group monitoring sites on July 28, 1998. July 28, 1998 corresponds to the date when U.S. Forest Service measured maximum water temperature over a five-year period in the Humptulips watershed.

Figure B3 shows both the diurnal change and peak hourly water temperature increase for each temperature group. A regression was performed to determine the peak hourly change target that corresponded to a maximum temperature of 16°C. Based on this relationship, the lowest peak hourly increase observed (0.50°C) is used to derive effective shade targets.

Figure B3. Temperature Group Summary - Diurnal Water Temperature Fluctuations



Loading Capacity

Identification of the loading capacity is an important step in developing TMDLs. The loading capacity provides a reference for calculating the amount of pollutant reduction needed to bring a water body into compliance with water quality standards. By definition, a TMDL is the sum of the allocations. An allocation is defined as the portion of a receiving water's loading capacity that is assigned to a particular source. EPA defines the loading capacity as "the greatest amount of loading that a water can receive without violating water quality standards".

Effective Shade

Using information about each channel class (e.g. estimated drainage area, estimated active channel width, range of flows, etc.) effective shade targets were developed. The channel classification system is used to assess stream reaches according to temperature groups. This approach leads to effective shade targets that recognize the variability in channel and riparian characteristics that occur across the landscape. As such, these targets reflect the range of active channel widths and riparian vegetation heights by GCU within the watershed analysis area. Table 3A provides a summary of effective shade TMDL and load allocations for the Upper Humptulips.

Figure B4. Photograph of Riparian Shade

Table B3. Summary of Effective Shade TMDL and Load Allocations for the Upper Humptulips River

Stream Order	Group	Estimated Active Channel Width *(m)*	Riparian Strategy	Length *(miles)*	Allocations *(Effective Shade as percent)*		
					TMDL	LA	MOS
Slope Deposit GCU							
sd(1)	G-a	1 - 2	Olympic Forest Plan	3.55	70%	98%	(28%)
sd(1)	G-a	1 - 2	Forest & Fish	0.55	70%	73%	(3%)
sd(2)	G-a	2 - 4	Olympic Forest Plan	2.12	69%	97%	(28%)
sd(2)	G-a	2 - 4	Forest & Fish	0.13	69%	72%	(3%)
Total for GCU				6.35			
Step Pool / Cascade GCU							
spc(1)	G-a	1 - 2	Olympic Forest Plan	54.50	70%	98%	(28%)
spc(1)	G-a	1 - 2	Forest & Fish	49.05	70%	73%	(3%)
spc(2)	G-a	2 - 4	Olympic Forest Plan	4.56	69%	97%	(28%)
spc(2)	G-a	2 - 4	Forest & Fish	7.27	69%	72%	(3%)
spc(3)	G-a	4 - 8	Olympic Forest Plan	0.38	70%	95%	(25%)
Total for GCU				115.76			
Terrace Transition GCU							
tt(1)	G-a	1 - 2	Olympic Forest Plan	34.98	70%	98%	(28%)
tt(1)	G-a	1 - 2	Forest & Fish	5.78	70%	73%	(3%)
tt(2)	G-a	2 - 4	Olympic Forest Plan	9.46	69%	97%	(28%)
tt(2)	G-a	2 - 4	Forest & Fish	3.48	69%	72%	(3%)
tt(3)	G-a	4 - 8	Olympic Forest Plan	3.31	70%	95%	(25%)
tt(3)	G-a	4 - 8	Forest & Fish	1.87	70%	73%	(3%)
tt(4)	G-a	8 – 12	Olympic Forest Plan	0.01	74%	90%	(16%)
tt(4)	G-a	8 – 12	Forest & Fish	0.35	74%	77%	(3%)
Total for GCU				59.24			

Notes:

[1] TMDL currently refers to temperature group. Development of allocations is based on maximum active channel width for class. As new data and methods are developed to better estimate effective shade that results from specific riparian strategy for a particular channel class, the TMDL may be revised.

Table B3 (cont'd). Summary of Effective Shade TMDL and Load Allocations for Upper Humptulips

Stream Order	Group	Active Channel Width (m)		Riparian Strategy	Length (miles)	Allocations (Effective Shade as percent)		
						TMDL	LA	MOS
Forced Pool / Riffle GCU								
fpr(1)	S-d	1 - 2		Olympic Forest Plan	7.26	77%	98%	(21%)
fpr(1)	S-d	1 - 2		Forest & Fish	10.44	77%	79%	(2%)
fpr(2)	S-d	2 - 4		Olympic Forest Plan	11.50	76%	97%	(21%)
fpr(2)	S-d	2 - 4		Forest & Fish	8.48	76%	78%	(2%)
fpr(3)	S-d	4 - 8		Olympic Forest Plan	2.21	76%	95%	(19%)
fpr(3)	S-d	4 - 8		Forest & Fish	1.91	76%	78%	(2%)
fpr(4)	S-d	8 – 16		Forest & Fish	1.13	78%	80%	(2%)
Total for GCU					42.93			
Bedrock Gorge GCU								
brg(3)	S-c	4 - 8		Olympic Forest Plan	2.71	76%	95%	(19%)
brg(4)	S-c	8 - 16		Olympic Forest Plan	2.84	78%	90%	(12%)
brg(4)	S-c	8 – 16		Forest & Fish	0.83	78%	80%	(2%)
Total for GCU					6.38			
Riverine Wetlands GCU								
rw(1)	C-a	1 - 2		Olympic Forest Plan	3.14			
rw(1)	C-a	1 - 2		Forest & Fish	7.43			
rw(2)	C-a	2 - 4		Olympic Forest Plan	0.58			
rw(2)	C-a	2 - 4		Forest & Fish	1.19			
rw(3)	C-a	4 - 8		Olympic Forest Plan	0.25			
Total for GCU					12.59			

Notes:

[1] TMDL currently refers to temperature group. Development of allocations is based on maximum active channel width for class. As new data and methods are developed to better estimate effective shade that results from specific riparian strategy for a particular channel class, the TMDL may be revised.

Table B3 (cont'd). Summary of Effective Shade TMDL and Load Allocations for Upper Humptulips

Stream Order	Group	Active Channel Width *(m)*	Riparian Strategy	Length *(miles)*	Allocations *(Effective Shade as percent)*		
					TMDL	LA	MOS
Babbling Brook GCU							
bb(1)	S-a	1 - 2	Olympic Forest Plan	2.92	83%	98%	(15%)
bb(1)	S-a	1 - 2	Forest & Fish	2.17	83%	85%	(2%)
bb(2)	S-a	2 - 4	Olympic Forest Plan	0.82	82%	97%	(15%)
bb(2)	S-a	2 - 4	Forest & Fish	0.85	82%	84%	(2%)
bb(3)	S-a	4 - 8	Olympic Forest Plan	0.26	81%	95%	(14%)
Total for GCU				7.02			
Hillslope Confined GCU							
hsc(4)	S-b	8 - 16	Olympic Forest Plan	0.97	82%	90%	(8%)
Total for GCU				0.97			
Terrace Confined GCU							
tc(3)	S-b	4 - 8	Olympic Forest Plan	1.09	81%	95%	(14%)
tc(5)	S-b	16 – 32	Forest & Fish	8.74	81%	83%	(2%)
tc(6)	S-b	> 32	Forest & Fish	0.02	79%	81%	(2%)
Total for GCU				9.85			

Notes:

[1] TMDL currently refers to temperature group. Development of allocations is based on maximum active channel width for class. As new data and methods are developed to better estimate effective shade that results from specific riparian strategy for a particular channel class, the TMDL may be revised.

Table 3B (cont'd). Summary of Effective Shade TMDL andLoad Allocations for Upper Humptulips

Stream Order	Group	Active Channel Width *(m)*	Riparian Strategy	Length *(miles)*	Allocations *(Effective Shade as percent)*		
					TMDL	LA	MOS
Low Gradient Pool / Riffle GCU							
lgpr(1)	S-a	1 - 2	Olympic Forest Plan	0.87	83%	98%	(15%)
lgpr(1)	S-a	1 - 2	Forest & Fish	2.97	83%	85%	(2%)
lgpr(2)	S-a	2 - 4	Olympic Forest Plan	7.26	82%	97%	(15%)
lgpr(2)	S-a	2 - 4	Forest & Fish	5.22	82%	84%	(2%)
lgpr(3)	S-a	4 - 8	Olympic Forest Plan	4.48	81%	95%	(14%)
lgpr(3)	S-a	4 - 8	Forest & Fish	4.82	81%	83%	(2%)
lgpr(4)	S-a	8 – 16	Olympic Forest Plan	1.73	82%	90%	(8%)
lgpr(4)	S-a	8 – 16	Forest & Fish	6.84	82%	84%	(2%)
lgpr(5)	S-a	16 - 32	Forest & Fish	7.10	81%	83%	(2%)
Total for GCU				41.24			
Flood Plain Migration GCU							
fpm(2)	C-b	2 - 4	Olympic Forest Plan	0.17	84%	97%	(13%)
fpm(3)	C-b	4 - 8	Olympic Forest Plan	10.86	84%	95%	(11%)
fpm(4)	C-b	8 – 16	Olympic Forest Plan	9.40	84%	90%	(6%)
fpm(5)	C-b	16 - 32	Forest & Fish	5.46	83%	85%	(2%)
Total for GCU				25.89			

Notes:

[1] TMDL currently refers to temperature group. Development of allocations is based on maximum active channel width for class. As new data and methods are developed to better estimate effective shade that results from specific riparian strategy for a particular channel class, the TMDL may be revised.

Appendix C

Description of Forest and Fish Agreement

By Ann Goos: Washington Forest Protection Association

State Forest Practices Program: The Forests & Fish Report

The Forests and Fish Report (FFR) is a science-based plan for fish habitat and water quality protection on non-federal forestland in the state of Washington. Federal and state regulatory agencies, Tribes, county government and private landowners negotiated the major elements of the FFR starting in 1997 and ending in the early winter of 1999. The agencies, tribes, landowners, and other key stakeholders developed a plan for forest practices that would meet the following goals:

1. To provide compliance with the Endangered Species Act for aquatic and riparian-dependent species on non-federal forestlands.
2. To restore and maintain riparian habitat on non-federal forestlands to support a harvestable supply of fish.
3. To meet the requirements of the Clean Water Act for water quality on non-federal forest-lands.
4. To keep the timber industry economically viable in the state of Washington.

The *Forests & Fish Report* (FFR) is a consensus recommendation for changes in forest practices statutes, regulations, and management systems to attain the stated goals. The FFR recommends increased resource protection through programmatic and prescriptive standards and guidelines. A primary focus of these new standards and guidelines is to manage riparian vegetation and sediment input to maintain or enhance stream habitats and water quality. The recommendations, which are now incorporated as permanent rules under the Forest Practices Act (76.09), are intended to improve management in several key resource areas, which are summarized below:

Fish and Stream Classification

The FFR-based rules will broaden the list of fish covered by the rules and change the classification of streams to expand the area where protection is applied. Under the FFR-based rules, all fish will receive the same protection. The old forest practices rules limited protection to salmon and resident game fish. Also, the new rules will place all streams that provide fish habitat in the same category as streams where fish are currently present. This change will provide equal protection for habitat that may become occupied as fish populations recover. In addition, riparian protection will be extended to the channel migration zones associated with fish habitat streams. These migration areas include off-channel habitat, wetlands, and floodplains that are likely to become part of the stream in the future as natural processes work the stream across the valley bottom.

Westside Riparian Strategies

Fish-Habitat Streams. West of the Cascade crest (Westside), fish-habitat streams will be protected with buffers that extend up to a site-potential tree height from the outer edge of the stream or channel migration zone. This distance is 90 to 200 feet, depending on the productivity of the land near the stream. Timber management within the buffers is progressively more restrictive in the zones

closer to the stream. The riparian strategy consists of three zones. The "core zone" is the 50-foot no-harvest area closest to the stream. The "inner zone" is the area between 50 feet and 80 to 150 feet from the stream. Management in the inner zone is regulated to ensure that desired future riparian conditions grow and develop. The "outer zone" is the area beyond the inner zone. It will be regulated to leave up to 20 trees per acre to protect special sites such as seeps, springs, or forested wetlands, or to provide permanent leave trees to support riparian protection.

Non-Fish-Habitat Streams. The upper reaches of streams typically are not expected to be occupied by fish, but are important because they deliver water, organic matter, and sediments downstream to fish habitat. In the FFR-based rules, these streams fall into two categories, perennial and seasonal streams. Perennial non-fish-habitat streams will receive a 50-foot-wide no-harvest buffer on each side for at least 50 percent of their length. The buffer will be placed at sensitive sites, such as perennial seeps, springs, unstable inner gorge slopes, alluvial fans, and perennial stream intersections. The buffering of special sites may increase the total percentage of buffer length along the perennial non-fish bearing streams. A 30-foot-wide equipment limitation zone on each side will border portions of perennial and all-seasonal non-fish-habitat streams that do not receive 50-foot-wide no-harvest buffers. The equipment limitation zone is designed to protect streambank vegetation, prevent bank erosion, and substantially limit the potential for sediment delivery to the streams.

Eastside Riparian Strategies

East of the Cascade crest (Eastside), riparian strategies are influenced by unique climatic and forest conditions that are different from the Westside. The goals for habitat protection are the same as on the Westside, but the rules differ.

Fish-Habitat Streams. Buffers on fish-habitat streams will extend to at least one site-potential tree height from the edge of the stream or channel migration zone, up to 130 feet. The no-harvest core zone will be 30 feet wide. The restricted inner zone will extend to 75 or 100 feet from the core zone, depending on stream width. Where site-potential tree height is greater than the fixed inner zone width, up to 20 of the largest trees per acre would be left in an outer zone**.** Timber management in the inner zone will be controlled by maximum and minimum tree densities over a range of growing sites to address current and future riparian function and forest health.

Non-Fish-Habitat Streams. Non-fish-habitat streams will receive either a continuous, managed 50-foot buffer where partial-cut management techniques are used, or a no-harvest, discontinuous buffer where clearcut-management techniques are used. The 30-foot equipment limitation zone will apply to portions of perennial streams without a leave-tree buffer and all-seasonal non-fish-habitat streams.

Unstable Slopes

The FFR-based rules require considerable improvements to forest practices permitting processes with the goal of preventing forest practices from causing an increased rate of landslide-related sediment delivery. Improved topographic and geologic mapping will provide landowners and the Department of Natural Resources (DNR) with more accurate tools to predict where landslides may occur. Detailed standards will be established to field-identify the most hazardous areas. Local slope stability issues will be identified through regional efforts following adoption of new rules**.** Resource professionals representing agencies, tribes, and landowners will be trained to recognize potentially unstable slopes and a team of geologists will map hazard areas and assist resource professionals in assessing slope stability issues on the ground.

Forest Roads

The FFR-based rules require that all existing forest roads be improved and maintained to a higher standard for providing fish passage, preventing landslides, limiting delivery of sediment and surface runoff water to streams, and avoiding capture or redirection of surface or groundwater. To accomplish this, landowners will be required to bring all of their forest roads into an approved maintenance plan within five years and to complete improvements within fifteen years. The rules specify new road construction standards to meet water quality goals. Standards, priorities, and implementation guidelines are recommended by FFR and are included in the forest practices rules and the Forest Practices Board manual.

Pesticide Application

The FFR-based rules require changes in buffering rules and best management practices for the application of forest pesticides, including herbicides, to prevent direct entry into water. There are also rules that limit unintentional damage to riparian vegetation by limiting spraying near riparian management zones.

Wetland Protection

The FFR acknowledges that timber harvest in some forested wetlands may influence the interaction between the wetland and fish-habitat waters. There are recommendations for specific scientific studies to assess the impacts of harvesting in these wetlands. In addition, the FFR recommends improved mapping of wetlands and clarification of existing rules for wetland protection.

Other Provisions

The FFR contains agreement on adaptive management and a number of additional issues covering programmatic changes to forest practice regulation, assurances from regulatory agencies, and funding that are not directly addressed in this review. These issues are essential to the consensus reached by the authors of the FFR and are critical components of the overall system of forest practices regulation.

Adaptive Management

The authors of the FFR recognized that current scientific knowledge falls short of providing definitive scientific answers to all of the water quality and fish habitat resource questions. Gaining answers to some of these questions in a timely manner and having confidence that new rules will respond to new findings was a critical element for the federal and state agency agreement on the provisions of FFR. The FFR-based rules established an adaptive management program to address:

- The effectiveness of the forest practices prescriptions in meeting resource objectives.
- The validity of the resource objectives for achieving the overall goals.
- Basic scientific uncertainties in the ecological interactions among managed forests, in-stream functions, and fish habitat.

Under the FFR-based rules, forest practices will be regulated to meet specific biological goals within the context of maintaining the sustainable, economic viability of the timber industry. The biological goals were established at the outset of FFR discussions: "Forest practices, either singly or cumulatively, will not significantly impair the capacity of aquatic habitat to:

- Support harvestable levels of salmonids;
- Support the long-term viability of other covered species; or
- Meet or exceed water quality standards (protection of designated uses, narrative and numeric criteria, and antidegradation)."

Objectives. The FPB established **"**resource objectives", which are intended to meet the overall performance goals. Individual resource objectives have been defined for each key aquatic condition or process affected by forest practices, such as water temperature, large woody debris or fish passage. Performance targets are measurable criteria that define specific, attainable forest conditions or processes for each resource objective. A preliminary list of key research and related resource objectives and performance targets is displayed in Schedule L-1 of the *Forests and Fish Report* (1999) and further refined in Schedule L-2. Both documents are available from the DNR and Ecology.

Monitoring. Monitoring is a key component of the adaptive management program.

Compliance monitoring will answer the question*: Are forest practices being conducted in compliance with the prescriptions contemplated in the FFR-based rules?* The DNR will continue to conduct compliance monitoring as part of the agency's responsibility to administer forest practices rules.

Effectiveness monitoring and research will answer the question*: Will the forest practices rules produce forest conditions and processes that achieve resource objectives within the context of natural spatial and temporal variability inherent to*

forest ecosystems? Effectiveness monitoring will be conducted over a sufficient time period to account for forest development toward target conditions.

Validation monitoring and research will answer the question: *Are the resource objectives appropriate to achieve the overall performance goals?* Monitoring and research is being designed to validate or verify the assumptions underlying the resource objectives.

The effectiveness and validation monitoring and research elements of the adaptive management program are designed to meet a strict set of protocols and standards and will be subjected to peer review to strengthen the value of results.

FFR-based rules Address Heat Energy

The amount of shade needed to meet the temperature standards is defined in the old forest practices rules (i.e., in effect prior to adoption of the FFR-based emergency rules passed in January 2000 and replaced by the FFR-based permanent rules which go into effect on June 30, 2001) (WAC 222-30-040). The shade targets were developed from the Timber Fish Wildlife (TFW) Temperature Study (Sullivan et al. 1990). The targets identify the minimum amount of shade, as measured by canopy cover, needed to maintain water temperature within water quality standards. The shade requirements (i.e., minimum canopy cover) vary by region, water temperature criteria, and elevation.

The FFR-based rules incorporate the Shade Rule without the distance restrictions imposed by the old rules to substantially increase protection of shade along streams and related habitat conditions on private forestland.

Prescriptive Rules: Shade Management Across the Landscape. The FFR recommended, and the FPB approved a set of specific rules for managing shade across the landscape. The forest practices measures are focused to protect resources at locations where water temperature is a concern for water quality and fish and other aquatic resources. The shade management measures include:

- **Shade Rule**—requirements to maintain water temperature in fish-habitat streams.
- **Bull Trout Overlay**—special shade provisions for bull trout habitat in eastern Washington.
- **Riparian Management Zones (RMZs)**—three distinct riparian management zones—the core, inner, and outer zones—for fish-habitat streams that provide more shade with increasing proximity to streams.
- **Sensitive Site RMZs**—tree retention provisions for sensitive sites, priority areas, and aquatic features on perennial, non-fish-habitat waters.

***Shade Rule*.** RMZs on both sides of fish-habitat streams will be managed to provide adequate shade to maintain compliance with temperature standards. The practical application of the Shade Rule requires that if a tree within 75 feet of a fish-habitat stream, or CMZ, is providing shade needed to meet water quality standards, the tree may not be

removed (see temperature prediction method of the Forest Practices Board Manual). Under some circumstances, harvest of trees beyond 75 feet may be restricted if they are shown by the methodology to be required to meet the Shade Rule. Furthermore, shade requirements must be satisfied whether or not a stream-adjacent parallel road is present. Shade requirements in the Forest Practices Board Manual will be adjusted if the Department of Ecology changes the water temperature standards.

Bull Trout Overlay. Within the bull trout overlay, all available shade to streams will be retained within 75 feet of the bankfull width or CMZ of the stream (Forest Practices Board Manual). The bull trout habitat overlay includes portions of perennial streams in eastern Washington with bull trout habitat identified by the Washington Department of Fish and Wildlife. The overlay area will be revised as better habitat information becomes available.

Riparian Management Zones (RMZs) and Sensitive Site RMZs. The same rules that require buffers to maintain LWD and litter recruitment will also provide additional shade.

Overall, the Shade Rule will be applied to fish-habitat streams across the landscape as forest practices are conducted. Discontinuous buffers apply to perennial non-fish-habitat streams. Equipment limitation zones apply to seasonally intermittent, non-fish-habitat streams.

Protection of Habitat Variables Important to Aquatic Habitat Functions

Prescriptive Rules: Vegetative (Riparian) Management Across the Landscape. The FFR-based rules allow for silvicultural options for management of large wood and litterfall, in addition to shade, that ensures these inputs where they are needed most and at locations where they can be effective. Rules will provide LWD, shade, and litterfall to streams in relation to channel type and presence of fish habitat by requiring buffers and leave-tree areas for riparian management zones and potentially unstable slopes.

Prescriptive Rules: Sediment Management Across the Landscape. The FFR-based rules specify a list of diagnostic landforms in Washington that are potentially unstable, and an administrative process for identifying, reviewing, and regulating forest practices on potentially unstable slopes, including road construction. The FFR–based rules also require an administrative process for identifying, reviewing, and regulating forest practices that may contribute to fine sediment delivery. In addition to buffers protecting streams from the effects of hillslope erosion and protecting bank stability, stricter standards for long-term road maintenance and improvement plans will ensure that erosion control methods are applied and monitored.

Prescriptive Rules: Hydrology. The FFR-based rules will reduce the undesirable effects on the surface water network by requiring road maintenance and abandonment plans, upgrading existing roads, and constructing new roads to minimize effects on water routing. Rules for perennial streams require the retention of functional riparian areas, including the retention of trees and downed wood around seeps, springs, and forested

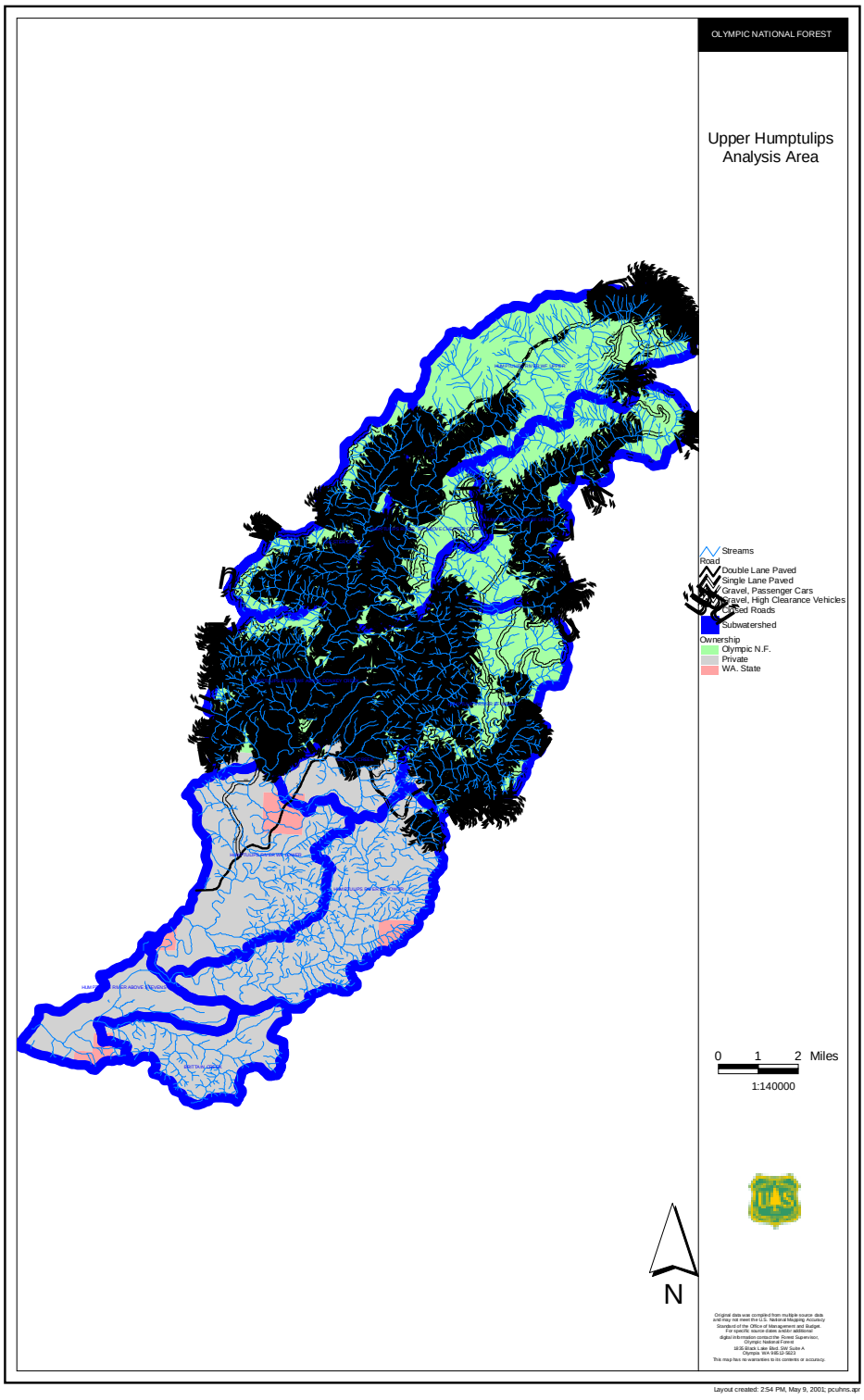
riparian areas. No-harvest buffers and equipment limitation zones in and around riparian areas, including channel migration zones, will protect the shallow subsurface flows beneath and adjacent to streams. Protection of the hydrological continuity of forested wetlands will be increased by impact avoidance and minimization, and wetland restoration and replacement.

Overall, the FFR-based rules require biologically sound and economically practical regulations that will improve and protect riparian habitat on non-federal forestlands in the Washington. Ecology believes that implementation of the rules will protect water quality and will provide a set of BMPs that will establish a trajectory toward meeting water quality standards where they are not currently being met.

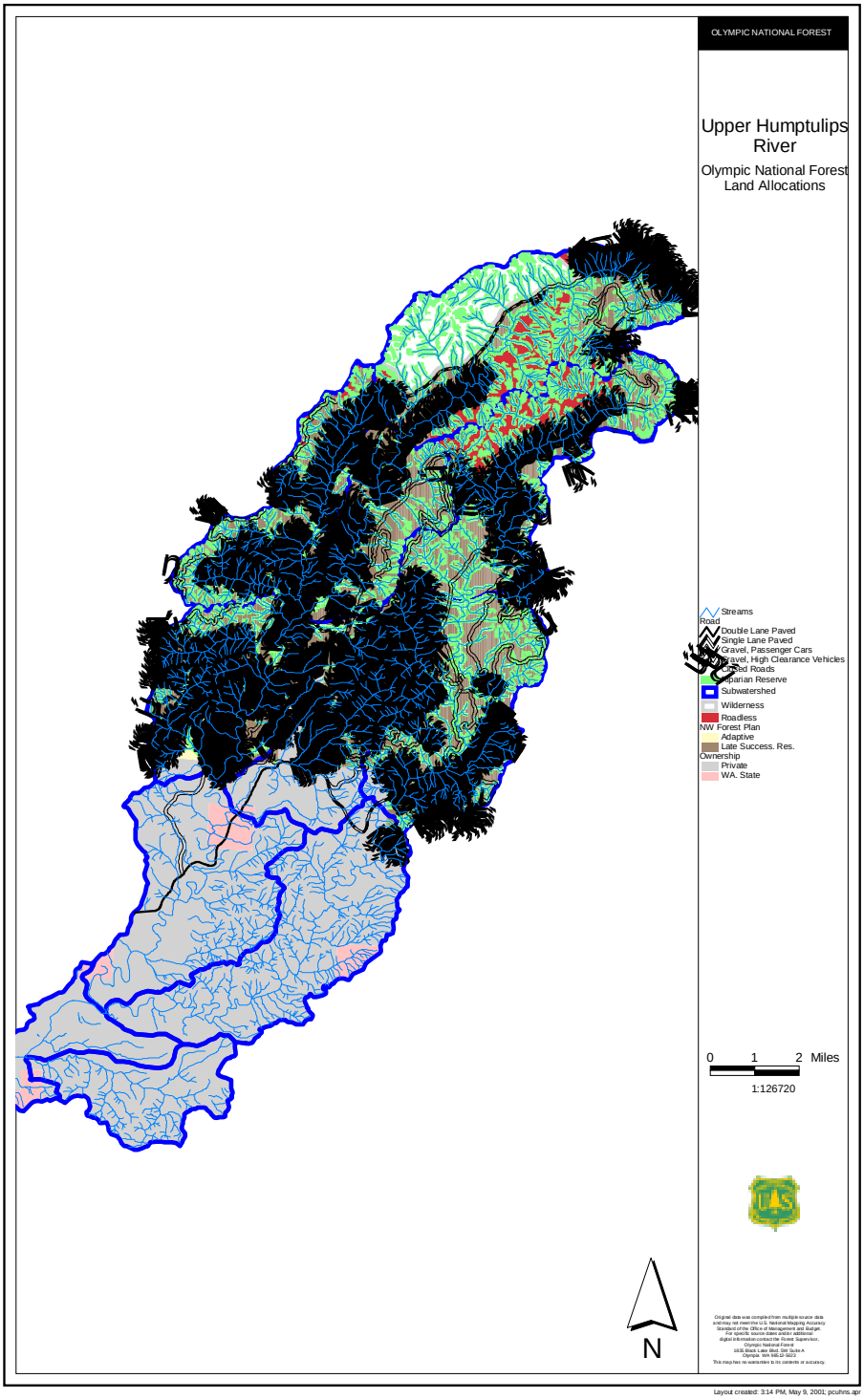
Appendix D

Maps

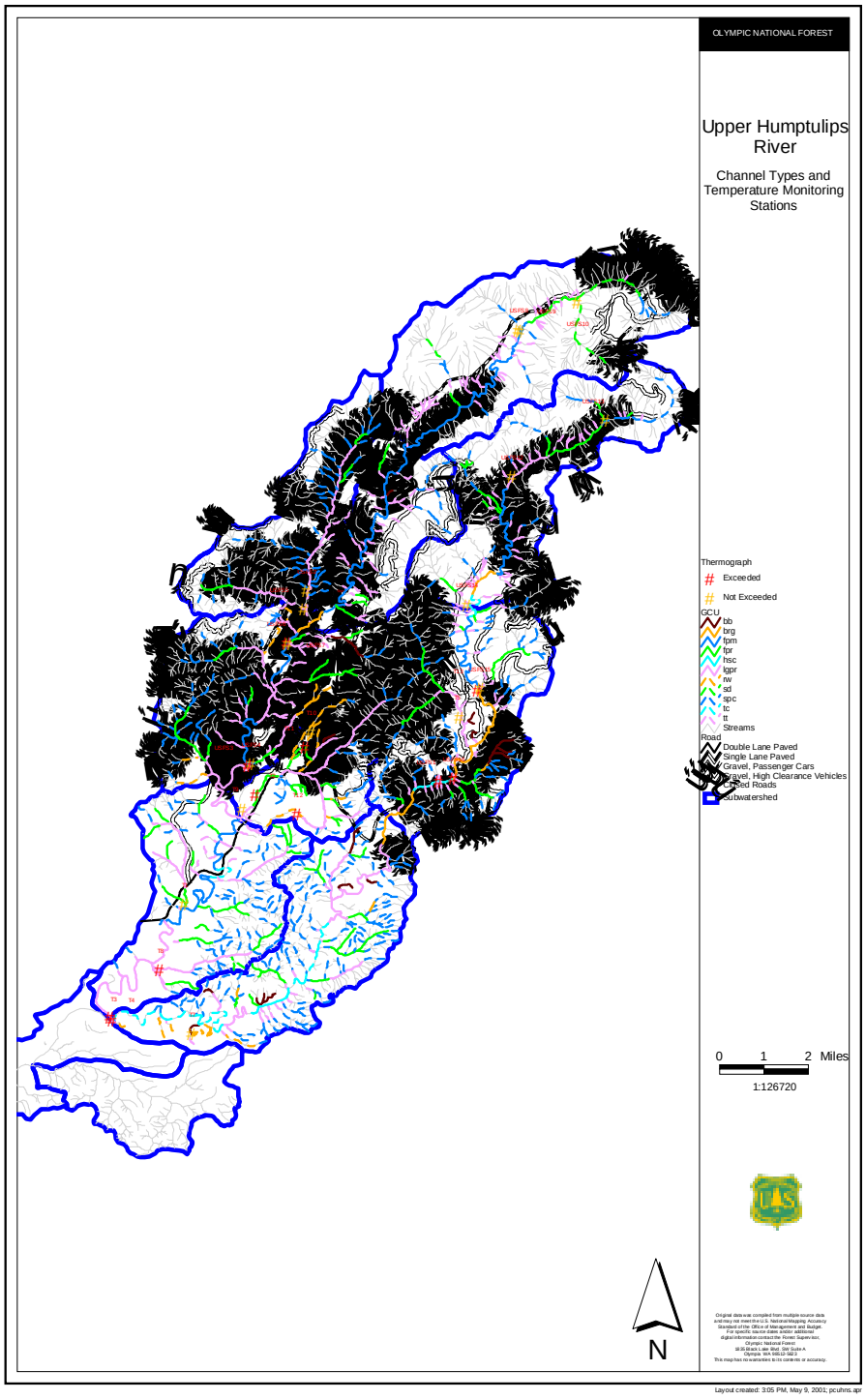
Map 1. Upper Humptulips River – Analysis Area



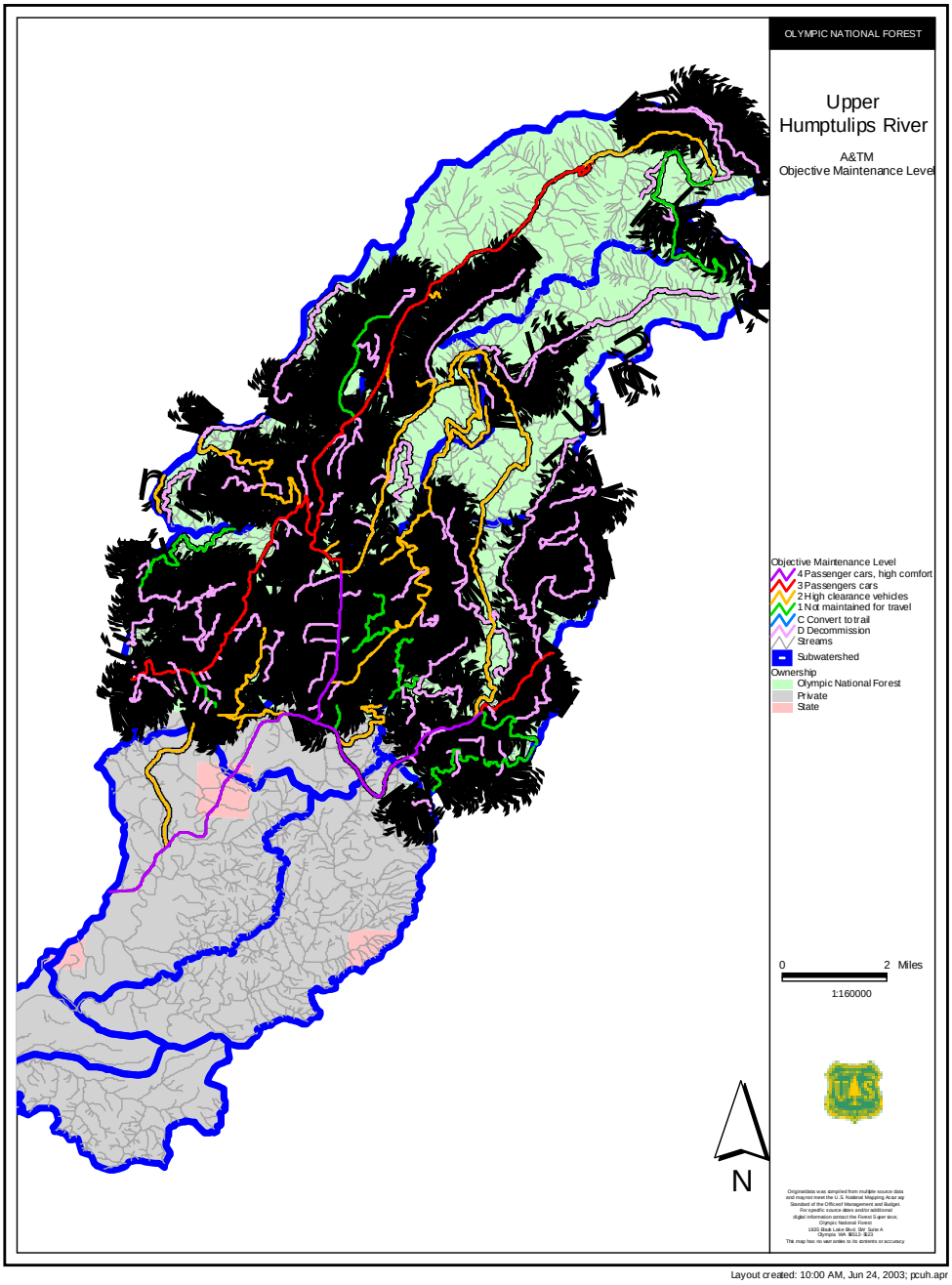
Map 2. Upper Humptulips – Olympic National Forest Land Allocations



Map 3. Upper Humptulips River – Channel Types and Temperature Monitoring Stations



Map 4. Upper Humptulips River – Olympic National Forest Access and Travel Management



Map 5. Upper Humptulips River - Olympic National Forest Watershed Restoration