Teanaway Temperature Total Maximum Daily Load

Detailed Implementation Plan

February 2003
Publication Number 03-10-025

This page purposely left blank.

Teanaway Temperature Total Maximum Daily Load

Detailed Implementation Plan

Prepared by:

Jane Creech
Washington State Department of Ecology
Water Quality Program

February 2003
Publication Number 03-10-025

Printed on Recycled Paper

For additional copies of this document contact:

Department of Ecology
Publications
P.O. Box 47600
Olympia, WA 98504-7600
Telephone: (360) 407-7472

If you have special accommodation needs or require this document in an alternative format, please call (360) 407-7529. The TTY number is 711 or 1-800-833-6388.

Table of Contents

List of Figures

Page

List of Tables

List of Tables in Appendices

Page

Acknowledgements

A great debt of gratitude is due to the Teanaway TMDL workgroup, for their patience, hard work, creative thinking and time spent editing several drafts of this document.

Thanks also to staff of the Washington Department of Ecology, who helped direct and edit the development of this detailed implementation plan.

Abstract

This detailed implementation plan (DIP) document outlines the steps that will be taken in an effort to reduce water temperatures in the Teanaway River basin in central Washington State. This document conforms to the intents and purposes of the Teanaway Temperature TMDL and extends the stream cooling strategies found in earlier reports written for this TMDL.

Four major causes of stream heating have been identified in the Teanaway Basin: lack of streamside shade, increased channel width to depth ratios, instability of streambanks, and low summer instream flows. Implementation measures are planned to address all of these causes.

Actions taken pursuant to this DIP are grouped into three main categories: 1) voluntary stewardship actions, 2) actions that are taken in accordance with a law, legal agreement, or land management plan, and 3) monitoring activities. Planned monitoring activities include tracking stream temperature, monitoring for attainment of site potential shade (includes sediment) and maintenance of flow, tracking implementation activities, tracking temperature-dependent biota, and possibly other studies as needed.

Progress toward goals will be measured by achievement of intermediate milestones, including completion of educational activities, riparian restoration, irrigation upgrades, and road improvements. Other milestones will include increased shade and reduction of water temperatures.

Water quality standards are ultimately expected to be achieved for several reasons. A dedicated workgroup of Teanaway landowners and other interested citizens is working hard to implement appropriate best management practices wherever possible. Various agencies are helping to coordinate and obtain funding for riparian restoration and irrigation upgrade projects, and more of these projects are planned for the near future. Monitoring programs are now in place that will establish baseline data to measure future success as well as help identify which pollution sources are natural vs. those related to current activities in the Teanaway Valley.

This page purposely left blank.

Introduction

The Teanaway River is a major tributary of the Yakima River in central Washington State, draining 207 square miles of the east slope of the Cascade mountain range. During the hottest time of the year (July through September), stream temperatures in the Teanaway River basin often exceed state water quality standards.

In 2000, a total maximum daily load (TMDL) technical evaluation was completed by the Washington Department of Ecology (Ecology) to address water temperatures in the Teanaway River Basin (Stohr and Leskie, 2000). An advisory workgroup – composed of Teanaway landowners and others who have a strong interest in and history of caring for the river – was also formed in 2000. Ecology and the workgroup drafted a TMDL submittal document (Irle, 2001). The summary implementation strategy (SIS) portion of this document sets forth the goals, objectives, and strategies for achieving cooler water in the Teanaway watershed. After a public review process, the Teanaway Temperature TMDL was approved by the US Environmental Protection Agency (EPA) Region 10 in January 2002.

This "detailed implementation plan" (DIP) document[1] evolves from the previous SIS and provides a framework for implementing load allocations[2] established in the Teanaway Temperature TMDL. The DIP builds on the Teanaway TMDL technical assessment and submittal document (referenced above) and on the findings contained in these documents. Excess solar radiation is considered to be the pollutant causing the warmer water temperatures, and streamside shade is used as a surrogate for excess solar radiation. For most locations in the Teanaway Basin (all locations below approximately 3500 feet elevation), the TMDL modeling predicted that it is not possible to meet numeric water temperature criteria even if the maximum shade possible is attained. In these locations "site potential shade" [3] is the load allocation[4].

The TMDL assessment and the TMDL submittal document found that effective reduction of stream temperatures will depend on increases in riparian shade, increased bank stability, and reductions in active channel width to depth ratios. Increasing instream flows, where possible, is also identified as a remedy. Alternate methods of storing water in the Teanaway Basin and voluntary opportunities to increase stream flow will also be considered. These concepts combine to have complex thermal effects. See Figure 1 (below) for an illustration of the interconnectedness of these concepts.

The fundamental implementation strategy for achieving temperature reductions in the Teanaway watershed is that if each of the remedies noted above is pursued, the subsequent changes should result in meeting the goals of the Teanaway Temperature TMDL. This document specifies the ways in which implementation activities may reduce water temperatures and generally improve

[1] The "detailed implementation plan" is required and described in the Memorandum of Agreement Between the United States Environmental Protection Agency and Washington Department of Ecology Regarding the Implementation of Section 303(d) of the federal Clean Water Act
[2] See Appendix A (Glossary) for definition.
[3] See Appendix A (Glossary) for definition.
[4] See Appendix B for more specific information on load allocations for this TMDL.

stream "health," and how water quality monitoring will be used to track progress and to indicate when adaptive management procedures may need to be employed.

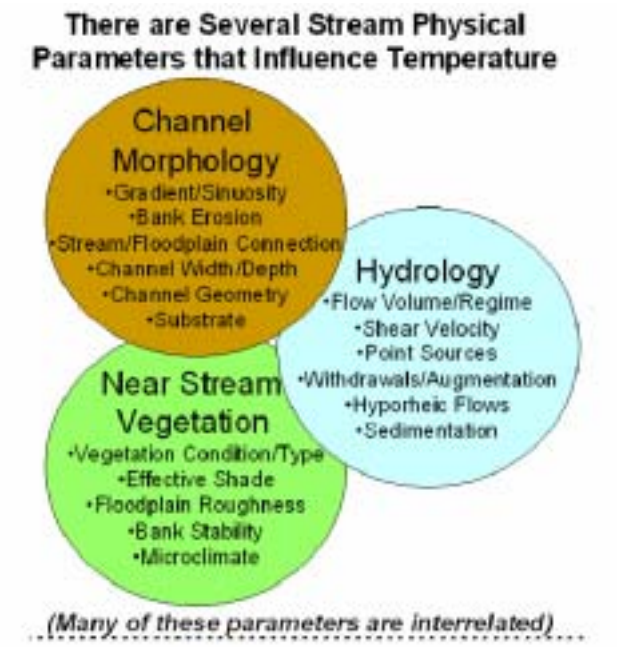

Figure 1: Shade and channel characteristics that impact water temperature (ODEQ, 2002)

Because it will take approximately 80 years to grow streamside trees to maturity, full site potential shade (and, consequently, compliance with water quality standards) is expected to be achieved in 2080.

Approach

Actions taken pursuant to this TMDL fall into three categories: voluntary stewardship actions, actions that are taken in accordance with a law or legal agreement, and monitoring activities. Emphasis will be placed on working together for success. Voluntary stewardship actions will be completed as funding allows. Actions that are taken in accordance with a law or legal agreement will be completed within the time frame prescribed in the law or legal agreement, if applicable. Monitoring activities will begin as soon as possible and will be repeated at least every five to ten years. (See the section on *"Management Roles, Activities and Schedules"* for more detail.)

Further, after months of careful deliberation by the Teanaway citizens' workgroup, Ecology, and others, we agree on the following:

- Establishing monitoring baselines for temperature and sediment is of paramount importance, in order to evaluate future progress.
- High winter flows can cause significant streambank erosion and mass wasting, resulting in removal of streamside trees and input of sediment into the river, which in turn increases width to depth ratios.

- On highly eroded, steep cutbanks, it makes sense to proceed with bank stabilization activities before planting new riparian vegetation (i.e., trees) on these banks.
- Any major bank stabilization activities (e.g., rock barbs, lateral debris jams, etc.), or any other activities that might change the way that high flows affect downstream neighbors, will be studied carefully before installation. This will include written design plans by qualified individuals who are experienced in designing in-stream bank stabilization structures.
- We will continue to pursue all types of bank stabilization as we believe that unchecked bank erosion may further de-stabilize the river system.
- We would like to reconnect the river to its floodplain wherever possible and appropriate.
- There are many parts of the river system that are currently functioning ("healthy"), and we are concerned that as the valley population increases, some functionality of these stream segments may be lost. Therefore, it is very important to continue to educate new – and existing – valley residents regarding riparian areas, stream function, and this TMDL.

The Teanaway citizens' workgroup, in conjunction with Ecology, will continue to be a main driver of all further decisions made regarding this TMDL.

Pollution Sources and Organizations Responsible For Reductions

Pollution Sources

As noted previously, solar radiation striking the stream surface is the pollutant, and full site potential shade is needed in most areas of the Teanaway basin to meet state water quality standards. Site potential shade includes the shade afforded by mature and healthy streamside vegetation, as well as the reduced channel width to depth ratio associated with streams in near natural conditions, which results from increased bank stability and reduced contributions of sediment.

Low summer instream flows also contribute to elevated water temperatures. A given amount of solar radiation heats a smaller volume of water more quickly than it does a larger volume of water.

Using the definitions noted above, Table 1 summarizes potential sources of elevated water temperatures.

Table 1: Sources of Elevated Water Temperatures in the Teanaway Basin

Source	Explanation	Possible Causes	Possible Remedies
1. Lack of streamside shade	Too few mature trees near summer thalweg of river allows more solar heating of river water. Lack of woody debris in river channel further enhances heating of water.	1.1 Mature streamside trees are removed by extensive bank erosion resulting from winter high flows.	Reduce winter high flow levels: • Reconnect with historic stream channels • Increase sinuosity of river • Increase use of hyporheic zone
		1.2. Streamside fallen timber (the source of large woody debris) also swept away by winter high flows.	Reduce winter high flow levels: • Reconnect with historic stream channels • Increase sinuosity of river • Increase use of hyporheic zone
		1.3 Erosive destruction of riparian areas slows growth of new trees.	Reduce winter high flow levels: • Reconnect with historic stream channels • Increase sinuosity of river • Increase use of hyporheic zone
		1.4 Grazing of cattle along riverbank for long periods may deter growth of new trees.	Seasonal grazing patterns implemented (direct animal access to riparian areas is controlled)
		1.5 Damage to riparian area by recreational users deters growth of new trees.	Protect riparian vegetation and streambanks.
2. Increased channel width:depth ratio	River and tributaries wider and shallower than they would be in "ideal" conditions. Shallow river in summer accelerates heating. Widening of channel causes remaining trees to be far from summer stream course, reducing availability of shade.	2.1 Sediment deposition and movement causes river to be shallower and wider.	Reduce sediment deposition: • Improve maintenance of earthen roads • Reduce sediment-laden return flows from irrigated agriculture • Reduce sediment-laden flows from other sources (construction, etc.)
		2.2 Excessive winter high flows move locations of streambanks and widen river.	Reduce winter high flow levels: • Reconnect with historic stream channels • Increase sinuosity of river • Increase use of hyporheic zone

Source	Explanation	Possible Causes	Possible Remedies
3. Instability of streambanks	Unstable streambanks contribute to bank erosion, contribute more sediment to the stream, endanger mature trees, and retard growth of new streamside vegetation.	3.1 High winter flows remove large sections of bank, increasing instability.	Reduce winter high flow levels: • Reconnect with historic stream channels • Increase sinuosity of river • Increase use of hyporheic zone
		3.2 Damaged riparian areas can start self-perpetuating erosive process for streambank.	Stabilize streambank with rock barbs, tree revetments; plant riparian vegetation
		3.3 Insufficient riparian vegetation to hold soils in place.	Plant riparian vegetation.
4. Low summer instream flows	Low flow levels during the hottest time of the year can result in more rapid heating of water.	4.1 "Flashy" hydrograph (see "*Definitions*" section)	Absorb more high stream flows, to allow summer release of water, by: • Reconnecting with historic stream channels, • Increasing sinuosity of river, • Increasing use of hyporheic zone.
		4.2 Loss of use of hyporheic zone due to excessive sediment input, channel straightening.	Increase use of hyporheic zone: • Reconnect with historic stream channels, • Increase sinuosity of river • Reduce instream sediment levels
		4.3 Possible illegal diversions.	Ecology staff will locate and prevent further use of illegal diversions.
		4.4 Possible climate change.	**???????**

Organizations Responsible For Reductions

Agriculture: The conservation agencies (the Kittitas County Conservation District and Natural Resource Conservation Service) are the entities responsible for technical assistance and financial support (where possible) to promote implementation of agricultural best management practices (BMPs) throughout the watershed. Individual irrigators are responsible for the implementation of irrigation BMPs. Irrigation BMPs can include irrigation upgrades, changes in point of diversion, diversion improvements, and elimination of agricultural return flows. Ranchers and other livestock managers are responsible for implementing BMPs that prevent destruction of riparian areas and bank erosion.

Forestry: Private and state timber owners are responsible for implementing appropriate BMPs (as specified in the Forests and Fish rules) on their lands. The Washington Department of

Natural Resources (DNR) is responsible for oversight of the Forests and Fish rules. The Cooperative Monitoring Evaluation and Research (CMER) committee is responsible for evaluation of the Forests and Fish rules to support the adaptive management process. The US Forest Service is responsible for implementation of appropriate BMPs (as specified in the Memorandum of Agreement [MOA] with Ecology) on its lands.

Other: Outside of the forested areas, Kittitas County and Washington State Dept. of Transportation (WSDOT) are responsible for maintaining roads and roadside ditches within their various jurisdictions. Individual homeowners who live adjacent to water bodies within the project area are responsible for avoiding actions that cause destabilization and erosion of streambanks.

Monitoring: The KCCD is currently (2002-05) conducting water quality monitoring for temperature and sediment in the Teanaway Basin per grant agreement. Ecology will be completing monitoring for stream macroinvertebrates during the summer of 2002, with one site to become a long-term reference site. The KCCD may conduct further macroinvertebrate monitoring in 2003-04 if a grant application is approved. All above noted monitoring will establish a baseline, so that future temperature reduction can be detected and documented. Monitoring for above elements will occur at least every five to ten years, to check progress. Monitoring arrangements may be modified in future years.

Ecology is the responsible entity for determining compliance with interim and final targets.

Management Roles and Activities

Management Roles

The next table organizes the responsible entities, and general actions and timelines, for the implementation of the TMDL. The information listed in the table is part of the overall strategy and may change as personnel and monetary resources are better defined during the development of the DIP.

Table 2: Key Groups and Their Contributions. *Note: Please refer to the list of acronyms in Appendix A for assistance with Table 2.*

Group	Management Roles
CMER	Monitors Forests and Fish rules in support of adaptive management
DNR	Administer and enforce Forests and Fish rules.
DNR	Determine if private and state timber owners are meeting water quality requirements of Forests and Fish rules.
Ecology	Locate and eliminate illegal diversions (if any).
Ecology	Evaluate if the water quality samples at set monitoring sites show (normalized) reductions in water temperature.
Ecology	Perform effectiveness monitoring. Track progress of TMDL over time.
Ecology, KCCD	Determine if alternate outreach efforts are needed.
Ecology, Teanaway Citizen's Workgroup (TCW), KCCD	Determine if changes in monitoring sites, tests or frequency are needed.
Homeowners with waterfront property	Avoid actions that will cause streambank destabilization or erosion, or will otherwise harm riparian vegetation or add sediment to area waterways.
Irrigators	Implement BMPs to prevent entry of suspended sediment into area waterways.
KCCD	Distribute a brochure regarding prevention of erosion from project area streambanks. Provide technical assistance.
KCCD, NRCS and Ecology	Continue to fund agricultural BMP implementation: controlling agricultural runoff, reducing suspended sediment in drains and tributaries, preventing streambank destabilization and erosion.
KCCD, NRCS	Extend outreach efforts and technical assistance to all agricultural producers (irrigators, livestock managers, others) in the watershed.
KCCD	Continue to monitor water quality of the watershed's surface waters.
Kittitas County	Administer Critical Area Ordinances and Shoreline Master Programs.
Kittitas County, WSDOT	Maintain roads and roadside ditches to prevent entry of sediment into area waterways.
Private and state timber owners	Implement forest management practices as required by Forests and Fish rules.
Ranchers	Implement livestock management BMPs to prevent removal of riparian vegetation or streambank destabilization and erosion.
TCW	Complete the DIP. Assist in tracking progress.
TCW	Discuss results of new BMPs and determine appropriate locations for implementation.
TCW	Identify future monitoring needs and funding sources, and develop strategy.
USFS	Implement forest management practices as required by MOA with Ecology.

Activities

As stated previously, actions taken pursuant to this TMDL fall into three categories: voluntary stewardship actions, actions that are taken in accordance with a law or legal agreement, and monitoring activities.

1. Voluntary stewardship activities. These are activities that are voluntarily undertaken to help improve overall stream health. Stewardship actions, which will be taken as funding allows, can include, but are not limited to:

    a. Restoration (planting) of riparian vegetation

    b. Installation of streambank stabilization structures
        i. Install large woody debris (LWD)
        ii. Install rock barbs
        iii. Install tree revetments (felled whole trees tied to bank with cable and/or large rocks)

    c. Hydraulic improvements
        i. Reconnection of active stream channel with historic stream channel
        ii. Reintroduction of beavers
        iii. Control floodwaters via development of "storage"

    d. Reduction of sediment inputs
        i. Install measures to reduce/eliminate bank erosion (see above)

    e. Increase of instream flow levels
        i. Irrigation efficiency upgrades (diversion relocation, convert from open ditch to pipe, convert from furrow irrigation to sprinkler)
        ii. "Saved water" leased or put in water trust

    f. Education
        i. Road-side signs and information booths
        ii. Newsletter
        iii. Newspaper articles
        iv. Circulate videotapes
        v. "New homeowner" info packet

2. Actions that are taken in accordance with a law or legal agreement. These actions can include, but are not limited to:

    a. For forest managers on private lands, compliance with the Forests and Fish rules
        i. Protection of riparian areas, including leaving an appropriate buffer and mature trees
        ii. Improved road maintenance on currently used roads, closure of unused roads

    b. For the US Forest Service, compliance with the Memorandum of Agreement with Ecology
        i. Protection of riparian areas, including leaving a buffer and mature trees
        ii. Improved road maintenance on currently used roads, closure of unused roads

    c. Elimination of illegal diversions (if any)

d. Protection of existing riparian vegetation (especially trees).
    i. Prevention of removal/damage due to prolonged livestock use
    ii. Prevention of removal/damage due to inappropriate recreational use
    iii. Prevention of removal/damage due to other uses

e. Prevention of entry of sediment into the river, where sediment-laden waters result from other activities
    i. Prevention of eroding earthen roads, or road-related erosion
        A. Road repair projects
        B. Culvert replacement projects
    ii. Prevention of sediment laden return flows from irrigated agriculture
        A. Irrigation conversions (rill to sprinkler)
        B. Construction of settling ponds
        C. Use of polyacrylamide (PAM)
    iii. Prevention of sediment-laden runoff from other sources (building construction, road construction, etc.)

3. Monitoring. Considerable additional monitoring has been recommended in both the technical assessment and submittal document for the TMDL.
    a. Baseline study of temperature (includes development of formula to compare with air temperature) and sediment
    b. Sediment modeling
    c. Analysis of "proper functioning condition"
    d. Biomonitoring (macroinvertebrate analysis, etc.)
    e. Comparison of ground water vs. surface water temperatures

Measuring Progress Toward Goals

As noted earlier, the target for most of the Teanaway basin is site potential shade, which will require increased bank stabilization, reduced width:depth ratios, and more riparian vegetation. Cooling of stream water may also be accomplished by increasing summer instream flows levels. Progress toward many of the TMDL goals can be measured using the "milestones" table 3.

Different implementation schedules will be used for different types of activities. Actions that are taken in accordance with a law or legal agreement will be completed within the timeframe prescribed in the law or legal agreement, if applicable. Voluntary stewardship actions will be completed as funding allows. Monitoring for temperature (water and air) and sediment will be completed as soon as possible to establish baselines, and will be conducted at least every five to ten years thereafter to assess progress. Suggested intermediate milestones are listed in Table 3.

Table 3: Intermediate Milestones for the Teanaway Temperature TMDL

	Description	Measurement Method	Goal	When Attained
1	**Education**			
	a. Ongoing educational activities	Number of education activities and area covered	Three educational activities each year	Annually
	b. Change in attitudes of valley residents	Biannual opinion survey of residents	Increased environmental awareness of Teanaway Valley residents	Ongoing
	c. Create, publish, and distribute educational publications regarding river protection and restoration	Number of educational publications released	Two publications each year sent to all residents of Teanaway Valley	Annually
	d. Informational road signs	Number of signs	Three educational road signs	End of 2002
2	**Road improvements**			
	a. Owners of large tracts of timber in Teanaway watershed (USFS, DNR, US Timberlands, Plum Creek)	Percentage of roads improved and maintained to minimize erosion	All roads improved to minimize erosion and maintained appropriately	Annual review
	b. Owners of small tracts of timber in Teanaway watershed	Percentage of roads improved and maintained to minimize erosion	All roads improved to minimize erosion and maintained appropriately	Annual review
	c. Other owners of small parcels of land in Teanaway watershed	Percentage of roads improved and maintained to minimize erosion	All roads improved to minimize erosion and maintained appropriately	Annual review
3	**Riparian revegetation**			
	a. Plant new vegetation along streambanks	Total number of plants (seedlings, bushes, etc.) planted, miles covered	Plant as much new vegetation as reasonably possible	Ongoing
	b. Protect, water, and otherwise nurture new plants during first year	Percentage of plants that survived the first year	80% survival rate for first year	Ongoing
	c. Revisit plants after 5 years to assess survival rate	Percentage of plants that survived 5 years	50% survival rate after five years	Ongoing
	d. Immature riparian vegetation is growing taller	Estimate height of immature riparian trees	New riparian trees now one half of desired mature height	2040

	Description	Measurement Method	Goal	When Attained
4	**Reduced stream temperatures**	Compare stream temperature to baseline (adjusted for variations in air temperature)	Data shows reduction in stream temperature	Re-check every 5 to 10 years
5	**Increased streamside shading**	Compare streamside shade to baseline via new aerial photos taken every 5-10 years (establish shade baseline or use values from TMDL assessment)	Studies show increase in streamside shading	Re-check every 5 to 10 years
6	**Irrigation upgrade projects completed**	Percentage of rill-irrigated farms remaining	All rill-irrigated farms converted to sprinklers	2010 (?)

Schedules for achievement of these milestones, by appropriate responsible groups, have been developed and placed in Appendix D. Over time, progressive milestones will be measured and tracked using these schedules. Tracking of progress toward goals will be coordinated by Ecology, with assistance from other responsible groups identified earlier.

Monitoring Plan

Monitoring is included as part of the implementation strategy. It serves to track and evaluate the effectiveness of implementation measures. Five general monitoring procedures, to be implemented concurrently, are described below. A detailed monitoring plan appears in Appendix C.

1. Track stream temperature

Stream temperature will be monitored for general trends and the results evaluated at five to ten-year intervals, or consistent with timelines established within the Forests and Fish Rules. This is expected to continue for decades, and results may not be observed for a decade or more.

In order to evaluate progress when there is much natural annual variation in temperature (e.g., very "hot" summers vs. relatively "cool" summers), a baseline relationship between stream temperature and air temperature will be established. The regression of water temperature against air temperature will be plotted over time to determine whether water temperatures are cooler for specific air temperatures.

2. Monitor for attainment of site potential shade (includes sediment) and maintenance of flow

Parameters that may be monitored include shade, active channel zone widths, width to depth ratio, sediment (bedload, suspended sediment, and turbidity), sediment loading, temperature, and flow. Baseline inventories of riparian vegetation and channel conditions will be established and

surveys conducted in at least five to ten-year intervals. Aerial photos may be used to evaluate progress.

3. Track implementation
Implementation of voluntary riparian restoration activities and instream flow restoration will be tracked. Effectiveness of these implementation measures will also be tracked.

4. Track temperature-dependent biota and other parameters as appropriate
The health of macroinvertebrate and salmonid populations and/or other indicators may be used to track recovery of the riparian and river systems. The presence of a healthy aquatic ecosystem typical of this type of stream will be a useful indicator of success of this project.

5. Additional studies
Over time, additional studies may also be identified as needed to evaluate existing conditions or implementation activities. This may include a comparison of groundwater vs. surface water temperatures.

6. Effectiveness Monitoring
Ecology has established an Effectiveness Monitoring group that will assist in determining the effectiveness of BMPs applied as a result of a TMDL. This group will periodically select waters where TMDLs have been in place and evaluate the status of the waters toward achieving the load allocations and water quality standards. This information will be processed through the regional office to the applicable groups engaged in implementation activities.

Reasonable Assurance

Overview

When establishing a TMDL, reductions of a particular pollutant are allocated among the pollutant sources (both point and nonpoint sources) in the water body – for the Teanaway Temperature TMDL, all sources are nonpoint. TMDLs (and related DIPs) must show "reasonable assurance" that the nonpoint sources will meet their allocated amount of reductions. Among the appropriate types of reasonable assurance for the Teanaway are implementation of best management practices (BMPs), developing and implementing nonpoint source control plans, and greater public awareness of related legal encouragement to remediate water temperature problems.

In the Teanaway, the local workgroup has recommended establishing an inventory of current conditions and considers this a high priority. Several grants have been secured to promote these activities; additional funding sources and technical support resources will be sought to further support these activities. Private individuals and organizations have also contributed significantly to restoration of the Teanaway through private financial expenditures as well as donation of many hundreds of hours of volunteer time. Government requests for funding from other sources concerning programs and actions to reduce instream temperatures will be shared with the Teanaway property owners in an effort to gain the maximum possible consensus to the best and most economical solutions. In addition, existing rules, ordinances, and agreements address the

protection of riparian buffer zones and sediment effects over the area covered by this TMDL. Adaptive management and enforcement of existing legal instruments may be used if compliance with laws and legal agreements does not occur. The proposed monitoring will track progress and identify whether additional measures are needed.

Current Implementation Efforts

Local residents, the Kittitas County Conservation District, the Natural Resources Conservation Service, and others are already implementing riparian restoration activities and conservation measures. Recent activities by local landowners on private riparian lands have included planting trees along stream banks, installing rock barbs to reduce bank erosion, and water conservation programs to increase instream flows. The Washington Department of Natural Resources and private forest landowners are actively involved in implementing the Forests and Fish Rules, and the US Forest Service is implementing road and trail improvements along with water quality restoration planning to address temperature issues on their lands.

Other specific examples of recent restoration activities, as well as planned activities with secure funding sources and scheduled completion dates, include the following:

- Private landowners have performed irrigation upgrades on most of the farms on the lower main stem Teanaway River, thereby increasing instream flows and eliminating irrigation return flows. These upgrades generally consist of replacing flood or rill irrigation systems with more efficient pressurized sprinkler systems. Funding has been secured to upgrade almost all of the irrigation systems in the Teanaway Valley by 2005, and funding is being actively pursued to upgrade the few remaining flood/rill systems.
- Most landowners have replaced their open irrigation ditches with pressurized pipes to deliver water to irrigation devices. These changes eliminate considerable water loss from evaporation and infiltration of open ditches, thereby increasing instream flows, as well as reducing temperature and sediment levels. As with the irrigation upgrades, funding has been secured to upgrade almost all of the irrigation systems in the Teanaway Valley by 2004, and funding is being actively pursued to upgrade the few remaining flood/rill systems.
- In spring 2001, Washington Conservation Corps crews planted thousands of trees in Teanaway Basin.
- Thousands of trees will be planted by the KCCD throughout the Teanaway watershed in 2003-05.
- Tree revetments[5] will be installed by the KCCD along streambanks at approximately 40 locations in the Teanaway basin in 2003-05. Installation of tree revetments promotes bank stabilization, protects existing riparian vegetation from erosion, develops protected sites for establishment of seedlings, adds to shading of the water body, adds large woody debris and enhances habitat for aquatic species.
- Nature Conservancy volunteers removed weeds and planted native species on 40 acres owned by the US Bureau of Reclamation near the mouth of Teanaway in October 2001.

[5] See Appendix A (Glossary) for definition

- The US Forest Service – Cle Elum Ranger District has received funding from Kittitas County for watershed restoration work, which they will implement in the Teanaway in 2002-03. This work will likely be continued in the future.
- The USFS-Cle Elum RD has also developed a "Respect the River" program to educate recreational users about riparian protection, manage and restore riparian vegetation, reduce streambank soil erosion, and improve floodplain water storage.
- All owners of private and state timberland within the project area, in accordance with the Forests and Fish rules, are actively working to identify and improve problem roads and to protect riparian areas to reduce bank erosion. Road maintenance and abandonment plans must be completed by 2006, using impaired-water body listings (such as in the Teanaway) as one of the prioritization criteria. Water quality is expected to improve quickly in the first years because landowners are required to address those roads causing the worst water quality problems and/or posing the greatest risk to beneficial uses first. An integral part of the Forests and Fish rules is the adaptive management process, which seeks to evaluate the effectiveness of these rules and modify them as necessary over time. Additionally, the private timber companies have enacted grazing programs and recreational use policies that will further protect riparian areas and protect bank erosion.
- All livestock along the main stem Teanaway River are now fenced away from the river to prevent damage to riparian areas.
- The NRCS and KCCD have been working with area landowners to develop seasonal grazing programs in the upper Teanaway River basin (above the forks) in order to protect riparian areas from livestock damage during the most sensitive times of the year.

Adaptive Management

If planned implementation activities are not producing expected or required results, Ecology or other entities may choose to perform additional studies to identify the significant sources of heat input to the river system. If the causes can be determined and the remedies are required by law or legal agreement, then additional implementation measures may be needed. If the causes cannot be determined or if the causes are found to be naturally occurring, then the TMDL targets may need to be revised. For non-federal forested areas, the agreements in the Forests and Fish Report incorporate adaptive management as needed to meet the allocations in this report. The USFS also has a policy of adaptive management. Re-evaluation of this TMDL is anticipated to occur at five to ten-year intervals. If progress toward cooler water temperatures cannot be detected, then the TMDL may be modified as a result.

Supporting Regulations, Legal Agreements and Enforcement

The Teanaway Temperature TMDL supports the efforts of several existing laws, regulations, legal agreements, and land management plans by guiding riparian area activities on lands under a variety of property ownership. These existing legal instruments include the Memorandum of Agreement with the US Forest Service/Region 6 (covers activities on US Forest Service lands); the Forests and Fish Rules (covers activities on private and state-owned forested lands); the Kittitas County Critical Areas Ordinance, Title 17A (certain sections cover riparian habitat areas on non-federal lands in Kittitas County); the Shoreline Management Act (covers shorelands within 200 feet of rivers, on non-federal lands); the Washington Water Code (covers water use

throughout the basin); and Washington State water quality laws and regulations (RCW 90.48 covers water quality in all waterbodies in the basin). Compliance with existing laws and legal agreements will preclude enforcement or other legal action by appropriate organizations. Where compliance with existing laws is not forthcoming, education, outreach, technical, and financial assistance will be used to their maximum extent prior to initiating any enforcement actions. See the Teanaway TMDL submittal report (Irle, 2000) for more detail on legal issues related to this DIP.

Public Involvement

The development of this detailed implementation plan has involved the public every step of the way. TMDL workgroup meetings regarding this DIP were held approximately monthly from October 2001 through late 2002, and the workgroup helped write much of this document. The TMDL workgroup also reviewed and edited several draft versions of this document. The timelines for implementation activities have been created in consultation with all of the landowners, agencies and organizations involved. Earlier versions of this document have been presented to all agencies with responsibilities outlined for comment prior to publication.

During the entire TMDL implementation period, monitoring data and status reports will be available for public review, and periodic updates will be provided to area media and other interested parties.

Funding Opportunities

Numerous funding sources are available to continue the work of restoration and water temperature reduction in the Teanaway River basin, including:

- The Natural Resources Conservation Service often provides cost-share funding to agricultural producers for farm plan implementation and conservation improvements on farms via its Environmental Quality Incentives Program (EQIP) and their Conservation Reserve Enhancement Program (CREP); additionally, the EQIP program can now fund forest road improvements, giving priority to fish passage improvements.
- The Kittitas County Conservation District provides cost-share funding for agricultural improvements.
- Ecology funds water quality facilities and activities through its water quality grants program.
- The Bonneville Power Administration has provided considerable funding to help reduce Teanaway water temperatures and will likely do so in the future.
- The Yakima River Basin Water Enhancement Program (YRBWEP) has also provided considerable funding for irrigation efficiency upgrades and acquisition of critical habitat and will likely do so in the future.
- Other programs that will likely provide future funding include Washington State's Water Irrigation Efficiencies Program, Washington Water Acquisition Program (for leasing of water rights), the Washington Department of Natural Resources (DNR) small landowners program, and so on.

As noted earlier, private individuals and organizations have also contributed significantly to restoration of the Teanaway through considerable private financial expenditures as well as donation of many hundreds of hours of volunteer time. Ecology greatly appreciates this support and hopes that it will continue in the future, as is possible based on means and capability. Multisource funding is preferred where possible.

References

Irle, P. 2001. Teanaway Temperature Total Maximum Daily Load Submittal Report. Washington State Department of Ecology, Water Quality Program, Olympia, WA. Publication No. 01-10-019. (Available via the internet at: http://www.ecy.wa.gov/biblio/0110019.html)

ODEQ. 2002. Upper Klamath Lake Drainage Total Maximum Daily Load (TMDL) and Water Quality Management Plan (WQMP). State of Oregon Department of Environmental Quality, Portland, Oregon. (Available via the internet at: http://www.deq.state.or.us/wq/TMDLs/UprKlamath/UprKlamathTMDL.pdf)

Stohr, A., and S. Leskie. 2000. Teanaway River Basin Temperature Pilot Technical Assessment. Washington State Department of Ecology, Environmental Assessment Program, Olympia, WA. Publication No. 00-03-015. (Available via the internet at: http://www.ecy.wa.gov/biblio/0003015.html)

US Environmental Protection Agency (EPA). 1997. Memorandum of agreement between the United States Environmental Protection Agency and the Washington State Department of Ecology regarding the implementation of Section 303(d) of the federal Clean Water Act.

APPENDIX A

Definitions and Acronyms

This page purposely left blank.

Appendix A: Definitions and Acronyms

Definitions

Active channel zone: Water surface plus adjacent channel bed, and unvegetated bars and/or terraces.
Adaptive management: A systematic process for continually improving management policies and practices by learning from the outcomes of operational programs.
Background levels: The level of a pollutant that represents the chemical, physical, and biological conditions that result from natural processes like weathering.
Best management practices (BMPs): Methods that have been determined to be the most effective, practical means of preventing or reducing pollution from nonpoint sources.
Hydrograph: A chart showing flow levels for a river or stream, plotted against time. A hydrograph provides a way of evaluating seasonal and yearly changes in the flow or discharge of a waterway. If the hydrograph responds to significant precipitation events quickly with a steep rise in volume (also a rise in stream height or stage), then the response is called "flashy" or "unstable."
Hyporheic zone: The interface between ground water and surface water; the area where water in a stream channel has moved back into the subsurface sediments. The hyporheic zone may occur under or next to the streambed.
Load allocation (LA): The portion of a receiving water's loading capacity that is attributed either to one of its existing or future nonpoint sources of pollution or to natural background sources.
Loading capacity: The maximum amount of a given pollutant that can be discharged to the water body and still meet water quality standards. The sum of the load allocations, wasteload allocations, and the margin of safety must be equal to or less than the loading capacity.
Macroinvertebrate: An animal without a backbone living in one stage of its life cycle, usually the nymph or larval stage.
Margin of safety: A required element of a TMDL that is meant to account for any lack of knowledge concerning the relationship between load and wasteload allocations and water quality.
Mature riparian forest: A group of trees adjacent to a water body that have reached full natural growth or development.
Mature riparian vegetation: Appropriate native plants, adjacent to a water body, that have reached full natural growth or development;: where possible, mature riparian vegetation equals or includes a mature riparian forest.
Natural conditions: 1. conditions prior to human influence, 2. " 'natural conditions' or 'natural background levels' means surface water quality that was present before any human-caused pollution. When estimating natural conditions in the headwaters of a disturbed watershed it may be necessary to use the less disturbed conditions of a neighboring or similar watershed as a reference condition." [Washington water quality regulations, WAC 173-201A]
Natural processes: those actions, operations, and cycles that occur in the natural environment without the intervention or aid of man.
Near-natural conditions: Surface water quality that is as similar to "natural conditions" (see above definition) as can reasonably be achieved in an area inhabited by humans.
Nonpoint source: Nonpoint source pollution is the single largest source of water pollution nationwide, and refers to pollution that enters any waters of the state from any ***dispersed*** *landbased or water-based activities*. Nonpoint source pollution can include, but is not limited to: atmospheric deposition; surface water runoff from agricultural lands, urban areas , forest lands; or subsurface or underground sources.
Point source: Any *discernible, confined, and discrete conveyance* from which pollutants are or may be discharged (e.g., an industrial facility's discharge pipe.) See Section 502 of the Clean Water Act.
Riparian zone: 1. the land area and associated vegetation bordering the bank of a river or other body of water; 2. a transition zone between dry land and water communities; 3. the zone of direct interaction between terrestrial and stream systems.

Salmonid: Belonging or pertaining to the family Salmonidae, including the salmons, trouts, chars (e.g., bull trout and Dolly Varden), and whitefishes
Seasonal variation: The change in pollution levels from one season to the next.
Sinuosity: The amount of bending, winding, and curving in a stream or river.
Site potential shade: Generally, the maximum riparian shade provided by a "mature riparian forest" along both sides of the stream, and a return of active channel zone width to more natural conditions. However, in areas where trees cannot grow in the riparian zone, site potential shade may be provided by "mature riparian vegetation" or natural landforms such as rock walls, ledges, etc.
Surrogate: Substitute; allowed per EPA regulations (40 CFR §130.2(i)).
Tree revetments: Whole trees laid horizontally in the water near the stream bank. Tree revetments reduce water velocity and increase sediment deposition around the revetment, and consequently reduce bank erosion and promote bank stabilization.
Thalweg: The center of flow of a stream or river; the area of maximum velocity in a stream or river.
Wasteload allocation (WLA): The amount of the total loading capacity allocated to an individual point source of pollution. Also used to describe the total amount of the loading capacity allocated to all point sources in a TMDL (e.g., the sum of individual wasteload allocations). The wasteload allocation for the Teanaway is zero.

Acronyms and Abbreviations

BMPs – best management practices
CAO – Critical Areas Ordinance
CMER – Cooperative Monitoring Evaluation and Research
CREP – Conservation Reserve Enhancement Program
CWA – Clean Water Act
DIP – detailed implementation plan
DNR – Washington Department of Natural Resources
Ecology – Washington Department of Ecology
EPA – US Environmental Protection Agency
EQIP – Environmental Quality Incentives Program
ESA – Endangered Species Act
F&F – Forests & Fish (Agreement or Rules)
FREP – Forestry Riparian Easement Program
KCCD – Kittitas County Conservation District
LA – load allocation
MOA – Memorandum of Agreement
NRCS – Natural Resources Conservation Service
NTU – nephelometric turbidity units
RCW – Revised Code of Washington
SIS – summary implementation strategy
SMA – Shoreline Management Act
TCW – Teanaway Citizens' Workgroup
TMDL – total maximum daily load
TSS – total suspended solids
USGS – US Geological Survey
USBR – US Bureau of Reclamation
USFS – US Forest Service
WCC – Washington Conservation Corps
WDFW – Washington Department of Fish and Wildlife
WLA – wasteload allocation
WSDOT – Washington Department of Transportation

APPENDIX B

Load Allocations

This page purposely left blank.

Appendix B: Load Allocations

Loading capacities for several locations in the Teanaway were established in the *Teanaway River Basin Temperature Pilot Technical Assessment* (Stohr and Leskie, 2000). As the tables below illustrate, for most locations in the Teanaway Basin (all locations below approximately 3500 feet elevation), modeling predicted that it is not possible to meet numeric water temperature criteria even if the maximum shade possible is attained. Therefore, the loading capacity for most areas of the basin is "site potential shade."

By definition, a load allocation for a pollutant cannot exceed the loading capacity of the water body. Therefore, the value of the loading capacity becomes the load allocation for most locations in the Teanaway Basin and the load allocation for most areas of the basin is site potential shade.

The tables below are adapted from the *Teanaway River Basin Temperature Pilot Technical Assessment* (Stohr and Leskie, 2000), and are provided for illustration only. The reader should refer to this original document for further explanation of this information.

Table B-1: ***Shade and Heat Loads for Stream Segments on North Forka and Mainstem Teanaway River***

Stream Reach (and Monitoring Stations)	Existing Shade (%)	Shade Required to Meet Numeric Temperature Standards	Estimated Site Potential Shade (riparian/ riparian & sediment)	Decrease in Current Mean Temperature with Achievable Shade (°C)	Current Solar Load (j/m2/s)	Solar Loading Capacity with Site Potential Shade (riparian/riparian & shade) (j/m2/s)	Required Solar Load Decrease (%)
Headwaters (no station) to Site 4	33	33*	63		213	122	0
Upper North Fork (4 to 9)	46	85*	66 71	1.5 1.9	173	109 93	46
Lower North Fork (9/10 to 5)	11	93**	46 55	1.9 2.4	285	173 144	50
Lower North Fork (5 to 6)	12	100+**	44 54	1.3 1.8	282	179 147	48
Mainstem (6 to 7)	3	100+**	41 52	1.3 1.7	310	189 154	50

* 16°C standard ** 18°C standard

Source: "Table 7. Loading capacity of modeled stream segments" (Stohr and Leskie, 2000)

Table B-2: ***Shade and Heat Loads for One-Mile SegmentsoOn Stafford Creek, MiddleaAnd West ForkTeanaway River,aAnd Tributaries***

Stream Reach (and Monitoring Station)	Existing Shade (%)	Shade Needed for No Temperature Gain/Mile (%)	Estimated Site Potential Shade (riparian/ riparian & sediment)(%)	Water Temperature Gain/Mile at Existing Conditions (ºC)	Water Temperature Gain/Mile at Goal Conditions (ºC)	Current Solar Load (j/m2/s)	Loading Capacity with Site Potential Shade (j/m2/s)	Required Solar Load Decrease (%)
Stafford Creek (Site 10)	27	73	70	NA	0.1	233	96	59
Upper Middle Fork (Site 8)	28	55	67	0.7	-0.3	233	105	35
Lower Middle Fork (Site 3)	11	80	57 64	1.7	0.4	284	138 115	59
Upper West Fork (Site 1)	13	55	67	1.1	-0.3	278	105	62
Lower West Fork (Site 2)	29	80	61 68	Similar to Site 3	0.3	228	124 102	55
Other Rosgen B Segments	N/A		70			N/A		
Other Rosgen C Segments	N/A		60			N/A		
All Other Tributaries	N/A		70			N/A		

Source: " Table 8. Loading capacity of one-mile modeled stream segments" (Stohr and Leskie, 2000).

APPENDIX C

Detailed Monitoring Plan

This page purposely left blank.

Appendix C: Detailed Monitoring Plan

There are three levels of monitoring included in this monitoring plan: 1) ambient water quality, 2) implementation, and 3) source identification. Each is used to evaluate the adequacy of implementation of restoration measures (e.g., "best management practices" (BMPs)). Every five years Ecology will prepare and publish a status of monitoring efforts and data.

Ambient Water Quality

Temperature data is currently being collected by the Kittitas County Conservation District. Temperature loggers have been installed at several key sites in the Teanaway Basin to track stream temperatures for at least two critical seasons (July through September) – loggers will be removed over winter to prevent destruction during high flows. At the end of each season, the temperature data is compared to water quality standards.

Collection of suspended sediment and turbidity data in the Teanaway Basin began in October 2002, and will continue for at least two years after this date. Again, data will be compared to water quality standards after data is evaluated for correctness.

Monitoring stations, which have been established for both temperature and sediment/turbidity monitoring, are summarized below in Tables 4 and 5.

Table C-1: Monitoring Stations for Temperature

Station Name	Station Description	Latitude	Longitude
Mainstem Teanaway at Lambert Bridge	North side of the bridge	47° 10' 30.51" N	120° 50' 09.84" W
Mainstem Teanaway at Red Bridge	North side of bridge on Red Bridge Rd	47° 12' 05.27" N	120° 46' 53.05" W
Mainstem Teanaway at Violet Burke's Property	Rock bar on east bank of river.	47° 13' 52.92" N	120° 48' 51.15" W
North Fork Teanaway at Mouth	On west bank upstream, near junction of West Fork Rd.	47° 15' 26.60" N	120° 52' 48.29" W
North Fork Teanaway at Dickey Creek	Near south side of second North Fork bridge, on south bank, downstream ~ 500+ ft.	47° 17' 17.11" N	120° 51' 33.15" W
North Fork Teanaway at Middle Creek	On east bank in pool just upstream from Middle Creek mouth (between Indian Creek and Middle Creek).	47° 17' 49.16" N	120° 51' 25.39" W
Middle Fork Teanaway at Mouth	On east bank of West Fork, near bridge. (*Note: This site shared with USFS for quality control)*	47° 15' 31.90" N	120° 53' 51.42" W
West Fork Teanaway at Mouth	Near rock face on south bank of West Fork, on near west end of Middle Fork bridge.	47° 15' 25.08" N	120° 53' 56.55" W

Table C-2: Monitoring Stations for Suspended Sediment and Turbidity

Station Name	Station Location	Latitude	Longitude
Mainstem Teanaway at Lambert Bridge	Upstream side of the Bridge	47° 10' 30.51" N	120° 50' 09.84" W
Mainstem Teanaway at Red Bridge	Upstream side of bridge	47° 12' 05.27" N	120° 46' 53.05" W
West Fork Teanaway at Mouth	Upstream of first bridge across the West Fork	47° 15' 25.08" N	120° 53' 56.55" W
Middle Fork Teanaway at West Fork Teanaway Road	Upstream of bridge	47° 15' 31.90" N	120° 53' 51.42" W
North Fork Teanaway at Mouth	Upstream side of 1st bridge across North Fork	47° 15' 26.60" N	120° 52' 48.29" W
North Fork Teanaway at Dickey Creek	Upstream side of bridge	47° 17' 17.11" N	120° 51' 33.15" W
North Fork at Camp Lake Road (USFS Road 9701)	Upstream side of bridge just above mouth of Jungle Creek		
Lick Creek @ NF Teanaway Road	Upstream side of culvert (this site is dry much of the year)		
Middle Creek @ NF Teanaway Road	Upstream side of culvert		
Indian Creek @ NF Teanaway Road	Upstream side of culvert		
Jack Creek @ NF Teanaway Road	Upstream side of culvert		
Stafford Creek at USFS Road 9737	Upstream side of bridge		
Beverly Creek at USFS Road 9737	Upstream side of bridge		

Implementation

The Kittitas County Conservation District and the Natural Resources Conservation Service have been coordinating many of the implementation activities. Ecology will work with these agencies to provide frequent status reports of implementation.

Source Identification

Where ambient water quality monitoring identifies persistent "hot spots," efforts will be made to locate sources. These "hot spots" can be for either temperature or sediment/turbidity. The Kittitas County Conservation District will be working to identify these specific sources and to determine if they are natural or the result of human activities. Where possible, Ecology will then work with landowners to reduce pollution sources.

APPENDIX D

Schedules and Tracking

This page purposely left blank.

Appendix D: Schedules and Tracking

In an attempt to predict and project future successes in the Teanaway Basin, the following tables contain elements that take a conservative estimate of implementation that is reasonably expected to occur during the life of the TMDL (2000-2080), based on planning and funding sources that have been identified and secured at the time this document was completed. Much of the "goal" column has been left unfilled in several tables as future funding sources are unknown; These columns should be filled in over time as plans develop and funds are located. Additionally, note that all projections for voluntary stewardship actions are dependent on availability of appropriate funding to complete implementation at the level estimated. Should, in a given year, all funding for any type of voluntary implementation become unavailable after reasonable efforts have been made to secure such funding, then that type of voluntary implementation may be considered unavailable for that year. Further, this plan can be changed at any time with mutual consent from the Teanaway Temperature TMDL workgroup and Ecology.

1) Public education program. Ecology has committed to coordinating a public education program for Teanaway residents and other landowners and resource users. The Kittitas County Conservation District will, as funding allows, prepare and mail at least two educational items each year re riparian protection and restoration, road maintenance, etc.

Table D-1: Public Education Program.

Year	Educational Items Mailed to Teanaway Residents		Percent Achievement
	Goal	Result	
2002	2 items		
2003	2 items		
2004	2 items		
2005	2 items		
2006			
2007			
2008			
2009			
2010			
2011			
2012			
2013			
2014 - 2080			

2) Road Improvements by State and Private Forest Landowners under Forests and Fish Rules. Each year during the first five years after the adoption of the rule package recommended in the Forests and Fish Report, forest landowners will submit road maintenance and abandonment (RMA) plans covering approximately 20 percent of their property base (or more) to DNR for approval.

Table D-2: Road Improvements by State and Private Forest Landowners.

Year	Road Improvements and Maintenance		Percent Achievement
	Goal	Result	
2000	Forest landowners submit RMA plans for ≥ 20% of property base to DNR		
2001	Same as 2000		
2002	Same as 2000		
2003	Same as 2000		
2004	Same as 2000		
2005	Implement plan		
2006	Implement plan		
2007	Implement plan		
2008	Implement plan		
2009	Implement plan		
2010	Implement plan		
2011	Implement plan		
2012	Implement plan		
2013	Implement plan		
2014-2080	Implement plan		

3) Road improvements by US Forest Service in the Teanaway Basin. Under the Memorandum of Agreement between the US Forest Service (Region 6), Ecology, and EPA, the USFS will complete road maintenance and abandonment (RMA) plans covering approximately 20 percent of their property base per year, for the first five years of this agreement.

Table D-3: Road Improvements by US Forest Service

Year	Road Improvements and Maintenance		Percent Achievement
	Goal	Result	
2001	USFS will complete RMA plans for ≥ 20% of property base		
2002	Same as 2001		
2003	Same as 2001		
2004	Same as 2001		
2005	Same as 2001		
2006	Implement plan		
2007	Implement plan		
2008	Implement plan		
2009	Implement plan		
2010	Implement plan		
2011	Implement plan		
2012	Implement plan		
2013	Implement plan		
2014-2080	Implement plan		

4) Natural Resources Conservation Service (NRCS) funding of irrigation upgrades and private road improvements. EQIP funding levels will increase eight-fold over the next six years, so only the first six years are estimated.

Table D-4: NRCS Funding Levels in the Teanaway Basin

Year	Irrigation Upgrades, Road Improvements and Maintenance		Percent Achievement
	Goal	Result	
2003	$75,000		
2004	$75,000		
2005	$75,000		
2006	$75,000		
2007	$75,000		
2008	$75,000		
2009	> $75,000		
2010	> $75,000		
2011	> $75,000		
2012	> $75,000		
2013	> $75,000		
2014-2080	> $75,000		

5) Revegetation of riverbanks. Planting of trees and shrubs to increase shade and stabilize banks, will be completed by KCCD, NRCS, local landowners, and others. Funding will come from the Bonneville Power Administration, Ecology, and others.

Table D-5: Revegetation of Riverbanks

Year	Revegetation of Riverbanks		Percent Achievement
	Goal	Result	
2003	At least ¼ mile of riverbank		
2004	At least ¼ mile of riverbank		
2005	At least ¼ mile of riverbank		
2006			
2007			
2008			
2009			
2010			
2011			
2012			
2013			
2014-2080			

6) Bank stabilization. Stabilization actions, such as installation of revetments and barbs, will be completed by NRCS, KCCD, and others. Funding will be provided by Bonneville Power Administration, Ecology, and others.

Table D-6: Riverbank Stabilization

Year	Riverbank Stabilization Completed		Percent Achievement
	Goal	Result	
2003			
2004	20 sites		
2005	20 sites		
2006			
2007			
2008			
2009			
2010			
2011			
2012			
2013			
2014-2080			

APPENDIX E

Responsiveness Summary

This page purposely left blank.

Appendix E: Responsiveness Summary

From December 2, 2002 to January 14, 2003, the Washington Department of Ecology solicited public comments on the DRAFT detailed implementation plan (DIP) document. During this period, Ecology received formal comments from the following groups or individuals:

- The Yakama Nation
- Washington Department of Fish and Wildlife
- Washington Environmental Council
- Mrs. John J. Hanson

Where appropriate, the DIP document was subsequently modified to address the concerns of the commenters. Responses have also been crafted to address the commenters' concerns. Because several comments were quite similar, Ecology has directed responses to the issues raised rather than to each commenter. Copies of all comment letters are available on request from Ecology.

Comments received were grouped into three main categories:

1. Comments related to Ecology's technical assessment of water temperature in the Teanaway River basin (Stohr and Leskie, 2000).
2. Comments directed at proposed implementation actions to reduce water temperatures in the Teanaway River basin.
3. Suggestions for additional studies.

1. Comments related to Ecology's technical assessment of water temperature in the Teanaway River basin

The purpose of a "detailed implementation plan" is to do just that: describe in detail what actions are planned, and will be planned, as future funding is secured, to restore a water body and meet state water quality standards. In the comments received regarding this DIP, many suggestions were made regarding the inclusion of new scientific studies and findings that are of interest in the Teanaway, as well as a re-evaluation of the original technical assessment for this TMDL (Stohr and Leskie, 2000). However, the sole purpose of this DIP document is to describe restoration actions, not to re-evaluate the science and studies that prescribe the restoration actions. Since the technical assessment was completed in 2000, Ecology has continued to closely study the water quality, hydrogeology, proper functioning condition, and history of the Teanaway Valley and has consequently planned many of the implementation actions prescribed in the DIP with this additional knowledge in mind.

While most comments directed at issues that stem from Ecology's 2000 technical assessment of water temperature in the Teanaway River basin are beyond the scope of this DIP, a few of the technical issues are addressed here:

a. TMDL Timline is too long. The 80-year timeline was established to allow trees planted at the start of the TMDL to grow to mature height for maximum shade, because many locations in the project area will need to reach site potential shade in order to meet TMDL targets. Much of the implementation for this TMDL is expected to occur in the next decade, so that all possible work that can be done soon will be done soon, and

conditions should improve within the next few years. Numerous locations in the project area may achieve TMDL target temperatures much earlier than the full TMDL timeline indicates.

b. ***Other scientific reports and data should be added to the TMDL/DIP.*** We are pleased that more data is being collected and more reports are being generated regarding the water quality and hydrogeology of the Teanaway River basin. Ecology is also continuing to collect data to better evaluate the Teanaway River and tributaries and to mark progress as conditions improve. However, Ecology has already completed the technical assessment of this basin for this TMDL. Other studies of the Teanaway will follow in future years. Through Ecology's adaptive management process, and in line with future monitoring plans, additional technical information will be sought and utilized when the success of this TMDL is evaluated in the future.

c. ***Solar radiation on its own should not be considered the pollutant. The alteration of the environment that allows additional thermal inputs to the streams better characterizes the pollution.*** Ecology agrees that alterations to the environment are a significant factor in allowing the solar radiation to reach the stream water and in reducing summer instream flows. See Table 1 in the DIP.

d. ***[Yakama Nation researchers found two creeks in the Teanaway Basin that are below 3500 feet elevation (Bear Creek at 3220 feet and Johnson Creek at 3140 feet) and that meet temperature standards; this contradicts the TMDL finding that elevations below 3500 feet elevation cannot meet standards]. We would recommend that the temperature model developed for this TMDL and the estimated site potential shade be reevaluated and appropriately modified to truly reflect the potential stream conditions in the Teanaway.*** Recommendation noted, and Ecology is grateful for the data. As noted above, Ecology has already completed the technical assessment for this TMDL, but additional data will be gathered when the success of the TMDL is evaluated in the future.

2. <u>Comments directed at proposed implementation actions to reduce water temperatures in the Teanaway River basin.</u>

a. ***What are the exact plans to reconnect with historic stream channels, increase sinuosity of river, and increase use of hyporheic zone?*** Ecology agrees that these actions are important and intends to promote these actions wherever possible through technical assistance and funding (if available). The commenter is correct that these are critical to improving the general health of the river and in lowering water temperatures. However, Ecology doesn't have the staffing, funding, or legal authority to do more than is already included in the DIP.

b. ***Groundwater management needs to be a major emphasis of this effort.*** Ecology agrees that appropriate groundwater management is important to protecting instream flows. As is true of most river systems, the aquifer that is in hydraulic connectivity with the Teanaway River system is the upper, relatively shallow, unconfined aquifer. Any future applications for shallow wells (in the upper aquifer) to be used for irrigation or other non-

domestic purposes would likely be approved only if a corresponding (surface) water right from the Teanaway was exchanged for the new groundwater right. Most new domestic wells in the Teanaway Basin will likely be drilled to the lower, confined aquifer that is not in hydraulic continuity with the river system.

c. ***Allowing areas to flood in order to recharge ground water must also be an emphasized strategy..... Floodplain re-connection would address a number of identified problems ….. Reconnecting the river to its floodplain could be highly beneficial for attenuating high flows and recharging the aquifer and hyporheic zone for groundwater delivery. However, the qualifier statement of "wherever possible and appropriate" gives little assurance that this work will be done, or how much reconnection will be attained. Most of the DIP outlines ideas that could be beneficial for moderating stream temperatures, but takes few steps to assure that they will be implemented.*** Ecology agrees that it would be beneficial for the river to re-connect with the floodplain wherever possible, for numerous reasons as noted in the DIP and by various commenters. Ecology has presented this concept at many TMDL workgroup meetings, and has actively sought funding to allow willing landowners to make changes in order to allow the river to flood more and/or increase its sinuosity. However, Ecology does not have the legal authority to require that property owners change their land management uses in order to promote flooding or reconnection with the floodplain. In fact, flooding is detrimental to homes, outbuildings and other structures – so reconnection to the floodplain must be done with great caution, hence our qualifier of "wherever possible and appropriate."

d. ***… the DIP's almost complete dependence on public funding for both the voluntary and regulatory aspects of the implementation plan makes recovery questionable at best.*** As noted in the revised DIP, considerable private funds and donations of hundreds of hours of volunteer time have been contributed to restoration of the Teanaway. Further, where beneficial actions are taken in accordance with a law or legal agreement, the landowner will be spending private funds.

e. ***… the DIP does not adequately identify the methods for achieving the DIP's proposed remedies, even if public funding were to become available. Indeed, many of the sources of temperature problems listed in the DIP contain remedies with no identified implementation method at all. These important remedies include: implement seasonal grazing patterns, improve maintenance of earthen roads not used for forestry, protect riparian vegetation and streambanks, reduce sediment-laden return flows from irrigated agriculture, reduce sediment-laden flows from other sources (construction, etc.), and stabilize streambank with rock barbs, tree revetments.*** Many of these remedies are addressed in the DIP, and are reiterated here:

- Implement seasonal grazing patterns – all livestock below the forks are fenced away from riparian areas and, above the forks, the major landowner has a specific grazing management plan that is monitored by both the landowner and the lessee.
- Improve maintenance of earthen roads not used for forestry – Kittitas County has progressive road maintenance policies to protect its roadways from erosion. On remaining roads, technical assistance will be provided by Ecology, the KCCD,

and NRCS to help landowners develop erosion-protection methods. Where necessary and appropriate, Ecology can be called on to enforce water quality protection laws.

- Protect riparian vegetation and streambanks – Kittitas County and Ecology have shorelands protection laws that can be enforced; Forests and Fish rules protect riparian areas on state and private timber lands.
- Reduce sediment-laden return flows from irrigated agriculture – most/all irrigation return flows will be eliminated within the next five years as irrigation systems are upgraded to sprinklers, which have produced no irrigation return flows.
- Reduce sediment-laden flows from other sources (construction, etc.) – technical assistance will be provided to contractors and others to prevent runoff from construction.
- Stabilize streambank with rock barbs, tree revetments – the KCCD has been awarded a grant to install at least forty tree revetments for bank stabilization in 2004.

f. Voluntary measures have been tried many times in the past and have typically had limited success on their own ….. We would recommend that appropriate target temperature, riparian, and watershed conditions be set. Land practices should then be required to be conducted in a manner that will attain these target conditions. Other than for sediment reduction and protection of riparian areas, there are no legal instruments that can force landowners to change land management practices to meet specific temperature standards. Ecology hopes that through a combination of education, technical assistance, and financial assistance, landowners can be supported in their choice to embark on voluntary stewardship activities to reduce Teanaway water temperatures and enhance the "health" of the Teanaway watershed.

g. [The] statement [regarding the need to educate new Teanaway homeowners regarding riparian protection] is … contradictory. First, it mentions that the working group is concerned that as the valley population increases, some functionality of the [currently healthy] stream segments may be lost. We would agree with the same concern. However, the DIP outlines that current regulations (such as Agriculture BMPs, Forest Practice Regulations, and County Ordinances) and voluntary actions will protect stream temperatures. If these approaches will satisfactorily protect and reduce stream temperatures, then why would an increasing population have much effect? From our viewpoint and expertise, the measures in the DIP are not adequate and an increasing population will only compound the situation. Ecology cannot, nor does it intend to, prevent development of additional riverfront homes in the Teanaway Valley. Yes, an increasing population in the Teanaway will likely compound the problems. However, one of the most important defenses against additional degradation of river "health" in the Teanaway is educating new residents about how to protect "their" river and its sensitive riparian area. Ecology does not see a contradiction in educating the public about riparian protection.

h. ***The general approach of the TMDL and DIP is to follow existing regulations that pertain primarily to forested lands [Forests and Fish rules], and are untested and unproven for meeting temperature standards. The remaining land practices such as grazing and irrigation may take voluntary actions to help protect stream temperatures. This gives little assurance that stream temperatures in the Teanaway watershed will be adequately protected and restored. Both the TMDL and DIP need clear targets, goals, nd objectives that can be evaluated through time and are highly likely to bring stream temperatures into compliance with water quality standards and the needs of fish and other aquatic-dependent species.*** Ecology acknowledges that the Forests and Fish rules are new and untested, and that voluntary actions are required to reduce impacts from irrigation and grazing. However, complete restoration of a watershed such as the Teanaway is also an untested process, and it would be unrealistic and somewhat disingenuous for Ecology to set up specific temperature goals based only on estimations. The DIP therefore sets forth targets, goals, and objectives that are 1) as ambitious as possible, 2) realistic, and 3) supported by the TMDL workgroup.

i. ***We would recommend that several milestones or performance targets be established at five-year time frames. The DIP talks about monitoring at five to ten-year periods, but says little regarding the expected or targeted outcome, nor measures to be taken to correct problems.*** The DIP discusses many measures that will be taken to correct problems in the Teanaway. Because funding in many cases is uncertain, Ecology staffing levels are limited, and legal authority to force changes is also limited, it is unrealistic to set highly specific targeted outcomes. The Teanaway is a high energy watershed, and efforts to restore it will undoubtedly need to adapt as we try different approaches over time.

j. ***"Low summer instream flows also contribute to elevated water temperatures." This points out the need to evaluate and modify water withdrawal activities where necessary to achieve stream temperature targets. The TMDL and DIP have little discussion pertaining to the quantification of the effects of water withdrawals on stream temperatures, or how they will be modified to attain water temperature standards. The DIP mentions improvements to water delivery efficiency, but does not outline the amount of water efficiency that is needed or expected.*** Other than increasing instream flows through increased irrigation efficiency, the Teanaway Temperature TMDL does not intend to amend any water withdrawals from the Teanaway River. The planned (already funded for completion by 2005) increases in instream flows that will result from increased irrigation efficiency have been estimated to be at least 2.25 cubic feet per second. If agreeable to the Teanaway TMDL workgroup and others, minimum flows may be addressed in the future through the 2514 process.

k. ***[Voluntary] stewardship actions will be contingent on funding …. This gives little or no assurance that these voluntary measures will adequately improve stream temperatures …. [Table 1] gives no quantification of [the] remedial actions …. and gives little or no assurance that the remedies will be implemented or to the degree necessary to achieve water quality standards.*** As noted earlier, because many proposed restorative actions taken are voluntary, it is very difficult to predict how many of these

actions will take place. Many agencies have worked hard to secure funding to allow many of these actions to proceed, but they remain voluntary and are consequently more difficult to predict.

l. While promoting [agricultural] BMPs can be beneficial, there is no assurance that the quantity and placement of the BMPs will sufficiently lower stream temperatures. The reliance by the TMDL and DIP on standard regulatory practices is untested. Furthermore, many of the agriculture BMPs being promoted have been in use for several years and yet most stream temperatures are not meeting standards. Ultimately, the goals and objectives [in Table 3, "Intermediate milestones for the Teanaway Temperature TMDL"] need to set quantifiable [not just qualitative] stream improvement targets, and measures that will take place if these targets are not being attained. Correction of nonpoint source pollution takes time, and the changes are often incremental. Many agricultural BMPs have been implemented in the Teanaway, and more will be set in place in the next few years. Additionally, please refer to earlier sections in this document under "Monitoring Plan" and "Adaptive Management" for information regarding how Ecology will re-assess, and if necessary re-direct, the TMDL if progress toward TMDL targets is not being attained in a timely fashion.

m. In addition, road maintenance requirements of the [Forests and Fish] rules only require road improvement work; not whether the sediment abatement work will be sufficient for protecting stream temperatures. The road maintenance plans have no set sediment reduction target. Ecology, likely via grantees and subcontractors, will continue to monitor the sediment levels in the Teanaway, as part of the *Upper Yakima River Basin Suspended Sediment, Turbidity and Organochlorine Pesticide TMDL*. Baseline sediment levels will be established, and sources of sediment will be identified. Once identified, sediment sources will be eliminated wherever possible.

n. … these actions [implementation of BMPs, developing and implementing nonpoint source control plans, and greater public awareness of related legal encouragement to remediate water temperature control problems] may help alleviate stream temperature problems, but by no means give reasonable assurance. Our goal for the Teanaway Temperature TMDL is "site potential shade" throughout most of the Teanaway Basin, which refers to "the shade that is [generally] achievable with [mature riparian vegetation] and a return of active channel zone width to more natural conditions." Therefore, Ecology has determined that full implementation of BMPs, thoughtful development and full implementation of well-planned nonpoint source control plans, and increased public awareness of related legal encouragement to remediate water temperature control problems does indeed provide legal reasonable assurance that "site potential shade" will be achieved.

o. Both the TMDL and DIP need to set clear targets, goals and objectives that can be evaluated through time and are highly likely to bring stream temperatures into compliance with water quality standards and the needs of fish and other aquatic-dependent species. As noted in the DIP, temperature monitoring will occur at regular intervals (at least every five to ten years) in the Teanaway to assess progress of this

TMDL. The Adaptive Management section of the DIP states that if reasonable progress is not being made (i.e., water temperature is not decreasing), additional measures may need to be taken to ensure that temperature is reduced. These additional measures may include further technical assistance, financial assistance, and enforcement of applicable laws and legal agreements by appropriate agencies.

p. Two of the most promising results of the TMDL were the rather obscure inclusion of consideration of mechanical deepening of the main channel, and also a possibility of including additional storage. These items are still under consideration, as appropriate.

3. <u>Suggestions for additional studies</u>

a. A GIS "Reaches" like study: this study would look at historic geomorphic features coupled with a detailed understanding of the gaining reaches, and would be a valuable exercise to help prioritize areas on which to focus. Ecology agrees. The workgroup is also strongly in favor of such a study.

b. One simple monitoring and implementation method that should be included in the DIP is an annual check on completion of the required 1/15 of the Road Maintenance and Abandonment Plans (RMAPs) by the Forest Service and private forestry companies in the basin. Good suggestion. Ecology will check annually with DNR to ensure that timber managers in the Teanaway are complying with the Forests and Fish rules.