4bAnalysis for Entiat River

The Washington Department of Ecology (Ecology) Integrated Report (IR) proposes to exclude two temperature listings (3731 and 73057), from the 303(d) list and place these water bodies in category 4b of the IR. Ecology's basis for excluding these water bodies from the 303(d) list is outlined in this analysis.

Identification of Segment and Statement of Problem Causing Impairment

These segments are located just above the mouth of the Entiat River, which empties into the Columbia River. The most likely causes of the temperature impairment are the loss of riparian vegetation and changes to the channel width-to-depth ratio caused by sedimentation from roads, timber harvest, and agricultural practices.

Description of Pollution Controls and How They Will Achieve Water Quality Standards

The Entiat Watershed Planning Group produced the Coordinated Resource Management Plan in 1999. This plan evaluated the watershed's condition and made recommendations designed to protect water quality and threatened and endangered fish. The sources of temperature impairment in the Entiat River are identified in the plan as:

- Reduced riparian shade resulting from removal of riparian vegetation and stream widening.
- Timber harvest and roads on Forest Service land in the upper basin also contribute to loss of riparian shade and degraded channel conditions.

The plan made several recommendations to help cool the water.

- Work with landowners to maintain and enhance riparian vegetation and wetlands, and implement streambank planting.
- Continue to work with NRCS on conserving water used for irrigation.
- Continue compliance with the forest practices rules, which protect riparian areas and allow for their re-establishment.
- Promote incentives for landowners to restrict unlimited access to streams by livestock.

The plan also included a recommendation to further plan under the Watershed Planning Act to evaluate base flow needs and establish minimum in-stream flows. The subsequent WRIA 46 Entiat Watershed Management Plan, which incorporated the findings of the Coordinated Resource Management Plan and recommended establishment of instream flows, was adopted unanimously by the Chelan County Board of Commissioners on September 13, 2004. The instream flow recommendations were codified as Chapter 173-546 of the Washington Administrative Code.

Land ownership in the basin is approximately 85% federal, which is primarily in the upper basin, 6% state, and 9% private. The upper watershed is in Wenatchee National Forest. Between the forest boundary, at river mile 26 and river mile 11.7, the land use is primarily rural residential, either year round or seasonal, with a few dispersed pasture

areas. Below river mile 11.5, the use is predominantly pear and apple orchards with some rural residential use.

The watershed planning committee performed an aerial remote sensing survey and used the Stream Network Temperature Model (SNTEMP) to identify problem areas in the river and to test different scenarios of best management practices implementation. The model was used to evaluate the effects of three alternative actions, singly and in combination. The three are:

1. Increase in stream flow,
2. System wide increase in riparian shade,
3. Reduction in channel width in the lower river.

Increases to streamflow were evaluated because a larger mass of water would take longer to warm. Increased shade was evaluated because it would reduce the amount and intensity of solar radiation reaching the water, thus reducing the water temperature. In the Entiat River watershed, numerous forest fires, combined with flood control measures in the lower 15 river miles, have significantly reduced the overall amount and quality of riparian vegetation along the river. The Entiat Watershed Planning Unit has recommended actions that would increase the riparian vegetation within the watershed, as well as reduce the threat of future forest fires that would threaten both the existing and proposed improved riparian vegetation. Decreased channel width was evaluated because it is expected that the channel will return to a more normal geomorphology once functioning riparian areas are re-established.

Based on the results of the model simulations performed with SNTEMP, the following recommendations were made:

- SNTEMP predicted reductions in water temperatures for all three alternative actions, suggesting that implementation of any of the three actions would help reduce water temperatures to some extent.
- Of the feasible alternatives, SNTEMP predicted the largest reductions in water temperatures when riparian shade was increased by 50% (Alternative Action 3). Therefore, an aggressive approach to increasing the current riparian shade conditions throughout the watershed should be undertaken to address high water temperatures.
- In addition, if Entiat Watershed Planning Unit resources are available, decreases to channel width in the lower 10 RMs in conjunction with changes in shade should also be considered (Alternative Action 4).
- A 10% change in streamflow is not likely to significantly affect water temperature.

As identified in the watershed plan and in the SNTEMP analysis of the Entiat River, the most effective best management practices to address the temperature listing are revegetating riparian areas, preventing further riparian vegetation removal, and restoring channel geomorphology and width-to-depth ratios.

Wenatchee National Forest has an approved TMDL, prepared by the Department of Ecology, which specifies areas throughout the forest where riparian shade must be maintained or re-established. The Forest Service is also required to comply with state

water quality standards. Implementation of the TMDL should restore 85% of the watershed to a fully functioning riparian condition and help re-establish the original channel geomorphology. Management of state and privately owned lands in the watershed must comply with the state forest practices rules, which are designed to achieve compliance with the state water quality standards and the Clean Water Act. For the remainder of the watershed, the 9% that is privately owned and not used for forestry, the watershed plan recommends re-establishing and maintaining riparian vegetation along at least 50% of the stream. The area is subject to wildfires, which make it unlikely that a higher percentage of riparian vegetation could be continuously maintained. This percentage is similar to that prescribed in the eastside section of the state forest practices rules. Implementation of the Wenatchee National Forest TMDL, combined with required compliance with the state forest rules and the riparian restoration strategy for the remainder of the land in the watershed is expected to restore riparian areas in the watershed to a fully functioning condition. This will result in compliance with the state water quality standards either by cooling the river to or below the numeric criterion or by achieving the Entiat River's natural condition.

Several enforceable pollution controls will assure implementation of the watershed plan.

- The Forest Service land is subject to the Wenatchee National Forest TMDL.
- The remainder of the watershed is subject to the state forest practices rules for forestry land uses.
- The agricultural and residential uses in the lower watershed are subject to the Chelan County Shoreline Master Program and critical areas ordinance, both of which are designed to minimize or eliminate impacts to riparian vegetation due to development activities on private lands.
- The Entiat Water Resources Management Program has been codified as Chapter 173-546 of the Washington Administrative Code. This rule establishes enforceable minimum in-stream flow requirements for the upper and lower Entiat River and the Mad River, a tributary of the Entiat.

State and local agencies are working together to restore Entiat riparian areas.

The following projects were completed prior to 2008.

- The Department of Fish and Wildlife completed the Wilson side channel reconnection project in 2004. This project consisted of placing a diversion pipe in the Entiat River that provides an estimated 10 cubic feet per second of flow through 1,000 feet of rehabilitated side channel. The side channel was restored using large woody debris, boulders, and riparian plantings. The project is located at river mile 6.7.
- The Department of Fish and Wildlife completed an off channel habitat project in 2004. This project deepened a .3 acre spring-fed pond and installed rootwads to provide habitat and cover for juvenile fish. The pond's outlet stream was cleared and deepened, and several large woody debris structures were installed along the Entiat River just upstream and downstream of the stream outlet. The project is located at river mile 6.2.

- Chelan County Public Works, with the cooperation of several other agencies, replaced the Stormy Creek culvert in 2004 with a pre-cast concrete bridge. The slope in the area was regarded from 6% to 4%, spawning gravel was placed in the creek, and riparian vegetation was planted. Approximately ½ mile of fish habitat was re-opened.
- The Cascadia Conservation District re-vegetated an estimated 1.3 acres of riparian vegetation between river mile 3.2 and 3.8 in 2005 and 2006. In 2007, an additional 1.1 acres were re-vegetated at several locations in the drainage.
- Three surface water diversions were converted to groundwater wells for four irrigators in the basin. Wells were installed at river miles 4.0 and 6.3.
- The Bridge-to-Bridge, Phase 1 project consisted of the installation of a rock crossvane, side-channel habitat improvements, irrigation intake and outfall improvements, and riparian restoration. A rock crossvane was constructed to convey water into the Chelan County PUD irrigation side-channel, canal and intake pipe. The rock crossvane and the eleven rootwads were constructed to increase pool habitat and instream complexity. The rehabilitated side-channel had three boulder clusters and two log structures (constructed from 4 logs) installed to increase complexity and off-channel habitat. The slide-gate to the irrigation intake was replaced to allow year round watering of the 1000 feet of irrigation canal. The irrigation outfall structure had an additional flashboard installed and two rock step-pools installed to assist in fish passage. This project was designed by the NRCS and installed by the Cascadia Conservation District in fall of 2006 at river mile 3.2.
- The Milne Project, located between river mile 2.8 and river mile 3.2, consisted of the installation of 13 logs with rootwads, six boulder barbs, six boulder clusters, and an irrigation diversion barb with sluice gate. Riparian planting along the access areas was also completed. The structures were installed in September 2007 with funds from the Salmon Recovery Funding Board and US Bureau of Reclamation.
- The Hanan-Detwiler rock crossvane and large woody debris were installed at rivermile 5.1 with funding from the Salmon Recovery Funding Board and US Bureau of Reclamation. The rock crossvane will serve to convey water into the Hanan-Detwiler irrigation system and provide pool habitat. The two log structures each consisted of two logs with rootwads installed into the banks to provide fish habitat and a source of gravel through scouring. The project was completed in October 2007.

The following projects were completed after 2008.

- The Roaring Creek Flow Enhancement and Barrier Removal project removed two surface water diversions from Roaring Creek between RM 0.85 and RM 1.3. This project was completed in 2010.
- The 2010 Lower Entiat Riparian Restoration Project restored 4.3 acres (.65 miles) of riparian habitat directly adjacent the Entiat River.
- The 2011 Entiat Riparian Project restored 4.2 acres of riparian habitat directly adjacent the Entiat River, by installing native riparian trees, shrubs, and native grasses (5 of 5 sites), livestock exclusion fencing (1 of 5 sites) and temporary irrigation systems (3 of 5 sites), and controlling of noxious weeds at all five sites.
- The Entiat RM 21.5 LWD and Riparian Restoration project established woody riparian vegetation at the site by combining the installation of 14 large woody debris

(LWD) structures along 645 feet of existing bank with an accompanying 100-foot wide, approximately 1.9 acre, riparian planting area behind it. This project was completed in 2010.

- The 2010 Surface Water to Wells Conversion project replaced a 1.5 cfs surface water diversion for the Gaines Ditch in the lower Entiat River with four irrigation wells. Replacing the surface water diversion avoids fish entrainment and mortality, as well as providing water savings through higher delivery efficiencies. The conversion also keeps surface water in stream during low flow, peak irrigation use periods in late summer and fall.
- The 2012 Tyee Ranch project installed 4.5 acres of riparian plantings, placement of engineered log jams and other large woody debris (LWD) structures, and an excavated re-connection to floodplain and abandoned side channels.

Estimate or Projection of Time When Water Quality Standards Will be Met

Because it will take time to complete restoration projects and for new vegetation to grow, we estimate that compliance with the temperature standard will be achieved in 2028.

Schedule for Implementing Pollution Controls

As described earlier in this report, the Entiat River Planning Unit has already begun implementing restoration projects, and continues to work with other agencies to design projects, obtain funding, and complete the actual restoration work. There is a good record of on-going implementation, and we expect this to continue.

Monitoring Plan to Track effectiveness of Pollution Controls

The Entiat River is monitored by one of Ecology's long term monitoring stations so there will be direct information available to determine whether implementation activities are making a difference.

Commitment to Revise Pollution Controls as Necessary

Ecology will continue to work with the Entiat River Planning Unit to ensure that implementation continues and that water quality in the Entiat River continues to improve. We fully expect the program to achieve compliance with water quality standards. However, if it does not, Ecology will work with the planning unit to determine other controls that could be used to achieve compliance.