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Umpqua Basin TMDL

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Umpqua Basin
Total Maximum Daily Load (TMDL)
and
Water Quality Management Plan (WQMP)

Primary authors are:
Daniel Turner, Brian Kasper, Paul Heberling, Bobbi Lindberg,
Mike Wiltsey, Gary Arnold, and Ryan Michie

For more information:
http://www.deq.state.or.us/WQ/TMDLs/UmpquaBasin.htm

Paul Heberling, Basin Coordinator
Oregon Department of Environmental Quality
221 Stewart Avenue, Suite 201
Medford, Oregon 97501
Phone 541-440-3338 x224 • Fax 541-776-6262

Umpqua Basin Total Maximum Daily Load (TMDL)

Outline of Contents

Executive Summary

Introduction

This document contains Total Maximum Daily Loads (TMDLs) for several types of water pollution causing impairment of waterbodies in the Umpqua Basin. TMDLs are limits on pollution intended to bring rivers, lakes and streams into compliance with water quality standards designed to protect human health, aquatic life, and other beneficial uses of water. Development of TMDLs is required by the federal Clean Water Act of 1972, and the Oregon Department of Environmental Quality is the state agency authorized by federal and state law and regulation to develop these pollution limits.

The Umpqua Basin in Southwestern Oregon comprises about 3.24 million acres, 90% of which is federal, state and private forestland (2.92 million acres). County population was estimated at 103,152 in 2004, and the basin is also home to a number of species of salmonid fishes, including coho salmon, fall and spring chinook salmon, summer and winter steelhead, and seagoing and resident cutthroat trout. The North Umpqua River is a world-renowned fishery, and water-based recreation is important throughout the basin. Recent reports from the team working on salmon recovery have identified water quality in the South Umpqua River and tributaries as one of the problems limiting coho salmon recovery there.

Much of the Basin's timberland is in federal ownership. The Umpqua National Forest comprises over 1 million acres, and another 593,000 acres are administered by the Bureau of Land Management. About 28,000 acres of the Elliot State Forest are in the Umpqua Basin. The balance of about 1.5 million acres of forestland is privately owned.

Section 303(d) of the federal Clean Water Act requires states to periodically list waterbodies that do not meet water quality standards ("303(d) list"). The 2004-06 303(d) list identified 262 stream segments in the Umpqua Basin as water quality limited, and needing TMDLs. The list is available online at http://www.deq.state.or.us/wq/303dlist/wq2004intgrrpt.htm and in Attachment D of Chapter 7, the Water Quality Management Plan.

The majority of these listings (162) are for stream temperature, which affects rearing and spawning habitat for salmonids, which need cold water to survive. Three spawning listings on the North Umpqua River, which need additional data and analysis, are not addressed by this TMDL.

There are 25 listings in the basin for bacteria violations, based on standards for both water-contact recreation and the safety of shellfish for human consumption. The TMDLs for bacteria will address all 25 bacteria listings on the 2004-06 303(d) list and allocations apply basinwide. Similarly, the six listings for biological criteria are all addressed by these TMDLs.

There are also 31 listings for dissolved oxygen, pH, phosphorus, chlorophyll a and excess algae. Most of these listings (29) are addressed by the TMDLs in this document. One fall-winter-spring dissolved oxygen listing (for Calapooya Creek) has changed as a result of revised standards, and further monitoring is needed to determine pollution limits. In addition, there is a pH listing for a one-mile stretch of the North Umpqua River that will not be covered by these TMDLs, but will likely be addressed through other processes. These listings will be addressed in the next TMDL cycle, estimated for approximately 2011, unless addressed earlier through other processes.

On the 2002 303(d) list, there were seven listings in the basin for sediment. Four of those streams, all in the North Umpqua subbasin, were de-listed on the 2004-06 303(d) list based on additional data showing criteria are being met, and TMDLs were not needed. However, the de-listing for Canton Creek may have been an error. See comments in Sediment Summary below. The remaining three sediment-listed streams are in the South Umpqua subbasin. Analysis of new data, together with re-analysis of old data, indicated that there is a continuing question as to whether sediment is impairing salmonid habitat and spawning in these streams. Therefore, until further data is gathered, work to develop TMDLs on these three streams has been placed on hold, and these streams will remain on the 303(d) list.

TMDLs address six water bodies identified as impaired for biocriteria. There are also 35 listings for toxic substances including mercury and arsenic. They will be addressed during the next TMDL cycle, when more data will be available. These streams were added to the 303(d) list after most Umpqua TMDL field work had been completed. Two chlorine impairments from the 2002 303(d) list are being addressed by point source effluent limits in the facilities' discharge permits, so these segments have been moved to Category 4, (Other pollution limits address the problem) on the 2004-06 303(d) list.

TMDLs

Total Maximum Daily Loads have been developed for most of the types of pollution causing impairment of beneficial uses in the Umpqua Basin. These TMDLs determine the amount of a given pollutant (e.g., heat, fecal bacteria, nutrients) that a waterbody may receive without violating a water quality standard. This amount of pollutant is called the Loading Capacity, which then is allocated to various uses. The allocations for point source discharges are termed "waste load allocations," and allocations for nonpoint sources of pollutants (e.g., urban, agricultural or forest runoff) are called "load allocations." The sum of all allocations, plus a margin of safety for uncertainty, and a reserve capacity for future needs, is the TMDL.

The TMDLs in this document cover 219 of 262 Umpqua Basin listings on the 2004-06 list. The TMDLs cover about 1,669 stream miles of the 5,000 stream miles in the basin, or about 33% of Umpqua Basin streams.

Bacteria TMDL Summary

Oregon's bacteria water quality standard incorporates protection of public health in two different ways. One numeric criterion protects water contact recreation; another, the more stringent of the two, protects waters used to grow shellfish for human consumption. The Umpqua Basin bacteria TMDLs address both aspects of the standard. The document addresses 25 bacteria listings on the 2004-06 list of impaired waterbodies, and the allocations apply basin-wide.

Violations of the bacteria standard protecting shellfish have occurred in the estuarine portion of the lower Umpqua River. Listings based on the water contact recreation standard occur throughout the basin, for Elk Creek, Calapooya Creek, Deer Creek, North Fork Deer Creek, Myrtle Creek, Yoncalla Creek, the South Umpqua River and the mainstem Umpqua River. In general, nonpoint sources account for most of the observed bacteria standard violations. Wastewater treatment plants were given waste load allocations based on the water contact recreation standard of an average of 126 *E.coli* organisms per 100 milliliters.

Loading capacity and nonpoint source load allocations were determined for various streamflows. Different load allocations were therefore determined for high flows, wet, midrange, dry and low flows.

Studies by DEQ during storms indicated that forested lands do not contribute any significant bacteria load to streams in the Umpqua Basin, but agricultural, rural residential and urban lands as well as possible turbulence releasing bacteria from stream sediments were the sources of bacteria. Since relative contributions could not be determined from the data, the load allocations for nonpoint sources were allocated to all nonpoint sources in the basin.

Temperature TMDL Summary

DEQ's water quality standards are applied to protect the most sensitive beneficial uses in a waterbody. Numeric criteria in the temperature standard were developed to protect different aspects of the life histories of salmon and trout: spawning, rearing and migration. During periods when spawning does not occur, all of the streams in the Umpqua Basin are designated as either core cold-water habitat or salmon rearing and migration habitat. Spawning areas and times of spawning have been determined for streams in the basin, and the spawning criterion was designed to protect the life history stages from spawning

through egg emergence. The document addresses 159 temperature listings on the 2004-06 list of impaired waterbodies, and the nonpoint source load allocations apply basin-wide.

Extensive temperature data collection in the basin was augmented with Thermal Infrared Radiometry, which measured surface water temperatures on major rivers and streams on an August afternoon. This data was used to develop mathematical models of stream temperature using the model Heat Source. Once the model is calibrated for a stream system (i.e., it accurately depicts current conditions), it can be used to simulate future conditions with changes in riparian vegetation, flows, channel width and other conditions.

The mainstem of the Umpqua River and its major tributaries were modeled to determine the "natural thermal potential" (NTP) of the system. The NTP is the thermal profile of a water body using best available methods of analysis and the best available information on the site potential riparian vegetation, stream geomorphology, stream flows and other measures to reflect natural conditions with human-caused influence minimized (i.e., the temperature that would result with natural streamflow and vegetation grown to its site potential). In nearly all cases, the "natural thermal potential" in the Umpqua Basin was determined to be higher than the relevant numeric stream temperature standard. In such cases, the "natural thermal potential" replaces the numeric criterion for the modeled stream reaches.

For point sources of heat such as wastewater treatment plants, waste load allocations have been developed that limits the increase in temperature of the receiving stream to a portion of the Human Use Allowance. The Human Use Allowance allocated to point sources in the Umpqua Basin point sources is a 0.1^{o}C increase above the applicable criterion. For nonpoint sources, the load allocation is to allow site potential vegetation to develop in the riparian zone. Site potential species and heights were determined by ecoregion, a geographic concept that takes into account climate, soils, slope, elevation and natural vegetation. Nonpoint sources are also allocated a 0.1^{o}C increase above the applicable criterion. The remaining 0.1^{o}C increase allowed for human use is allocated to reserve capacity to accommodate for future growth.

This document addresses rearing/migration and spawning temperature impairments on streams without point sources or dams for the entire basin. In rivers that have no point sources or dams, activities designed to improve summer stream temperatures are the same activities that will improve fall and winter temperatures. TMDLs have been completed for streams with point sources and dams during the rearing/migration time period. During the spawning period, there are three impaired segments on the North Umpqua River that are downstream of a hydro-electric project and a point source is present. More data and analysis are needed to complete those TMDLs. Likewise, on other steams and rivers that are not currently identified as impaired during the spawning period and have point sources or dams, the TMDLs were not computed.

Nutrients (Including Dissolved Oxygen, pH, Phosphorus, Chlorophyll a, and Algae/Aquatic Weeds) TMDL Summary

Nutrient enrichment is the underlying cause for most of the Umpqua Basin's 303(d) listings for dissolved oxygen, pH, phosphorus, chlorophyll a and aquatic weeds/algae. Elevated stream temperatures and water which has little natural capacity for nutrient assimilation due to the area's geology contribute to the problems. Both nonpoint and point sources contribute nutrients, but streams with wastewater treatment plants typically show the most impact, particularly in the late summer and fall. This document addresses 29 listings related to excesses nutrients on the 2004-06 list of impaired waterbodies, including those associated with Diamond Lake (see below).

For most of the stream listings, mathematical water quality models were developed using extensive instream data to determine the Loading Capacity for nutrients. The modeling was done using data from mid- to late summer in order to simulate the conditions at the time of year when most of the standards violations occurred.

DEQ used the model QUAL2Kw, which is an EPA-supported model for nutrient interactions. The version includes equations that take into account the attached algae (periphyton) which are common in the Umpqua system. The modeling indicated that the capacity of some streams, in particular the South Umpqua River, is very low for assimilating nutrients, and that the excess nutrients were fueling the growth of the periphyton, which depresses dissolved oxygen and increases pH. High stream temperatures affect these processes and also affect dissolved oxygen directly, since water's capacity to hold oxygen decreases as it warms up.

Model results were used to develop waste load allocations for the point sources and load allocations for nonpoint sources in these systems which will lead to the achievement of water quality standards.

Modeling of Calapooya Creek during the summer indicated pH under natural nutrient and shade conditions would exceed the water quality criterion. In cases where natural pH values exceed the numeric criterion in the standard, the natural values replace the numeric criterion. Waste load and load allocations were calculated so that Calapooya Creek will meet the summer standard for DO, and provide for no increase over the pH criterion, or the estimate of natural pH, whichever is larger.

For Cow Creek, listed on the 2004-06 303(d) list for pH during the summer, meeting the waste load and load allocations for phosphorus is expected to result in meeting the pH standard.

The South Umpqua River is listed for dissolved oxygen, pH, phosphorus, chlorophyll a and algae violations during the summer. The water quality model indicated that in portions of the river, natural pH would exceed the water quality criterion in the standard; therefore estimated natural pH becomes the standard. Waste load allocations and load allocations were developed to meet the dissolved oxygen and pH standards during the summer.

In Steamboat Creek, listed for both pH and dissolved oxygen during the summer, non-spawning period, and in Jackson and Black Canyon Creeks, both listed for pH violations, analysis indicated that the only discernable sources of nutrients are natural, but that pH and DO were being affected by lack of riparian shade causing increased stream temperatures. For Steamboat Creek, a water quality model was used to estimate the impact of riparian shade on pH and to estimate natural pH values. For Jackson and Black Canyon Creeks, analysis showed that meeting the temperature TMDL allocations for shade would result in the streams meeting the pH criterion. For all three streams, background and natural sources were given load allocations equivalent to the Loading Capacity for the nutrients, and the load allocation for nonpoint sources and reserve capacity is to cause no measurable increase in pH levels.

In Elk Creek, analysis indicates that sediment oxygen demand is the source of dissolved oxygen deficits and pH violations during the summer. Sediment oxygen demand is the process that results from excessive loads of organic materials that feed biochemical activity occurring in stream bottoms, particularly those stretches where slow velocity has allowed river sediments to collect. In these situations, reducing organic solids to prevent the buildup of sediments is expected to reduce sediment oxygen demand and therefore improve dissolved oxygen. Allocations to point and nonpoint sources therefore target organic solids. The allocations addressing the temperature and dissolved oxygen impairments will also improve pH levels.

In Deer Creek, Biochemical Oxygen Demand (BOD) was determined to be the pollutant causing dissolved oxygen problems. Since there are no point sources, nonpoint sources were given a load allocation to reduce inputs of organic solids. Agricultural land, rural and urban areas are the most likely contributors of substances causing BOD.

Sediment Summary

Four North Umpqua subbasin streams were listed for sediment on the 2002 303(d) list: Canton Creek, Little Rock Creek, Horseheaven Creek and Steamboat Creek, all in the Steamboat Creek Watershed. The Umpqua National Forest submitted additional data seeking to de-list these four streams. After reviewing the additional data, these four streams were delisted on the 2004-06 303(d) list. However, after some additional comments were received by the 303(d) list review staff, during the public review process for the Umpqua TMDL, it appears that Canton Creek will be placed back on the 303(d) list for sedimentation.

The South Umpqua Subbasin has three listings for excess sediment: Beaver Creek, Jackson Creek and the South Umpqua River. Extensive re-analysis of the data supporting the listings in light of recent scientific advances indicates that there is no clear evidence that sediment levels are impairing salmonid habitat or spawning.

DEQ is currently developing a new method of determining the condition of streambeds with respect to sedimentation. Until the Department completes this work, these three South Umpqua streams will remain on the 303(d) list and will be reassessed when data relevant to the new criteria have been collected.

The Little River TMDLs approved by EPA in 2001 included a TMDL addressing excessive sediment in Little River and Cavitt Creek. Stakeholders in the basin requested that the Department reconsider this portion of the TMDL. Since the TMDL was adopted, there have been significant restoration activities in the Little River Watershed, including road and culvert work, that address sediment concerns. And although additional data has been provided, until the Department completes work on sedimentation criteria, DEQ will decline to remove or change the existing sediment TMDL.

Biocriteria TMDL Summary

The Umpqua Basin has six listings for Biological Criteria on five waterbodies, based on indices reflecting the integrity of the macroinvertebrate (aquatic insect) community at each sampling site. This approach does not identify a particular pollutant, although characteristics of the local macroinvertebrate community can be suggestive of the type of water quality problem affecting the site. For example, if a greater percentage of the community is composed of species able to tolerate higher temperatures while species sensitive to temperature are absent, this suggests that temperature is a problem for that location.

For each biocriteria listing, analysis indicated that the problem was likely heat or another pollutant which is being addressed elsewhere in this document. Implementing the allocations for the identified pollutants is expected to result in a return to reference conditions of the local macroinvertebrate community. Therefore, no additional allocations were developed for the biocriteria listings.

Diamond Lake TMDL Summary

Diamond Lake, in the Umpqua National Forest, is listed for algae and pH, which have led to the overgrowth of *Anabaena flos-aquae*, a species of blue-green algae which produces toxins under certain conditions. Algae blooms during the summer, and, most recently, the fall, have led to closures of the lake due to danger from the toxins.

Extensive studies have been conducted by the Umpqua National Forest, the Environmental Protection Agency, and DEQ. The studies identified the massive population growth of an invasive fish (Tui chub) as the source of the nutrients fueling the algae growth. The proposed TMDL will control water quality through limitations on biomass, implemented by removing or killing all fish in the lake and restoring limited stocking of sport fish by the Oregon Department of Fish and Wildlife. Continued monitoring will determine if the fish stocking levels are appropriate. This TMDL is already being implemented by the Umpqua National Forest and many state and federal agencies after an extensive public and environmental review process.

Chlorine Summary

The South Umpqua River and Cow Creek were both identified as water quality limited for violation of the chlorine standard on previous 303(d) lists. The chlorine limitation was based on the concentrations of chlorine in effluent from wastewater treatment plants in the vicinity.

Analysis indicated that the problem could be addressed through provisions of the DEQ discharge permits applicable to the wastewater treatment plants. Those permits have been renewed recently, and contain effluent limitations for chlorine. These limits will result in the chlorine water quality standard being met. Since this will adequately address the listings, Total Maximum Daily Loads and allocations are not necessary. For this reason, the South Umpqua River and Cow Creek have been designated as category 4(b) (Other pollution control requirements are expected to address all pollutants and will attain water quality standards) on the 2004-06 303(d) list.

Total Dissolved Gases Summary

Four streams in the North Umpqua subbasin, all within the PacifiCorp North Umpqua hydroelectric project, were identified on the 2002 303(d) list as impaired for excess total dissolved gases related to operation of the turbines in the system. These problems have been addressed through the Clean Water Act Section 401 certification process required as part of the system's relicensing by the Federal Energy Regulation Commission. That has eliminated the need for TMDLs. For this reason, the four streams are now designated as category 4(b) (Other pollution control requirements are expected to address all pollutants and will attain water quality standards) on the 2004-06 303(d) list.

Water Quality Management Plan

The TMDLs include a Water Quality Management Plan designed to identify strategies and approaches for implementing the TMDLs. The WQMP identifies the Designated Management Agencies (local, state and federal government agencies with responsibility for addressing pollution problems), as well as proposed management strategies designed to meet the allocations in the TMDLs. It identifies currently-available Implementation Plans (all of which currently are Water Quality Restoration Plans prepared by the Umpqua National Forest, Siuslaw National Forest, and the Bureau of Land Management). It also establishes a schedule for the submission of Implementation Plans by other Designated Management Agencies. It also incorporates voluntary action plans developed by the former Umpqua Basin Watershed Council (now known as Partnership for Umpqua Rivers – Your Watershed Council).

Public Process

The Umpqua Basin TMDLs have been developed over a course of many years and have involved extensive participation by the public during public meetings addressing various aspects of the TMDL process. In addition, a Technical Advisory Committee representing basin stakeholders made many recommendations during the process that have greatly improved these TMDLs.

These TMDLs were available for public review for 60 days. All comments were considered before final TMDLs were adopted. Responses to the public comments are available in a separate document located on DEQ's website.

Conclusion

The TMDLs address 219 out of 262 listings of impaired waterbodies in the Umpqua Basin, and almost one-third of Umpqua Basin streams. Implementation of the waste load allocations and load allocations is expected to bring those waterbodies back into compliance with water quality standards so the beneficial uses will be protected. The other 43 listings will await new methods or additional data before TMDLs or other assessments are completed.