Stakeholders Implement Practices to Reduce Bacteria in the Tillamook River

Waterbodies Improved

High bacteria levels from livestock and human sources caused Oregon's Tillamook River and several of its tributaries to violate water quality standards, prompting the Oregon Department of Environmental Quality (ODEQ) to add these to the state's Clean Water Act (CWA) section 303(d) list of impaired waters in 1998. With support from multiple organizations, landowners installed best management practices throughout the watershed. Data analyses show that bacteria levels declined significantly between 1999 and 2012. The downward trends are expected to continue; the Tillamook River and many of its tributaries should soon consistently meet recreation water quality standards for bacteria.

Problem

The 62-square-mile Tillamook River watershed (Figure 1) is one of five main drainage basins feeding Tillamook Bay on Oregon's coast. The Tillamook River Basin includes 45 square miles (mi^2) of forest, 13 mi^2 of agriculture and approximately 1.6 mi^2 each of rural residential and rural industrial land uses. The river offers salmon and trout habitat and feeds into shellfish waters. The public uses the river for swimming and wading.

Oregon's current bacteria water quality standard for recreational contact use and aquatic life requires that the 30-day log mean should not exceed 126 *Escherichia coli* counts per 100 milliliters (mL), based on a minimum of five samples; and that no single sample shall exceed 406 *E. coli* counts per 100 mL.

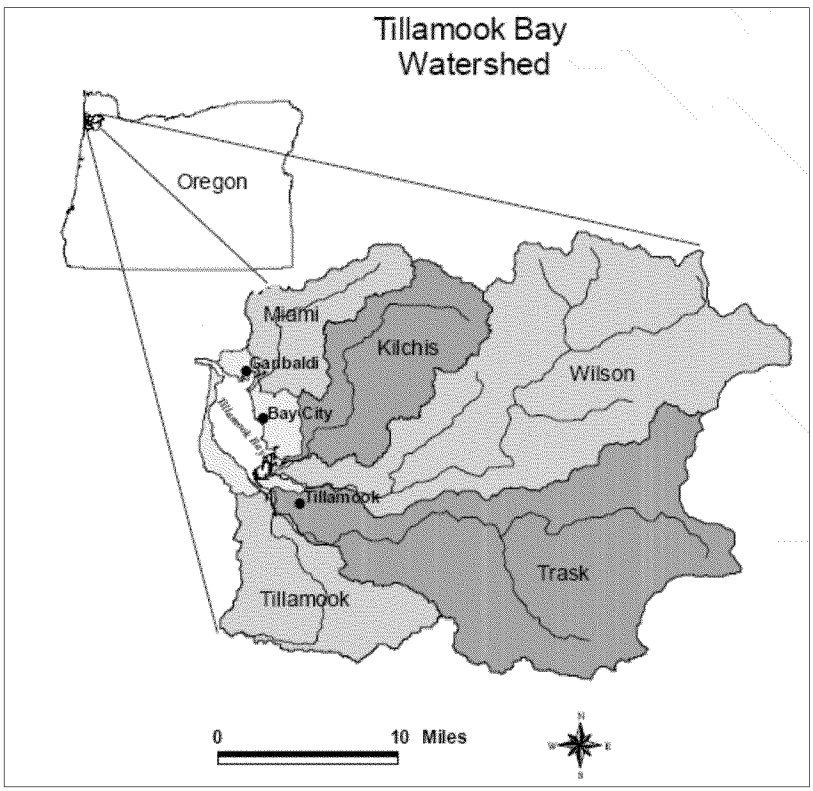
Figure 1. The 62-square-mile Tillamook River watershed is one of five major tributaries within Oregon's Tillamook Bay Basin.

Data collected at river mile 13 of the Tillamook River between 1986 and 1990 showed that 36 percent (8 of 22) of values violated the applicable bacteria water quality standard in fall, winter and spring. Data collected from 1986 to 1989 showed that 80 percent (8 of 10) of values exceeded the standard in the summer. As a result, ODEQ added an 18.5-mile segment of the Tillamook River (OR_1238834454692_0_18.5) to the CWA section 303(d) list in 1998 for bacteria. Because data showed that several Tillamook River tributaries (Killam, Simmons, Mill, and Bewley creeks) also failed to meet bacteria standards, ODEQ added them to the 1998 CWA section 303(d) list in 1998 as well.

Project Highlights

The Tillamook Bay National Estuary Program, now known as the Tillamook Estuaries Partnership (TEP), worked closely with community, state and federal entities to develop and implement the Tillamook Bay Comprehensive Conservation and Management Plan beginning in 1999. The plan recommended 63 specific actions to improve water quality, enhance aquatic habitat and mitigate flooding.

ODEQ completed a Tillamook Bay watershed total maximum daily load (TMDL) for temperature and bacteria in 2001 (addresses all Bay rivers, including the Tillamook River). Also in 2001, the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS) and the Tillamook Soil and Water Conservation District (SWCD) published a Watershed Plan/Environmental Assessment for the Lower Tillamook Bay watershed. The 2001 document identifies agricultural practices and restoration activities that must be implemented to address TMDL-related issues.



In 2001 TEP began working with Oregon State University on a 3-year genetic marker study on bacteria in the watershed. The study found that bacteria in the upper Tillamook River came from ruminant sources, while that in the lower Tillamook River came from both humans and ruminants. Using these data, watershed managers began targeting practices to reduce bacteria.

Between 2002 and 2012, the Tillamook County SWCD cooperated with federal, state and local partners to work directly with landowners to address

sources of bacteria by installing best management practices (BMPs) and completing other projects, including: (1) at 28 sites, removed invasive plants and restored native plants in riparian and other sensitive areas; (2) at five sites, fenced out livestock and restored native vegetation around streams; (3) replaced or modified 12 culverts to reduce flooding and erosion; (4) added one flood spillway to reduce flooding on agricultural lands; and (5) decommissioned two roads to reduce sedimentation (Figure 2).

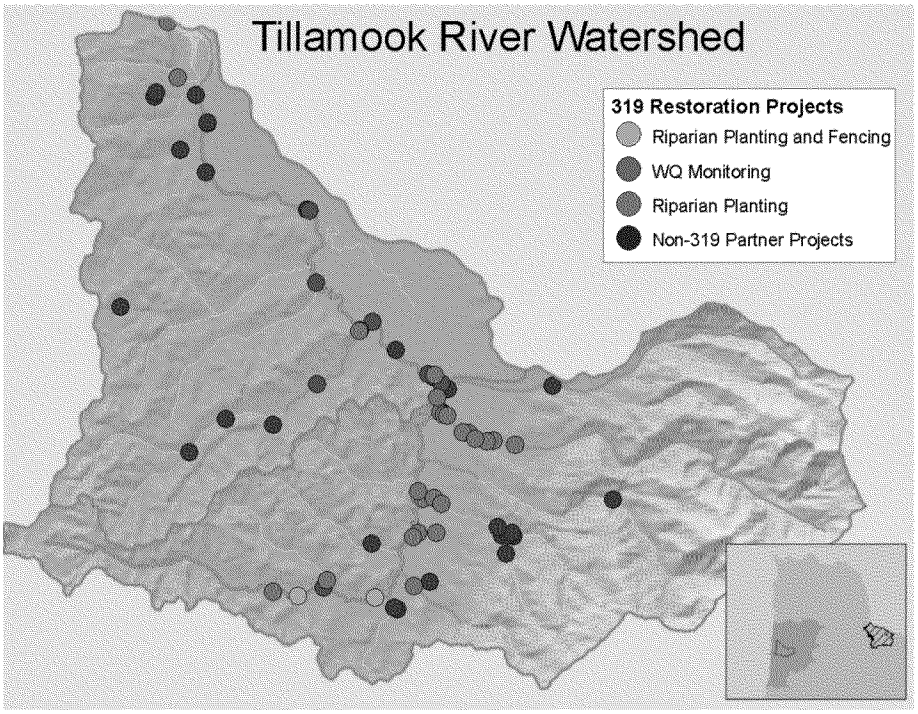


Figure 2. BMPs installed throughout the Tillamook River Basin (2002–2012).

Both the TEP and SWCD conduct numerous education and outreach activities in the Tillamook River and greater Tillamook Bay watersheds, including distributing fact sheets, hosting field trips, holding workshops and classroom-based discussions, and publishing articles in local newspapers.

Results

Stakeholders' efforts to reduce bacteria pollution throughout the Tillamook Bay watershed are working. Since 1997, TEP has collected monitoring data from 10 stations throughout the watershed (extending from the river's mouth to its headwater tributaries). ODEQ performed a Seasonal Kendall trend analysis test on the data from all 10 monitoring stations. This statistical test determines if the bacteria levels are generally increasing or decreasing over time (and assigns a confidence level associate with the trend). Although no stations consistently meet the bacteria water quality standards for recreation, all stations but one show a significant decreasing trend in bacteria counts over time (Table 1). A sample of site-specific data can be seen in Figure 2.

Table 1. Data analyses show that bacteria levels had dropped significantly in the Tillamook River subbasin through 2012.

Impaired Water	Monitoring Site(s)	Data Collection Period	Bacteria Reductions: Seasonal Kendall Test Confidence Level[1]
Tillamook River	TL0	1999–2012	99%
	TL1	1999–2012	99%
	TL2	1999–2012	99%
	TL4	1999–2012	99%
	TL10	2003–2012	99%
	TL7	1999–2012	99%
Killam Creek	TL11	2003–2012	95%
Fawcett Creek[2]	TL12	2003–2012	99%
Bewley Creek	TL13	2003–2012	80%

[1] The confidence level indicates the probability that the values are correctly showing a decreasing trend.

[2] Not listed as impaired for recreational use, however, this water is included in the TMDL. Data collected show periodic exceedances of the recreation water quality standard since 2003.

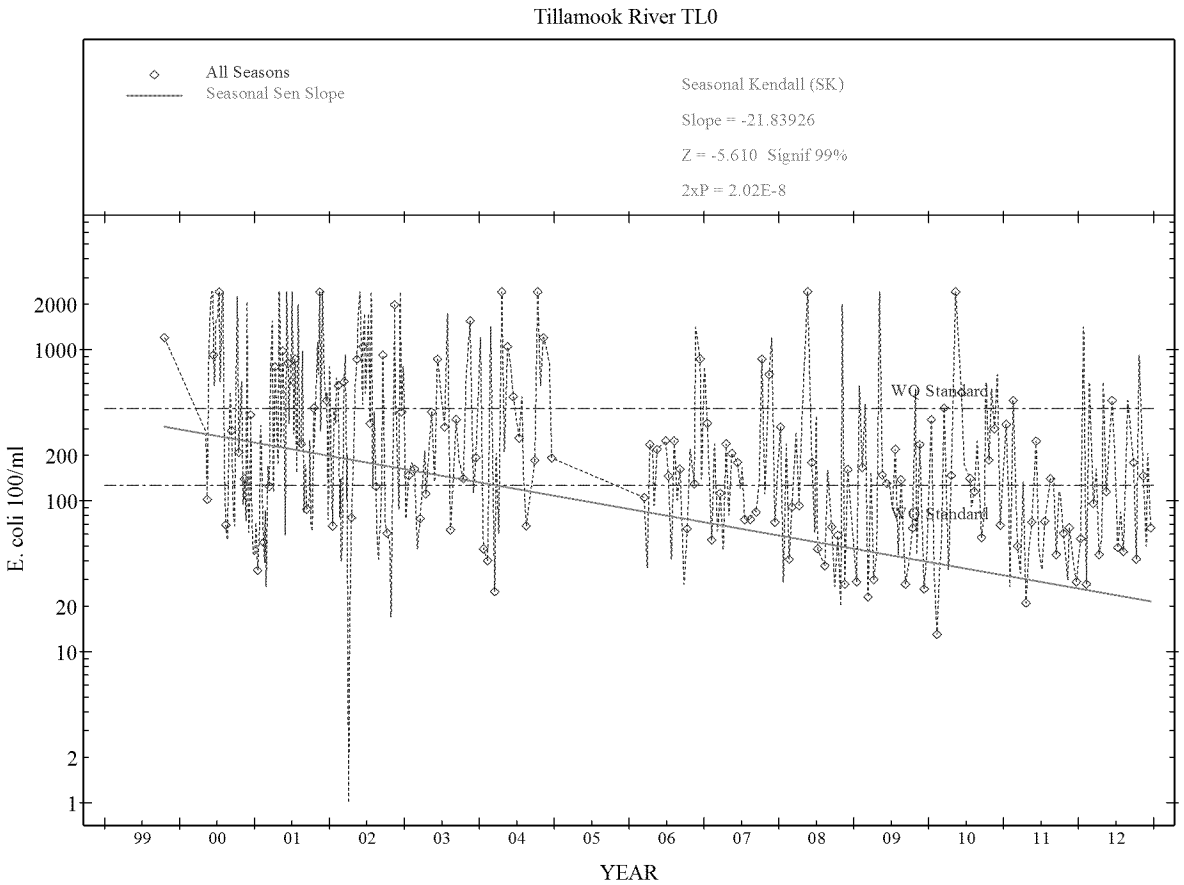


Figure 3. Seasonal Kendall test results for site TL0 (1999–2012) on the lower Tillamook River main stem.

Partners and Funding

Partners working to restore Tillamook Bay and its watershed have included the Tillamook SWCD, TEP, NRCS, ODEQ, Oregon Department of Agriculture, Oregon Department of Forestry, Oregon Department of Fish and Wildlife, Oregon Watershed Enhancement Board, Oregon Solutions, Tillamook Bay Watershed Council, Tillamook County, U.S. Fish and Wildlife Service, Tillamook County Creamery Association, the Northwest Oregon Restoration Partnership and private landowners.

The TEP and Tillamook SWCD and their federal, state and local partners have spent approximately $1.4 million restoring and protecting the Tillamook River watershed. This total includes 31 projects with a total project cost $234,970 using Clean Water Act section 319 as a portion of the funding source.

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