CHAPTER 8
TMDL CALCULATIONS AND ALLOCATIONS

A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. The TMDL equals the loading capacity of the waterbody for the pollutant plus a margin of safety to account for any uncertainties. For this TMDL project, an implicit margin of safety is included in the determination of the loading capacities so the loading capacities are equivalent to the TMDL values. The loads are allocated among the various sources of the pollutant. Anthropogenic pollutant sources are characterized as either point sources that receive a wasteload allocation or nonpoint sources that receive a load allocation. Point sources include all sources subject to regulation under the NPDES program (e.g., wastewater treatment facilities and some storm water discharges). Nonpoint sources include a variety of diffuse sources transported by water moving over and through the ground.

8.1 TMDLS, LOADING CAPACITIES & MARGIN OF SAFETY

The TMDLs for the Russian River Watershed are shown in Table 8.1 and are expressed as concentrations of *E. coli* and enterococci bacteria in surface waters and discharges. In accordance with 40 CFR §130.2(i), the TMDLs are to be expressed as concentrations instead of loads. This is appropriate since public health risks associated with recreation are based on concentrations of pathogen indicator bacteria in water and not the total load of bacteria passing through the Russian River in a day.

The TMDLs are set to equal the loading capacities for each parameter and attain standards.[1] The TMDLs are equivalent to the numeric targets and the wasteload and load allocations.

[1] As discussed in Chapter 2, this TMDL is established at levels expected to implement the proposed state bacteria water quality objective. To ensure that this TMDL is protective, staff recommends that this TMDL not go before the State Board for adoption until after the State Bacteria objective is adopted. An update may be necessary to conform with the new statewide objectives, should they be more restrictive than the national criteria.

Table 8.1
TMDLs, Loading Capacities, Wasteload Allocations, and Load Allocations

Parameter	Portion of the Bacteria Objective the Target will Attain	TMDL, Loading Capacity, Wasteload Allocation & Load Allocation
E. coli Geometric Mean	Recreation	The geometric mean of the samples collected* within the permitted period shall not exceed 100 cfu/100mL**.
E. coli Statistical Threshold Value	Recreation	No more than 10% of the samples collected* within the permitted period shall exceed 320 cfu/100mL**.
Enterococci Geometric Mean	Recreation	The geometric mean of the samples collected* within the permitted discharge period shall not exceed 30 cfu/100mL**.
Enterococci Statistical Threshold Value	Recreation	No more than 10% of the samples collected* within the permitted discharge period shall exceed 110 cfu/100mL**.

* The sampling frequency and period of sampling is important to proper interpretation of monitoring results. Any WLAs or LAs monitoring of fecal indicator bacteria must be in accordance with the appropriate sampling frequency and period of sampling defined in the controlling regulatory mechanism.
** Colony forming units (cfu) are equivalent to the most probable number (MPN) values.

8.1.1 E. COLI AND ENTEROCOCCI BACTERIA TMDLS/LOADING CAPACITIES

The *E. coli* and enterococci geometric mean and statistical threshold value (STV) TMDLs/loading capacities are the same as the *E. coli* and enterococci bacteria numeric targets.

The sampling frequency and period of sampling is important to proper interpretation of monitoring results. But, the frequency and period are not defined here because they are , dependent on the monitoring purpose, season of interest, and other relevant factors. As such, any WLAs or LAs monitoring of fecal indicator bacteria must be in accordance with the appropriate sampling frequency and period of sampling defined in the controlling regulatory mechanism. It is recommended that a minimum of ten samples be collected within a year so as to calculate a meaningful geometric mean and STV. Such an approach may be appropriate to assess the impacts from storm water discharges, since they are episodic. In many cases, weekly sampling may be appropriate, especially for point source discharges that are already monitored on a weekly basis for other parameters. The geometric mean and STV should be calculated in a static, not rolling, fashion.

8.1.2 MARGIN OF SAFETY

The Clean Water Act and regulations require that a TMDL include a margin of safety (MOS) to account for any lack of knowledge concerning the relationship between the load and wasteload allocations and water quality (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)). U.S. EPA (1991) guidance explains that the MOS may be implicit (i.e., incorporated into the TMDL through conservative assumptions in the analysis) or explicit (i.e., expressed in the TMDL as loadings set aside for the MOS).

Implicit margins of safety are used for *E. coli* and enterococci bacteria TMDLs. For the *E. coli* and enterococci bacteria TMDLs, the implicit margins of safety are due to the selection of the U.S. EPA criteria (2012) associated with 32 illnesses per 1,000 recreators, instead of 36 illnesses per 1,000 water recreation users. By selecting the values linked to fewer illnesses, an additional MOS is provided for those partaking in water contact recreation in the watershed.

8.2 WASTELOAD ALLOCATIONS

Regulations require that a TMDL include wasteload allocations (WLAs), which identify the portion of the loading capacity allocated to individual existing and future point sources (40 C.F.R. §130.2(h); 40 C.F.R. §130.2(i)).

The concentration-based WLAs for *E. coli* and enterococci bacteria are shown in Table 8.1 and apply to all existing and new point source discharges that are likely to include pathogens or pathogen indicator bacteria in the Russian River Watershed. Examples of point sources include but are not limited to discharges from wastewater treatment facilities, municipal separate storm sewer systems, and confined animal feeding operations. Table 8.2 lists the existing point sources of pathogens in the watershed. The *E. coli* and enterococci bacteria WLAs shall be incorporated into permits for discharges of pathogen or pathogen indicator bacteria point sources at the time of permit adoption or permit renewal. The compliance point for the WLAs shall be at the point of effluent discharge from the point source to the receiving water, or at a location where sample results are representative of the targeted waste stream.

Table 8.2
NPDES Permittees with WLAs in the Russian River Watershed

Hydrologic Area Name	Hydrologic Subarea Name	Facility Name	Facility Type NPDES	Permit No.
Upper Russian River	Ukiah	City of Ukiah	Phase II MS4 Storm Water	CAS0000004
		City of Ukiah WWTP	Municipal Wastewater	CA0022888
Middle Russian River	Warm Springs	City of Healdsburg	Phase II MS4 Storm Water	CAS0000004
	Geyserville	Cloverdale City WWTP	Municipal Wastewater	CA0022977
	Laguna	City of Cotati	Phase II MS4 Storm Water	CAS0000004
		City of Rohnert Park	Phase II MS4 Storm Water	CAS0000004
		Sonoma State University	Phase II MS4 Storm Water	CAS0000004
	Santa Rosa, Laguna	Santa Rosa Subregional Facility	Municipal Wastewater	CA0022764
	Mark West	Town of Windsor	Phase II MS4 Storm Water	CAS0000004
		Town of Windsor WWTP	Municipal Wastewater	CA0023345
Lower Russian River	Guerneville	City of Healdsburg WWTP	Municipal Wastewater	CA0025135
		Forestville Water District	Municipal Wastewater	CA0023043
		Occidental CSD	Municipal Wastewater	CA0023051
		SCWA Graton CSD	Municipal Wastewater	CA0023639
		SCWA Russian River CSD	Municipal Wastewater	CA0024058

Several NPDES permit holders in the Russian River Watershed are not a source of pathogens or pathogenic indicator bacteria. These include, but are not limited to, discharges from waterway modification permits related to aquatic pesticide application, discharges from log deck sprinkler water runoff, and discharges of highly treated groundwater that was previously contaminated with petroleum hydrocarbons and volatile organic compounds. Consequently, WLAs have not been assigned to these facility types in this TMDL.

8.3 LOAD ALLOCATIONS

Regulations require that a TMDL include load allocations (LAs), which identify the portion of the loading capacity allocated to existing and future nonpoint sources. LAs may range from reasonably accurate estimates to gross allotments (40 C.F.R. §130.2(g)).

The concentration-based LAs for *E. coli* and enterococci bacteria are shown in Table 8.1 and apply to all existing and new non-natural background, nonpoint sources in the Russian River Watershed. Examples of nonpoint sources include but are not limited to domestic

wastewater discharges < 1,500 gpd, discharges from homeless encampments, pet waste, and livestock waste. The *E. coli* and enterococci bacteria LAs shall be incorporated into nonpoint source permits at the discretion of the Regional Water Board at the time of adoption of a new or renewed nonpoint source permit. Additional, non-permit implementation actions to attain the LAs are described in Chapter 9. These include efforts to identify, cleanup, and prevent nonpoint source discharges through the use of public outreach and education, best management practices, assessment, and adaptive management.

8.4 ESTIMATED REDUCTIONS NEEDED

Regional Water Board staff conducted an analysis of the reductions likely needed to achieve the TMDLs for *E. coli* and enterococci bacteria concentrations at numerous locations in the watershed (Butkus 2013d). Using multiple lines of evidence to assess the extent of fecal waste contamination, this TMDL demonstrates that both the mainstem and tributaries are impacted by fecal waste with the potential to deliver pathogens. Some waste sources of concern are identified due to exceedances of *E. coli* bacteria targets. Others sources are identified due to exceedances of enterococci bacteria targets. The estimated percent reductions needed are provided here to highlight priorities for implementation actions; but, they are not the load allocations, which are represented as *E. coli* and enterococci concentrations.

E. coli and enterococci bacteria measurements collected since 2001 were used to estimate the percent reduction needed to meet both TMDL values, as shown in Tables 8.3 and 8.4. In most cases, a larger percent reduction is needed to meet the STV as opposed to the geometric mean.

A large percentage of the locations in the mainstem Russian River met the TMDLs for *E. coli* bacteria concentrations and require no reductions. However, most of the tributaries do not meet the TMDLs for *E. coli* bacteria and will require controls to reduce fecal waste loads. Percent reductions of *E. coli* bacteria concentrations needed to meet the TMDLs in tributaries range from 49% to 99%. Percent reductions of enterococci bacteria concentrations needed to meet the TMDLs in the mainstem Russian River range from 18% to 50%. Percent reductions of enterococci bacteria concentrations needed to meet the TMDLs in tributaries range from 78% to 98%.

Table 8.3
Percent Reductions Needed to Meet *E. coli* Bacteria TMDLs in Tributaries

Hydrologic Area Name	Hydrologic Subarea Name	Tributary Location	*E. coli* Bacteria Reduction Needed To Attain	
			Geometric Mean ≤ 100 cfu/100mL	STV ≤ 320 cfu/100mL
Middle Russian River	Warm Springs	Foss Creek at Matheson Street	97%	99%
	Laguna	Laguna de Santa Rosa at Sebastopol Community Center	42%	92%
	Santa Rosa	Santa Rosa Creek at Highway 12	60%	66%
		Santa Rosa Creek at Railroad Street	79%	84%
Lower Russian River	Guerneville	Atascadero Creek at Green Valley Road	80%	91%
		Green Valley Creek at Martinelli Road	12%	49%

Table 8.4
Percent Reductions Needed to Meet Enterococci Bacteria TMDLs in the Russian River and Tributaries

Hydrologic Area Name	Hydrologic Subarea Name	Location	Enterococci Bacteria Reduction Needed To Attain	
			Geometric Mean ≤ 100 cfu/100mL	STV ≤ 320 cfu/100mL
Middle Russian River	Warm Springs	Foss Creek at Matheson Street	97%	97%
	Geyserville	Russian River at Crocker Road	35%	22%
	Laguna	Laguna de Santa Rosa at Sebastopol Community Center	78%	92%
	Santa Rosa	Santa Rosa Creek at Highway 12	72%	78%
		Santa Rosa Creek at Railroad Street	77%	90%
		Santa Rosa Creek at Wildwood Mountain Road	77%	78%
	Mark West	Mark West Creek at Trenton-Healdsburg Road	88%	92%

Table 8.4
Percent Reductions Needed to Meet Enterococci Bacteria TMDLs in the Russian River and Tributaries

Hydrologic Area Name	Hydrologic Subarea Name	Location	Enterococci Bacteria Reduction Needed To Attain	
			Geometric Mean ≤ 100 cfu/100mL	STV ≤ 320 cfu/100mL
Lower Russian River	Guerneville	Atascadero Creek at Green Valley Road	92%	98%
		Green Valley Creek at Martinelli Road	76%	93%
		Russian River at Bridgehaven	0%	36%
		Russian River at Duncans Mills	0%	18%
		Russian River at Jenner Boat Ramp	0%	25%
		Russian River at Riverfront Park	0%	50%

In summary, the TMDLs and load allocations are established as concentrations of E. coli and enterococci bacteria, at levels equivalent to the numeric targets and U.S. EPA's national criteria. Substantial reductions in the discharge of fecal waste in the Middle and Lower Russian River hydrologic areas are particularly necessary to attain the TMDLs and protect the full-body contact recreational beneficial use.