

Bishop Creek Indicator Bacteria Vision Project Water Quality Problem Statement

(Version 5, February 2021)

The Lahontan Regional Water Quality Control Board (Water Board) has identified that water quality in the middle and lower reaches of Bishop Creek (Inyo County, CA) is impaired by fecal indicator bacteria (FIB). Data collected by the Water Board show that the Water Contact Recreation (REC-1) and Municipal and Domestic Supply (MUN) Beneficial Uses (BUs) are not supported, as demonstrated by FIB concentrations recovered from the waterbody which exceed water quality objectives (WQOs) set in [Chapter Three of the Water Quality Control Plan for the Lahontan Region](#) (Basin Plan) and in [Part 3 of the Inland Surface Waters, Enclosed Bays, and Estuaries Plan](#) (ISWEBE). Existing water quality warrants the addition of the creek to the Clean Water Act (CWA) Section 303(d) List of Impaired Waters (303(d) List). Impaired waterbody segments are shown in Table 1. Placement of a waterbody segment on the 303(d) List requires the development of a Total Maximum Daily Load (TMDL) or alternative regulatory mechanism to address the BU impairment and improve water quality.

Table 1: Bishop Creek waterbody segments impaired by FIB

Waterbody segment name	Waterbody ID (WBID)	Type of FIB assessed	BUs impaired (threatened)*
Bishop Creek Forks (North and South Forks downstream of bifurcation)	CAR6032028020170908057813	<ul style="list-style-type: none"> • Fecal coliform • <i>E. coli</i> 	<ul style="list-style-type: none"> • MUN • REC-1
Bishop Creek B-1 Drain	CAR6032028020171227020994	<ul style="list-style-type: none"> • Fecal coliform • <i>E. coli</i> 	<ul style="list-style-type: none"> • MUN • (REC-1)
Bishop Creek Canal	CAR6032000020020528152837	<ul style="list-style-type: none"> • Fecal coliform • <i>E. coli</i> 	<ul style="list-style-type: none"> • MUN

**A threatened BU is determined when water quality data exists to suggest BU impairment, but there is not the requisite amount of data to make a full BU impairment determination per the Water Quality Control Policy for Developing California's Section 303(d) List (Listing Policy).*

In 2013, the U.S. Environmental Protection Agency (U.S. EPA) announced a new collaborative framework for implementing the CWA Section 303(d) program called the [Long-Term Vision for Assessment, Restoration, and Protection under the Clean Water Act Section 303\(d\) Program](#) (The Vision). The Vision describes a watershed-wide plan focused on improving water quality and provides flexibility to use tools beyond TMDLs to

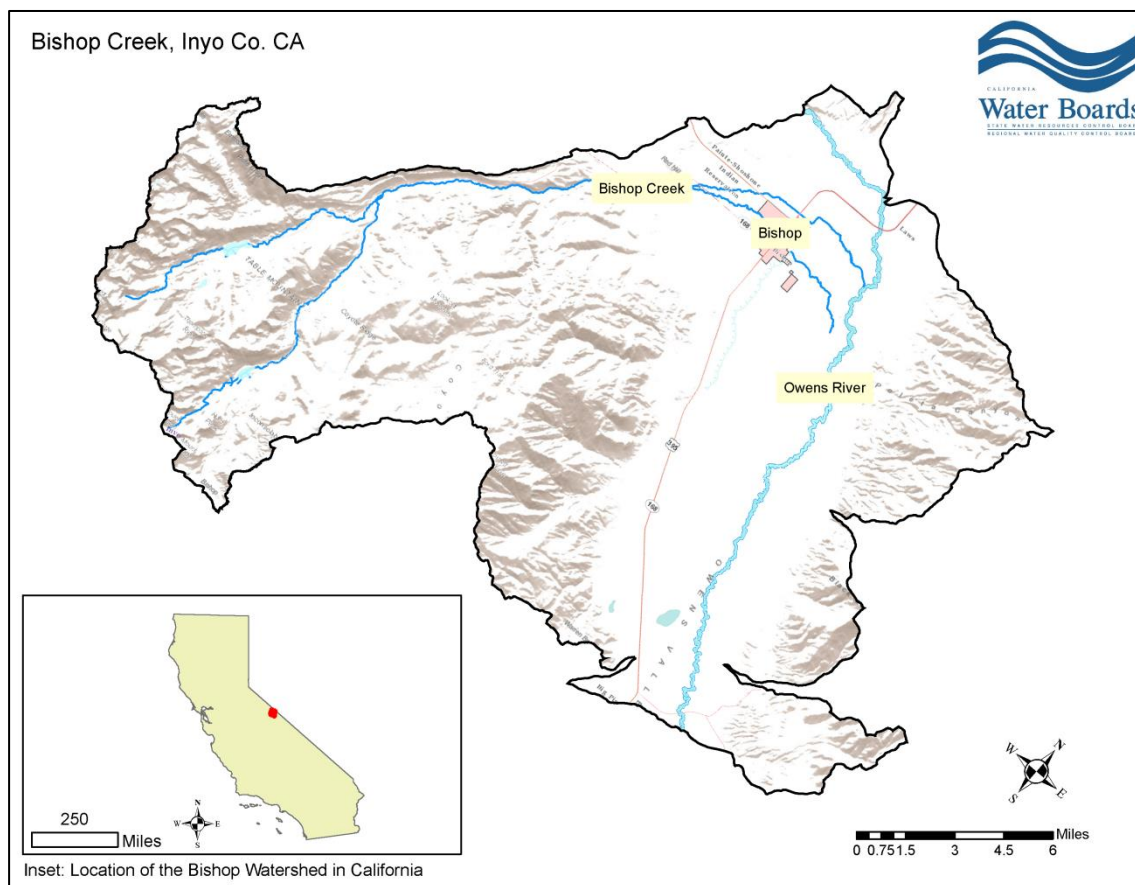
attain water quality restoration and protection. In 2015, the Water Board staff identified Bishop Creek as one of two “Vision Watersheds” to be addressed by 2022 through the implementation of the Vision Program. Water Board staff is developing a Vision Project Plan (Vision Plan) to guide restoration and protection efforts in the Bishop Creek watershed. Collaboration and partnerships with stakeholders in the watershed are integral to the success of the Vision Plan. The Vision Project includes collaboration with the Bishop Paiute Tribe (Tribe), the Los Angeles Department of Water and Power (LADWP), the Natural Resources Conservation Service (NRCS), the Inyo County Water Department, the agricultural community, local residents, and other interested parties in the watershed to address the FIB water quality impairments.

Watershed Description

The Bishop Creek watershed, shown in Figure 1, spans approximately 129,052 acres of Inyo County in eastern California and drains 104 square miles of the Sierra Nevada mountains (Sierra). It flows through the communities of Aspendell, West Bishop, and the City of Bishop before joining the Owens River. The watershed is significantly altered in its headwaters by a system of dams and reservoirs built for water storage and electricity generation, while the lower watershed has experienced extensive hydromodification for irrigation of agricultural land. In the Vision Project study area, land uses are intermixed and are characterized as rural, urban and agricultural. REC-1 occurs throughout the watershed. The Bishop Paiute Tribe owns approximately 877 acres of land on the alluvial fan up-gradient of Bishop, with mixed rural-residential and agricultural land uses occurring on their lands.

Originating as several tributaries in its headwaters, Bishop Creek converges near Aspendell and flows from the slopes of the Sierra as a single channel. The creek then bifurcates into North and South Forks upstream of the Paiute Tribe Reservation near West Bishop, and both channels eventually empty into Bishop Canal downstream of Bishop. The section of creek is called ‘Bishop Creeks Forks (north and south fork below bifurcation)’ for 303(d) assessment purposes, and this section of creek has been grouped as such because of the highly similar, intermixed land uses and pollutant sources that exist in this area. A plethora of irrigation ditches stem from both Forks as they flow through the Bishop area, with diversions used primarily for cattle ranching, as well as horse pasture, sheep grazing and residential backyard landscaping. In several locations, irrigation ditches connect the two main channels, adding to the complexity of water quality issues in the Forks reach. The South Fork flows through Bishop City Park where REC-1 occurs frequently, and REC-1 is also commonly observed at many other Bishop Creek locations especially during the summer months.

Figure 1: Bishop Creek Watershed, Inyo County, CA



Water Quality Standards

Water quality standards in California comprise of BUs, narrative and/or numeric WQOs used to determine excess concentrations of pollutants in a waterbody, and an antidegradation policy to prevent degradation. As stipulated in the Basin Plan, the BUs for all or part of Bishop Creek and its tributaries are Municipal and Domestic Supply (MUN), Agricultural Supply (AGR), Industrial Service Supply (IND), Groundwater Recharge (GWR), Hydropower Generation (POW), Water Contact Recreation (REC-1), Non-Contact Water Recreation (REC-2), Commercial and Sport fishing (COMM), Cold Freshwater Habitat (COLD), Wildlife Habitat (WILD), and Spawning of Aquatic Organisms (SPWN). Beneficial uses are designated for Bishop Creek at the locations of: Bishop Creek Canal, Bishop Creek (above Intakes), Bishop Creek (below Intake 2), and Bishop Creek (below last Power House) which includes the Bishop Creek Forks, Bishop Creek B-1 Drain, and Bishop Creek Canal waterbody segments.

The Basin Plan sets both a numeric standard and narrative objective for coliform bacteria for waters region-wide, including the Bishop watershed, as:

'Waters shall not contain concentrations of coliform organisms attributable to anthropogenic sources, including human and livestock wastes.

The fecal coliform concentration during any 30-day period shall not exceed a log mean of 20/100 ml, nor shall more than 10 percent of all samples collected during any 30-day period exceed 40/100 ml. The log mean shall ideally be based on a minimum of not less than five samples collected as evenly spaced as practicable during any 30-day period. However, a log mean concentration exceeding 20/100 ml for any 30-day period shall indicate violation of this objective even if fewer than five samples were collected.'

In 2018, the State Water Resource Control Board (State Board) adopted the [Bacteria Provisions and a Water Quality Standards Variance Policy](#) (Provisions). The Provisions contain WQOs developed specifically to protect the REC-1 BU and apply to all California surface waters, including Bishop Creek, where the REC-1 BU exists. The Provisions also implement *E. coli* FIB to determine BU support. Together with the Basin Plan fecal coliform WQO, two FIB WQOs apply to Bishop Creek. The WQOs are show in Table 2.

Table 2: FIB WQOs that apply for the Bishop Creek Vision Project

Beneficial Use	FIB	Numeric WQO
Water Contact Recreation (REC-1)	<i>E. coli</i>	<u>Geometric Mean</u> ^A : ≤100 CFU ¹ /100 mL in any six-week period <u>Statistical Threshold Value (STV)</u> ^B : No more than 10% of samples >320 CFU/100 mL in any calendar month
Municipal and Domestic Supply (MUN)	Fecal coliform	<u>Log mean</u> ^C : ≤20 CFU/100 mL in any thirty-day period <u>Single sample</u> : No more than 10% of samples >40 CFU/100 mL in any thirty-day period

- A. A geometric mean is a type of mean or average which indicates the central tendency or typical value of a set of numbers. It is defined as the n^{th} root of the product of n numbers. For the WQO listed in this table, the geometric mean is calculated on data collected at the same site in the same six-week (42-day) period.
- B. The Statistical Threshold Value (STV) is the allowable concentration for a single sample, beyond which is a violation of the WQO. The STV must not be exceeded by more than 10% of all samples collected at the same station in a calendar month.
- C. A log mean is calculated by determining the natural logarithms of a set of numbers, calculating the average of the natural logarithms, and then convert this average back to a base 10 number.
1. CFU: Colony Forming Units. This is a unit of measurement of bacteria growth during analysis in the laboratory.

In addition to the FIB WQOs which apply to Bishop Creek described above, and the WQOs described in the Basin Plan which apply to all surface waters in the Lahontan Region, the Basin Plan also includes site-specific objectives (SSOs) for two reaches of Bishop Creek. Bishop Creek is not being listed for exceeding these objectives, but they are provided for information purposes. SSOs for Bishop Creek are listed in Table 3.

Table 3: Site Specific Objectives for Bishop Creek. All objectives units are mg/L

Waterbody Reach	TDS	Cl	SO ₄	F	B	NO ₃ -N	Total N	PO ₄
Bishop Creek (Intake 2)	$\frac{27}{29}$	$\frac{1.9}{3.0}$	-	$\frac{0.15}{0.15}$	$\frac{0.02}{0.02}$	$\frac{0.1}{0.2}$	$\frac{0.1}{0.4}$	$\frac{0.05}{0.09}$
Bishop Creek (at Hwy 395)	$\frac{59}{105}$	$\frac{2.4}{6.0}$	$\frac{7.2}{12.0}$	$\frac{0.12}{0.30}$	$\frac{0.04}{0.10}$	$\frac{0.5}{0.9}$	$\frac{0.7}{1.0}$	$\frac{0.09}{0.18}$

¹ Annual Average value/90th Percentile Value

Water Quality Impairments

The Water Board is required to routinely assess water quality data for Lahontan Region surface waters to determine if waterbodies are supporting BUs. Waterbodies where pollutants are found to exceed WQOs are determined to not support BUs and are placed on the 303(d) List. 303(d) assessments in California follow the methodology found in the [Water Quality Control Policy For Developing California's Clean Water Act Section 303\(d\) List](#).

Assessment of Bishop Creek FIB data collected by the Water Board has determined exceedances of the fecal coliform and *E. coli* FIB WQOs. Thus, the Water Board has recommended that three reaches of Bishop Creek shown in Table 1 be included on the 303(d) List because of impairment by Indicator Bacteria. Listing recommendations can be found in the [Lahontan Region's 2018 Integrated Report](#), which is currently under review at the State Board and is scheduled to be sent to U.S. EPA for final approval in October 2020.

Placement of Bishop Creek on the 303(d) List requires the development of a TMDL or other regulatory action that will address the impairment. The Water Board staff has initiated the development of the Bishop Creek Vision Project to address the FIB impairments in segments of Bishop Creek.

303(d) Listed segments

Table 4 describes the extent of the segments of Bishop Creek which are recommended additions to the 303(d) List because of impairment by Indicator Bacteria as demonstrated by concentrations of FIB.

Table 4: Delineation of Bishop Creek 303(d) Listed waterbody segments

Waterbody segment name	Segment begins:	Segment begins latitude/ longitude	Segment ends:	Segment begins latitude/ longitude
Bishop Creek Forks (North and South Forks below bifurcation)	Bifurcation of north and south forks downstream of Powerhouse 6	37.350786, -118.461704	Each respective channel confluence with Bishop Creek Canal	North channel: 37.380567, -118.393293 South channel: 37.367929, -118.386344
Bishop Creek B-1 Drain	Bishop Creek Forks South channel near the western end of Rome Drive	37.368658, -118.405917	Confluence with Bishop Creek Forks North channel near HWY 395	37.380052, -118.404886
Bishop Creek Canal	Terminus of Bishop Creek Forks North channel	37.380567, -118.393293	Confluence with Lower Rawson Canal near HWY 395	37.292148, -118.373080

Potential Sources of Impairments to Water Quality

As part of the multi-year Eastern Sierra Bacteria Study (Study), Water Board staff retained the University of California Sierra Nevada Aquatic Research Laboratory (SNARL) to perform microbial source tracking (MST) assays for fecal indicator bacteria (FIB) in surface waters of the Eastern Sierra. MST assays can identify likely sources of bacteria using quantitative real-time Polymerase Chain Reaction (qPCR) methods. The results of MST assays can identify the relative source contributions of fecal bacteria in surface waters. Bishop Creek was included in the Study.

MST results indicate that “ruminant derived fecal contamination, including that from cattle, was common in the study streams and often in high concentrations” (Knapp & Nelson, 2016, p. 4). MST samples from Bishop Creek also identify human derived fecal contamination, and the Study reported that “given the high contact rates of people with contaminated water in this drainage, the potential for water-borne illness is likely to exist” (Knapp & Nelson, 2016, p. 17).

MST analyses indicate that sources of bacteria in the drainage are predominantly anthropogenic in nature. Relative contribution analyses indicate that “ruminants are a

much more important source of bacterial contamination than are humans. Because cattle are ubiquitous throughout the middle and lower watershed where bacterial contamination is highest, the available evidence indicates that domestic cattle are the predominant source of bacteria in lower Bishop Creek” (Knapp & Nelson, 2016, p. 17).

The weight of the evidence suggests that cattle derived fecal material is a major source of FIB detected in Bishop Creek waters. Water Board staff acknowledge that fecal bacteria in Bishop Creek may also come from a variety of sources besides cattle, including from recreational users, pet waste, residential wastewater and natural sources.

A phased approach to water quality improvement

Because two FIB WQOs apply to Bishop Creek, and because of the sources of FIB impairment, the Water Board is investigating a two phased approach to improve water quality. Phase One will focus on implementation of cattle grazing and hobby ranching Best Management Practices (BMPs). The goal of the first phase is to improve water quality to support the REC-1 BU. Phase Two will focus on implementing BMPs targeting other controllable sources of FIB, such as residential wastewater and pet wastes. The goal of Phase Two is to improve water quality to support the MUN BU.

Information Sources

2012 California Integrated Report (Clean Water Act Section 303(d) List & 305(b) Report):

http://www.waterboards.ca.gov/lahontan/water_issues/programs/tmdl/303d_305b/

2018 Lahontan Region Integrated Report (Clean Water Act Section 303(d) List and 305(b) Report):

https://www.waterboards.ca.gov/lahontan/water_issues/programs/tmdl/integrated_report/index.html

[Bacteria Provisions and a Water Quality Standards Variance Policy](#), State Water Resources Control Board, 2018:

<https://www.waterboards.ca.gov/bacterialobjectives/docs/bacteria.pdf>

Data for the Bishop Creek Watershed, available through the California Environmental Data Exchange Network (CEDEN):

<http://ceden.waterboards.ca.gov/AdvancedQueryTool>

Inyo County Planning Documents, *5.10 Land Use and Planning*:

http://www.inyocounty.us/ab628/documents/e5_10_LandUse_071414.pdf

R. Knapp & C. Nelson, 2015. *Assessment of Bacterial Water Quality in the Lahontan Region*:

http://www.waterboards.ca.gov/lahontan/publications_forms/available_documents/index.shtml

R. Knapp & C. Nelson, 2016. *Microbial Source Tracking (MST) at Bacteria Impaired Waters of the Lahontan Region*:

http://www.waterboards.ca.gov/lahontan/publications_forms/available_documents/index.shtml

Water Quality Control Plan for the Lahontan Region (Basin Plan):

http://www.waterboards.ca.gov/lahontan/water_issues/programs/basin_plan/references.shtml

Water Quality Control Policy For Developing California's Clean Water Act Section 303(d) List:

https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2015/020315_8_amendment_clean_version.pdf