

Lower American River Bacteria Study

Data Summary of Phase 1 Source Identification Results

Overview

Monitoring results for Phase 1 of the Lower American River Bacteria Study indicate most sample locations generally meet the statewide bacteria water quality objectives¹. The bacteria objectives were developed to protect recreational users from effects of pathogens in California water bodies. The exception is the right bank at Sutter's Landing, where 100% of samples exceeded the bacteria objective (six-week rolling geometric mean of 100 MPN²/100mL). Microbial source tracking (MST) analysis of samples with elevated *E. coli* indicates that birds are the largest and most consistent source of contamination in this section of the river. Dogs are also a consistent source of fecal contamination in some areas, particularly on the left bank at Paradise Beach Downstream where the dog marker was detected in over 60% of tested samples. Humans were not a significant or consistent source of fecal contamination in this reach during the study period.

Mid-river sampling locations show that the main channel is of high quality and meeting the bacteria objectives. Overall, the results indicate that fecal matter from birds and dogs are causing high bacteria levels along the bank and in shallow water areas.

Background

The Lower American River flows west from Nimbus Dam to the confluence of the American and Sacramento Rivers. This 23-mile reach is bounded by the American River Parkway and is protected as a recreational river within the California and National Wild and Scenic Rivers Systems. The river is a popular destination for boating, swimming, fishing, and other recreational activities.

The Central Valley Regional Water Quality Control Board (Central Valley Water Board) has conducted extensive monitoring on the Lower American River to assess the protection of recreational use. The sampling has shown that fecal indicator bacteria results in the lower 6 miles of the reach frequently exceed the water quality objectives. The Central Valley Water Board, Sacramento County Regional Sanitation District (Regional San), Sacramento Area Sewer District, Sacramento Stormwater Quality Partnership³, and Sacramento County Regional Parks have initiated a study to identify the sources of fecal pollution in this section of the Lower American River.

Study Design

Phase 1 of the source tracking study focused on the 3-mile reach of the Lower American River from the upstream end of Paradise Beach to Sutter's Landing Regional Park. The Phase 1 study area and monitoring locations are shown in Figure 1.

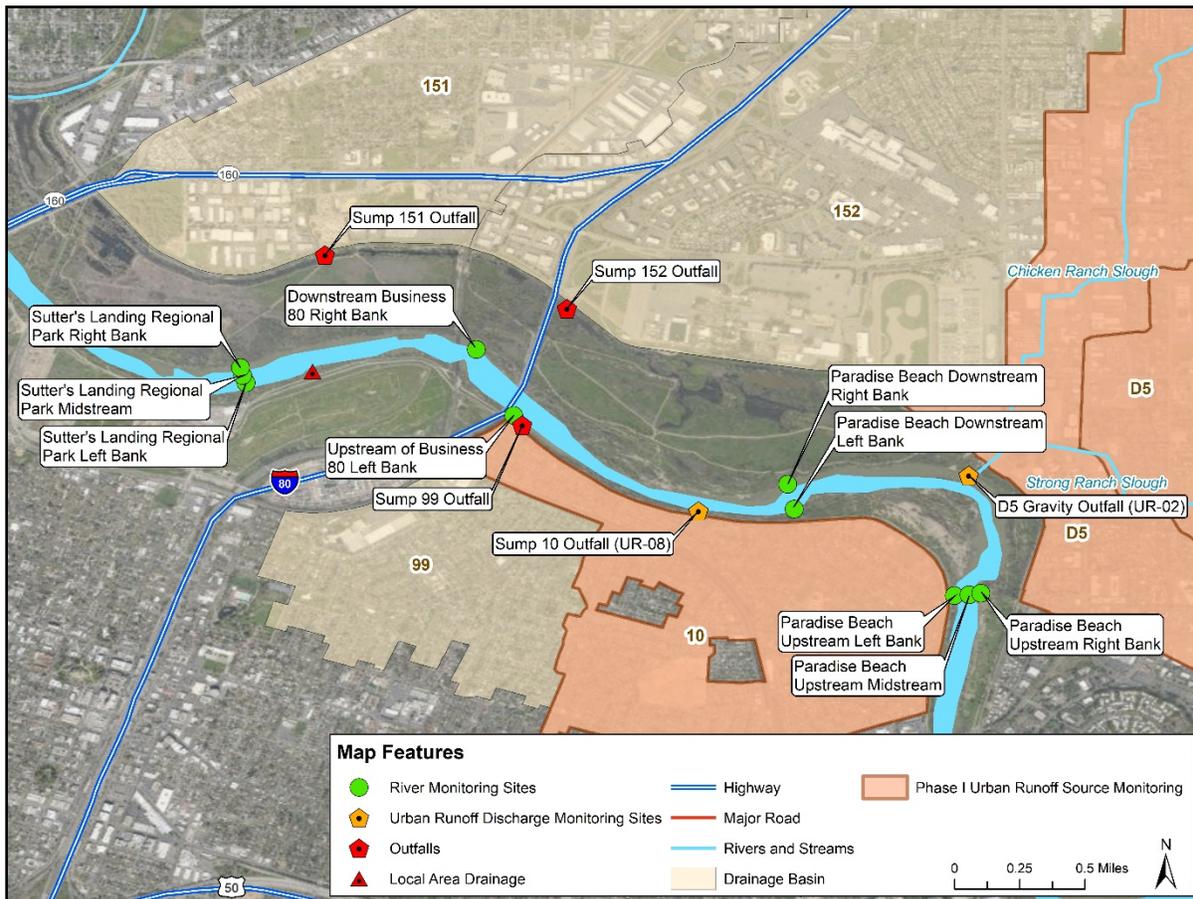
¹ Statewide bacteria water quality objectives are included in part 3 of the Water Quality Control Plan for Inland Surface Water, Enclosed Bays, and Estuaries Plan of California (https://www.waterboards.ca.gov/plans_policies/docs/bacteria.pdf).

² Most probable number (MPN) is a statistical estimate of the number of bacteria in a sample.

³ The Sacramento Stormwater Quality Partnership is comprised of Sacramento County and the cities of Sacramento, Citrus Heights, Elk Grove, Folsom, Galt, and Rancho Cordova.

Twelve locations were monitored during Phase 1 to provide information on spatial trends and potential sources of fecal pollution. River monitoring sites were selected upstream and downstream of potential source inputs (see Table 2). Since there is unlikely complete mixing of sources from one bank to the other given the size and hydrology of river, monitoring sites were distributed on the south (river left) and north (river right) banks, as well as two midstream locations at the upstream and downstream ends of the study reach. In addition, two storm drainage outfalls were monitored to characterize *E. coli* sources in dry weather urban runoff.

Figure 1. Map of the Phase 1 study area showing the river monitoring locations, storm drainage outfalls, and outfall drainage areas. The Sump 10 and D5 outfalls (marked in orange) were monitored throughout the study period. Map provided by the Sacramento Stormwater Quality Partnership.

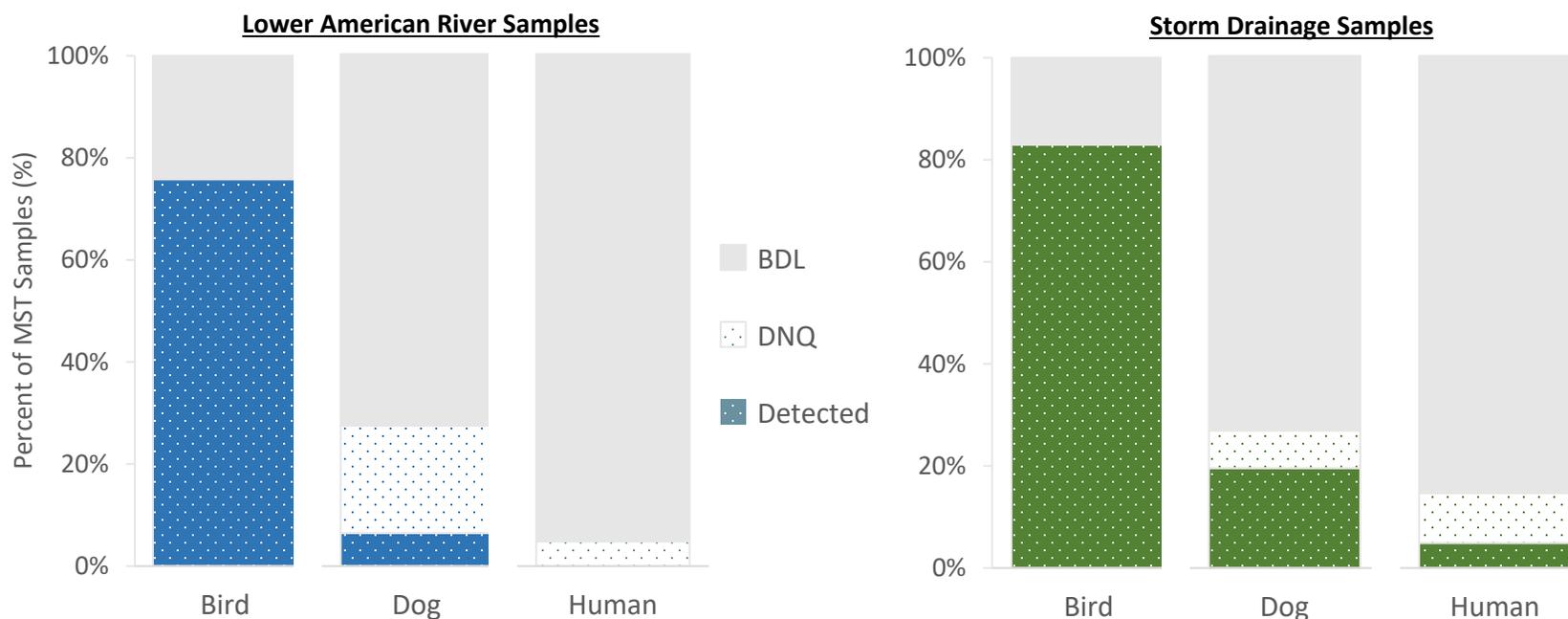


Sampling was conducted approximately weekly during dry weather conditions in the summer of 2019 (August 13 through October 1) and 2020 (May 21 through September 29). A total of 30 sampling events were completed, although the 2 midstream locations were not sampled in 2020. All samples were analyzed for the indicator bacteria *E. coli*. Samples with *E. coli* greater than a pre-determined level (100 MPN/100 mL) were selected for microbial source tracking (MST) analysis. MST samples were analyzed for genetic markers chosen to identify human, dog, and bird sources.

Table 1. Summary of *E. coli* sample data for each river sampling location. Summary includes median *E. coli* result (in MPN/100 mL), percentage of results greater than 100 MPN/100 mL, and percentage of bacteria water quality objective (WQO) exceedances.

Sampling Location	Left Bank			Midstream			Right Bank		
	Median Result	% >100	% WQO Exceedances	Median Result	% >100	% WQO Exceedances	Median Result	% >100	% WQO Exceedances
Paradise Beach Upstream	18.7	7%	0%	17.5	0%	0%	23.1	3%	0%
Paradise Beach Downstream	46.9	23%	19%	-	-	-	35.0	23%	0%
Business 80	22.9	20%	0%	-	-	-	25.8	7%	0%
Sutter's Landing	39.8	20%	19%	18.5	0%	0%	201.6	73%	100%

Figure 2. Summary of Phase 1 MST sample data for river and storm drainage outfall locations. Each graph shows the percentage of sample results that were below the detection limit (BDL), detectable but not quantifiable (DNQ), and detected above the quantification limit for the bird, dog, and human markers. The detection limit is the lowest concentration (i.e., the smallest amount) that can be detected by the method. The quantification limit is the lowest concentration a sample can be measured with reasonable accuracy and precision. Results that are between the detection and quantification limits are detectable but not quantifiable, meaning the targeted marker was present but at too low of a concentration to determine the amount.



Results

Sampling in the Phase 1 segment has shown that most sites generally meet the bacteria objective for *E. coli*. The exception is the right bank site at Sutter’s Landing Regional Park, which exceeded the water quality objective throughout the study period. Table 1 provides the median *E. coli* values and number of exceedances for each site. There are two points along the river with notable increases in exceedances and median concentrations. These sites are the left bank at Paradise Beach Downstream and right bank at Sutter’s Landing. Table 2 provides information to better understand what sources may be contributing to the *E. coli* levels at these sample locations.

Table 2. Summary of potential indicator bacteria sources by river reach. Reaches are bounded by upstream and downstream sampling locations (see Figure 1). The blue arrow shows the direction of river flow.

River Reach	Left Bank	Right Bank
Paradise Beach Upstream to Paradise Beach Downstream	<ul style="list-style-type: none"> • Dispersed beach area with swimmers and dogs • Waterfowl 	<ul style="list-style-type: none"> • Urban runoff from D5 outfall • Multi-use trail with river access • Encampments
Paradise Beach Downstream to Business 80	<ul style="list-style-type: none"> • Urban runoff from sumps 10 and 99 • Hiking trail along river • Sporadic encampments 	<ul style="list-style-type: none"> • Multi-use trail with limited river access • Sporadic encampments
Business 80 to Sutter’s Landing	<ul style="list-style-type: none"> • Beach area with swimmers and dogs • Multi-use trail with river access • Local drainage outfalls • Few encampments. 	<ul style="list-style-type: none"> • Urban runoff from sumps 151 and 152 • Waterfowl • Sporadic encampments

The increase on the left bank between upstream and downstream locations at Paradise Beach could be attributable to waterfowl, dogs accompanying recreational visitors, or other unmeasured sources. There are no outfalls and minimal encampments in this reach. Samples sent for MST analysis detected bird and dog markers.

The increase on the right bank between Business 80 and Sutter’s Landing sites is the most consistent and significant increase of *E. coli* in the Phase 1 sample area. Potential sources in this section include waterfowl, the outfalls for sumps 151 and 152, and sporadic encampments. Visual inspections of the channels draining from the outfalls indicate no runoff reached the river during the study period. MST marker results suggest birds are the dominant source of contamination, with a small contribution from dogs.

Figure 2 above provides a graphical summary of the MST data for river sample sites of the Phase 1 area. This data indicates that birds and dog are the most likely sources of fecal contamination in the Phase 1 area. There were 2 detections of the human marker in the river, although both detections were at very low levels and not quantifiable.

Two storm drainage outfalls (Drainage Sump 10 and D5 gravity outfall) were also monitored during Phase 1 to characterize urban runoff as a potential source. MST results for the outfalls indicate bird and dog as the most consistent sources of fecal contamination. There were a small number of human marker

detections in the outfalls (6 of 41 samples), including two samples that were quantifiable (see Figure 2). Sample results for human detections were at much lower magnitude than the bird and dog markers, but they indicate there may be minor sources of human contamination. The small number of detections and magnitude indicate sporadic human sources and not leaking sewer lines, cross connections, or illicit discharge to the municipal storm drainage system.

Further Reading

Griffith, J.F., Layton, B.A., Boehm, A.B., Holden, P.A., Jay, J.A., Hagedorn, C., McGee, C.D., Weisberg, S.B. (2013) The California microbial source identification manual: a tiered approach to identifying fecal pollution sources to beaches. Southern California Coastal Water Research Project technical report 0804. https://www.waterboards.ca.gov/water_issues/programs/beaches/cbi_projects/docs/sipp_manual.pdf

Central Valley Water Board, 2019. Lower American River Bacteria Study Plan—Fecal Indicator Bacteria Characterization and Source Identification.

Central Valley Water Board, 2019. Lower American River Bacteria Source Identification Phase 1— Dry Weather Conditions, Paradise Beach to Sutter’s Landing Regional Park.

Sacramento Stormwater Quality Partnership, 2019. Lower American River Bacteria Source Identification Phase 1—Dry Weather Urban Runoff Discharge Evaluation Sampling and Analysis Plan.

Plans are available on request by e-mailing Alisha.Wenzel@waterboards.ca.gov.