

**Los Angeles River  
Bacteria TMDL**

**TMDL Elements Summaries**

*Prepared for:*

**CREST Technical Committee**

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# Step 1: Problem Identification

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## What do we Know?

### *Los Angeles River Watershed – Listed Reaches for Bacteria*

- 2002 303(d) list - 15 reaches/tributaries impaired for coliform (Table 1, Figure 1).
- Proposed 2006 update to the 303(d) list (pending EPA approval) - two additional listed tributaries: Aliso Canyon Wash (for bacterial indicators) and Burbank Western Channel (for fecal coliform).
- Listings in 2002, 1998, and 1996 based on monitoring data between 1988 and 2002 during which there were a number of exceedances of water quality objectives for the applicable LAR reaches.

### *Beneficial Uses*

- Multiple beneficial uses for each reach/tributary (Table 2).
- For bacteria, primary concern is risk to human health → beneficial use of interest is REC-1 (full contact water recreation or “uses...involving body contact with water, where ingestion of water is reasonably possible”).
- All bacteria-listed LAR reaches and tributaries are designated REC-1.

### *Numeric Targets*

- Although the source of contaminants is considered to be a distributed, non-point source, the storm water system is regulated as a point source through Los Angeles Municipal Storm Water NPDES permit, or MS4 permit.
- Water quality objectives for REC-1 (Table 3) apply to all listed reaches/tributaries
- High Flow Suspension of Beneficial Uses (described in Step 2)
- Determination of how bacteria objectives are achieved:
  - Reference watershed approach - will require the identification of an appropriate inland reference watershed, and/or
  - Watershed hydrologic and water quality modeling.

### *Preliminary Identification of Sources*

- Based on a preliminary analysis of water quality monitoring data, the primary source of bacterial indicators in the L.A. River is from land use specific distributed sources that feed the waterbodies through storm drains and tributaries.

## What are our Questions/Concerns?

- When were beneficial uses for LAR last reviewed? Is REC-1 an appropriate beneficial use for all bacteria-listed reaches based on actual use, access, and/or water depths? A use attainability analysis will not be conducted by CREST as part of this TMDL development effort, as previously discussed, but are use surveys of certain reaches appropriate?
- Reach 1 ("upstream of Carson Street bridge to Estuary") beneficial uses includes "Marine Habitat" and "REC-1". Does this mean "Marine REC-1"? Do we need to consider Marine REC-1 water quality objectives for Reach 1 (this would include enterococcus and total coliform; there are no E. Coli water quality objectives for Marine REC-1)?

Table 1. Listed Reaches and tributaries for Bacteria – L.A. River Watershed

<b>Reach</b>	<b>Impairment</b>
<i>Listed on 2002 303(d)List for Bacteria</i>	
Arroyo Seco Rch 1 (d/s Devil's Gate Dam)	coliform
Arroyo Seco Rch 2 (W. Holly Ave. to Devil's Gate)	coliform
Bell Creek	coliform
Compton Creek	coliform
Dry Canyon Creek	coliform
Los Angeles River Reach 1 (u/s Carson St. to estuary)	coliform
Los Angeles River Reach 2 (Figueroa St. to u/s Carson St.)	coliform
Los Angeles River Reach 4 (Sepulveda Dam to Riverside Dr.)	coliform
Los Angeles River Reach 6 (u/s of Sepulveda Basin)	coliform
McCoy Canyon Creek	coliform
Rio Hondo Reach 1 (Santa Ana Fwy to Los Angeles River)	coliform
Rio Hondo Reach 2 (Whittier Narrows Flood Control Basin to Spreading Grounds)	coliform
Tujunga Wash (d/s Hansen Dam to Los Angeles River)	coliform
Verdugo Wash Reach 1 (LA River to Verdugo Rd)	coliform
Verdugo Wash Reach 2 (above Verdugo Road)	coliform
<i>Proposed for the 2006 Update to the 303(d)List for Bacteria</i>	
Aliso Canyon Wash	Bacteria Indicators
Burbank Western Channel	Fecal Coliform

Table 2. Beneficial Uses for L.A. River Reaches and Tributaries

Reach	Beneficial Uses
<i>Listed on 2002 303(d)List for Bacteria</i>	
Arroyo Seco Rch 1 (d/s Devil's Gate Dam)	
Arroyo Seco Rch 2 (W. Holly Ave. to Devil's Gate)	
Bell Creek	Municipal (Potential*) Groundwater Recharge (Intermittent) REC 1 (Intermittent <sup>1</sup> ) REC 2 (Intermittent) Wildlife Habitat Warm (Intermittent)
Compton Creek	Municipal (Potential*) Groundwater Recharge REC 1 <sup>1</sup> REC 2 Wildlife Habitat Warm Wetlands
Dry Canyon Creek	Municipal (Potential*) Groundwater Recharge (Intermittent) REC 1 (Intermittent <sup>1</sup> ) REC 2 (Intermittent) Wildlife Habitat Warm (Intermittent)
Los Angeles River Reach 1(u/s Carson St. to estuary)	Municipal (Potential*) Groundwater Recharge REC 1 <sup>1</sup> REC 2 Wildlife Habitat Warm Shellfish (Potential <sup>1</sup> ) Rare Migratory (Potential) Spawning (Potential) Marine Habitat Industrial Service Supply (Potential) Industrial Process Supply (Potential)
Los Angeles River Reach 2 (Figueroa St. to u/s Carson St.)	Municipal (Potential*) Groundwater Recharge REC 1 <sup>1</sup> REC 2 Wildlife Habitat (Potential) Warm Industrial Service Supply (Potential)
Los Angeles River Reach 4 (Sepulveda Dam to Riverside Dr.)	Municipal (Potential*) Groundwater Recharge REC 1 <sup>1</sup> REC 2 Wildlife Habitat Warm Wetlands Industrial Service Supply (Potential)
Los Angeles River Reach 6 (u/s of Sepulveda Basin)	
McCoy Canyon Creek	Municipal (Potential*) Groundwater Recharge (Intermittent) REC 1 (Intermittent) REC 2 (Intermittent) Wildlife Habitat Warm (Intermittent)
Rio Hondo Reach 1 (Santa Ana Fwy to Los Angeles River)	Municipal (Potential*) Groundwater Recharge (Intermittent) REC 1 (Potential <sup>1</sup> ) REC 2 Wildlife Habitat (Intermittent) Warm (Potential)

Rio Hondo Reach 2 (Whittier Narrows Flood Control Basin to Spreading Grounds)	Municipal (Potential*) Groundwater Recharge (Intermittent) REC 1 <sup>1</sup> (Intermittent) REC 2 Wildlife Habitat (Intermittent) Warm (Potential)
Tujunga Wash (d/s Hansen Dam to Los Angeles River)	Municipal (Potential*) Groundwater Recharge (Intermittent) REC 1 <sup>1</sup> (Potential) REC 2 (Intermittent) Wildlife Habitat (Potential) Warm (Potential)
Verdugo Wash Reach 1 (LA River to Verdugo Rd)	
Verdugo Wash Reach 2 (above Verdugo Road)	
<b><i>Proposed for the 2006 Update to the 303(d)List for Bacteria</i></b>	
Aliso Canyon Wash	Municipal (Potential*) Groundwater Recharge (Intermittent) REC 1 <sup>1</sup> (Intermittent) REC 2 (Intermittent) Wildlife Habitat Warm (Intermittent)
Burbank Western Channel	Municipal (Potential*) REC 1 <sup>1</sup> (Potential) REC 2 (Intermittent) Wildlife Habitat (Potential) Warm (Potential)

\*Municipal designations marked with an asterisk are conditional.

<sup>1</sup> Use restricted by LACDPW.

[insert Figure 1]

## Step 2: Numeric Targets

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### What do we Know?

#### *Water Quality Objectives*

Table 3. Water Quality Objectives – LAR

Beneficial Use	Indicator	Geometric Mean Objective (per 100ml)	Single Sample Objective (per 100ml)
REC-1 Fresh Water Contact Recreation	Fecal coliform	200	400 (Not more than 10% of samples to exceed 400 mpn/100 ml in 30-day period)
	E. Coli	126	235

- High Flow Suspension - Suspension of recreational beneficial uses and the associated bacteriological objectives; applies to engineered channels on days with rainfall greater than or equal to ½ inch and the 24 hours following the end of the ½-inch or greater rain event.

#### *Determination of Achievement of Bacteria Objectives*

- Reference Watershed Approach:
  - ♦ Single sample maximum targets for winter dry weather and year-round wet weather are allowed a certain number of exceedances, as based upon the number of historical exceedance days determined at a reference watershed that has been selected as being representative of natural background water quality runoff from undeveloped areas.
  - ♦ Reference system selected by the Regional Board for the Santa Monica Bay Beaches Bacteria TMDL is the Arroyo Sequit Canyon watershed (and Leo Carrillo Beach monitoring site);
- Modeling:
  - ♦ Model of the watershed and pollutant loading could be used to determine loading capacity and a linkage between loading and water quality targets, and ultimately to estimate necessary pollutant reductions needed to meet water quality objectives.
  - ♦ Used HSPF model for the LAR metals and nutrient TMDLs, and for simulation of bacteria concentrations in the LAR.
  - ♦ Additional work necessary to make the model suitable for determining bacteria assimilative capacity and load allocations, particularly during dry weather, because the model was calibrated using “snapshot” data, which represent only a few days of the historic record.

### What are our Questions/Concerns?

- ♦ Will use of reference watershed approach require identification of a suitable inland reference watershed? If so, should CREST join ongoing SCCWRP reference watershed study? If so, how many sites and which locations?
- ♦ What are the real benefits of joining SCCWRP study - if use existing reference watershed, get 17 exceedance days; perhaps SCCWRP study indicates that a different number of exceedance days (larger or smaller) is more appropriate. Will this have an impact on TMDL or TMDL implementation?
- ♦ In what way, if at all, will participation in SCCWRP reference watershed study affect timing TMDL?

## Step 3: Source Analysis

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### What do we Know?

- Preliminary data analysis indicates that loading of bacterial indicators to the LAR is from distributed sources that feed the waterbodies through storm drains. Actual sources of bacteria are as yet unproven and may include distributed land use based sources, broken sewer lines, bacteria growth in drains, and others.
- Permitted POTW point sources contribute a significant amount of flow to the LAR during dry weather and are likely a substantial dilution source of indicator bacteria from other sources in the LAR.

### *Preliminary Dry Weather Source Assessment*

- Dry weather bacteria concentrations in the mainstem LAR exhibit a systematic spatial pattern, on both wet season dry-weather days and dry season.
- The highest dry weather mainstem LAR bacteria concentrations are often observed upstream in Reach 6 at White Oak Ave., where flow rates are relatively low.
- The lowest dry weather bacteria concentrations are observed at the upstream ends of Reach 4 and Reach 2 (downstream of tertiary-treated POTW discharges). Wastewater discharge improves water quality with respect to bacteria through dilution; also possible that the soft bottom in these reaches is beneficial to water quality.
- Downstream of wastewater discharges, it appears that sources of bacteria are impacting the LAR during dry weather, leading to rapid increases in indicator bacteria concentrations and frequent exceedances of WQOs. Possible sources include storm drains, tributaries, homeless, or regrowth in the water column or sediments.

### *Preliminary Wet Weather Source Assessment*

- E. coli concentrations are typically much higher during wet weather conditions, regardless of whether daily rainfall was less or greater than 0.5”.
- Bacteria concentrations on days of and the day after <0.5” of daily rainfall are highly variable. (Exceptions = upstream ends of Reach 2 and Reach 4, which are dominated by wastewater discharges, implying that greater rainfall is required to overcome the “dilution” provided by disinfected wastewater)
- Concentrations on the day of and day after 0.5” of daily rainfall are consistently high with little spatial variation along the mainstem LAR → strong, ubiquitous source of bacteria during and after high rainfall events.

### What are our Questions/Concerns?

- The analysis of LAR bacteria data is in preliminary phases. What is the preferred approach for subsequent data analysis (statistical techniques which attempt to determine relationships among parameters; and/or a water quality model)?
- What are the actual sources of indicator bacteria: distributed land use specific runoff; broken sewer lines; growth of bacteria in drains; natural bacterial loading? What are the relative contributions of different sources? How can these sources be identified and differentiated?
- Using existing monitoring data sets, what are the exceedances when taking into account high flow suspension and 17 exceedance days based on Arroyo Sequit reference watershed? Where are these exceedances?

## Step 4: Linkage Analysis

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### What do we Know?

#### *Linkage Analysis*

- Goal is to "**link**" water quality exceedances with pollutant sources in order to:
  1. Establish a cause and effect relationship between identified sources of pollutants and existing water quality, and
  2. Set the load capacity of the waterbody.
- Margin of safety is considered to be implicitly incorporated for bacteria TMDLs, if the numeric targets and waste load allocations are set as the water quality objective.
- Approaches used for linkage analysis:
  1. simple empirical methods;
  2. analysis of fate and transport of bacteria sources using a variety of modeling techniques.

Both methods address the linkage between loading and water quality through analysis of existing water quality data.

- For SMBB Beaches and Ballona Creek Bacteria TMDLs rigorous linkage analyses was not needed because these TMDLs were concentration or density-based rather than load-based, and the assimilative capacity was defined as the water quality objective.

#### *Previous Approaches to Linkage Analysis Using Modeling*

- ♦ LAR Metals and Nutrient TMDLs (Tetra Tech under contract to US EPA): one-dimensional flow model (EFDC) coupled with HSPF water quality model.
- ♦ Bacterial indicator loading to Malibu Creek watershed (Tetra Tech, 2002): HSPF model used to determine source loads, critical conditions, and suggested source reductions considered necessary to meet numeric targets under critical conditions.
- ♦ Modeling for San Diego area bacteria TMDL loading and linkage analysis (Tetra Tech) - recoded version of HSPF; technical approach similar to modeling approach for Malibu Creek Bacterial TMDL and Los Angeles River Nutrient and Metals TMDLs.
- ♦ Recent SCCWRP research concerns source loading and application of BMPs to source reduction; also utilizes HSPF (Ackerman et al., 2005).

### What are our Questions/Concerns?

- ♦ Is there an advantage to using WQOs as allocations versus modeling load capacity?
- ♦ Is modeling of bacteria loading worthwhile, given unknowns and difficulty?
- ♦ If modeling is selected, is the model that is partially developed HSPF model the preferred option or should alternative modeling techniques be investigated?

## **Step 5: Pollutant Allocation**

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### **What do we Know?**

Based on the results of the linkage analysis step, the waste load and load allocations are determined for point and non-point sources.

The allocation step:

- Translates the TMDL into allowable loads;
- Distributes loads among sources;
- Accounts for margin of safety;
- Accounts for seasonal variation;

And allocations should:

- Reflect relative size and magnitude of sources
- Include adequate documentation;
- Provide reasonable assurance that water quality standards will be attained
- Involve stakeholders in development.

The primary allocation for LAR bacteria TMDL will be to NPDES MS4 permits as a point source. These allocations will be based on either the number of exceedance days (reference watershed approach) or load capacity (modeling approach).

In the case of LAR indicator bacteria TMDL, the load allocations will be determined under dry weather and wet weather conditions.

### **What are our Questions/Concerns?**

- Can modeling assist in refining allocations by determining specific reductions, and therefore allocations by subwatershed?
- Will there be allocations made to unlisted reaches and tributaries?

## Step 6: Implementation Strategy

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### What do we Know?

- The implementation strategy is a recommended, but not required, approach to reaching the goals of the TMDL that incorporates:
  - Implementation actions;
  - Responsible agents for implementing the actions;
  - A schedule for the implementation and final compliance with the water quality standard;
  - Schedule and format of an adaptive management approach to the TMDL, which provides for incorporation of greater knowledge and adaptation of the TMDL.
- The following items should be considered during the investigation of the implementation strategy:
  - Other TMDL implementation plans;
  - Proposed BMP implementation projects within watershed and IRP;
  - Existing stormwater BMP implementation within watershed; and,
  - Other TMDL implementation schedules.
- The EPA requires that TMDLs provide a reasonable assurance that implementation will result in attainment of water quality standards. Reasonable assurance requires that the allocations are technically feasible and can be implemented in a reasonable amount of time.
- Cost estimates for implementation strategies are required as a precursor to establishing basin plan amendments based on the TMDL.
- The schedule needs to outline the timeframe for preparation of a detailed implementation plan, a detailed monitoring and compliance plan, and milestones for meeting compliance.

Extension of a compliance schedule has been proposed, in other Southern California bacteria TMDLs, if an integrated watershed approach to implementation is carried out. For LAR, an integrated approach will need to incorporate:

- Aspects of the City of LA Integrated Resources Plan (IRP);
- Other integrated watershed plans that have been adopted, or that are in preparation; and,
- Implementation strategies that incorporate multiple TMDLs.

A watershed approach will require a range of BMPs, and incorporate new data regarding effectiveness of specific BMP implementation. SCCWRP watershed modeling can be particularly useful for maximizing BMP effectiveness and efficiently determining scenarios for BMP implementation.

Implementation could be phased so that resources are allocated to address areas of greatest risk first: Protection of sites where actual REC-1 use activity occurs, during hydrologic periods when REC-1 use is most likely to occur, and where the bacteria sources are predominantly human sources.

### What are our Questions/Concerns?

- Is there a specific time frame under which compliance with the TMDL needs to be met?
- What are the projects that are already proposed or planned (i.e. IRP, integrated watershed plans, etc)?

## Step 7: Monitoring

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### What do we Know?

The monitoring section of the TMDL defines the key questions the monitoring plan needs to address, including:

- Incorporation of existing monitoring programs (City Status and Trends, POTWs);
- Provide data to evaluate implementation actions;
- Provide data for adaptive management decisions;
- Provide basis for evaluating compliance.

A monitoring plan is outlined within the TMDL, with a timeframe scheduled for development of a detailed plan after formal adoption of the TMDL. The detailed monitoring plan should ultimately include:

- Sampling and analysis plans;
- Quality Assurance Policies and Procedures;
- Field sampling protocols;
- Laboratory analyses required
- Descriptions of data management and data analysis

### *Special Studies*

- On-going dry weather monitoring of LAR Reaches 2 and 4 aimed at understanding spatial and temporal distribution of bacteria.
- Studies may be designed to better understand the specific waterbody and loading issues, or the value of specific BMPs and other implementation actions.
- Often results of these special studies are incorporated into the TMDL through an adaptive management schedule and commitments that are made under the implementation plan.
- Most special studies described in the TMDL will be “recommended” and will be designed to refine waste load allocations and/or assist with TMDL implementation, although some may be required. Responsible entities may also be requested to undertake beneficial use investigations of certain reaches (e.g. to determine applicability of the high-flow suspension of recreational uses).
- Special studies that can be implemented in a short timeframe and that directly impact the content of the TMDL may be most appropriately conducted as part of the TMDL Development Process. (e.g. ongoing monitoring effort funded by the EPA Region 9, with stakeholder assistance, in Reaches 2 and 4)
- Special studies that require a longer period for study development and implementation. These studies can be implemented during the initial three-year to six-year period after the TMDL is adopted, and if appropriate, results may be used to modify the TMDL at the time the TMDL is revisited.

### What are our Questions/Concerns?

- Will unlisted reaches and tributaries be required to have additional monitoring?
- Will initial monitoring, after effective date of TMDL, need to be proscribed in the TMDL, or can a flexible adaptive monitoring program be instituted that will assist with obtaining results from Special Studies, prior to compliance dates?
- Is the existing monitoring adequate for compliance monitoring?

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