SECTION 11
Santa Ana Region
2019-2020 Monitoring Annual Report

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SANTA ANA REGION

2019-2020 Monitoring Annual Report

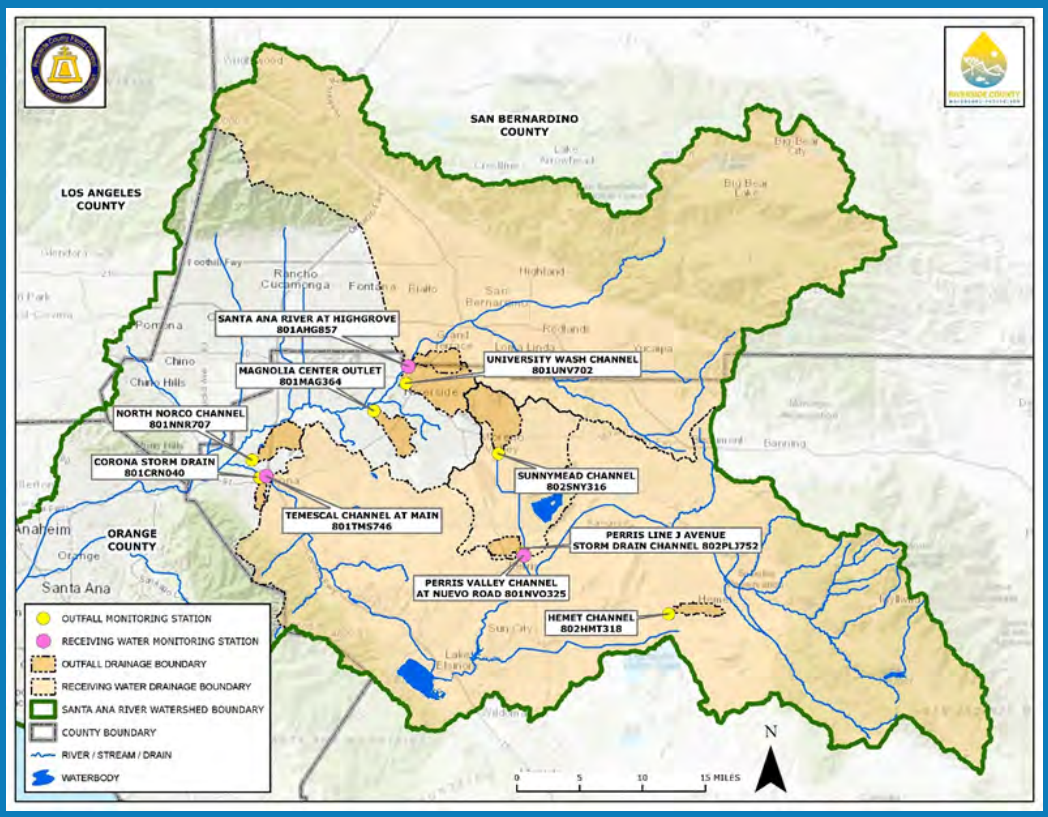
Executive Summary

Strawberry Creek
SMC Bioassessment Trend Site

Monitoring was conducted by the Riverside County Watershed Protection Program during the 2019-2020 monitoring year to address the objectives of the Monitoring and Reporting Program (MRP) of the 2010 Municipal Separate Storm Sewer System (MS4) Permit. This report presents the results of this ninth year of monitoring under the MRP of the 2010 MS4 Permit. The MRP is limited to the area of Riverside County under Permittee jurisdiction within the Santa Ana River Watershed, referred to throughout this report as the Santa Ana Region or SAR.

The climate of the SAR is Mediterranean, characterized by warm, dry summers and cool, rainy winters. Annual precipitation ranges from less than 10 inches in the alluvial valleys to over 36 inches in the mountains. In general, shading from the coastal western boundary of the Santa Ana Mountains translates to very little precipitation throughout valley areas of the inland SAR. Under natural conditions, the majority of streams in the SAR are ephemeral, meaning they are dry and only flowing during and immediately after rain.

SAR Boundary and Monitoring Sites



PERMITTEES

EXECUTIVE SUMMARY - SANTA ANA REGION MONITORING ANNUAL REPORT 2019-2020 YEAR 1

Monitoring and Assessment Requirements

During the 2019-2020 monitoring year, the SAR Monitoring Program was implemented in accordance with the requirements of the 2010 MS4 Permit. All wet and dry weather monitoring components of the MS4 outfall monitoring program, receiving water monitoring program, and bioassessment monitoring (through participation in the Southern California Stormwater Monitoring Coalition [SMC] regional monitoring program) were completed. In addition, illicit connection/illegal discharge inspections were conducted, and appropriate illicit discharge detection and elimination procedures were implemented.

The Permittees also participated in Total Maximum Daily Load (TMDL) Task Forces, which implemented the monitoring and reporting requirements of the Middle Santa Ana River (MSAR) Bacterial Indicator TMDL and the Lake Elsinore and Canyon Lake Nutrient TMDL. Special studies were also conducted to address specific research or management actions that are not addressed by the Permit-prescribed monitoring program.

Summary of the 2019-2020 SAR Monitoring Program

Monitoring Program	Monitoring Component	Sampling Frequency	No. Stations	Completed?
MS4 Outfall Monitoring	MS4 Outfall Monitoring	2 Dry Events, 3 Wet Events	7 Stations	✓
IC/ID Monitoring	IC/ID Investigations	Dry weather, scheduled and monitored per Permittee Local Implementation Plan		✓
Receiving Water Monitoring	Receiving Water Monitoring	2 Dry Events, 2 Wet Events*	3 Stations (1 wet only, 1 dry only, 1 wet and dry)	✓
	Water Column Toxicity	2 Dry Events, 2 Wet Events	3 Stations	✓
	Follow-up Toxicity Analyses	Sampling as necessary		✓
	SMC Bioassessment Monitoring Program	1 Dry Event (2020)	2 Condition, 2 Trend Sites	✓
Special Studies		TMDL/303(d) Listed Waterbody Monitoring •MSAR Bacterial Indicator TMDL Monitoring •Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Regional Monitoring Programs •SMC LID BMP Special Study •Hydromodification Monitoring Program •Salinity Management Program Post-Fire Monitoring Studies		✓

MSAR - Middle Santa Ana River, LID - Low Impact Development, BMP - Best Management Practices
*During the 2019-2020 monitoring year, an additional wet weather event was sampled for chemistry at one receiving water station.

Assessment and Reporting

The 2019-2020 monitoring year water quality data, in conjunction with historical monitoring results, were used to evaluate the status and trends of conditions in receiving waters and discharges from the MS4 that may impact beneficial uses of receiving waters in the SAR.

Water quality sampling results were compared to Basin Plan water quality objectives (WQOs), California Toxics Rule WQOs, and standards from the Statewide Bacteria Provisions – statistical threshold values (STVs) or TMDL numeric targets for *E. coli,* as applicable. Sample results from MS4 outfall stations were compared to these receiving water WQO criteria for comparison purposes only.

Large and/or high intensity precipitation is needed to generate flow in ephemeral receiving waters. If a site was dry or flow was insufficient for sample collection, dry weather events were classified as visited, not sampled (VNS).

Santa Ana River

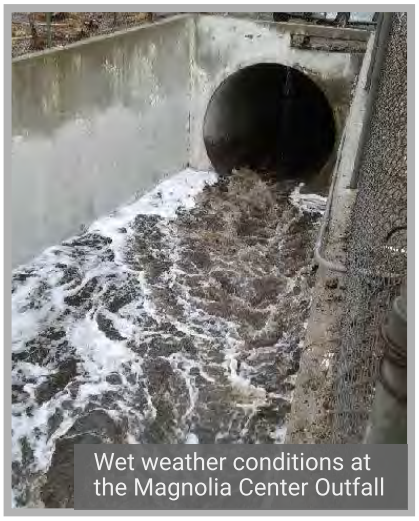
Data Assessment Overview

- *Comparison to WQOs*
- *Trend Analysis*
- *Persistence Analysis*
- *Frequency Analysis*
- *Land Use and Sources Evaluation*
- *Model Monitoring Program Management Questions*

7 Core Outfalls
3 Receiving Water Stations

Wet Weather Monitoring Results Summary

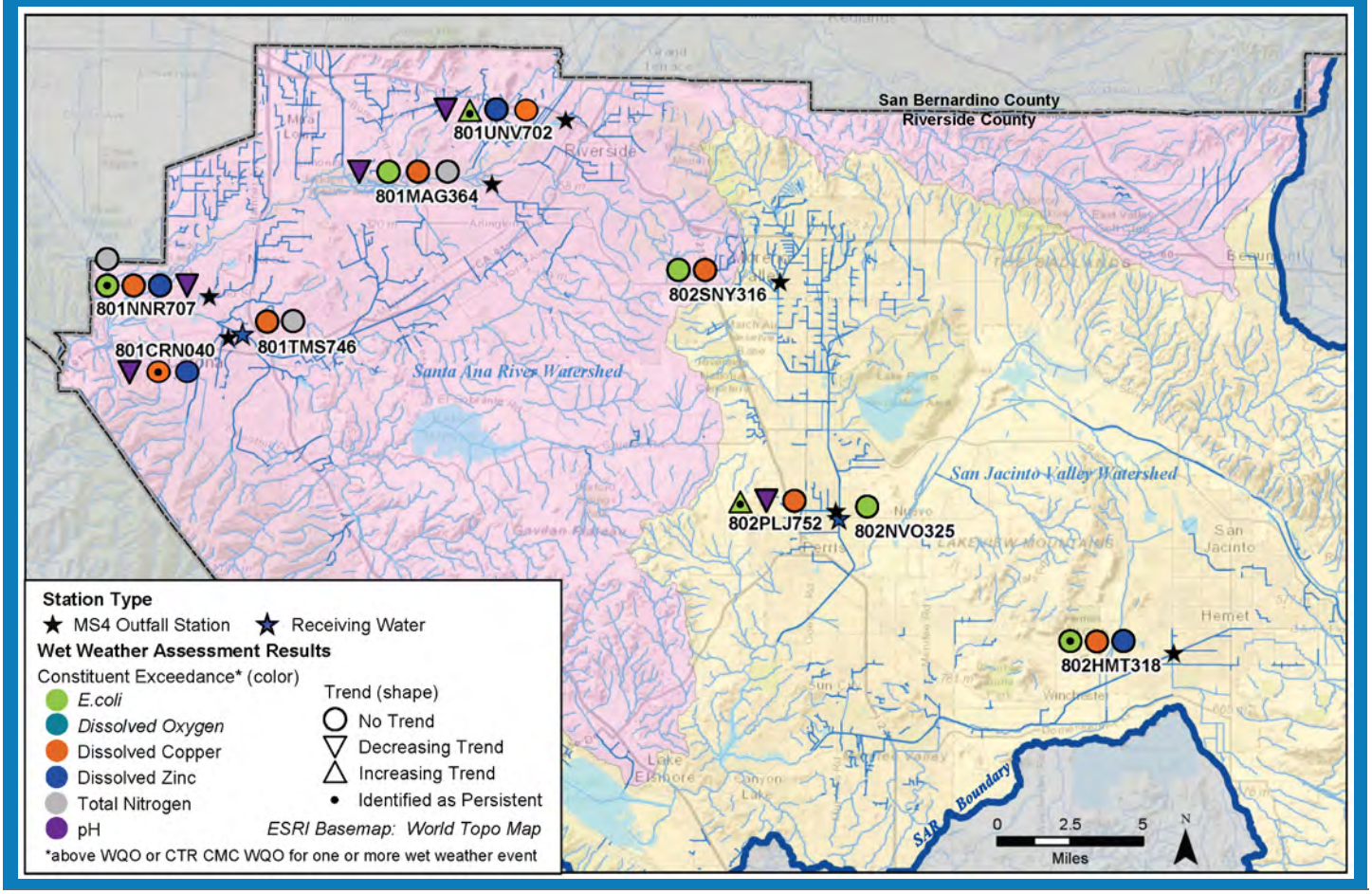
- MS4 outfall data were more frequently above WQOs than receiving water station data. MS4 discharges are not required to meet WQOs, which are applicable to receiving water data only for compliance.
- *E. coli* was above receiving water WQOs during at least one wet weather event at six MS4 outfall stations and the Perris Valley Channel at Nuevo Road receiving water station.
- Dissolved copper concentrations were above receiving water WQOs during at least one wet weather event at all seven MS4 outfall stations and the Temescal Channel at Main receiving water station.
- pH was outside of the Basin Plan WQO range at five MS4 outfall stations (one event each) but in range at receiving water stations.
- Total nitrogen exceeded at two MS4 outfall stations (one event each) and also once at Temescal Channel at Main receiving water station.



Wet weather conditions at the Magnolia Center Outfall

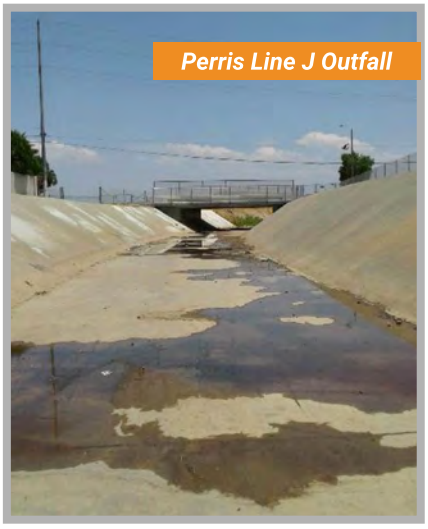
Spatial Overview of 2019-2020 Wet Weather Monitoring Results

Only parameters with concentrations exceeding receiving water WQOs are shown below. For these parameters, statistically significant long-term trends and results that persistently exceed WQOs are also presented as symbols on the map. Trends varied among parameters and stations. While dissolved copper was above WQOs, total copper concentrations were found to be decreasing at two MS4 outfalls and the Temescal Channel at Main receiving water station.



Dry Weather Monitoring Summary

- Three of the seven MS4 outfall stations and one receiving water station were VNS during dry weather monitoring events.
- *E. coli* was below the WQO at the one receiving water station where dry weather samples were collected.
- Dissolved copper was below the WQO at all MS4 outfalls and the sampled receiving water station during dry weather.
- Chronic toxicity to *P. subcapitata* growth was observed in both dry weather samples at Santa Ana River at Highgrove.
- Nitrogen-Nutrients met WQOs during dry weather at all MS4 outfall and receiving water stations, where applicable, except total nitrogen during a single dry weather event at the North Norco Outfall.
- 4,4' DDT had slight exceedances of the receiving water WQO at three of the four outfalls sampled in dry weather.

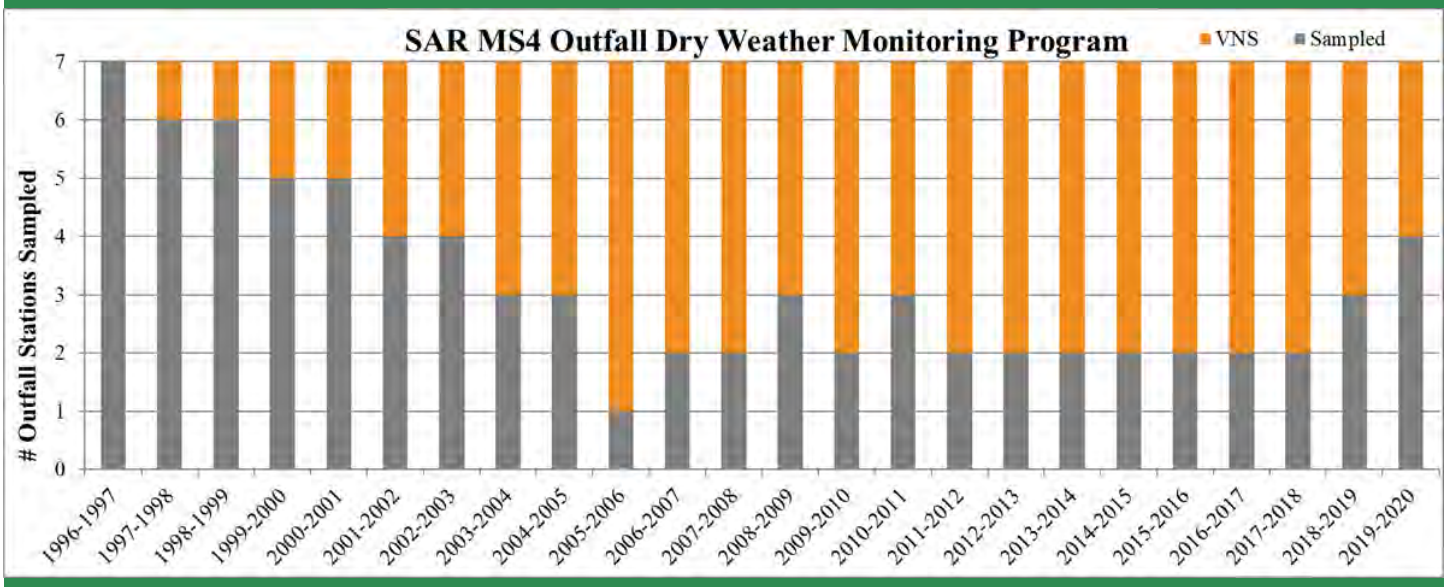


- Nitrate showed a decreasing trend at Santa Ana River at Highgrove and two MS4 outfall stations, although total organic nitrogen was increasing and dissolved oxygen decreasing at the two outfalls.
- *E. coli* concentrations showed an increasing trend at Magnolia Center Outfall and University Wash Channel. Total and dissolved copper were found to be increasing at Santa Ana River at Highgrove.

Frequency of VNS Results at SAR MS4 Outfall Stations

During the 2010 MS4 Permit term, VNS results have been frequent during dry weather events as shown in the figure below that illustrates in orange the proportion of outfalls that were VNS during each year.

During the 2019-2020 monitoring year, three of the seven MS4 outfall stations were reported as VNS during both dry weather events. These same three MS4 stations have been VNS for all dry weather monitoring activities conducted in accordance with the 2010 MS4 Permit. Two additional outfalls that are historically VNS were sampled during the 2019-2020 year, due to a flowing lateral from one outfall and a changed flow regime at the other outfall (resulting from sediment buildup within the storm drain).



Bioassessment Monitoring Results

The bioassessment component of the receiving water monitoring program was fulfilled through District participation, on behalf of the Permittees, in the SMC Regional Watershed Monitoring Program (RWMP). Bioassessment monitoring was conducted at two condition sites and two long-term trend sites in June 2020 within the SAR, which has a large number of engineered and modified flood control channels.

- At the Strawberry Creek trend site, the California Stream Condition Index (CSCI) benthic health score was in the likely intact range during the 2020 survey. The California Rapid Assessment Method (CRAM) score indicated fair physical habitat quality. No significant trend was identified at Strawberry Creek based on 2015-2020 CSCI scores.
- At the Cucamonga Channel trend site, a fully hardened – engineered channel, CSCI scores in the 2020 survey were consistent with previous years in the very likely altered to likely altered range, and CRAM scores have consistently indicated poor physical habitat quality.
- The condition sites at the upper and lower end of North Fork San Jacinto River received CRAM scores that indicated fair to very good physical habitat quality. The CSCI scores for both trend sites were in the likely intact range.

Strawberry Creek (SMC Trend Site)

Progress of the SAR Monitoring Program

The SAR Monitoring Program was implemented per the 2010 MS4 Permit requirements and SAR Monitoring Program plans during the 2019-2020 monitoring year. The wet and dry weather MS4 outfall and receiving water programs, IDDE program, and SMC RWMP efforts were completed as required. Key ongoing efforts to improve the SAR Monitoring Program are described below.

Regional Coordination

The Permittees continued to participate in the SMC RWMP, which focuses on improvement of stormwater monitoring science, development and improvement of monitoring standards and techniques, coordination among data collection programs, and evaluation of the effects of stormwater discharges to receiving waters. The Permittees also participated in several technical advisory committees (TACs), task forces, and other groups designed to address water quality within the SAR. They also funded special studies for the benefit of their local and regional program efforts. During 2019-2020, a six week synoptic study was conducted at selected major outfalls to the Santa Ana River to re-evaluate bacterial indicator sources and inform the Triennial Review with regard to the MSAR TMDL. Further, the District is moving forward with several projects to divert dry weather flows to the sanitary sewer system from MSAR outfalls in an effort to address the TMDL.

Revisions to the Monitoring Program Parameter Lists

The current list used to evaluate SAR monitoring stations includes several parameters, such as dissolved metals, that, while technically not required by the 2010 MS4 Permit, have been monitored to better understand water quality conditions across the SAR. An analysis of non-detect results was conducted again during the 2018-2019 monitoring year and reduced constituent lists were proposed in the 2018-2019 Monitoring Annual Report. These changes represent effective management of the MRP based on increasing knowledge of water quality conditions in the SAR and focus resources for the benefit of water quality improvement.

Implementation of Program-Specific Laboratory Standards to the Maximum Extent Practicable

The Permittees continue to foster a close working relationship with contracted laboratories to communicate program needs in order to improve the quality of water quality analysis. A new Quality Assurance check was instituted in May 2020 after multiple samples were found to be either missing required analysis or analyzed for constituents that were neither requested nor required. Laboratory log-in confirmation emails are now reviewed after submission of samples to ensure all required analyses are requested. This approach will continue to be used during the 2020-2021 monitoring year.

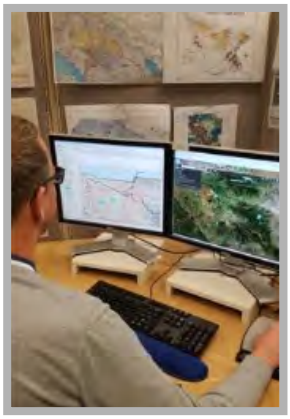
Updated Electronic Data Collection and Management Tools

In 2017, the District acquired a new database management system, which includes some automated QC checks of laboratory data. The new system will continue to be tested, refined and expanded (as appropriate), based on lessons learned during each year of use and the needs of the MRP. The District also purchased new water quality meters (sondes) in September 2020. These new state-of-the-art sondes have the capability to document and record in-situ field measurements that can be saved to the District files for later review if any questions arise after the monitoring event. This capability provides a backup record of field measurements to prevent data loss and correct transcription errors.

Recommendations

In anticipation of the upcoming Permit renewal, recommended next steps for the SAR Monitoring Program in the 2020-2021 monitoring year may include, but are not limited to:

- Consider modifications to monitoring locations to include pairings of outfalls and receiving water stations in order to facilitate assessment of urban runoff as it relates to water quality in receiving waters.
- Continue to use available technologies and tools to improve data management, access, and assessment.



University Wash Channel (Downstream)

The Permittees also request that the Regional Board consider the following actions for the pending MS4 Permit:

- Remove the requirement from the Permit for data comparison to United States Environmental Protection Agency (USEPA) Benchmarks for industrial discharges.
- Use the parameter monitoring lists generated based on Permit criteria as the basis for water quality analysis under the next Permit, while streamlining the lists for consistency and comparability across station and event types.

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11-1.0 INTRODUCTION

11-1.1 MONITORING AND REPORTING PROGRAM

Monitoring was conducted by the Riverside County Watershed Protection Program during the 2019-2020 monitoring year to address the objectives of the Monitoring and Reporting Program (MRP) (Appendix 3 of the 2010 Municipal Separate Storm Sewer System [MS4] Permit[1]). This report presents the results of this ninth year of monitoring under the MRP of the 2010 MS4 Permit. The activities and objectives of the MRP are summarized in **Table 1-1**. The MRP is limited to the area of Riverside County under Permittee jurisdiction within the Santa Ana River Watershed, referred to throughout this report as the Santa Ana Region (SAR).

Table 1-1: Summary of Monitoring and Reporting Program Overall Objectives

Objectives	
• To determine water quality status, trends, and pollutants of concern associated with urban runoff and their impact on the beneficial uses of the receiving waters. • To identify receiving waters that require additional action to control pollution from urban storm water runoff to achieve or maintain applicable Water Quality Standards of the Basin Plan. • To analyze and interpret the collected data to determine the impact of urban runoff and/or validate relevant water quality models. • To identify significant water quality problems, related to discharges of urban runoff within the Permit area. • To characterize pollutants associated with urban runoff, and to assess the influence of urban land uses on receiving water quality and associated beneficial uses.	• To develop and support an effective urban runoff management program. • To identify other sources of pollutants in urban run off to the maximum extent possible (e.g., including, but not limited to, atmospheric deposition, contaminated sediments, other non-point sources, etc.) • To identify and permit or prohibit Illicit Connections. • To identify, verify and prohibit Illegal Discharges. • To verify and to identify sources of pollutants in urban runoff. • To evaluate the effectiveness of the DAMP and WQMPs, including an estimate of pollutant reductions achieved by the Site Design (Low Impact Development [LID], treatment control and source control BMPs implemented by the Permittees. • To evaluate the effectiveness of proposed Urban Runoff management programs to protect Receiving Water quality.

IC/ID – illicit connection/illegal discharge; QA – quality assurance; QC – quality control; WQO – water quality objective
Objectives summarized from Section I of Appendix 3 of the 2010 MS4 Permit.

[1] The 2010 MS4 Permit expired on January 29, 2015. The Regional Board provided direction to the Permittees to continue monitoring under the 2010 Permit MRP and CMP for the 2019-2020 monitoring year.

The SAR MRP includes monitoring of receiving waters, outfalls, illicit connection/illegal discharge (IC/ID) monitoring, and special studies, including participation in the Southern California Stormwater Monitoring Coalition (SMC) Regional Bioassessment Monitoring Program. The procedures for each of these individual monitoring programs of the overall SAR MRP are described in the District's Consolidated Monitoring Program (CMP, **Attachment A**), which covers all three Permit regions of MS4 compliance for the District (Santa Ana, Santa Margarita and Whitewater River Regions). For the SAR, the "monitoring year" begins on July 1, 2019 and ends on June 30, 2020, similar to the fiscal year. The wet season/wet weather (i.e., October 1 through May 31) and dry season/dry weather (i.e., June 1 through September 30) establish monitoring event periods. Monitoring events during wet weather must meet the wet weather mobilization criteria described in the CMP. Samples are analyzed for water quality parameters specific to the monitoring requirements of the SAR MRP and regional programs in which the SAR Permittees participate.

Monitoring data are evaluated to address the assessment and reporting requirements of the MRP. Water quality objectives (WQOs) are only required to be applied to receiving waters but have been used in SAR monitoring annual reporting for MS4 outfall data as well in order to assess levels of pollutants in discharges. The application of WQOs to non-stormwater and stormwater discharges is intended for comparison purposes only and does not indicate non-compliance when the WQOs are exceeded. Flow and water quality data are used to calculate instantaneous mass loadings. In addition, the results of the annual monitoring year are evaluated in the context of historical monitoring results using trend analysis, exceedance frequencies, comparison to baseline, and determination of persistence. Integrated results are used to address the five management questions from the Model Monitoring Program for MS4 in Southern California (MMP) (SMC, 2004) as required by the 2010 MS4 Permit.

11-1.2 WATERSHED CHARACTERISTICS

The climate of the SAR is Mediterranean, characterized by warm, dry summers and cool, rainy winters. Annual precipitation ranges from less than 10 inches in the alluvial valleys where urban development is concentrated to over 36 inches in the San Bernardino, Santa Ana, and San Jacinto Mountains. In general, shading from the coastal ranges that form the western boundary of the SAR (Santa Ana Mountains) translates to very little precipitation throughout valley areas of the inland SAR. The Santa Ana River flows perennially (i.e., streams with year-round continuous flow) from the County of San Bernardino through Prado Dam because of permitted discharges from publicly owned treatment works (POTWs) such as the Rialto Waste Water Treatment Plan and the City of San Bernardino's Rapid Infiltration and Extraction Plant. Under natural conditions, the majority of streams in the SAR are ephemeral (i.e., dry and only flowing during and immediately after rainfall events). The SAR includes Reaches 3 and 4 of the Santa Ana River and its tributaries, the San Jacinto River basin and its tributaries, Lake Elsinore, Canyon Lake, and numerous other lakes, reservoirs, and surface waters.

11-1.3 PRECIPITATION

The Riverside County Flood Control and Water Conservation District (District) uses forecasts and annual precipitation records for five District precipitation stations (Riverside, Corona, Elsinore, Hemet/San Jacinto, and Perris/Moreno Valley) to characterize conditions within the SAR. Annual rainfall data for each precipitation station are summarized in **Table 1-2**. The annual total amount of rainfall measured at each precipitation station for the current Permit term is presented in **Table 1-3**.

Wet weather mobilization criteria are defined in the CMP, and additional daily precipitation data for each station are summarized in **Attachment B**.

Table 1-2: Long-Term Average Rainfall by Precipitation Station

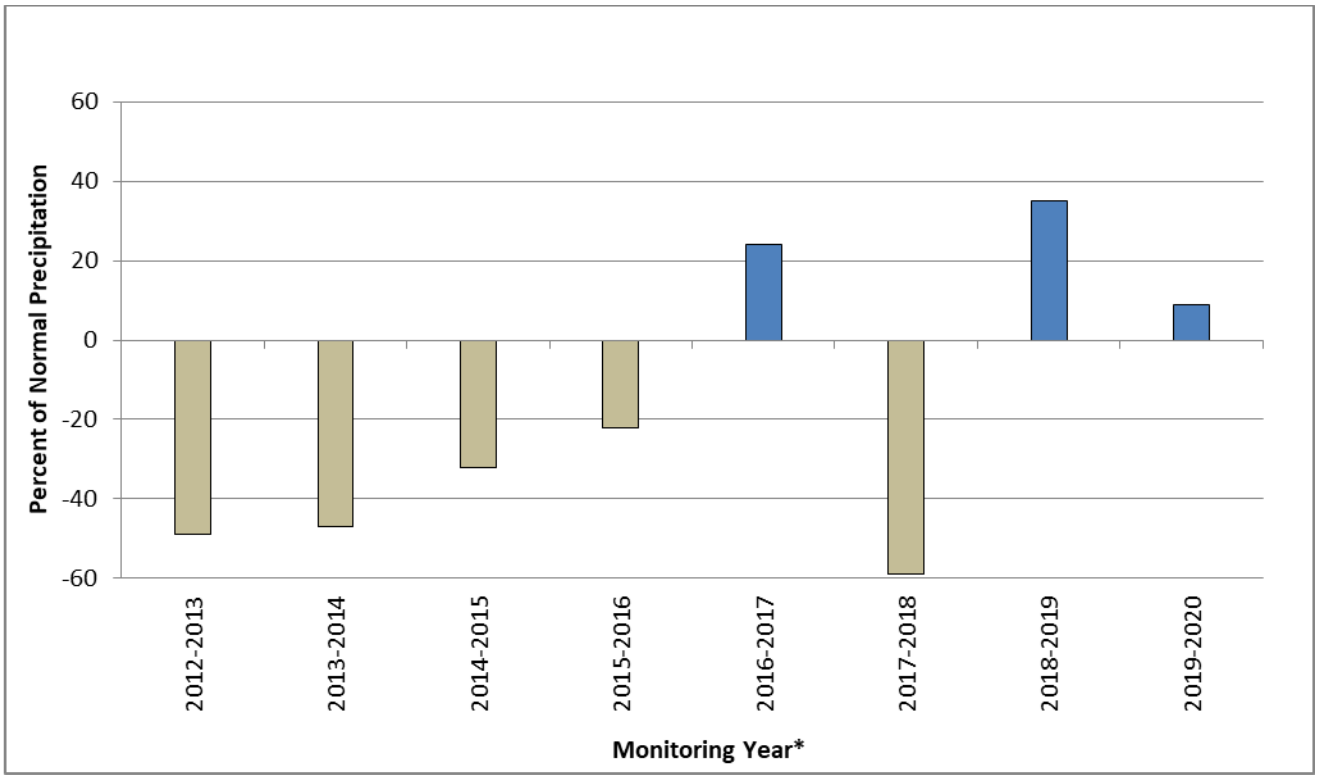
Station Name	ID No	Location	Years of Data	Average Annual Rainfall (inches)
Riverside	178	2S/5W-14	72	11.00
Corona	035	4S/7W-02	91	14.47
Elsinore	067	6S/4W-07	123	11.98
Hemet/San Jacinto	186	4S/1W-35	128	12.61
Perris/Moreno Valley	155	4S/3W-30	64	12.28

ID – identification

Table 1-3: SAR Annual Rainfall Summary

Monitoring Year *	Annual Rainfall (inches)				
	Riverside	Corona	Elsinore	Hemet/ San Jacinto	Perris/ Moreno Valley
2011-2012	6.93	9.19	5.78	8.55	7.44
2012-2013	6.22	6.44	4.42	6.33	7.74
2013-2014	6.59	7.22	4.59	6.32	8.28
2014-2015	8.96	7.29	7.01	8.79	9.57
2015-2016	9.49	11.11	6.62	8.81	12.1
2016-2017	13.72	17.66	14.95	14.39	15.96
2017-2018	5.18	4.55	3.38	5.14	7.08
2018-2019	14.48	20.79	14.43	16.35	18.52
2019-2020	11.35	15.50	12.31	13.23	15.84
* Fiscal Year = July 1 through June 30					

The 2019-2020 monitoring year was an average year with 109% of the long-term average precipitation recorded for the SAR as a whole. **Figure 1-1** shows eight years of rainfall data as a percentage of the long-term average rainfall ("Percent of Normal Precipitation") based on an average of the five rain gauges (Riverside, Corona, Elsinore, Hemet/San Jacinto, and Perris/Moreno Valley).



* Fiscal Year = July 1 through June 30

Figure 1-1: Average Annual Rainfall in the SAR as a Percentage of Normal

11-1.4 WILDFIRES

The Santa Ana River watershed is known for its semi-arid climate with shorter wet seasons and extended dry seasons, and is primarily comprised of sage-scrub chaparral and mixed conifer in upper elevations.[2] According to Cal Fire, within the past seven years, Riverside County has encountered several large wildfires that have burned more than 20,000 acres. Once a wildfire has affected a natural area, there is significant vegetation disturbance causing hillslope soils to be more susceptible to stormwater erosion, and in some cases having sediment yields of up to three orders of magnitude greater than unburnt areas.[3] Without vegetation buffers, the overall magnitude of stormwater runoff increases, resulting in higher erosion rates, and producing sediment-laden floods that carry high concentrations of trace metals, nutrients and organic matter from the burn area to the nearest waterbody.[2] As the sediment settles to the bottom of a waterbody, more sunlight is able to penetrate through the water column causing algal mass growth when nutrients are present. Other environmental effects include changes to the natural hydrology, normal soil cohesion and infiltration functions, and increased soil water repellency.[2] Although most wildfires are naturally occurring and are beneficial to Southern

[2] Kinoshita, A. & Hogue, T. (2011). Spatial and Temporal Controls on Post-fire Hydrologic Recovery in Southern California Watersheds. *Fuel and Energy Abstracts*. 87. 10.1016/j.catena.2011.06.005. Retrieved from https://www.researchgate.net/publication/251575985_Spatial_and_Temporal_Controls_on_Post-fire_Hydrologic_Recovery_in_Southern_California_Watersheds.

[3] Blake, W., Wallbrink, P. & Droppo, I. (2009). Sediment aggregation and water quality in wildfire-affected river basins. *Marine and Freshwater Research*. 60. 653-659. Retrieved from https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.854.7161&rep=rep1&type=pdf.

California's ecology, they increase landscape's susceptibility to severe erosion and major flooding in the watershed.

Major Fires in Recent Years

- The Sandalwood Fire, located near Calimesa, began on October 10, 2019 and burned 1,011 acres. The entire fire was located within the SAR watershed.

- The Cranston Fire began on July 25, 2018, located near Highway 74 / Mountain Center within San Bernardino National Forest. The wildfire burned 13,229 total acres, of which 13,160 acres burned within the SAR watershed.

- The Holy Fire began on August 6, 2018, located within Cleveland National Forest and was confirmed to be the largest wildfire during the Riverside County 2018 fire season. The wildfire burned 23,025 total acres, of which approximately 17,053 acres burned within the SAR watershed. The Northeastern portion of the fire burn area drains into Temescal Wash which eventually drains into the Prado Flood Control Basin on the Santa Ana River.

Post-fire Monitoring Special Studies

Due to the rise in total wildfire incidents throughout Southern California in recent years, the District has expanded its post-fire monitoring efforts. These special studies began with the 2013 Falls Fire and that burned approximately 1,383 acres within Cleveland National Forest. The Falls Fire special study was designed to better understand changes in the natural drainage area, characterize post-fire sediment flows, and document effects on Lake Elsinore during the storm season. The Falls Fire post-fire study can be found in the 2013-2014 and 2014-2015 SAR Monitoring Annual Reports.

The 2018 Holy Fire, which was located in the Cleveland National Forest mountain range, burned 23,025 acres of primarily Mixed Chaparral, Mixed Conifer Forest, and Riparian Willow Scrub.[4] Assessments by the USFS BAER team determined that the dominant soil type is a granitic residuum derived Cieneba soil known for its increased water repellency causing high erosion rates.[4] During the course of the Holy Fire, conditions were met with extremely high winds that mobilized ash across the entire County. Just a few weeks after the Holy Fire was fully contained, Southern California received several sizeable storms that prompted the District to initiate a new post-fire monitoring study in the burned tributary.

In coordination with NV5, formally "Alta Environmental", and with guidance from the Lake Elsinore/Canyon Lake Total Maximum Daily Load (TMDL) Task Force, the District evaluated the impacts that the Holy Fire would have on downstream receiving waters. Although very similar to the Falls Fire study, the Holy Fire post-fire study was more focused on determining contaminant flux from storm runoff and comparing results to an unburned monitoring station with similar terrain and vegetation. This monitoring effort characterized burn area stormwater runoff and sediment before it entered Lake Elsinore, a 303(d) listed waterbody. Long-term effects of the Holy Fire ash and sediment are still unknown. The full post-fire report, including data and figures, is provided in the 2018-2019 SAR Post-Fire Monitoring Report (Alta, 2019).

[4] USFS BAER team. (2018). Holy Fire Burned-Area Report. USDA Cleveland National Forest.https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd594859.pdf.

Concurrently with the Holy Fire Post-Fire Monitoring Study, the District conducted another special study that highlights the nutrient load prevented from entering Lake Elsinore by performing pre-storm season maintenance and capacity improvements at two District facilities (i.e., Leach Canyon Dam and McVicker Canyon Basin). During the study, District staff collected grab samples from sediment stockpiles staged at Leach Canyon Dam and McVicker Canyon Basin. For more information about the District's *Sediment Quantity and Nutrient Load Reduction Report*, refer to the 2018-2019 SAR Monitoring Annual Report. With the knowledge and understanding of burn area hydrology, the District was not only prepared to defend sensitive aquatic habitat, but more importantly, protect communities from severe flooding.

The District's post-fire monitoring efforts and associated special studies have gained some attention and have been highlighted in two leading stormwater management industry magazines, as well as admitted for presentation in the CASQA 2019 Annual Conference and the Association of California Water Agencies 2019 Fall Conference. Specifically, in the spring 2020 issue of STORMWATER[5], an article was published describing the District's emergency efforts to protect local communities and environment from flooding impacts during the storms immediately following the Holy Fire. Another notable mention was the technical article in World Water: Stormwater Management[6] that focused on the District's water quality monitoring conducted in immediate proximity to the fire effected area and its effects on the overall stormwater quality analytical results.

To better understand potential impacts to water quality, District staff annually tracks wildfire incidents within each watershed using various publicly available emergency response databases. Wildfires can significantly contribute to pollutant loading in the discharges entering waterbodies. This can be evident just after active burning and typically noticeable for months, and sometimes years, after the fire has been fully contained. The Wildfire Location Map herein is focused on displaying the three most recent fire years as relevant to the current monitoring year's data (**Figure 1-2**). Pollutant concentrations in discharges are generally highest during the first major storms after intense wildfires, as is supported by the District's Holy Fire study and others. The District downloads Geographic Information System (GIS) data using Cal Fire's Incident webpage[7] to build wildfire extent maps. **Table 1-4** shows the 2019-2020-year wildfires (greater than 20 acres) and historical wildfires (since 2015) for reference. The table also includes general incident information and acreage burned within the SAR watershed. Both the map and associated table are updated annually.

[5] Shim, R. (2020). *First Fire, Then Flood.* STORMWATER. http://digital.stormh2o.com/publication/?m=4264&i=652258&p=8

[6] World Water: Stormwater Management. (2020). 'Holy Fire' affects stormwater quality in Southern California. WWSM. https://edition.pagesuite-professional.co.uk/html5/reader/production/default.aspx?pubname=&edid=ca262914-5148-4b19-a03a-32ad0965098f

[7] Cal Fire. (2020). Incidents Overview. State of California. Retrieved from https://www.fire.ca.gov/incidents/.

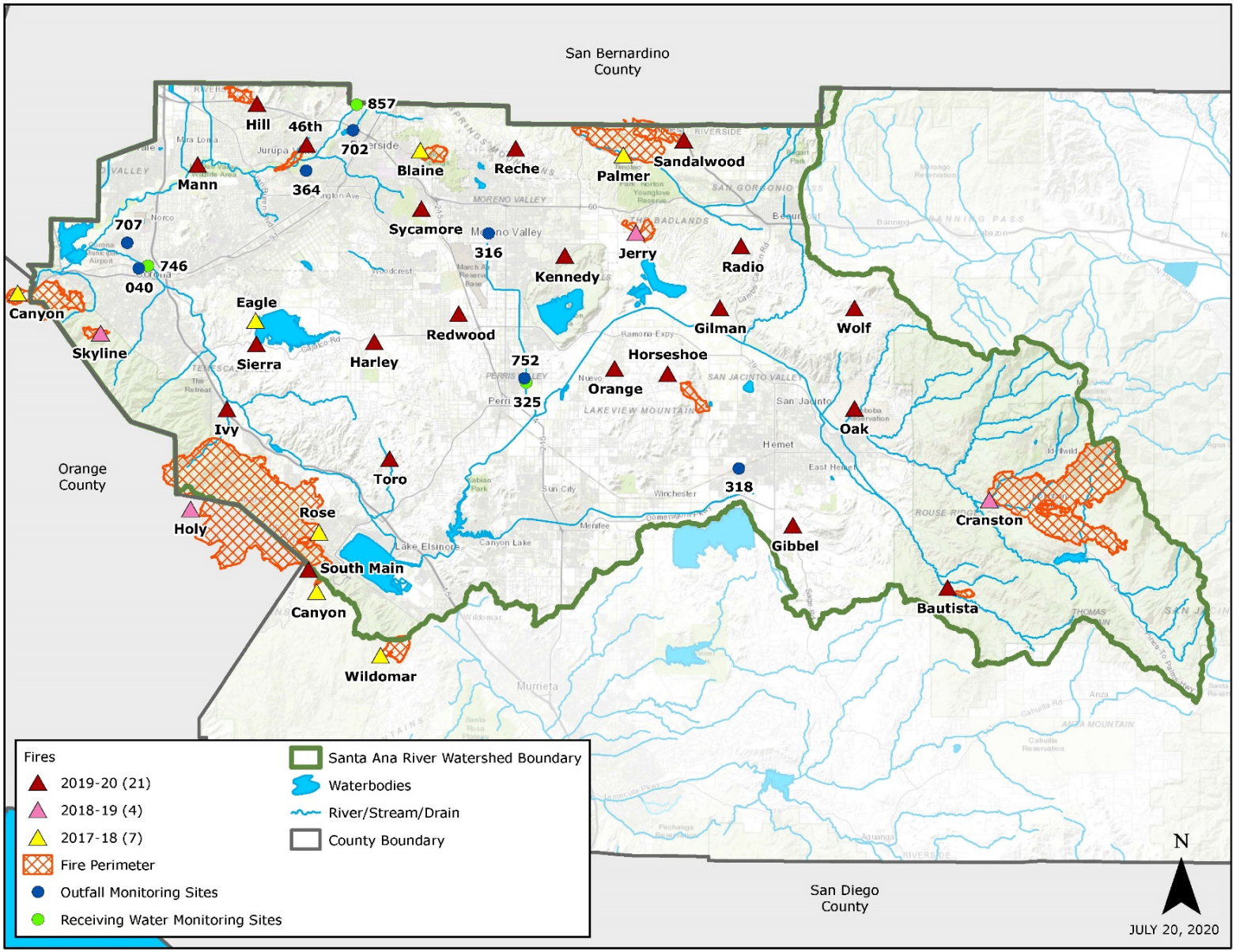


Figure 1-2: Wildfires within SAR Watershed from 2017-2020

Table 1-4: Wildfires within SAR Watershed

Event ID	Fire Name	Start Date	Total Acres	Acres Within SAR	Location	Latitude	Longitude	Station Potentially Impacted[+]
Monitoring Year 2019-2020 Wildfires								
CA-RRU-88358	Gibbel	7/11/2019	20	20	Off Girard Street and Quiet Hills Drive	33.69056	-116.95389	**318**
CA-RRU-89236	Orange	7/13/2019	96	96	27000 block of Orange Avenue in Nuevo	33.81284	-117.12289	**752 / 325**
CA-RRU-99849	Toro	8/5/2019	94	94	26000 block of El Toro Road, north of Lake Elsinore	33.74022	-117.33373	**746**
CA-RRU-102937	Radio	8/12/2019	20	20	David Mountain Radio Road at David Mountain Road in Beaumont	33.90979	-117.00467	**Unknown**
CA-RRU-108956	Ivy	8/25/2019	80	80	Near Northbound Interstate 15 and Temescal Canyon	33.77777	-117.48758	**746**
RIV #19-026767	Sycamore	9/7/2019	250	250	Kangaroo Court and River Ridge Drive, Riverside	33.93690	-117.30630	**346**
CA-RRU-117671	Redwood	9/12/2019	34	34	Mead Valley	33.85460	-117.27014	**752 / 325**
CARRU-118651	Horseshoe	9/15/2019	520	520	Horseshoe Trail and Stagecoach Road, Juniper Flats	33.80883	-117.07287	**Unknown**
CABDF-014540	Bautista	9/16/2019	167	167	Bautista Road and Tripp Flats, west of Lake Hemet	33.64250	-116.80806	**Unknown**
CA-RRU-121824	Kennedy	9/21/2019	98	98	Moreno Beach Drive and John F. Kennedy Drive, near Lake Perris	33.90099	-117.17059	**316**
CARRU-130198	Reche	10/10/2019	350	350	Reche Canyon Road and Jordan Drive, City of Moreno Valley	33.98482	-117.21794	**316**
CARRU-130233	Sandalwood	10/10/2019	1011	1011	Calimesa Boulevard and Sandalwood Drive	33.99246	-117.05921	**857**
CA-RRU-130314	Wolf	10/10/2019	75	75	Wolfskill Truck Road near Silver Creek Drive, south of Banning	33.86150	-116.89733	**Unknown**
CARRU-139654	Hill	10/30/2019	494	494	Granite Hill and Pyrite Street, in Jurupa Valley	34.01778	-117.46250	**Unknown**
CARRU-139997	46th	10/31/2019	328	328	5300 block of 46th Street, in Jurupa Valley	33.98611	-117.41528	**Unknown**
CA-RRU-29970	Mann	3/3/2020	180	180	Santa Ana River bottom near California Avenue and Grulla Court, south of Jurupa Valley	33.96957	-117.51793	**Unknown**
NA	South Main	3/6/2020	20	20	Off South Main Divide and Hacienda Road, El Cariso	33.65263	-117.40906	**Unknown**
NA	Gilman	5/18/2020	20	20	Gilman Springs Road and Slegers Street, southeast of Moreno Valley	33.86105	-117.02411	**Unknown**
NA	Harley	5/28/2020	60	60	19000 block of Gustin Road, east of Lake Mathews	33.83167	-117.34934	**Unknown**
CA-RRU-71224	Oak	6/8/2020	20	20	45000 block of Castile Canyon Road, east of San Jacinto in Riverside County	33.78275	-116.89655	**Unknown**
CA-RRU-71265	Sierra	6/8/2020	100	100	La Sierra Avenue and Cajalco Road	33.82925	-117.46036	**746**
TOTAL (acres)			**4,037 (4,037 within SAR Watershed)**					
Monitoring Year 2018-2019 Wildfires								
CARRU-079226	Jerry	6/21/2019	525	525	Off Gilman Springs Road, between Highway 60 and Jack Rabbit Trail	33.91951	-117.10377	--
CACNF-002664	Holy	8/6/2018	23,025	17053	Holy Jim Canyon, west of North Main Divide	33.69888	-117.52055	--
CABDF-011390	Cranston	7/25/2018	13,229	13160	Off Highway 74 and Control Road, east of Hemet	33.71129	-116.76930	--

Table 1-4: Wildfires within SAR Watershed

Event ID	Fire Name	Start Date	Total Acres	Acres Within SAR	Location	Latitude	Longitude	Station Potentially Impacted[+]
CARRU-090869	Skyline	7/19/2018	282	282	Off Skyline Drive and Burrero Way, in an unincorporated county area west of Corona	33.83610	-117.60758	--
TOTAL (acres)			**37,061 (31,020 within SAR Watershed)**					
Monitoring Year 2017-2018 Wildfires								
CARRU-082316	Eagle	7/04/2017	205	205	Off Tin Mine Road and La Sierra Avenue, near Lake Mathews	33.84750	-117.46139	--
CARRU-00094091	Rose	7/31/2017	200	200	Ridge above Toft Drive outside of Lake Elsinore	33.8455	-117.4115	--
CARRU-099747	Blaine	8/03/2017	1,044	1,044	Off Blaine Road and Terrace Drive in Box Spring Mountain	33.98250	-117.30806	--
CACNF-002924	Canyon	8/27/2017	46	46	Highway 74 and South Main Divide, two miles southwest of Lake Elsinore	33.63525	-117.4011	--
CARRU-108660	Palmer	9/02/2017	3,874	3,874	Off San Timoteo Canyon Road and Fisherman's Retreat, Beaumont	33.98056	-117.11639	--
CAORC-105068	Canyon	9/25/2017	2,662	2662	CA-91 and Cole Canyon, City of Anaheim	33.8668	-117.68598	--
CACNF-003839	Wildomar	10/26/2017	866	66	South Main Divide Road and Wildomar OHV Park, west of Wildomar City	33.58587	-117.34040	--
TOTAL (acres)			**8,897 (8,097 within SAR Watershed)**					
Monitoring Year 2016-2017 Wildfires								
CARRU-105125	Bogart	8/30/2016	975	693	Off Winesap Avenue and International Park Road, north of Beaumont	33.98310	-116.95390	--
CARRU-053193	Opera	4/30/2017	1,350	1,350	Off Opera Loop & East Palmyrita Avenue, in Highgrove	34.00556	-117.30639	--
CARRU-078840	Manzanita	6/26/2017	6,309	6,309	Off Hwy 79 North, Lambs Canyon south of Dump Road, south of Beaumont	33.88167	-116.98972	--
TOTAL (acres)			**8,634 (8,352 within SAR Watershed)**					
Monitoring Year 2015-2016 Wildfires								
CARRU-090069	Anza	8/10/2015	543	543	Highway 74 east of Highway 371	33.569444	-116.59139	--
TOTAL (acres)			**543 (543 within SAR Watershed)**					

NA – Not Available; OHV – Off Highway Vehicle

[+]Water quality may be directly or indirectly impacted from wildfires occurring in and around the county. Post-fire ash aerial, stormwater water runoff containing trace metals, fire suppressant chemicals and other parameters may have entered a proximate receiving waterbody or monitoring station.

11-2.0 MONITORING PROGRAM OVERVIEW AND METHODS

The monitoring program is detailed in the CMP. This section provides an overview of the monitoring program, including monitoring station characteristics, monitoring components and parameters, and water quality issues and assessment criteria.

11-2.1 CMP

Objectives, requirements, and methods of the monitoring and reporting program are all detailed in the CMP, which includes a Quality Assurance Project Plan (QAPP, CMP Volume II) and the SAR Monitoring Plan (CMP Volume IV).

The CMP is updated as needed, and the most current version of the CMP will be submitted with this annual report and will also be available online from the District's website: (http://rcflood.org/NPDES/Monitoring.aspx). The SAR Monitoring Plan and its program components include the following:

- Introduction
- WQOs
- Receiving Water Monitoring Program
- MS4 Outfall and Mass Emissions Monitoring Program
- IC/ID Monitoring
- Special Studies
  - TMDL/303(d) Listed Waterbody Monitoring
  - Regional Monitoring Programs
  - Low Impact Development Best Management Practice (BMP) Monitoring
- Data Records, Management, and Reporting

11-2.2 MONITORING STATIONS

Monitoring stations have been established throughout the SAR, including three receiving water locations and seven historical "Core" MS4 outfalls, hereafter referred to as MS4 outfall stations. Each station has been assigned a nine-digit alpha-numeric code (SAR hydrologic unit code [HUC], site descriptor, three-digit database code)[8], which has been used throughout the Monitoring Annual Report. **Table 2-1** provides a summary of receiving water station locations, and **Table 2-2** provides a summary of MS4 outfall station locations. Additional information about SAR monitoring stations, land uses, changes in land use over time, and population, is provided in **Attachment C**.

[8] These codes were assigned to the historical MS4 outfall stations during the 2009-2010 monitoring year. For simplicity, several maps use the three-digit database code as an identifier for the MS4 outfalls.

Table 2-1: Receiving Water Monitoring Station Summary

Station ID	Station Name	Facility Type	Receiving Water	WQO Receiving Water	HUC	Permittee
801AHG857	Santa Ana River at Highgrove Channel [1]	Natural Channel	Santa Ana River Reach 4	Santa Ana River Reach 4	801.27	Riverside
801TMS746	Temescal Channel at Main Street	Concrete Channel	Temescal Creek Reach 1a	Temescal Creek Reach 1a	801.25	Corona
802NVO325	Perris Valley Channel at Nuevo Road	Natural Channel	San Jacinto River Reach 3	San Jacinto River Reach 3	802.11	Perris

[1] The Santa Ana River at Highgrove receiving water station is located at the County line and does not receive runoff from the Riverside County MS4. It characterizes perennial dry weather flow as it enters the County from San Bernardino.

Table 2-2: MS4 Outfall Monitoring Station Summary

Station ID	Station Name	Facility Type	Receiving Water	WQO Receiving Water [1]	HUC	Permittee
801CRN040	Corona Outfall	Rectangular	Temescal Creek Reach 1a	Temescal Creek Reach 1a	801.25	Corona
802SNY316	Sunnymead Channel NPDES – Line B at Alessandro Boulevard and Heacock Street (Sunnymead Outfall)	Trapezoidal	Perris Valley Storm Drain	San Jacinto River Reach 3	802.11	Moreno Valley
802HMT318	Hemet Channel NPDES – Sanderson Avenue to Cawston Avenue (Hemet Outfall)	Trapezoidal	Salt Creek	Salt Creek	802.12	Hemet
801MAG364	Magnolia Center Outfall	Pipe	Santa Ana River Reach 3	Santa Ana River Reach 3	801.26	Riverside
801UNV702	University Wash Outfall	Natural Channel	Lake Evans	Santa Ana River Reach 4 [2]	801.27	Riverside
801NNR707	North Norco Outfall	Rectangular	Prado Flood Control Basin	PBMZ / Santa Ana River Reach 3 (historically Temescal Creek Reach 1)	801.25	Corona
802PLJ752	Perris Line J Outfall	Trapezoidal	San Jacinto River Reach 3	San Jacinto River Reach 3	802.11	Perris

NPDES – National Pollutant Discharge Elimination System; PBMZ – Prado Basin Surface Water Management Zone

[1] The WQOs for the receiving water associated with each MS4 outfall station were determined by the downstream HUC and beneficial uses. This receiving water is used to determine the site-specific WQOs for water quality parameters at MS4 outfall stations and evaluate the potential impact of urban runoff on receiving waters in accordance with the 2010 MS4 Permit.

[2] There is potential connectivity to Santa Ana River Reach 4 if Lake Evans overflows, which only occurs during significant precipitation events. Hydrologic connectivity is ascertained and documented by field crews during each monitoring event.

The relative positions of receiving water stations and the MS4 outfall stations are shown in **Figure 2-1** and described in **Table 2-3.**

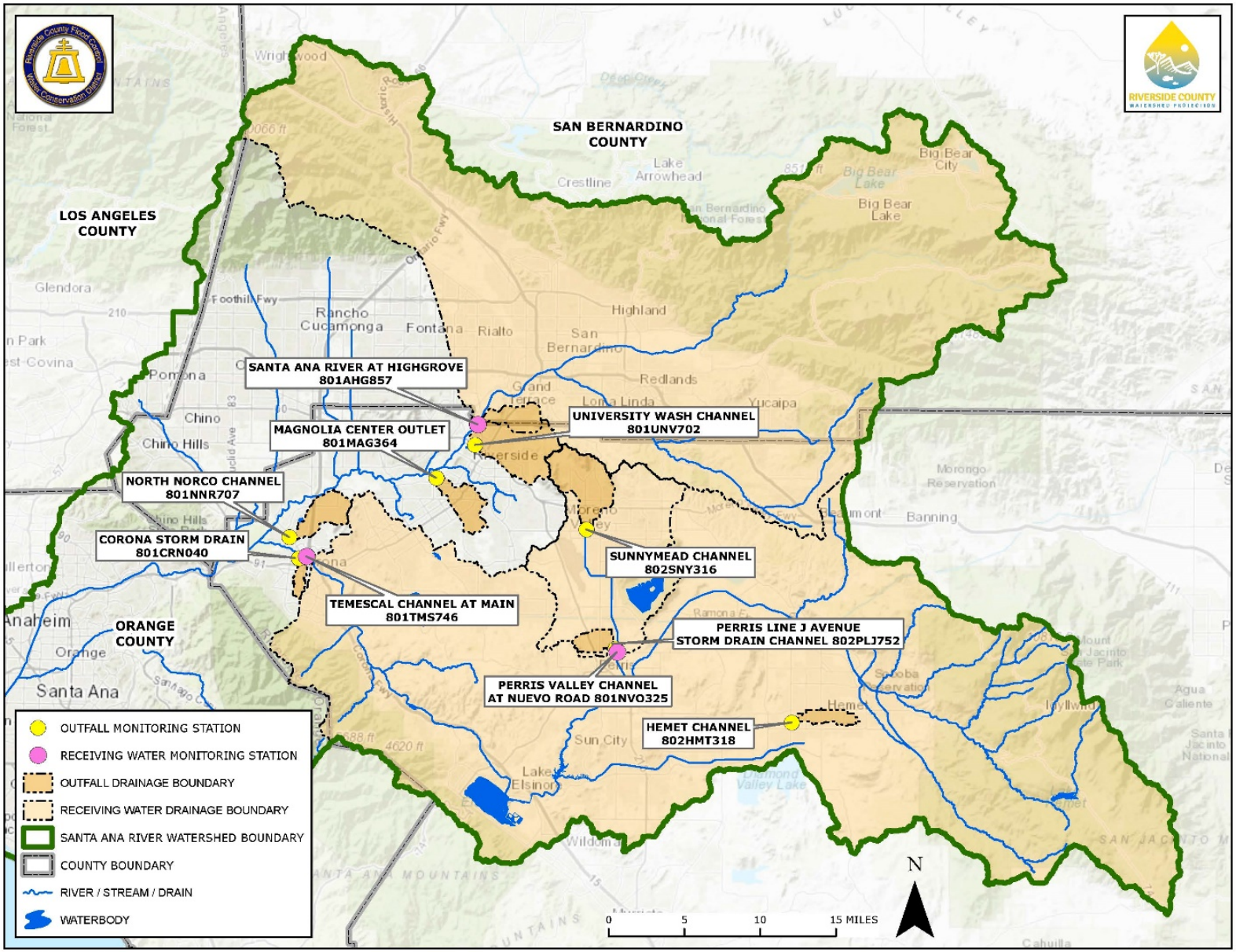


Figure 2-1: MS4 Outfall and Receiving Water Monitoring Station Locations in the SAR

The total distance between a MS4 outfall station and a receiving water station, shown in **Table 2-3**, does not imply a single flow path or imply flow from a MS4 outfall to a receiving water station. The Perris Valley Channel at Nuevo Road receiving water station is the only receiving water location downstream of MS4 outfall stations. As a result, the evaluation of urban runoff and its impact on water quality and beneficial uses of SAR receiving waters is limited to this small portion of San Jacinto River Reach 3.

The Santa Ana River at Highgrove receiving water station is located at the County line with San Bernardino County. Data from this station are used to characterize perennial dry weather flows entering Riverside County through Reach 4 of the Santa Ana River. Perennial flows are due to effluent from the Rialto Wastewater Treatment Plan (WWTP) and the Colton/San Bernardino Rapid Infiltration and Extraction Facility (RIX), which are located approximately two miles upstream from this receiving water station. There are no MS4 discharges between these POTWs and the receiving water station; therefore, data from this station represent a permitted discharge outside the control of the Permittees and not the effects of discharges from the Permittees' MS4.

Table 2-3: Relative Location of MS4 Outfall and Receiving Water Monitoring Stations

Station ID	MS4 Outfall Station	Relative Location of MS4 Outfall Station to Nearest Receiving Water Station	Distance from MS4 Outfall Station to Point of Confluence with Receiving Water	Distance from Point of Confluence to a Receiving Water Station	Total Distance between MS4 Outfall and Receiving Water Stations [1]
801CRN040	Corona Outfall	Discharges to the PBMZ/Temescal Creek downstream of 801TMS746	0.6 mile along storm drain channel to Temescal Creek	801TMS746 is 0.8 mile upstream on Reach 1a of Temescal Creek	1.4 miles
802SNY316	Sunnymead Outfall	Discharges to Perris Valley Channel upstream 802NVO325	4.5 miles along storm drain channels to Perris Valley Channel at termination of Lateral A	802NVO325 is 5.0 miles downstream of Lateral A	9.5 miles
802HMT318	Hemet Outfall	Discharges to tributary upstream of Salt Creek	N/A	N/A	N/A
801MAG364	Magnolia Center Outfall	Discharges to Santa Ana River downstream of 801AHG857	1.2 miles along "tributary" to Santa Ana River	RW station is 5.5 miles upstream on Santa Ana River	6.7 miles
801UNV702	University Wash Outfall	Discharges to Lake Evans	0.1 mile to Lake Evans	N/A	N/A
		Discharge from Lake Evans to Santa Ana River downstream of 801AHG857	0.9 mile from Lake Evans spillway to Santa Ana River [2]	RW station is 2.4 miles upstream on Santa Ana River	3.4 miles
801NNR707	North Norco Outfall	Discharges to the PBMZ downstream of 801TMS746	0.9 mile along "tributary" to historical Temescal Creek Reach 1 (now PBMZ)	RW station is 1.9 miles upstream on Reach 1a of Temescal Creek	2.8 miles
802PLJ752	Perris Line J Outfall	Discharges to Perris Valley Channel upstream of 802NVO325	0.2 mile to Perris Valley Channel	RW station is just downstream of Line J intersection with Perris Valley Channel	0.2 mile

N/A – Not applicable. There is no receiving water station associated with this MS4 outfall station
RW – Receiving water; PBMZ – Prado Basin Surface Water Management Zone
[1] Distances are approximate. The "total distance between MS4 outfall and receiving water stations" does not represent a single flow path or imply flow from a MS4 outfall to a receiving water station.
[2] Potential connectivity to the Santa Ana River receiving water if Lake Evans overflows, which may only occur during significant wet weather events. The flow path from Lake Evans to the receiving water is approximate. Total distance does not include lake area.

11-2.3 WATER QUALITY MONITORING AND PARAMETERS

Table 2-4 provides a summary of individual monitoring program requirements and where current year results are presented in this Monitoring Annual Report. Samples are collected at SAR monitoring stations during both wet and dry weather events, with the exception of the Santa Ana River at Highgrove receiving water station, which is monitored during dry weather only, and Temescal Channel at Main, which is monitored during wet weather only. Complete lists of water quality parameters, analytical methods, and reporting limits (RLs) requested of the laboratory for the 2019-2020 monitoring year are provided in **Attachment D.**

Table 2-4: Summary of 2019-2020 SAR Monitoring Program

Monitoring Program (Report Section)	Monitoring Component	Sampling Frequency	No. Stations	Analytical Requirements
MS4 Outfall Monitoring (**Section 11-3.2**)	MS4 Outfall Monitoring	2 Dry Events 3 Wet Events	7 stations	Flow; field parameters; chemistry; bacterial indicators
IC/ID Monitoring (**Section 11-3.2.2**)	IC/ID Investigations	Dry weather, scheduled and monitored per Permittee Local Implementation Plan.		Flow (if present); field parameters (if present)
Receiving Water Monitoring (**Section 11-3.3**)	Receiving Water Monitoring	2 Dry Events 2 Wet Events	3 stations [1]	Flow; field parameters; chemistry; bacterial indicators
	Water Column Toxicity	2 Dry Events 2 Wet Events	3 stations [2]	Toxicity
	Follow-up Toxicity Analyses	Sampling as necessary.		Toxicity for TIEs and TREs; field parameters and chemistry as needed for source identification
	SMC Bioassessment Monitoring Program	1 Dry Event (2020)	2 condition, 2 trend sites	CRAM; benthic algae; benthic macroinvertebrates; physical habitat; flow; hydromodification screening; field parameters; chemistry; invasive vertebrates' checklist; channel engineering checklist; bioanalytic screens; hydrologic state checklist; water level logging; sediment toxicity[3]; sediment chemistry[3]
Special Studies (**Section 11-4.0**)	TMDL/303(d) Listed Waterbody Monitoring • MSAR Bacterial Indicator TMDL Monitoring • Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Regional Monitoring Programs • SMC LID BMP Special Study • Hydromodification Monitoring Program • Salinity Management Program Post-Fire Monitoring Studies			

MS4 – municipal separate storm sewer system; IC/ID – illicit connection/illegal discharge; CRAM – California Rapid Assessment Method; LID – Low Impact Development; MSAR – Middle Santa Ana River; TIE – toxicity identification evaluation; TRE – toxicity reduction evaluation

[1]Three receiving water stations are monitored as described in the CMP. One receiving water station is monitored during both wet and dry weather, whereas the other two receiving water stations are monitored only during one condition (dry or wet).

[2]These monitoring efforts are typically coordinated with receiving water chemistry sample collection.

[3]Sediment chemistry and sediment toxicity were added to the 2015-2019 SMC Program monitoring protocols in 2017. Testing for these parameters is dependent upon availability of qualifying depositional sediment material at monitoring sites.

During wet weather, the CMP requires the Temescal Channel at Main and Perris Valley Channel at Nuevo Road receiving water stations to be monitored for the first sampleable storm of the wet season (October 1 to May 31) and one additional wet weather event. Flow-weighted composite samples are collected at these receiving water stations. The seven MS4 outfall stations are required to be monitored for the first sampleable storm and two additional wet weather events by collecting grab samples. If samples could not be collected during wet weather monitoring, a wet weather event was determined to be a false start (FS). A FS event can result from station conditions not representative of precipitation-generated runoff, flow insufficient for sample collection, unsafe weather conditions, other safety concerns within the vicinity of the station, station conditions not representative of the forecasted information, etc. If a monitoring station had one or more FS wet weather event(s), field personnel were mobilized to that monitoring station for subsequent storms in attempt to fulfill the required frequency of wet weather events until successfully completed, or until the end of the wet weather season.

Dry weather monitoring is conducted as grab samples at the seven MS4 outfall stations and two receiving water stations. Water quality samples are only collected when there is sufficient flow for sample collection. Care is taken not to collect samples that would characterize ponded, stagnant water. When monitoring stations were dry or observed flow was insufficient for sample collection, a dry weather event was recorded as visited not sampled (VNS). Up to two site visits (samples collected or identified as VNS) are conducted annually at dry weather monitoring stations.

During the 2010 MS4 Permit term, parameter lists were standardized and refined. Several parameters (nutrients, iron, and total petroleum hydrocarbons [TPH]) were re-introduced for a station or type of monitoring event, even though they are not required to be monitored to ensure consistent data will be collected among the monitoring stations. Further, the 2010 MS4 Permit requires monitoring only total phase metals, but the Permittees chose to add dissolved metals to the SAR receiving water and MS4 outfall monitoring programs to evaluate metals concentrations using the California Toxics Rule (CTR) WQOs for comparison purposes, which are expressed in the dissolved fraction (see **Section 11-2.5**).

The 2010 MS4 Permit allows Permittees to re-evaluate analytical monitoring lists annually. The analysis identifies parameters that have been non-detect (ND) in samples for at least three consecutive monitoring events, as described in MRP Section III.E.1(b)(iv). A thorough analysis of parameters with ND results was completed and presented in the 2013-2014 Monitoring Annual Report. A revised monitoring parameter list, provided in **Attachment E**, was agreed upon through discussion with the Regional Water Quality Control Board (Regional Board) and has been used since the 2016-2017 monitoring year. Parameters that were ND but had analytical detection limits above corresponding CTR/Santa Ana Region Basin Plan (Basin Plan) WQOs or Multi-Sector General Permit (MSGP) benchmarks (current 2008 MSGP) were kept on the list.

A subsequent ND analysis was conducted concurrently with the development of the 2018-2019 Monitoring Annual Report, using data collected through the 2018-2019 monitoring year. Based on the results of this analysis, revised parameter lists, provided in **Attachment E** herein, were proposed in Attachment F of the 2018-2019 Monitoring Annual Report and are being implemented in the 2020-2021 monitoring year. The Permittees recommend that the Regional Board adopts the standardized and refined lists in the next Permit term.

The CMP QAPP prescribes program wide quality assurance/quality control (QA/QC) procedures for both field sampling and laboratory analyses (CMP Volume II available at: http://rcflood.org/NPDES/Monitoring.aspx). A QA/QC review for the 2019-2020 monitoring year was

conducted to identify issues needing corrective action to facilitate increased data quality and program efficiency in accordance with the QAPP. The results are provided in **Attachment F**. In summary, several laboratory errors occurred, including QC failures in the batch, missed analyses, incorrect sample volume used for QC analyses which resulted in missed analyses, MDL reported greater than the RL, replicate analyses that were not within acceptance limits, detections in the method blank above the RL, and method blanks between the MDL and the RL. The District has worked with Babcock to improve quality of all data, and communication of program goals, constraints, and expectations has been paramount. In the 2019-2020 monitoring year, Babcock submitted written documentation detailing corrective investigations and actions being taken in response to current year data QA/QC exceptions. In May 2020 the District began requesting confirmation log-in emails for each submitted sample to ensure all required analyses were appropriately ordered. This new QA check was instituted after multiple samples were found to be either missing required analysis or analyzed for constituents that were neither requested nor required. The District will continue to communicate the program needs with the laboratory in order to improve the quality of future analysis and improve consistency, as possible, with the SWAMP recommended criteria and the guidance provided in the CMP.

11-2.4 Beneficial Uses and 303(d) Listed Waterbodies by Monitoring Station

Beneficial uses represent the various ways that a waterbody may be used for the benefit of people and/or wildlife (Regional Board, 1995; updated in 2008, 2011, and 2016). The beneficial uses associated with the SAR receiving waters downstream of each MS4 outfall and receiving water station are presented in **Table 2-5**. This table reflects changes made to waterbody delineations and beneficial uses through February 2016. The Regional Board is currently conducting the 2019-2022 Basin Plan Triennial Review. The Staff Report that summarizes basin planning priorities identified by Santa Ana Water Board staff and recommendations by stakeholders was published in June 2019.

In accordance with Section 303(d) of the Clean Water Act (CWA), the State Water Resources Control Board (State Board) conducts a biennial assessment of water quality data for California surface waters to determine if pollutant levels exceed water quality standards and, therefore, represent a potential impact to receiving water beneficial uses. Waterbodies and pollutants identified by this assessment are then prioritized and recorded in the 303(d) list. The 2014/2016 Integrated Report (CWA Section 303(d)/305(b) List) (State Board, 2017) provides the most recent list of impaired waterbodies in the SAR watershed. Those waterbodies listed in the Riverside portion of the SAR are presented in **Table 2-6.**

Table 2-5: Beneficial Uses for Receiving Waters Associated with MS4 Outfall and Receiving Water Monitoring Stations

Beneficial Use	Receiving Water Station ID:	-	-	-	-	-	-	-	801TMS746	801AHG857	802NVO325
	MS4 Outfall Station ID:	801CRN040	802SNY316	802HMT318	801MAG364	801UNV702	801NNR707	802PLJ752	-	-	-
	Receiving Waterbody:	Temescal Creek Reach 1a	San Jacinto River Reach 3	Salt Creek	Santa Ana River Reach 3	Santa Ana River Reach 4	PBMZ	San Jacinto River Reach 3	Temescal Creek, Reach 1a	Santa Ana River Reach 4	San Jacinto River Reach 3
Municipal and domestic supply (MUN)		E	E	E	E	E	E	E	E	E	E
Agricultural supply (AGR)			I		X			I			I
Groundwater recharge (GWR)			I		X	X		I		X	I
Water contact recreation / Primary contact recreation (REC-1)		E**	I	I	X	X*	X*	I	E**	X*	I
Non-contact water recreation / Secondary contact recreation (REC-2)		X	I	I	X	X	X	I	X	X	I
Warm freshwater habitat (WARM)		X	I	I	X	X	X	I	X	X	I
Wildlife habitat (WILD)		X	I	I	X	X	X	I	X	X	I
Rare, threatened, or endangered species (RARE)					X	X	X			X	
Spawning, reproduction, and development (SPWN)					X	X				X	

PBMZ = Prado Basin Surface Water Management Zone.
E – Receiving water is exempt from beneficial use.
I – Intermittent beneficial use.
X – Present or potential beneficial use.
*Access prohibited in some portions.
**Primary contact recreation (REC-1) beneficial use was determined to be unattainable for Temescal Creek Reach 1a by means of a use attainability analysis (UAA).

Table 2-6: SAR Receiving Waters and the 2014/16 Section 303(d) List of Impaired Waterbodies

SAR Waterbody on the Section 303(d) List	Watershed ID	Affected Area	Listed Pollutant	Current TMDLs (Office of Administrative Law Approval Date)	Applicable MS4 Outfall Stations	Applicable Receiving Water Stations
Canyon Lake (Railroad Canyon Reservoir)	80211000	453 acres	Nutrients ***	Lake Elsinore and Canyon Lake Nutrient TMDL (7/26/2005)	--	--
Chino Creek Reach 1A (Santa Ana River R5 confluence to just downstream of confluence with Mill Creek)	80121000	0.8 mile	Bacterial indicators; nutrients	MSAR Bacterial Indicator TMDL (9/1/2006)	--	--
Chino Creek Reach 1B (Mill Creek confluence to start of concrete lined channel)	80121000	7.0 miles	Bacterial indicators; nutrients; chemical oxygen demand	MSAR Bacterial Indicator TMDL (9/1/2006)	--	--
Cucamonga Creek Reach 1 (Valley Reach)	80121000	9.6 miles	Cadmium; copper; lead; zinc	MSAR Bacterial Indicator TMDL (9/1/2006)	--	--
Elsinore, Lake	80231000	2,431 acres	Nutrients; organic enrichment/low DO; PCBs; toxicity; DDT	Lake Elsinore and Canyon Lake Nutrient TMDL (7/26/2005)	--	--
Goldenstar Creek	80126000	2.4 miles	Bacterial indicators	--	--	--
Mill Creek (Prado Area)	80121000	1.6 miles	Bacterial indicators; nutrients; TSS	MSAR Bacterial Indicator TMDL (9/1/2006)	--	--
Prado Basin Management Zone (historically, listed as Temescal Creek Reach 1)**	80125000	6,835 acres	pH	--	801CRN040; 801NNR707	801TMS746
San Timoteo Creek Reach 3	80152000	23.5 miles	Bacterial indicators	--	--	--
Santa Ana River Reach 3 *	80121000	26 miles	Bacterial indicators; copper; lead	MSAR Bacterial Indicator TMDL (9/1/2006)	801MAG364	--
Santa Ana River Reach 4	80127000	14.2 miles	Bacterial indicators	--	801UNV702	801AHG857

TMDL – total maximum daily load; DO – dissolved oxygen; DDT – dichlorodiphenyltrichloroethane ; PCB – polychlorinated biphenyl; TSS – total suspended solids

*In 2010, the 303(d) listing for copper included a caveat indicating the impairment only applied to wet weather conditions. The 2014/16 Section 303(d) List did not include a seasonal qualifier for the copper listing.
**Temescal Creek Reach 1 was listed for pH on the 2010 Section 303(d) List. The 2014/16 Section 303(d) List changed the listing to PBMZ due to a mapping change. Lines of Evidence for this listing include samples collected in the Temescal Creek receiving water above Main Street at Corona (approximate location of 801TMS746). Stations located on Temescal Reach 1a have been maintained as MS4 outfall and receiving water stations for which this listing is relevant.
***The 2014/16 Section 303(d) List delisted Canyon Lake for indicator bacteria impairment because water quality standards for *Escherichia coli* (*E. coli*) are not being exceeded.

11-2.5 COMPARISON CRITERIA FOR WATER QUALITY ASSESSMENT

The 2010 MS4 Permit identifies two sources of WQOs for evaluating water quality within the SAR: WQOs defined in the Basin Plan and WQOs defined in the CTR (40 Code of Federal Regulations [CFR] Part 131). The 2019-2020 Monitoring Annual Report applies the criteria defined in the most recent regulatory documents. The WQOs and CTR WQOs are provided in Table 2-1 of the SAR Monitoring Plan (CMP Volume IV, **Attachment A**). In accordance with the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays and Estuaries of California*, where a WQO and a CTR criterion are in effect for the same pollutant, the more stringent of the two applies. Discussion of water quality results is provided in comparison to both WQOs and/or CTR WQOs equally. It is important to note that sample results from the MS4 outfall stations were compared to these criteria for comparison purposes only, as WQOs and CTR WQOs are only applicable to receiving waters (State Board, 2005).

Chapter 4 of the Basin Plan provides WQOs for inland surface streams in Table 4-1 and includes WQOs for total dissolved solids, hardness, sodium, chloride, total inorganic nitrogen (TIN), sulfate, and chemical oxygen demand, which vary by waterbody. While the tables list TIN in the header, footnotes shown with WQOs for a few water bodies state "Total nitrogen, filtered sample, " and include Santa Ana River Reach 3 and Chino Creek Reach 1A (Santa Ana River confluence to downstream of confluence with Mill Creek). Therefore, at stations associated with these water bodies, the concentration for total nitrogen is compared to the WQO rather than TIN. Temescal Reach 1a does not have a WQO in Table 4-1. The WQO for Santa Ana River Reach 3 has been applied to the Temescal Channel at Main receiving water station and Corona Outfall because Temescal Reach 1A flows into the Prado Basin Management Zone (PBMZ). As a result, the following stations compare total nitrogen to the WQO: Magnolia Center Outfall, North Norco Outfall, Corona Outfall, and Temescal Channel at Main. The TIN WQO is applied to values for TIN at the other stations.

Santa Ana River Basin Plan WQOs and Statewide Bacteria Provisions

The Basin Plan contains WQOs that are intended to protect designated beneficial uses of waterbodies in the SAR. Some reaches of a waterbody may have different or multiple beneficial uses and, therefore, may have different or multiple corresponding WQOs. The Basin Plan WQOs are based on the February 2016 version of the Basin Plan, which incorporated several amendments to designated beneficial uses and WQOs, which include but are not limited to:

- Addition of a rare, threatened, or endangered species (RARE) and a spawn (SPWN) beneficial use to Santa Ana River Reach 4.
- Elimination of the WQO for fecal coliform bacteria and establishment of new site-specific and beneficial use specific WQOs for *Escherichia coli* (*E. coli*).
- Establishment of criteria for temporary suspension of recreation use designations and corresponding *E. coli* objectives during high flow/unsafe flow conditions.
- Shortening and division of Temescal Creek Reach 1 into two reaches, Reach 1a and Reach 1b. The section of Reach 1 downstream of the newly designated Reach 1a was incorporated into the PBMZ.
- Determination that the primary contact recreation (REC-1) beneficial use is unattainable for Temescal Creek Reach 1a by means of a use attainability analysis (UAA).

In August 2018, the State Board adopted the *Bacteria Provisions and a Water Quality Standards Policy for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (Statewide Bacteria Provisions).

The Bacteria Provisions became effective upon approval by the Office of Administrative Law on February 4, 2019. These Statewide Provisions supersede the Basin Plan WQOs for REC-1 use except where: a Basin Plan has established site-specific objectives (SSOs), when there is an exemption based on UAA, when there are approved high flow suspension criteria, or when there are TMDL numeric targets for the waterbody, prior to the Statewide Bacteria Provisions. The WQOs for *E. coli* include both a geometric mean (applicable to five samples within a six-week period) and a statistical threshold value (STV) applicable to fewer samples within a 30-day period.

Table 2-7 lists the *E. coli* WQOs for REC-1 that were used for water quality data assessment at each monitoring station, unless the Basin Plan criteria for the temporary suspension of REC-1 beneficial use designations and corresponding *E. coli* WQOs were met due to "unsafe flow" conditions in systems engineered or highly modified for flood control purposes. Unsafe flow conditions are presumed given either of two physical site conditions defined in the Basin Plan: 1) Measured stream velocities of greater than eight feet per second (fps); or 2) Measured stream depth-velocity of greater than 10 feet squared per second. Temescal Creek Reach 1a has only a secondary contact recreation (REC-2) beneficial use because there is a REC-1 exemption based on an approved UAA. Therefore, REC-1 WQOs were not applied to the Temescal Channel at Main (801TMS746) receiving water station or Corona Outfall, which discharges to Temescal Creek 1a. The WQOs used for the Magnolia Center Outfall are based on the Middle Santa Ana River (MSAR) TMDL compliance target for *E. coli*.

Table 2-7: *E. coli* Water Quality Objectives Used for Assessments

MS4 Outfall Station ID	Comparative Receiving Water	Single-Sample *E. coli* Criteria	
		Comparative Basis	*E. coli* WQO
801CRN040	Temescal Creek Reach 1a*	N/A	359 MPN/100 mL (dry weather only)
802SNY316	San Jacinto River Reach 3	STV - Statewide Bacteria Provisions	320 CFU/100 mL
802HMT318	Salt Creek	STV - Statewide Bacteria Provisions	320 CFU/100 mL
801MAG364	Santa Ana River Reach 3	MSAR TMDL	212 MPN/100 mL**
801UNV702	Lake Evans	STV - Statewide Bacteria Provisions	320 CFU/100 mL
	Santa Ana River Reach 4	STV - Statewide Bacteria Provisions	320 CFU/100 mL
801NNR707	PBMZ (wetlands, inland)	STV - Statewide Bacteria Provisions	320 CFU/100 mL
802PLJ752	San Jacinto River Reach 3	STV - Statewide Bacteria Provisions	320 CFU/100 mL
Receiving Water	**Receiving Water**	**Receiving Water Basis**	***E. coli* WQO**
801AHG857	Santa Ana River Reach 4	STV - Statewide Bacteria Provisions	320 CFU/100 mL
801TMS746	Temescal Creek, Reach 1a*	N/A	359 MPN/100 mL (dry weather only)
802NVO325	San Jacinto River Reach 3	STV - Statewide Bacteria Provisions	320 CFU/100 mL

N/A – Not applicable; PBMZ – Prado Basin Surface Water Management Zone; CFU – colony-forming unit; mL – milliliters; MPN – most probable number
STV – statistical threshold value
* This waterbody is designated REC-2 only and, therefore, subject to an anti-degradation WQO (dry weather only).
**Based on numeric target of "not more than 10% of the samples exceed 212 organisms/100mL. The TMDL numeric target for 5-sample/30-day logarithmic mean is not applicable to low sampling frequency of SAR monitoring program.

California Toxics Rule WQOs

In addition to the WQOs listed in the Basin Plan (both general and site-specific), the CTR (40 CFR Part 131.38) requires WQOs for priority toxic pollutants for waterbodies within California, including the SAR. The CTR defines up to two freshwater WQOs protective of aquatic life for each parameter, a criterion maximum concentration (CMC) and a criterion continuous concentration (CCC). CMCs are water quality concentrations based on acute conditions, the highest concentration that aquatic life

can be exposed to without deleterious effects for a short period of time. CMCs have been applied to wet weather event data. CCCs are water quality concentrations based on chronic water quality conditions and are based on the four-day average concentration to which aquatic life can be exposed without deleterious effects. CCCs have been applied to dry weather event data. Many of the CTR WQOs for dissolved metals are hardness-based calculations.

USEPA Multi-Sector General Permit Benchmarks

The 2010 MS4 Permit also requires water quality results to be compared to the United States Environmental Protection Agency (USEPA) Parameter Benchmark Values (USEPA Benchmarks) defined in the MSGP for stormwater discharges associated with industrial activities (USEPA, 2015). However, application of the USEPA Benchmarks may be inappropriate for the SAR monitoring program because the USEPA Benchmarks lack specificity to MS4 discharges and the SAR. The USEPA Benchmarks are provided in Table 2-1 of CMP Volume IV (SAR Monitoring Plan).

11-3.0 RESULTS

11-3.1 MOBILIZATION HISTORY

During the 2019-2020 monitoring year, the SAR Monitoring Program was implemented as follows:

- All wet weather monitoring components of the MS4 outfall monitoring program and receiving water monitoring program were completed.
- All dry weather monitoring components of the MS4 outfall monitoring program, receiving water monitoring program, and SMC bioassessment monitoring program were completed.
- TMDL monitoring was conducted by task force groups.

A summary of mobilization activities and sampling events for the MS4 outfall and receiving water stations is presented in **Table 3-1**.

Table 3-1: 2019-2020 Monitoring Year Event Summary

Date of Monitoring Event	MS4 Outfall Stations (Station ID)							Receiving Water Stations (Station ID)		
	Corona Outfall (801CRN040)	Sunnymead Outfall (802SNY316)	Hemet Outfall (802HMT318)	Magnolia Center Outfall (801MAG364)	University Wash Outfall (801UNV702)	North Norco Outfall (801NNR707)	Perris Line J Outfall (802PLJ752)	Santa Ana River (801AHG857)	Temescal Channel (801TMS746)	Perris Valley Channel (802NVO325)
Wet Weather Events										
November 20, 2019	FS	●	●	FS	FS	FS	●	N/A	FS	FS
November 27, 2019	●	--	--	●	●	●	--	N/A	●*	FS
December 4, 2019	●	●	●	●	●	●	●	N/A	●	●
December 23, 2019	●	●	●	●	●	●	●	N/A	--	--
March 10, 2020	--	--	--	--	--	--	--	N/A	●	●
Dry Weather Events										
September 16, 2019	VNS	VNS	VNS	--	--	VNS	VNS	●	N/A	VNS
September 17, 2019	--	--	--	●	●	--	--	--	N/A	--
June 3, 2020	--	--	--	--	VNS	--	●	●	N/A	VNS
June 4, 2020	VNS	VNS	VNS	●	--	●	--	--	N/A	--

● = Sample collected
* Water column toxicity samples were not analyzed for the November 27, 2019 event due to a laboratory closure over the Thanksgiving holiday. Two additional events were conducted, and water column toxicity samples were analyzed on December 4, 2019 and March 10, 2020.
N/A = Not applicable
VNS = Visited Not Sampled. Site was dry or ponded.
FS = False Start. Not enough storm flow to sample.

11-3.1.1 Wet Weather Mobilization

Wet weather samples were collected when storm flows were observed, and sufficient volume was present for sample collection. To successfully collect wet weather samples as required by the CMP, field crews mobilized four times during the 2019-2020 monitoring year. A summary of mobilization criteria for wet weather sampling is presented in **Table 3-2**.

Table 3-2: 2019-2020 SAR Wet Weather Event Mobilization Summary

Wet Weather Event Date	Quantitative Precipitation Statement Meeting CMP Criteria	Max 6-Hour Forecast (inches); 24-Hour Forecast (inches)[1]	Antecedent Dry Weather Period	Storm Period (Duration, days)	Min. Rainfall Total (inches)[2]	Max. Rainfall Total (inches)[2]	Average Rainfall Total (inches)[2]
November 20, 2019	6 hours prior to storm	**0.52; 0.79**	First flush	11/20-22/2019 (2)	0.14	0.41	0.32
November 27, 2019	24 hours prior to storm	**0.40; 0.82**	6 days	11/28-30/2019 (2)	1.68	2.14	1.94
December 4, 2019	12 hours prior to storm	**0.47; 0.95**	6 days	12/4-5/2019 (2)	0.67	0.99	0.86
December 23, 2019	24 hours prior to storm	**0.23; 0.66**	12 days	12/23-27/2019 (5)	0.92	2.82	1.92
March 10, 2020	24 hours prior to storm	**0.36; 0.92**	18 days	3/10-11/2020 (2)	0.69	1.28	0.97

Underlined and bolded values indicate storm forecasts that met CMP wet weather mobilization criteria.
[1] Determined by evaluating Quantitative Precipitation Statement forecasts for Riverside, Perris, and Hemet.
[2] Min, max, and average of event rainfall among stations calculated from rainfall recorded on field data sheets.

11-3.1.2 Evaluation of Unsafe High Flow Conditions during Wet Weather Events

An analysis of the potential for unsafe flow conditions at MS4 outfall stations and receiving water stations is detailed in **Attachment B** and summarized in **Table 3-3**. For monitored events with these conditions, the REC-1 beneficial use is suspended (i.e., no application of the REC-1 WQO).

Table 3-3: 2019-2020 SAR High Flow Suspension Assessment Results

Station Type	Station ID	Storm Event Date	Determination
MS4 Outfall	801CRN040[1]	11/27/2019	NA - UAA
		12/04/2019	NA - UAA
		12/23/2019	NA - UAA
	802SNY316	11/20/2019	No Suspension
		12/04/2019	No Suspension
		12/23/2019	No Suspension
	802HMT318	11/20/2019	No Suspension
		12/04/2019	No Suspension
		12/23/2019	No Suspension
	801MAG364	11/27/2019	No Suspension
		12/04/2019	No Suspension
		12/23/2019	No Suspension
	801UNV702	11/27/2019	No Suspension
		12/04/2019	No Suspension
		12/23/2019	No Suspension
	801NNR707	11/27/2019	No Suspension
		12/04/2019	No Suspension
		12/23/2019	No Suspension
	802PLJ752	11/20/2019	No Suspension
		12/04/2019	No Suspension
		12/23/2019	No Suspension
Receiving Water	802NVO325	12/04/2019	**REC-1 Suspended**
		3/10/2020	No Suspension[2]
	801TMS746[1]	11/27/2019	N/A - UAA
		12/4/2019	N/A - UAA
		3/10/2020	N/A - UAA

[1]N/A – use attainability analysis (UAA) determined that REC-1 not attainable at Temescal Reach 1a. No need to conduct high flow suspension assessment.
[2]Does not apply based on depth-velocity calculation although regional precipitation > 0.5 inch.

11-3.1.3 Dry Weather Mobilization

A summary of mobilization criteria for dry weather sampling is presented in **Table 3-4**. Dry weather samples were collected when flow was observed, and sufficient volume was present for sample collection; care was taken not to collect samples that would characterize ponded, stagnant water. When a site was dry, flow was ponded, or flow was too shallow to sample (sheet flow), monitoring events were identified as VNS. Three of seven MS4 outfall stations were VNS for both dry weather events, and three additional stations were VNS during one dry weather event. The Perris Valley Channel at Nuevo Road receiving water station was observed to be dry during both dry weather events (i.e., VNS). Perennial flow at the Santa Ana River at Highgrove receiving water station was sampled during two dry weather events to characterize inputs to the SAR from San Bernardino County. In accordance with

the CMP, no dry weather events were monitored at the Temescal Channel at Main receiving water station because this station is assigned for wet weather monitoring only.

Table 3-4: 2019-2020 SAR Dry Weather Event Mobilization Summary

Dry Weather Event Date	Antecedent Dry Weather Period for >0.1-inch Rainfall (Days)	Preceding Storm Event	Storm Event Total Rainfall (inches) [1]
September 16, 2019	111	May 27, 2019	0.19
September 17, 2019	112	May 27, 2019	0.19
June 3, 2020	52	April 11, 2020	0.16
June 4, 2020	53	April 11, 2020	0.16

[1] Based on an average of the five rain gauges (Riverside, Corona, Elsinore, Hemet/San Jacinto and Perris/Moreno Valley) for each storm (see **Attachment B**).

11-3.2 MS4 OUTFALL MONITORING PROGRAM RESULTS

This section summarizes MS4 outfall results for the 2019-2020 monitoring year. Detailed results tables are provided in **Attachment G** with comparison to Basin Plan and CTR WQOs. Comparison to USEPA MSGP Benchmarks per the 2010 MS4 Permit requirements are provided in **Attachment H**.

11-3.2.1 Monitoring Summaries by MS4 Outfall Station

Monitoring results are summarized in the following section by MS4 outfall station and type of monitoring event (i.e., wet or dry weather). In accordance with Section II.K.2.(d) of the 2010 MS4 Permit, **Table 3-5** presents parameters that exceeded WQOs or CTR WQOs at MS4 outfall station for one or more monitoring events. Parameters not shown in **Table 3-5** and not discussed below met WQOs and CTR WQOs. A more detailed table of analytical results compared to the WQOs or CTR WQOs is presented in **Attachment G**. It should be noted that sample results from the MS4 outfall stations were compared to these criteria for comparison purposes only, as WQOs and CTR WQOs are applicable to receiving waters and are not required for MS4 samples (State Board, 2005).

Table 3-5: Summary of Parameters that Exceeded WQOs or CTR WQOs by MS4 Outfall Station

MS4 Outfall Station (Station ID)	Wet Weather	Dry Weather
Corona Outfall (801CRN040)	Dissolved Copper, Dissolved Zinc, pH	VNS
Sunnymead Outfall (802SNY316)	*E. coli*, Dissolved Copper	VNS
Hemet Outfall (802HMT318)	*E. coli*, Dissolved Copper, Dissolved Zinc	VNS
Magnolia Center Outfall (801MAG364)	*E. coli*, Dissolved Copper, Total Nitrogen[2], pH	*E. coli*, 4,4'-DDT, pH
University Wash Outfall (801UNV702)	*E. coli*, Dissolved Copper, Dissolved Zinc, pH	*E. coli*, Dissolved Oxygen[1]
North Norco Outfall (801NNR707)	*E. coli*, Dissolved Copper, Dissolved Zinc, Total Nitrogen[2], pH	*E. coli*, Total Selenium, Total Nitrogen[2], Total Hardness, Total Dissolved Solids, 4,4'-DDT, Dissolved Oxygen, pH
Perris Line J Outfall (802PLJ752)	*E. coli*, Dissolved Copper, pH	*E. coli*, Total Boron, 4,4'-DDT

VNS – Visited not sampled due to insufficient sampleable flow

[1] During dry weather, flows from University Wash Outfall are not hydraulically connected to the Santa Ana River.
[2] The WQO has been applied to total nitrogen rather than TIN for stations associated with Santa Ana River Reach 3 and PBMZ per footnotes in Table 4-1 of Basin Plan.

MS4 Outfall Station No. 801CRN040: Corona Outfall

The proximate receiving water for the Corona Outfall is Temescal Creek Reach 1a, which was listed as impaired for pH in 2010.[9] The Regional Board determined that a REC-1 beneficial use is not attainable for Temescal Creek Reach 1a. Therefore, the Statewide Bacteria Provisions *E. coli* WQO is not applied to this monitoring station. The Basin Plan lists a REC-2 beneficial use for Temescal Creek Reach 1a, which has only a dry weather WQO.

Wet Weather Monitoring Results

Three measured parameters exceeded Basin Plan WQOs or CTR WQOs (CMCs) during wet weather monitoring. The pH measurement exceeded the lower limit of the Basin Plan WQO range during the December 4, 2019 event. Dissolved copper concentrations exceeded the hardness-dependent site-specific Basin Plan WQOs and the hardness-dependent CTR WQOs (CMCs) for all three wet weather events sampled. The dissolved zinc concentration exceeded the CTR WQO (CMC) during the November 27, 2019 event.

Dry Weather Monitoring Results

This station was VNS during dry weather.

MS4 Outfall Station No. 802SNY316: Sunnymead Outfall

The proximate receiving water for the Sunnymead Outfall is the Perris Valley Channel and, ultimately, San Jacinto River Reach 3. This waterbody is not listed as impaired for any monitored parameters.

[9] Temescal Creek Reach 1 was listed for pH on the 2010 Section 303(d) List. The 2014/16 Section 303(d) List changed the listing to PBMZ due to a mapping change. Lines of Evidence for this listing include samples collected in the Temescal Creek receiving water above Main at Corona (approximate location of 801TMS746).

Perris Valley Channel also has limited access, with a subsection of bike trail along one side, and it is also a low flowing, ephemeral receiving water that historically has been observed to be dry during dry weather monitored events.

Wet Weather Monitoring Results

Two measured parameters exceeded WQOs or CTR WQOs (CMCs) during wet weather monitoring. During all three wet weather events, dissolved copper concentrations exceeded the CTR WQO (CMC). Measurements of *E. coli* during all three wet weather events exceeded the statistical threshold value (STV) from the Statewide Bacteria Provisions. *E. coli* measured on November 20, 2019 exceeded at a value of ≥160,000 MPN/100mL.

Dry Weather Monitoring Results

This station was VNS during dry weather.

MS4 Outfall Station No. 802HMT318: Hemet Outfall

The proximate receiving water for the Hemet Outfall is Salt Creek. This waterbody is not listed as impaired for any monitored parameters.

Wet Weather Monitoring Results

Three measured parameters exceeded WQOs or CTR WQOs (CMCs) during wet weather monitoring. The dissolved copper concentration measured during the December 4, 2019 event exceeded the CTR WQO (CMC) and the dissolved zinc concentration measured during the December 23, 2019 event exceeded the CTR WQO (CMC). There are no site-specific Basin Plan WQOs for metals for Salt Creek. Site flow conditions during the December 4, 2019 and December 23, 2019 monitored wet weather events did not met the high flow suspension criteria, and *E. coli* concentrations exceeded the STV from the Statewide Bacteria Provisions for all three wet weather events.

Dry Weather Monitoring Results

This station was VNS during dry weather.

MS4 Outfall Station No. 801MAG364: Magnolia Center Outfall

The proximate receiving water for the Magnolia Center Outfall is the Santa Ana River Reach 3. This waterbody is listed as impaired for bacterial indicators, lead, and copper and is subject to the MSAR Bacteria TMDL. The TMDL numeric target for *E. coli* includes a threshold of no more than 10% of the samples exceeding 212 organisms/100 milliliters (mL) in a 30-day period and is used to determine REC-1 compliance unless the high flow suspension criteria are met.

Wet Weather Monitoring Results

E. coli results were above the TMDL numeric target during all three wet weather events and the high flow suspension of the REC-1 beneficial use did not apply. The pH measurement of 6.39 on December 4, 2019 was slightly below the lower limit of the Basin Plan WQO of 6.5. The dissolved copper concentration measured during the December 23, 2019 event exceeded the Basin Plan WQO and the CTR WQO (CMC). The total nitrogen concentration exceeded the Basin Plan WQO during the November 27, 2019 event.

Dry Weather Monitoring Results

Field crews successfully collected dry weather samples on September 17, 2019 (instantaneous flow of 0.36 cubic feet per second [cfs]) and June 4, 2020 (instantaneous flow of 2.43 cfs). *E. coli* and pH

results were above the TMDL numeric target during both dry weather events. The pH measurements of 8.52 on September 17, 2019 and 8.66 on June 4, 2020 exceeded the Basin Plan WQO upper range of 8.5. The June 4, 2020 event also had an exceedance of 4,4'-DDT (0.0021 µg/L) to the CTR WQO (CCC) of 0.001 µg/L; this result was qualified with a calibration verification recover outside the method control limits due to matrix interference carried over from analytical samples.

MS4 Outfall Station No. 801UNV702: University Wash Outfall

The proximate receiving water for the University Wash Outfall is Lake Evans. Lake Evans is not listed as impaired for any water quality parameters. If Lake Evans overflows during a significant precipitation event, there is potential connectivity to Santa Ana River Reach 4. Hydrologic connectivity is ascertained and documented by field crews during each monitoring event. The Santa Ana River Reach 4 is listed as impaired for bacterial indicators.

Wet Weather Monitoring Results

Parameters not meeting WQOs or CTR WQOs (CMCs) included *E. coli*, pH, dissolved zinc, and dissolved copper. *E. coli* concentrations exceeded the STV from the Statewide Bacteria Provisions for all three wet weather events. The pH measurement exceeded the lower limit of the Basin Plan WQO range on December 4, 2019. Dissolved copper concentrations in samples collected during the November 27, 2019 and December 23, 2019 monitored wet weather events exceeded the site-specific WQOs and CTR WQOs (CMCs). The dissolved zinc concentration during the November 27, 2019 event also exceeded the CTR WQO (CMC).

Dry Weather Monitoring Results

A field crew successfully collected samples on September 17, 2019 (instantaneous flow of 0.20 cfs). Two parameters exceeded WQOs or CTR WQOs during dry weather monitoring. *E. coli* results exceeded the STV, and DO concentrations were measured below the minimum limit of the WQO range. During the September 17, 2019 event, an abundance of algal growth and animal activity were observed that could decrease DO in the water column. Ponded conditions can also lead to low DO measurements due to elevated water temperature. During this dry weather event when ponding was present upstream and samples were collected, there was no connectivity from Lake Evans to the Santa Ana River receiving water. During the second dry weather event in June the inlet to Lake Evans was observed to be blocked leading to ponded conditions and no flow was observed by field crews. As there was no flowing water, no samples were collected, and there was no hydraulic connection from University Wash into Lake Evans, nor from Lake Evans into the Santa Ana River.

MS4 Outfall Station No. 801NNR707: North Norco Outfall

The proximate receiving water for the North Norco Outfall is the Prado Basin Surface Water Management Zone (PBMZ), a surface water management zone with artificially created wetlands. The PBMZ was identified as impaired for pH on the 2014/2016 Section 303(d) List.

Wet Weather Monitoring Results

Five parameters exceeded WQO or CTR WQOs during wet weather monitoring. All three wet weather samples had *E. coli* results that were greater than the STV from the Statewide Bacteria Provisions, and none of the sampling events had flow that qualified for high flow suspension of the REC-1 beneficial use. The dissolved copper concentration measured during the November 27, 2019 and December 4, 2019 wet weather events exceeded the Basin Plan WQO and CTR WQO (CMC). The dissolved zinc concentration and total nitrogen measured in the November 27, 2019 sample exceeded the CTR WQO

(CMC) and Basin Plan WQO respectively, and the field-measured pH during the December 4, 2019 event exceeded the lower limit of the Basin Plan WQO range.

Dry Weather Monitoring Results

Historically at this site, sheet flow with insufficient depth to sample has been observed and the site has typically been VNS, as was the case during the first dry weather event (September 16. 2019). Due to sediment build up within the channel, the wetted width was reduced by approximately 66% leading to an increase in depth and the ability to collect a sample during the June 4, 2020 sampling event (instantaneous flow of 0.34 cfs). The flow remained constant during the sampling event. Eight parameters did not meet WQOs: *E. coli*, DO, pH, total hardness, total dissolved solids (TDS), selenium, total nitrogen, and 4,4'-DDT. 4,4'-DDT results on this date were qualified by the laboratory as "Calibration Verification recovery was outside method control limits for this analyte due to matrix interference carried over from analytical samples." Babcock laboratories confirmed that this qualifier does not affect the results (See **Section 11-5.0**, MMP Question 4 for additional details).

MS4 Outfall Station No. 802PLJ752: Perris Line J Outfall

The proximate receiving water is Perris Valley Channel, ultimately discharging to the San Jacinto River Reach 3. This waterbody is not listed as impaired for any monitored parameters. Perris Valley Channel is earthen and flows only during, or immediately following storm events.

Wet Weather Monitoring Results

Three parameters exceeded WQOs or CTR WQOs during wet weather monitoring. During all three wet weather events, *E. coli* results exceeded the STV from the Basin Plan and the high flow suspension of the REC-1 beneficial use did not apply. The pH measurement of 6.37 on December 23, 2019 was slightly below the lower limit of the Basin Plan WQO of 6.5. Dissolved copper concentrations for two wet weather events (November 20, 2019 and December 4, 2019) exceeded the CTR WQO (CMC).

Dry Weather Monitoring Results

Historically this channel has been observed to be dry during dry weather as was the case for both monitoring events on September 16, 2019 and June 3, 2020. Although the channel itself was dry, minimal flow was observed from the one actively discharging lateral draining a residential area. Though the flow was minimal, the field team was able to collect samples by modifying procedures to hold a scoop under the discharging lateral due to the location of the discharge. By using this modified approach, a dry weather sample was successfully collected on June 3, 2020 (instantaneous flow of 0.007 cfs) and the flow remained constant during the sampling event. Three parameters did not meet WQOs: *E. coli*, boron, and 4,4'-DDT. Ponding was noted downstream.

11-3.2.2 Detection and Elimination of IC/IDs to the MS4

During regular maintenance, MS4 facilities are inspected to identify potential IC/IDs. When an observed discharge warrants further investigation, such as when field parameter thresholds are exceeded (see Section 5.2, CMP Volume IV, **Attachment A**), a source investigation is conducted by the Permittee in accordance with their Local Implementation Plan (LIP) and Section 5.3 of CMP Volume IV. Lines of communication within each Permittee's jurisdiction and between Permittees represents an extremely important method for responding to IC/ID incidents. Permittee contact information is continually updated in the CMP, as needed (Appendix K of CMP Volume II – QAPP). The establishment and promotion of a toll-free hotline (1-800-506-2555) encourages County residents to report possible IC/ID incidents.

The National Pollutant Discharge Elimination System (NPDES) complaints received by District staff are included in the main body of the SAR 2019-2020 Annual Progress Report (Appendix K – IC/ID Results Database). For the 2019-2020 reporting period, 126 IC/ID reports were received and reviewed by the District. Of the incidents reported, 103 of these required follow-up investigations and/or field visits by District staff. Results of the IC/ID monitoring and any follow-up investigations conducted during the 2019-2020 monitoring year are addressed in the individual Permittees' Annual Reports. Four reported incidents that may have influenced water quality results occurred in the SAR watershed during the 2019-2020 monitoring year (**Table 3-6**). Response to these incidents included containment and clean-up activities by the reporting party. Additionally, no impact to future water quality is expected due to the removal and construction of a new bridge over Perris Valley Channel on Nuevo Road, see **Section 11-6.2** for further details regarding this construction.

Table 3-6: IC/ID Incidents in the SAR Watershed that correspond to monitoring events during the 2019-2020 Monitoring Year

Date of Incident	Description of Incident	Release to Storm Drain or Waterway	Potentially Impacted Station	Potential Impacted Parameters
11/19/2019	Homeless encampment located in the District facility Sunnymead Channel near the northeast corner of Alessandro Blvd. and Heacock St.	Yes	801SNY316	Bacterial Indicators
11/25/2019	Homeowner had dumped dog feces on the access road of the District facility Perris Valley MDP Line J.	Unknown	802PLJ752 & 802NVO325	Bacterial Indicators
12/6/19	Sewer overflow event by EMWD	Unknown	801SNY316	Bacterial Indicators
12/30/19	Homeless encampment located in the District facility Temescal Channel at Main St.	No	801TMS746	Bacterial Indicators

11-3.2.3 Instantaneous Mass Loads for MS4 Outfall Stations

Instantaneous mass loads are calculated for each monitored event at each MS4 outfall station. The instantaneous mass load for each station and parameter is calculated by multiplying the instantaneous flow and the concentration of the detected water quality parameter. Instantaneous mass loads may be subject to significant variability because the SAR MS4 outfall water quality data reflect discharges from many sources, including discharges from non-urban land uses and permitted discharges. Varying flows between events and/or monitoring years may also result in significant variability. The estimated instantaneous mass load results for each MS4 outfall station are presented in **Attachment G**.

11-3.3 RECEIVING WATER MONITORING PROGRAM RESULTS

This section summarizes the receiving water results as required by Section III.E.8 of the MRP.

11-3.3.1 Monitoring Summaries by Receiving Water Station

Table 3-7 provides a summary of parameters that exceeded WQOs or CTR WQOs at the receiving water stations during the 2019-2020 monitoring year. Parameters not shown in **Table 3-7** met WQOs and CTR WQOs, where applicable, and are not discussed below. A more detailed table of all analytical

results, and comparisons to the WQOs or CTR WQOs is presented in **Attachment G**. Monitoring results are summarized in the following section by receiving water station and are discussed according to wet weather and dry weather monitoring results.

A table of receiving water monitoring results compared to the USEPA MSGP Benchmarks is presented in **Attachment H**.

Table 3-7: Summary of Parameters that Exceeded WQO or CTR WQOs by Receiving Water Station

Receiving Water Station (Station ID)	Wet Weather	Dry Weather
Perris Valley Channel at Nuevo Road (802NVO325)	*E.coli*	VNS
Temescal Channel at Main Street (801TMS746)	Dissolved Copper, Total Nitrogen	N/A
Santa Ana River at Highgrove (801AHG857)[1]	N/A	None

N/A – Not applicable, monitoring not required.

VNS – Visited not sampled due to insufficient sampleable flow.

[1] The Santa Ana River at Highgrove receiving water station is located at the County line and, therefore, characterizes conditions in the receiving water from San Bernardino County.

Receiving Water Station No. 801AHG857: Santa Ana River – Highgrove Channel

The Santa Ana River at Highgrove receiving water station is located at the County line with San Bernardino County, and the data from this station characterize perennial dry weather flow entering Riverside County. The receiving water station is the Santa Ana River Reach 4, which is listed as impaired for bacterial indicators. The Santa Ana River is a perennial stream at this location due to effluent from two POTWs located approximately two miles upstream from the station. There are no MS4 discharges between the effluent from these POTWs and the receiving water station; therefore, this receiving water station does not represent the effects of discharges from the Permittees' MS4. Sampled flow is representative of a permitted discharge outside the control of the Permittees.

Dry Weather Monitoring Results

No parameters exceeded WQOs or CTR WQOs during the two dry weather monitoring events.

Receiving Water Station No. 801TMS746: Temescal Channel at Main

The Temescal Channel at Main receiving water is Temescal Creek Reach 1a, a concrete channel that was listed as impaired for pH in 2010.[10] The Regional Board determined that the REC-1 beneficial use is not attainable for Temescal Creek Reach 1a. The reach is designated with a REC-2 beneficial use, which does not have a corresponding wet weather WQO for *E. coli.* Of note, the northeastern portion of Holy Fire burn area drains to Temescal Creek, eventually flowing to Reach 1a then to the PBMZ. This fire occurred in August 2018.

[10] Temescal Creek Reach 1 was listed for pH on the 2010 Section 303(d) List. The 2014/16 Section 303(d) List changed the listing to PBMZ for samples collected on Temescal Creek Reach 1a.

Wet Weather Monitoring Results

Although the permit only requires two wet weather events at this station, three wet weather events were monitored at this site during 2019-2020. This was done as a conservative measure in order to capture the first flush event on November 27, 2019 and ensure that all required analyses were conducted this monitoring year. The first flush event occurred the day before the Thanksgiving holiday, and therefore water column toxicity samples could not be analyzed due to a laboratory closure over the holiday. Therefore, two additional events were conducted, and water column toxicity samples were analyzed on December 4, 2019 and March 10, 2020. Two parameters exceeded applicable WQOs or CTR WQOs during the three wet weather monitoring events. The total nitrogen concentration on November 27, 2019 was over 18 mg/L, exceeding the Basin Plan WQO. While the source of these atypical results was not identified, the higher total nitrogen concentration during this first storm event of the 2019-2020 monitoring season may potentially represent extended post fire effects from the Holy Fire. The dissolved copper concentration on December 4, 2019 exceeded the site-specific Basin Plan WQO and the CTR WQO (CMC).

Receiving Water Station No. 802NVO325: Perris Valley Channel at Nuevo Road

The receiving water for the Perris Valley Channel at Nuevo Road receiving water station is San Jacinto River Reach 3, which is an ephemeral waterbody. This station is the only receiving water location downstream of MS4 outfall stations. The San Jacinto River Reach 3 is not listed as impaired for any water quality parameters.

Historical station flow consistently illustrates a two-part wet weather flow response at the Perris Valley Channel at Nuevo Road receiving water station. Hydrographs from the local USGS gauge show a small flow response representative of the local drainage area, followed hours later by a second flow response, magnitudes greater, which is representative of runoff from the larger Moreno Valley. Therefore, sampling at this receiving water station has been conducted only when flows include inputs from the entire upper tributary area. Field protocols determine this occurs when hydraulic connectivity between the upstream watershed (above Orange Street) and local flows from Perris Line J is observed.

Wet Weather Monitoring Results

The only parameter that exceeded applicable WQOs during wet weather was *E. coli*, which exceeded the STV from the Statewide Bacteria Provisions during one (March 10, 2020) of the two monitoring events. The first monitored event on December 4, 2019 met the high flow suspension criteria for REC-1 beneficial use activities, and therefore *E. coli* results were not considered an exceedance. Estimated flows were 858 cfs on December 4, 2019 and 385 cfs on March 10, 2020.

Dry Weather Monitoring Results

This station was VNS during both dry weather events.

11-3.3.2 Instantaneous and Mass Load Calculations for Receiving Water Stations

Wet weather mass loads were calculated for receiving water stations using the following method. The cumulative discharge volume for each receiving water was calculated using flow data obtained from the proximate USGS station during the three-hour wet weather monitoring period (based on aliquot sample times). The wet weather mass load was calculated by multiplying the discharge volume and the concentration of the detected water quality parameter. Instantaneous mass loads were calculated for wet weather grab samples (bacterial indicators, oil and grease, volatiles, and hydrocarbons). Instantaneous mass loads were also calculated for all dry weather receiving water samples. The

estimated instantaneous and mass loads for each water quality parameter detected in discharges from the receiving water stations are presented in **Attachment G**. Note that instantaneous mass loads may be subject to significant variability because flows vary between events and/or monitoring years.

11-3.3.3 Water Column Toxicity Results for Receiving Water Stations

Section III.E.2 of the 2010 MS4 Permit requires receiving water samples to be tested for toxicity to aquatic species. Toxicity of water samples was measured using the following three species and USEPA protocols:

- Acute test methods:
  - *Ceriodaphnia dubia* (water flea) – EPA-821-R-02-012 (USEPA, 2002a).
  - *Pimephales promelas* (freshwater fish, fathead minnow) – EPA-821-R-02-012 (USEPA, 2002a).
- Chronic test method:
  - *Pseudokirchneriella subcapitata*, formerly *Selenastrum capricornutum*, (unicellular green algae) – EPA-821-R-02-013 (USEPA, 2002b).

Toxicity is expressed in toxic units (TUs) for both acute and chronic toxicity. Survival is the endpoint used for the acute toxicity tests using the fathead minnow (*P. promelas*) and the water flea (*C. dubia*). Acute toxicity units (TU_a) are calculated as follows:

$$TU_a = 100/LC_{50}.$$

The LC_{50}, or median lethal concentration, is the concentration of a sample that causes a lethal effect on 50% of the toxicity test organisms. The LC_{50} is extrapolated from the results of the toxicity test and cannot be calculated if no toxicity is observed. The lower the LC_{50}, the more toxic the sample; for example, when a laboratory reports an "LC_{50} >100%," it means that the full-strength (undiluted) sample did not kill more than half of the organisms. An LC_{50} of 50% means that a half-strength (2:1 dilution) sample killed 50% of the organisms. In cases where there is less than 50% mortality in the undiluted sample, the TU_a value is classified as being <1.0. Conversely, TU_a values above 1.0 are associated with samples that exhibit greater than 50% mortality and have an LC_{50} of less than 100%.

The organism used to assess chronic toxicity was the freshwater green algae, *P. subcapitata*, and growth inhibition (i.e., cell numbers) was the endpoint used to measure chronic toxicity. Similar to the LC_{50} for acute toxicity, the EC_{50} is the median effective concentration (i.e., concentration that has an effect on 50% of the population). Toxicity is determined using a no observed effect concentration (NOEC) value, which is defined as the highest concentration tested where no toxicity is statistically discernible. The lower the NOEC value, the more toxic is the sample. The NOEC is used to calculate chronic toxicity units (TU_c), which can range from a lower limit of 1.0 (in the case of no toxicity) to values much greater than 1.0 (in the case of a very high toxicity). TU_c are calculated as follows:

$$TU_c = 100 / NOEC$$

11-3.3.3.1 Wet Weather Toxicity Results

Wet weather samples were assessed for toxicity for two wet weather events at the Temescal Channel at Main and Perris Valley Channel at Nuevo Road receiving water stations. A summary of toxicity testing statistical results for the 2019-2020 monitoring year are presented in **Table 3-8** and **Table 3-9**. No acute or chronic toxicity was observed in wet weather event samples from either receiving water

station. Historically, wet weather toxicity had been infrequent. During the previous five monitoring years, only three of 51 toxicity tests (17 samples tested with three species) have shown toxicity, and all were slight toxicity to *P. subcapitata*, which occurred every other year.

Table 3-8: Wet Weather Event Toxicity Testing Results in Toxicity Units

Receiving Water Station (Station ID)	Date	Acute Toxicity *P. promelas*	Acute Toxicity *C. dubia*	Chronic Toxicity *P. subcapitata*^
Temescal Channel at Main Street (801TMS746)	12/4/2019	<1.0	<1.0	1.0
	3/10/2020	<1.0	<1.0	1.0
Perris Valley Channel at Nuevo Road (802NVO325)	12/4/2019	<1.0	<1.0	1.0
	3/10/2020	<1.0	<1.0	1.0

^Formerly *Selenastrum capricornutum.*

Table 3-9: Summary of Wet Weather Event Statistical Results for Toxicity Testing

Receiving Water Station (Station ID)	% Sample Conc.	Acute Toxicity *P. promelas*		Acute Toxicity *C. dubia*		Chronic Toxicity *P. subcapitata*^	
		Survival (%)	LC_{50} (% Sample)	Survival (%)	LC_{50} (% Sample)	Algal Growth (cells/mL x10^6)	EC_{50} (% Sample)
Temescal Channel at Main Street (801TMS746)	**Date: 12/4/2019**						
	Lab Control	100	>100	96.0	>100	3.81	>100
	100	96.0		100		3.55	
	Date: 3/10/2020						
	Lab Control	96.7	>100	100	>100	3.06	>100
	100	96.7		100		3.10	
Perris Valley Channel at Nuevo Road (802NVO325)	**Date: 12/4/2019**						
	Lab Control	100	>100	96.0	>100	3.81	>100
	100	96.0		100		3.51	
	Date: 3/10/2020						
	Lab Control	96.7	>100	100	>100	3.06	>100
	100	96.7		100		3.28	

^Formerly *Selenastrum capricornutum.*

EC_{50} – effect concentration; concentration of a sample that caused an adverse effect on 50% of the toxicity test organisms.
LC_{50} – lethal concentration; concentration of a sample that caused a lethal effect on 50% of the toxicity test organisms.

11-3.3.3.2 Dry Weather Toxicity Results

Samples were assessed for toxicity for the two dry weather events monitored at the Santa Ana River at Highgrove receiving water station. A summary of toxicity testing statistical results for the 2019-2020 monitoring year is presented in **Table 3-10** and **Table 3-11**. No acute toxicity was observed in either dry weather sample. Chronic toxicity to *P. subcapitata* growth was observed in both dry weather samples. These results are not typically enough to warrant a Toxicity Identification Evaluation (TIE).

The standard is to conduct a TIE upon repeated toxicity and for a sample with at least a 50% effect. During the previous five monitoring years, only one of 30 tests (10 dry weather samples tested with three species) showed toxicity. An August 2016 sample had resulted in slight toxicity to *P. subcapitata.*

Table 3-10: Dry Weather Event Toxicity Testing Results in Toxicity Units

Receiving Water Station (Station ID)	Date	Acute Toxicity *P. promelas*	Acute Toxicity *C. dubia*	Chronic Toxicity *P. subcapitata*^
Santa Ana River at Highgrove (801AHG857)	9/16/2019	<1.0	<1.0	>1.0
	6/3/2020	<1.0	<1.0	>1.0

^Formerly *Selenastrum capricornutum.*

Table 3-11: Summary of Dry Weather Event Statistical Results for Toxicity Testing

Receiving Water Station (Station ID)	% Sample Conc.	Acute Toxicity *P. promelas*		Acute Toxicity *C. dubia*		Chronic Toxicity *P. subcapitata*^	
		Survival (%)	LC_{50} (% Sample)	Survival (%)	LC_{50} (% Sample)	Algal Growth (cells/mL x10^6)	EC_{50} (% Sample)
Santa Ana River at Highgrove (801AHG857)	**Date: 9/16/2019**						
	Lab Control	96.7	>100	93.3	>100	3.46	>100
	100	96.7		86.7		2.27*	
	Date: 6/3/2020						
	Lab Control	100	>100	100	>100	3.00	>100
	100	96.7		96.0		1.80*	

^Formerly *Selenastrum capricornutum.*
*Significant effect was observed in the sample.
EC_{50} – effect concentration; concentration of a sample that caused an adverse effect on 50% of the toxicity test organisms.
LC_{50} – lethal concentration; concentration of a sample that caused a lethal effect on 50% of the toxicity test organisms.

11-3.3.4 Bioassessment Results

The bioassessment component of the 2019-2020 receiving water monitoring program was fulfilled through District participation in the SMC Regional Monitoring Program. The Spring 2020 Bioassessment monitoring effort followed the existing study design for the 2015-2019 program by sampling two condition and two trend locations in the SAR. For more information about bioassessment monitoring see **Section 11-4.1** and **Attachment I**.

11-3.4 RESULTS ASSESSMENT

An evaluation of 2019-2020 monitoring year results in the context of historical data is presented in this section. With a focus on historical pollutants of concern, 2010 MS4 Permit-required assessments are addressed herein including an analysis of trends, persistence, comparison to baselines for total inorganic nitrogen (TIN) and TDS, and land use correlations.

Historical priority pollutants of concern are signified in **Table 3-12** for wet weather (•) and dry weather (♦). Bacterial indicators are considered a regional pollutant of concern for the entire Santa Ana River watershed due to the MSAR Bacterial Indicator TMDL and specific language in Section II.E of the 2010 MS4 Permit. Parameters on the Section 303(d) List are also considered receiving water-specific pollutants of concern. These pollutants of concern apply to: 1) receiving water monitoring stations associated with the listed waterbody, and 2) MS4 outfall stations that discharge to that receiving water.

Nitrogen-nutrients are considered a historical pollutant of concern for the PBMZ (North Norco Outfall) and Santa Ana River Reach 3 (Magnolia Center Outfall) due to dry weather surface water evaluation and management requirements established by the Basin Plan, and are identified as pollutants of concern in the 2010 MS4 Permit. None of the proximate receiving waters for monitoring stations evaluated by the three receiving water and seven MS4 outfall monitoring stations that comprise the MRP are listed for nutrients. Data collection and evaluation efforts for the Lake Elsinore and Canyon Lake Nutrient TMDL are separate from this MRP and are conducted in accordance with the Comprehensive Nutrient Reduction Plan (CNRP).

Because of the dry, arid environment, hydraulic connectivity within the SAR watershed only occurs during wet weather conditions. Perris Valley Channel at Nuevo Road is the only receiving water station with MS4 outfall stations located upstream. Therefore, the relative contribution from the MS4 to the receiving water may be directly evaluated only for San Jacinto River Reach 3 (see **Section 11-5.0**). For the remainder of the SAR wet weather monitoring data, the relative contributions from the MS4 to the receiving water cannot be directly assessed because the receiving water station is either located upstream of, or in a different receiving water from, MS4 outfall stations. To provide a more robust assessment of historical pollutants of concern, the integrated findings in **Section 11-5.0** give consideration to waterbodies upstream of inland surface waters with a wet weather priority pollutant. These parameters are denoted in **Table 3-12** with footnotes describing the reasons for these considerations. Dry weather results were not considered because flows tend to evaporate and infiltrate without reaching receiving waters.

Table 3-12: Historical SAR Pollutants of Concern and Priority Constituents

Receiving Water	**Temescal Creek Reach 1a**		**PBMZ**	**Santa Ana River**			**San Jacinto River Reach 3**			**Salt Creek**
				Reach 3	**Reach 4**					
Station *Station Type*	**801CRN040** *MS4 Outfall*	**801TMS746** *Receiving Water*	**801NNR707** *MS4 Outfall*	**801MAG364** *MS4 Outfall*	**801UNV702** *MS4 Outfall*	**801AHG857 #** *Receiving Water*	**802SNY316** *MS4 Outfall*	**802PLJ752** *MS4 Outfall*	**802NVO325** *Receiving Water*	**802HMT318** *MS4 Outfall*
Bacterial Indicators	UAA	UAA N/A	--	● ♦	● ♦	N/A ♦	-- --	-- --	-- --	-- --
Copper	1 --	1 N/A	1 --	● ♦ *	--	--	--	--	--	--
Lead	1 --	1 N/A	1 --	● ♦	--	--	--	--	--	--
pH	● ** ♦ **	● ** N/A	● ♦	--	--	--	--	--	--	--
Nitrogen-Nutrients	-- --	-- N/A	-- ♦ ^	-- ♦ ^	-- 2	N/A --	3 --	3 --	3 --	3 --

TABLE KEY:
● – Wet Weather Historical Pollutant of Concern
♦ – Dry Weather Historical Pollutant of Concern
N/A – Not applicable, monitoring is only required for wet or only dry season.
UAA – Only the REC-2 dry weather anti-degradation WQO applies to this station. The Regional Board determined by use attainability analysis that a REC-1 beneficial use is not attainable.

HISTORICAL SAR POLLUTANT OF CONCERN NOTES:
Historical pollutants of concern are based on TMDL or 303(d) listing for the proximate receiving water.
– 801AHG857 characterizes perennial dry weather flow from San Bernardino County.
* – In 2010, the 303(d) listing for copper included a caveat indicating the impairment only applied to wet weather conditions. The 2014/16 Section 303(d) List did not include a seasonal qualifier for the copper listing; therefore, dry weather is also listed herein.
** – The 2014/16 Section 303(d) List changed the listing to PBMZ due to a mapping change. The pH listing was retained for stations located on Temescal Reach 1a based on a review of the supporting Lines of Evidence.
^ – Total nitrogen/TIN and TDS objectives are required by the Basin Plan for groundwater and surface water management zones for control of dry weather flows from Permittee activities. Dry weather data assessments were conducted for monitoring stations with applicable proximate receiving waters, including Reach 3 of the Santa Ana River (801MAG364) and the PBMZ (801NNR707).

UPSTREAM/DOWNSTREAM CONSIDERATIONS:
The discussion of monitoring data in the integrated assessment also considers wet weather parameters at monitoring locations upstream of SAR historical water quality conditions of concern as follows:
[1]Temescal Creek and the PBMZ are located upstream of Santa Ana River Reach 3, which is listed as impaired for copper and lead.
[2]The Basin Plan establishes WQOs for Santa Ana River Reach 4 for TDS and TIN. Because a long-term dry weather record is available for 801UNV702, consideration was given to dry weather data from this station for comparison to 801MAG364.
[3]Salt Creek and San Jacinto River are located upstream of Canyon Lake, which is subject to the Lake Elsinore and Canyon Lake Nutrient TMDL. TMDL data are collected during and analyzed separately from data collected under this MRP, in accordance with CNRP.

PBMZ - Prado Basin Surface Water Management Zone; TDS – total dissolved solids; TIN – total inorganic nitrogen; CNRP – Comprehensive Nutrient Reduction Plan.

11-3.4.1 Statistical Trend Analysis Results

Current and historical monitoring data for the SAR monitoring stations were analyzed for statistically significant trends. Statistical methods included regression analysis for constituents that met normal or log-normal distribution requirements and the nonparametric Mann-Kendall test for linear trend for those parameters that did not. **Table 3-13** (wet weather) and **Table 3-14** (dry weather) provide the results of the trend analyses for SAR pollutants of concern (**Table 3-12**) and parameters that exceeded WQOs during the current monitoring year. Reported trend results include the number of monitoring years of data, p-value, trend, proportion of ND results, and, if calculable, the regression slope or Theil-Sen's slope for non-parametric data. The slope represents the change in concentration in terms of constituent-specific units per years of data. The direction of the trend result is signified by an arrow, where an upward arrow (△) signifies a statistically significant increasing long-term trend and a downward arrow (▽) signifies a statistically significant decreasing long-term trend. The potential effect of a water quality trend is signified by color-coding. Potential water quality improvements are colored **green**, whereas declines in water quality are colored **orange**. For constituents such as pH that have a WQO range rather than a single threshold, trends are colored **black** without assignment to potential water quality improvement or decline because increasing or decreasing trends alone cannot be used to make this determination. Where pH has been low, an increase could signify improving water quality conditions but where pH has been high, an increase could identify degradation. Trends for parameters that exceeded WQO or CTR WQOs during 2019-2020 monitoring are indicated with **bold typeface**. Constituents identified as historical pollutants of concern for a monitoring station are indicated with underlined typeface.

A compilation of all statistically significant trends for the 2019-2020 trend analysis are presented in **Attachment J**. Additional discussion of trend results in the context of pollutants of concern and regional water quality is provided in **Section 11-5.0**.

Table 3-13: Statistically Significant Long-Term Wet Weather Trends for Pollutants of Concern and Parameters with 2019-2020 Results Exceeding WQOs or CTR WQOs

Monitoring Station	Parameter	Years of Data	p-value	Trend	% Data with ND Result	Regression or Theil-Sen's Slope
MS4 Outfall Station						
Corona Storm Drain NPDES – Line K below Harrison and Sheridan Streets (801CRN040)	*E. coli*	14	0.038	▼	5.6%	-0.00015
	Copper, Total	28	0.005	▼	1.3%	-0.00003
	Lead, Total	28	<0.001	▼	10.7%	-0.00008
	Nitrite (as N)	28	<0.001	▼	45.3%	NA
	Total Phosphorus	28	0.002	▼	0.0%	-0.00002
	pH	22	0.001	▼	0.0%	-0.00018
Sunnymead Channel NPDES – Line B at Alessandro Boulevard and Heacock Street (802SNY316)	Lead, Total	17	0.023	▼	0.0%	-0.00005
	Total Kjeldahl Nitrogen (TKN)	16	0.006	▲	0.0%	0.00006
	Total Nitrogen	16	0.004	▲	0.0%	0.00005
	pH	16	0.007	▼	0.0%	-0.00016

Table 3-13: Statistically Significant Long-Term Wet Weather Trends for Pollutants of Concern and Parameters with 2019-2020 Results Exceeding WQOs or CTR WQOs

Monitoring Station	Parameter	Years of Data	p-value	Trend	% Data with ND Result	Regression or Theil-Sen's Slope
Hemet Channel NPDES – Sanderson Avenue to Cawston Avenue (802HMT318)	Copper, Total	15	0.001	▲	2.3%	0.00007
	Total Kjeldahl Nitrogen (TKN)	18	<0.001	▲	3.8%	0.00006
	Total Nitrogen	15	<0.001	▲	0.0%	0.00006
	Total Phosphorus	18	<0.001	▲	0.0%	0.00005
	Ammonia (as N)	13	<0.001	▲	0.0%	0.00006
	Nitrogen, Total Inorganic	12	<0.001	▲	0.0%	0.00004
	pH	17	<0.001	▼	0.0%	-0.00021
Magnolia Center NPDES – Storm Drain Outlet at Santa Ana River (801MAG364)	Copper, Total	29	0.020	▼	1.2%	-0.00002
	Lead, Total	29	<0.001	▼	6.0%	-0.00005
	Zinc, Total	29	0.032	▼	1.2%	-0.00387
	Nitrate (as N)	29	0.019	▼	0.0%	-0.00003
	pH	20	<0.001	▼	0.0%	-0.00024
University Wash Channel – Market Street and Bowling Green Drive (801UNV702)	***E. coli***	14	<0.001	▲	0.0%	4.39
	Fecal Coliform	14	<0.001	▲	0.0%	4.17
	Total Coliform	14	0.034	▲	0.0%	0.00012
	Lead, Total	20	0.002	▼	6.0%	-0.00005
	Lead, Dissolved	9	0.034	▼	11.5%	-0.00007
	Total Kjeldahl Nitrogen (TKN)	19	0.034	▲	0.0%	0.00009
	Nitrogen, Total Organic	12	0.005	▲	0.0%	0.00019
	Orthophosphorus	9	0.036	▲	0.0%	0.00013
	pH	17	<0.001	▼	0.0%	-0.00036
North Norco Channel at Country Club Lane (801NNR707)	Nitrite (as N)	18	0.001	▼	21.3%	NA
	Nitrogen, Total Organic	11	0.004	▲	0.0%	0.00008
	pH	15	<0.001	▼	0.0%	-0.00032
Perris Line J at Sunset Avenue Storm Drain Channel below Murrieta Road (802PLJ752)	***E. coli***	15	0.024	▲	0.0%	0.00012
	Fecal Coliform	15	0.023	▲	0.0%	1.93800
	Copper, Total	18	0.006	▲	4.7%	0.00005
	Total Kjeldahl Nitrogen (TKN)	18	<0.001	▲	0.0%	0.00006
	Total Nitrogen	18	0.007	▲	0.0%	0.00037
	Ammonia (as N)	12	0.003	▲	4.2%	0.00011
	Nitrogen, Total Organic	12	<0.001	▲	0.0%	0.00009
	Orthophosphorus	9	0.022	▲	0.0%	0.00012
	pH	16	<0.001	▼	0.0%	-0.00030

Table 3-13: Statistically Significant Long-Term Wet Weather Trends for Pollutants of Concern and Parameters with 2019-2020 Results Exceeding WQOs or CTR WQOs

Monitoring Station	Parameter	Years of Data	p-value	Trend	% Data with ND Result	Regression or Theil-Sen's Slope
Receiving Water Station						
Perris Valley Channel at Nuevo Road (802NVO325)	No Statistically significant trends.					
Temescal Channel at Main (801TMS746)	Copper, Total	9	0.034	▼	0.0%	-0.00357
	Lead, Dissolved	9	0.016	▼	22.2%	NA
	Selenium, Dissolved	9	0.034	▼	44.4%	NA
	Zinc, Dissolved	9	0.036	▼	0.0%	-0.00439
	Orthophosphorus	9	0.046	▲	0.0%	0.00007

▽ – Statistically significant downward (inverse) trend.
△ – Statistically significant upward (direct) trend.
Green arrow signifies improving water quality.
Orange arrow signifies declining water quality.
Black arrow signifies no determination of potential water quality impact because WQO is based on a range of values..
NA – Regression slope and Sen's slope not calculated for parameters with greater than 15% non-detects (NDs).
Underlined parameters designate pollutants of concern.
Bold parameters did not meet WQO or CTR WQOs during the 2019-2020 monitoring year.

Table 3-14: Statistically Significant Long-Term Dry Weather Trends for Pollutants of Concern and Parameters with 2019-2020 Results Exceeding WQOs or CTR WQOs

Monitoring Station	Parameter	Years of Data	p-value	Trend	% Data with ND Result	Regression or Theil-Sen's Slope
MS4 Outfall Station						
Corona Storm Drain NPDES – Line K below Harrison and Sheridan Streets (801CRN040)	VNS in 2019-2020	*	*	*	*	*
Sunnymead Channel NPDES – Line B at Alessandro Boulevard and Heacock Street (802SNY316)	VNS in 2019-2020	*	*	*	*	*
Hemet Channel NPDES – Sanderson Avenue to Cawston Avenue (802HMT318)	VNS in 2019-2020	*	*	*	*	*
Magnolia Center NPDES – Storm Drain Outlet at Santa Ana River (801MAG364)	***E. coli***	16	<0.001	▲	13.5%	0.00024
	Enterococcus	15	0.048	▲	8.6%	0.00014
	Fecal Coliform	16	0.001	▲	11.8%	0.53000
	Nitrate (as N)	29	0.0385	▼	0.0%	-0.00015
	Nitrogen, Total Organic	19	0.0116	▲	13.3%	0.00005
	Dissolved Oxygen	27	0.0321	▼	0.0%	-0.00013

Table 3-14: Statistically Significant Long-Term Dry Weather Trends for Pollutants of Concern and Parameters with 2019-2020 Results Exceeding WQOs or CTR WQOs

Monitoring Station	Parameter	Years of Data	p-value	Trend	% Data with ND Result	Regression or Theil-Sen's Slope
University Wash Channel – Market Street and Bowling Green Drive (801UNV702)	***E. coli***	9	0.011	▲	6.7%	0.00050
	Fecal Coliform	8	0.035	▲	7.1%	0.00042
	Boron, Total	24	0.004	▼	0.0%	-0.00817
	Boron, Dissolved	8	0.002	▼	0.0%	-0.05760
	Nitrate (as N)	23	0.002	▼	13.2%	-0.00013
	Total Kjeldahl Nitrogen (TKN)	22	0.009	▲	1.9%	0.00004
	Ammonia (as N)	22	0.000	▲	29.4%	NA
	Nitrogen, Total Organic	18	0.010	▲	7.3%	0.00009
	Dissolved Oxygen	22	0.000	▼	0.0%	-0.00115
	pH	23	0.000	▼	0.0%	-0.00013
	Total Hardness	23	0.000	▼	0.0%	-0.00839
North Norco Channel at Country Club Lane (801NNR707)	--	--	--	--	--	--
Perris Line J at Sunset Avenue Storm Drain Channel below Murrieta Road (802PLJ752)	--	--	--	--	--	--
Receiving Water Station						
Perris Valley Channel at Nuevo Road (802NVO325)	VNS in 2019-2020	*	*	*	*	*
Santa Ana River at Highgrove (801AHG857)**	Fecal Streptococci	9	0.039	▲	0.0%	0.00015
	Boron, Total	9	0.004	▲	0.0%	0.00688
	Copper, Total	9	0.02	▲	0.0%	0.00038
	Copper, Dissolved	9	0.001	▲	0.0%	0.00050
	Nitrite (as N)	9	0.003	▼	0.0%	-0.00002
	Total Hardness	9	0.048	▼	0.0%	<-.00001

▽ – Statistically significant downward (inverse) trend.
△ – Statistically significant upward (direct) trend.
Green arrow signifies potential improving water quality.
Orange arrow signifies potential declining water quality.
Black arrow signifies no water quality impact.
VNS – visited not sampled
NA – Regression slope and Sen's slope not calculated for parameters with greater than 15% non-detects (NDs).
* No samples were collected during dry weather during the 2019-2020 Monitoring Year.
** The Santa Ana River at Highgrove receiving water station characterizes perennial dry weather flow from San Bernardino County.
-- For North Norco Channel (801NNR707), one sample was collected during 2018-2019 and 2019-2020 monitoring year. Station has been VNS since 2011 and, therefore trends were not analyzed. For Perris Line J (802PLJ752), one sample was collected during 2019-2020 monitoring year. Station has been VNS since 2005 and, therefore trends were not analyzed.
Underlined parameters indicate pollutants of concern.
Bold parameters did not meet WQO or CTR WQOs during the 2019-2020 monitoring year.

11-3.4.2 Persistence Analysis

The object of the persistence analysis is to evaluate which parameters, if any, are regularly measured at concentrations that could impact existing or potential beneficial uses designated for SAR receiving waters. The SAR CMP defines persistence as "an exceedance of the relevant Basin Plan or CTR objectives by 20% for three sampling periods" (SMC, 2004). Therefore, a parameter was determined to be persistent for a monitoring station when concentrations exceeded a WQO or CTR WQO by 20% or more for all monitored events during the three most recent monitoring years (i.e., 2017-2018, 2018-2019, and 2019-2020). Wet weather and dry weather monitoring data were evaluated separately. Where a high flow suspension of REC-1 was met, the event was not considered an exceedance contributing to persistence for *E. coli*. Parameters with persistent exceedance of WQOs and CTR WQOs at receiving water and/or MS4 outfall stations are presented in **Table 3-15**. Additional discussion of persistence in the context of pollutants of concern and regional water quality is provided in **Section 11-5.0.**

Table 3-15: Parameters with Persistent Exceedances of the WQOs and CTR WQOs at MS4 Outfall and Receiving Water Stations

Station Name (Station ID)	Wet Weather Persistent Exceedances	Dry Weather Persistent Exceedances
MS4 Outfall Stations		
Corona Outfall (801CRN040) [1]	Dissolved Copper	VNS
Sunnymead Outfall (802SNY316)	No persistence identified.	VNS
Hemet Outfall (802HMT318)	*E. coli*	VNS
Magnolia Center Outfall (801MAG364)	No persistence identified.	*E. coli*
University Wash Outfall (801UNV702)	*E. coli*	*E. coli*
North Norco Outfall (801NNR707)	*E. coli*	NA[3]
Perris Line J Outfall (802PLJ752)	*E. coli*	NA[4]
Receiving Water Stations		
Temescal Channel at Main Street (801TMS746)	No persistence identified.	--
Santa Ana River at Highgrove (801AHG857)	--	No persistence identified.
Perris Valley Channel at Nuevo Road (802NVO325)	No persistence identified.[2]	VNS

N/A – Not applicable; VNS – visited not sampled.

-- Receiving water station is not monitored during for this type of event.

[1] This monitoring station is only subject to the REC-2 dry weather anti-degradation WQO for *E. coli*.

[2] Monitoring stations that had one or more high flow suspensions of the E. coli WQO within the evaluation period were determined not to have a persistent exceedance.

[3] This monitoring station was VNS during 2017-2018 monitoring year; therefore, persistence could not be evaluated.

[4] This monitoring station has been VNS for the past two years; therefore, persistence could not be evaluated.

11-3.4.3 Dry Weather Baseline Conditions Assessments for TIN and TDS

The Basin Plan and Section II.L.3 of the 2010 MS4 Permit requires the Permittees to establish baseline dry weather discharge concentrations for TIN and TDS. Further, this assessment addresses the MRP objective to "identify baseline conditions." Baseline dry weather concentrations for the Magnolia Center Outfall and the University Wash Outfall, the only two MS4 outfall stations with consistent sufficient flow to collect samples in dry weather, were evaluated based on available historical dry weather data. Baselines were not developed for stations that are consistently VNS. The TIN dry weather baseline was established using data from 2011-2012 through 2016-2017, and the TDS dry weather baseline was based on data collected prior to the start of the 2010 MS4 Permit. The baseline is numerically represented by the average measured dry weather concentrations, with consideration for standard deviations around the average. The dry weather baseline also evaluates the range of measured concentrations (minimum and maximum). **Table 3-16** presents the range and average dry weather concentrations for TIN and TDS from the Magnolia Center Outfall and the University Wash Outfall. These data are compared to current year analytical results for each constituent for dry weather sampling conducted on September 17, 2019 (Magnolia Center Outfall and the University Wash Outfall) and June 4, 2020 (Magnolia Center Outfall). Results are also graphically presented as box whisker plots in **Figure 3-1**. The green shading represents the historical concentrations and the yellow diamonds represent current-year results.

Both dry weather results for the two evaluated MS4 outfall stations were less than the WQO and historical maximum for TIN and TDS, but the Magnolia Center Outfall results for TIN on September 17, 2019 were greater than the historical average. The University Wash Outfall was recorded as VNS during the June 4, 2020 dry weather event.

Table 3-16: Comparison of TIN and TDS Baseline Dry Weather Results Compared with 2019-2020 Dry Weather Results

2019-2020 Results	Magnolia Center Outfall (801MAG364)		University Wash Outfall (801UNV702)	
	TIN	TDS	TIN	TDS
WQO (mg/L)	10[#]	700	10	550
9/17/2019 Result (mg/L)	5.2	600	1.5	430
6/4/2020 Result (mg/L)	4.4	530	VNS	VNS
Baseline Parameter	**Dry Weather Baseline**			
Number of Samples	10	43	8	39
Number of Monitoring Years	6	16*	5^	14*
Minimum (mg/L)	0.34	290	0.2	320
Maximum (mg/L)	6.8	1,000	5.2	640
Average ± Std Dev (mg/L)	4.89 ± 2.2	617 ± 176	1.69 ± 1.5	482 ± 81

TIN – total inorganic nitrogen; TDS – total dissolved solids; mg/L – milligram per Liter

* Represents data collected up to the start of the 2010 MS4 Permit.

[#] Applies to total nitrogen not TIN.

^ Represents data collected during the 2010 MS4 Permit term (2011-2012 through 2016-2017). Both dry weather events were VNS during the 2012-2013 monitoring year.

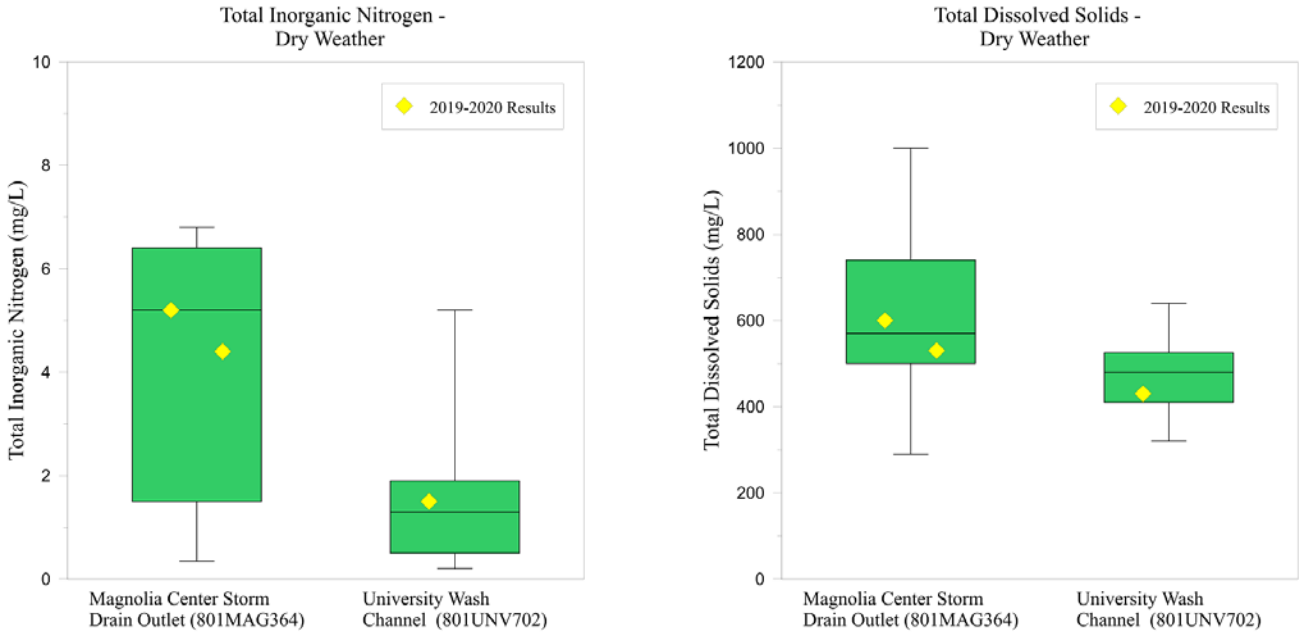


Figure 3-1: TIN (Left) and TDS (Right) 2019-2020 Dry Weather Concentrations (Points) Compared to Baseline Dry Weather Results (Box and Whisker Plots)

Historically, there has been insufficient dry weather flow in general to sample at the North Norco Outfall and at the Perris Line J Outfall. Due to lack of analytical results under the 2010 MS4 Permit, no baselines have not been developed for these stations. During the 2019-2020 monitoring year, one dry weather event was sampled at each of these two outfalls, and one event at the North Norco Outfall was sampleable during the 2018-2019 monitoring year.

While no baselines have been developed for these stations, the 2019-2020 results were compared to available historical data. At the North Norco Outfall during the June 4, 2020 event total nitrogen (37.94 mg/L) was measured above Basin Plan WQOs for the station's receiving water (PBMZ). TIN was measured last year in June 2019 with a result of 26 mg/L. There is a lengthy data gap until the next historical measurements for TIN during the 1994-1995 monitoring year, when the results were 0.2 mg/L, 3.8 mg/L, and 24.8 mg/L. TDS during the June 4, 2020 event (1,200 mg/L) was also above the Basin Plan WQOs. In terms of historical data, TDS was measured from September 6, 1997 through March 20, 2005 and on June 10, 2019, and the range of the results was 560 mg/L to 2,800 mg/L. If we use these historical data to represent the range for TIN and TDS, the 2019-2020 results at the North Norco Outfall are above this range for TIN and within this range for TDS. The water was observed to pond and infiltrate into the soil at the end of the concrete lined channel well upstream of the potential confluence point with flows from Temescal Channel.

At the Perris Line J Outfall during the June 3, 2020 event, neither TIN nor TDS exceeded Basin Plan WQOs. TIN was measured once historically on September 7, 1994 with a result of 0.4 mg/L. TDS was measured historically from September 1994 to May 2003 and the range of results was 320 mg/L to 1,700 mg/L. The 2019-2020 results are above the sole historical TIN value and within this range for TDS. The required evaluation of TIN and TDS monitoring results compared to baselines focuses on

dry weather only, as stormwater was considered to be an insignificant source of TIN and TDS (Regional Board, 2010). This discharge represented a single flowing lateral within the dry channel with sample collection only possible with modifications to the Districts standard procedures.

11-3.4.4 Frequency Analysis

A historical frequency analysis of station events above receiving water WQOs, although not required by the 2010 MS4 Permit, was conducted to provide a broader context for the current monitoring year's data. Historical frequencies, given as percentages, document the number of times water quality results for a given station, monitoring type, and parameter were outside the bounds of receiving water WQOs and/or CTR WQOs. For simplicity the term "exceedance frequency" is used to refer the historical results for MS4 outfall stations as well as receiving water stations, even though WQOs do not directly apply to outfall discharges. This comparison of MS4 outfall monitoring results to receiving water WQO is provided for assessment purposes only and does not imply compliance.

This analysis focuses on historical pollutants of concern, as well as other constituents with results that exceeded WQOs at least once during the 2019-2020 monitoring year (e.g., DO and zinc). The same constituents were analyzed for wet weather and dry weather to illustrate potential seasonal variations. The high flow suspension criteria for recreational beneficial uses and the *E. coli* WQO (Basin Plan Amendment No. R8-2012-0001) were employed as applicable to historical datasets for consistency between exceedance frequencies and results reported in the monitoring annual reports.

Wet Weather Frequency Analysis

Wet weather exceedance frequencies are presented in **Table 3-17** and **Table 3-18** for SAR receiving water monitoring stations and MS4 outfall stations, respectively. The number of samples represented by the percentage exceedance is also provided for each assessment. The historical frequency percentages do not include the 2019-2020 monitoring year data to allow comparison to the most recent monitoring results. An integrated analysis of exceedance frequencies in the context of pollutants of concern and regional water quality is provided in **Section 11-5.0.**

Table 3-17: Wet Weather WQO and CTR WQO Exceedance Frequencies for Receiving Water Stations

Analyte	802NVO325				801TMS746			
	Perris Valley Channel at Nuevo Road				Temescal Channel at Main Street			
	2019-2020		Historical		2019-2020		Historical	
	n	% Exceed	n	% Exceed	n**	% Exceed	n	% Exceed
E. coli	2	50%*	11	33%*	No numeric WQO - UAA			
pH	2	0%	11	9%	3	0%	15	13%
Total Dissolved Solids (TDS)	2	0%	11	0%	3	0%	15	0%
Copper, Dissolved	2	0%	11	0%	3	33%	15	53%
Lead, Dissolved	2	0%	11	0%	3	0%	15	7%
Zinc, Dissolved	2	0%	11	0%	3	0%	15	0%
Total Nitrogen (calculated)	No numeric WQO				3	33%	13	0%
Nitrogen, Total Inorganic	2	0%	11	0%	No numeric WQO			

*The *E. coli* WQOs were suspended for one wet weather event in 2019-2020, one wet weather event in 2017-2018, one wet weather event in 2016-2017, one event in 2015-2016 and for both wet weather events in 2014-2015.

UAA – Use Attainability Analysis. The Regional Board found the REC-1 beneficial use to be unattainable for Temescal Creek Reach 1a.

**Three wet weather events were monitored at this site in order to capture the first flush event on November 27, 2019, which coincided with the Thanksgiving holiday, as well as conduct all required testing. Because water column toxicity samples could not be analyzed for the first event due to a laboratory closure, two more events were conducted on December 4, 2019 and March 10, 2020.

Table 3-18: Wet Weather WQO and CTR WQO Exceedance Frequencies for MS4 Outfall Stations

Analyte	801CRN040				802SNY316				802HMT318				801MAG364				801UNV702				801NNR707				802PLJ752			
	Corona Outfall				Sunnymead Outfall				Hemet Outfall				Magnolia Center Outfall *				University Wash Outfall				North Norco Outfall				Perris Line J Outfall			
	2019-2020		Historical		2019-2020		Historical		2019-2020		Historical		2019-2020		Historical		2019-2020		Historical		2019-2020		Historical		2019-2020		Historical	
	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed	n	% Exceed
E. coli	No WQO – UAA				3	100%	34	94%*	3	100%	35	97%	3	100%	35	86%*	3	100%	34	100%	3	100%	34	100%	3	100%	32	97%*
pH	3	33%	49	24%	3	0%	40	8%	3	0%	74	18%	3	33%	50	18%	3	33%	41	17%	3	33%	38	42%	3	33%	37	16%
Total Dissolved Solids (TDS)	3	0%	56	5%	3	0%	25	0%	No numeric WQO				3	0%	65	5%	3	0%	33	0%	3	0%	32	6%	3	0%	24	0%
Copper, Dissolved	3	100%	23	96%	3	100%	22	86%	3	33%	22	91%	3	33%	23	74%	3	67%	23	83%	3	67%	23	48%	3	67%	20	45%
Lead, Dissolved	3	0%	23	35%	3	0%	22	0%	3	0%	22	0%	3	0%	23	26%	3	0%	23	35%	3	0%	23	4%	3	0%	20	0%
Zinc, Dissolved	3	33%	23	22%	3	0%	22	23%	3	33%	22	18%	3	0%	23	4%	3	33%	23	9%	3	33%	23	0%	3	0%	20	0%
Total Nitrogen (calculated)	3	0%	70	3%	No numeric WQO				No numeric WQO				3	33%	77	8%	No numeric WQO				3	33%	42	12%	No numeric WQO			
Nitrogen, Total Inorganic	No numeric WQO				3	0%	20	0%					No numeric WQO				3	0%	21	0%	No numeric WQO				3	0%	18	0%

* The *E. coli* WQOs were suspended for two events at Magnolia Center Storm Drain (801MAG364) during the 2018-2019 monitoring year, one event at Sunnymead Channel (802SNY316) and two events at Magnolia Center Storm Drain (801MAG364) during the 2017-2018 monitoring year, and one event at both Magnolia Center Storm Drain (801MAG364) and Perris Line J (802PLJ752) during the 2015-2016 monitoring year in accordance with Basin Plan Amendment No. R8-2012-0001.
UAA – Use Attainability Analysis; the Regional Board found the REC-1 beneficial use to be unattainable for Temescal Creek Reach 1a.

Dry Weather Frequency Analysis

For over 15 years, VNS results have been frequent during dry weather events. To provide a more holistic view of water quality conditions in the Santa Ana River Watershed, the dry weather frequency of exceedance analysis is presented in the context of VNS results.

VNS Frequency

During the 2019-2020 monitoring year, three of the seven MS4 outfall stations were reported as VNS during both dry weather events. These same three MS4 stations have been VNS for all dry weather monitoring activities conducted in accordance with the 2010 MS4 Permit (**Figure 3-2**).

Dry weather flows are typically very low, where they occur at MS4 outfall stations. When field personnel have tracked flows downstream, these small dry weather flows have been generally observed to evaporate and/or infiltrate without reaching downstream receiving waters. The dry weather sample collected at the University Wash Outfall station was associated with an instantaneous field flow measurement of 0.20 cfs. Magnolia Center Outfall dry weather samples were associated with instantaneous field flow measurements of 0.36 cfs and 0.43 cfs during the 2019-2020 dry weather monitoring. North Norco Outfall was associated with an instantaneous field flow measurement of 0.336 cfs. Perris Line J Outfall was associated with an instantaneous flow measurement of 0.007 cfs and would have been insufficient for sampling but for modifications to standard procedures.

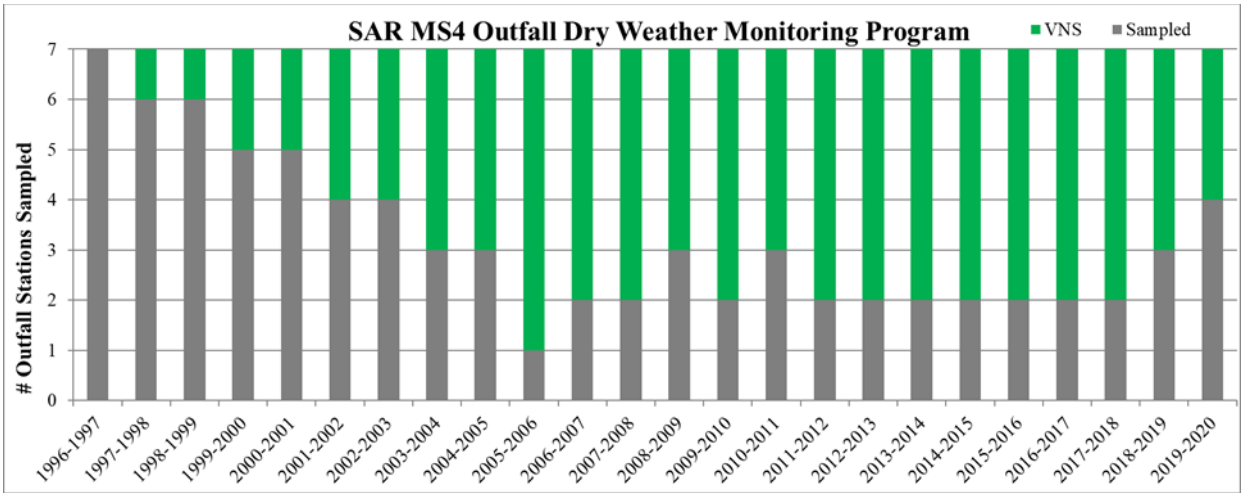


Figure 3-2: Increasing Frequency of VNS Results at SAR MS4 Outfall Stations

For receiving water stations, which are not shown in **Figure 3-2**, the Perris Valley Channel at Nuevo Road station has been VNS for all dry weather site visits since monitoring began at this location in 2011. Flow has been observed and sampled since monitoring began in 2011 at the Santa Ana River at Highgrove station. The Santa Ana River is a perennial stream at this location due to permitted discharges from the Rialto WWTP and the Colton/San Bernardino RIX. Therefore, dry weather samples collected at this location tend to characterize inputs to the Santa Ana River from San Bernardino County. Flow rates during dry weather sampling were 41.44 cfs and 41.06 cfs.

Exceedance and VNS Frequency Analysis

During the 2019-2020 monitoring year, the only stations that had sampleable dry weather flow for at least one event were University Wash Outfall, Magnolia Center Outfall, North Norco Outfall, and Perris Line J Outfall, and the Santa Ana River at Highgrove receiving water station. It should be noted

that the samples at North Norco could only be collected due to changes in the site conditions that resulted in reduced bank-full width, presenting flow that was at minimally sufficient depth for proper sampling technique. Samples at Perris Line J could only be collected due to the location of the lateral and the ability to fill the sample bottles as the water dropped into the dry channel. **Table 3-19** presents the current and historical WQO and CTR WQO dry weather exceedance frequencies and VNS frequencies for these stations during the 2019-2020 monitoring year. An integrated analysis of exceedance frequencies in the context of pollutants of concern and regional water quality is provided in **Section 11-5.0**.

Table 3-19: Dry Weather WQO and CTR WQO Exceedance Frequencies and VNS Results for MS4 Outfall Station and Receiving Water Stations with Sampleable Flow

Analyte	MS4 Outfall Stations																									Receiving Water Station							
	801MAG364							801UNV702							801NNR707							802PLJ752							801AHG857						
	Magnolia Center Storm Drain Outlet at Santa Ana River							University Wash Channel – Market Street and Bowling Green Drive							North Norco Channel at Country Club Lane							Perris Line J at Sunset Avenue Storm Drain Channel							Santa Ana River at Highgrove						
	2019-2020		Historical		Total Samples	Total VNS	% VNS	2019-2020		Historical		Total Samples	Total VNS	% VNS	2019-2020		Historical		Total Samples	Total VNS	% VNS	2019-2020		Historical		Total Samples	Total VNS	% VNS	2019-2020		Historical		Total Samples	Total VNS	% VNS
	n	% Exceed	n	% Exceed				n	% Exceed	n	% Exceed				n	% Exceed	n	% Exceed				n	% Exceed	n	% Exceed				n	% Exceed	n	% Exceed			
E. coli	2	100%	35	71%	37	1	3%	1	100%	14	57%	15	10	40%	1	100%	3	0%	4	35	90%	1	100%	0	0%	1	37	97%	2	0%	16	6%	18	0	0%
Dissolved Oxygen (DO)	2	0%	52	0%	54	2	4%	1	100%	35	40%	36	24	40%	1	100%	9	0%	10	44	81%	1	0%	7	14%	8	44	85%	2	0%	16	0%	18	0	0%
pH	2	100%	68	38%	70	2	3%	1	0%	47	23%	48	24	33%	1	100%	14	93%	15	44	75%	1	0%	10	60%	11	44	80%	2	0%	16	13%	18	0	0%
Total Hardness	2	0%	61	33%	63	2	3%	No numeric WQO							1	100%	15	33%	16	44	73%	1	0%	10	40%	11	44	80%	No numeric WQO						
Total Dissolved Solids (TDS)	2	0%	57	25%	59	2	3%	1	0%	50	18%	51	24	32%	1	100%	15	93%	16	44	73%	1	0%	10	50%	11	44	80%	2	0%	16	0%	18	0	0%
Boron	2	0%	74	0%	76	2	3%	1	0%	53	2%	54	24	31%	1	0%	15	80%	16	44	73%	1	100%	11	0%	12	44	79%	2	0%	16	0%	18	0	0%
Selenium	2	0%	75	12%	77	2	3%	1	0%	53	8%	54	24	31%	1	100%	16	38%	17	44	72%	1	0%	11	27%	12	44	79%	2	0%	16	0%	18	0	0%
Copper, Dissolved	2	0%	19	0%	21	0	0%	1	0%	12	8%	13	6	32%	1	0%	1	0%	2	16	89%	1	0%	0	0%	1	17	94%	2	0%	16	0%	18	0	0%
Lead, Dissolved	2	0%	19	0%	21	0	0%	1	0%	12	0%	13	6	32%	1	0%	1	0%	2	16	89%	1	0%	0	0%	1	17	94%	2	0%	16	0%	18	0	0%
Zinc, Dissolved	2	0%	19	0%	21	0	0%	1	0%	12	0%	13	6	32%	1	0%	1	0%	2	16	89%	1	0%	0	0%	1	17	94%	2	0%	16	0%	18	0	0%
Total Nitrogen (calculated)	2	0%	72	13%	74	2	3%	No numeric WQO							1	100%	16	44%	17	44	72%	No numeric WQO							No numeric WQO						
Nitrogen, Total Inorganic	No numeric WQO							1	0%	15	0%	16	24	60%	No numeric WQO							1	0%	1	0%	2	44	96%	2	0%	16	13%	18	0	0%
4,4'-DDT	2	50%	17	0	19	0	0%	1	0%	12	8%	13	6	32%	1	100	1	0%	2	16	89%	1	100%	0	0%	1	17	94%	2	0%	16	13%	18	0	0%

VNS - Visited not sampled.

11-3.4.5 Land Use Correlations

As stated in the Drainage Area Management Plan (DAMP), "The Permittees are collecting stormwater monitoring data from each region of Riverside County. This data is analyzed for trends in Pollutant loading and to see if Pollutant problems can be tied to particular activities or land uses" (https://www.waterboards.ca.gov/santaana/water_issues/programs/stormwater/docs/rcpermit/damp/SAR_DAMP2014.pdf). Permittees use land use data to help understand potential sources of pollutants in the SAR, and then implement effective management actions for these different land uses and associated sources to prevent impacts to receiving waters. Land use considerations play a key role in IC/ID and TMDL pollutant source investigations (see Section 13 of this 2019-2020 Annual Report) and have helped Permittees identify possible sources of SAR historical pollutants of concern and appropriate targeted management actions (**Table 3-20**). These actions and controls, which are defined in each Permittee's LIP, consider dry and wet weather sources and flows as they relate to land use.

Table 3-20: Potential Sources of SAR Pollutants of Concern

Potential Pollutant Source	Indicator Bacteria	pH	Nutrients		Metals			Potential Pollutant Management Measure(s)
			Nitrogen Compounds	Phosphorus Compounds	Copper	Lead	Zinc	
Potential Permitted Sources								
POTW *	● ♦	● --	● ♦	--	● ♦	--	--	Direct flows to the Brine Line
Industrial (IGP Permittee)	--	● --	● --	--	● --	● --	● --	Outreach, inspection, enforcement programs
Construction (CGP Permittee)	● --	● --	● --	● --	● --	● --	● --	
Potential Urban Sources								
Spills & Other IC/IDs	-- ♦	-- ♦	-- ♦	-- ♦	-- ♦	-- ♦	-- ♦	IC/ID Program
Human Fecal Wastes	● ♦	--	● ♦	● ♦	--	--	--	
Vehicles (brake pads, tires, wheel weights, gasoline)	--	● ♦	--	--	● ♦	● ♦	● ♦	Street sweeping; Source control (State Bill 346)
Landscaping (irrigation, fertilizers, pesticides)	-- ♦	-- ♦	● ♦	● ♦	● ♦	--	--	Green Gardening (e.g., water conservation; native landscaping; integrated pesticide management)
Nursery	-- ♦	-- ♦	● ♦	● ♦	● ♦	--	--	
Atmospheric Deposition	--	--	● ♦	● ♦	● ♦	● ♦	● ♦	Street sweeping
Potential Uncontrollable Natural Sources								
Non-Human Fecal Wastes	● ♦	--	● ♦	● ♦	--	--	--	Dry weather flow elimination and management
Bio-film (natural regrowth)	-- ♦	--	--	--	--	--	--	
Plants (decomposition)	-- ♦	-- ♦	--	--	--	--	--	Channel/ catch basin cleaning
Soils & Sediments	-- ♦	● --	● --	● --	--	● --	--	Erosion controls (binders/ hydroseeding)
Wildfires	--	● --	● --	● --	● --	● --	● --	--

Table 3-20: Potential Sources of SAR Pollutants of Concern

Potential Pollutant Source	Indicator Bacteria	pH	Nutrients		Metals			Potential Pollutant Management Measure(s)
			Nitrogen Compounds	Phosphorus Compounds	Copper	Lead	Zinc	
POTW – publicly owned treatment works; CGP – Construction General Permit; IGP – Industrial General Permit; IC/ID - illicit connection/illegal discharge Potential Pollutant Source *(Reference Sources: USEPA, 1999; District, 2016)* ● – Wet Weather ♦ – Dry Weather *The Santa Ana River is a perennial stream near the County boundary in large part due to permitted effluent from the Rialto Wastewater Treatment Plant and the Colton/San Bernardino Rapid Infiltration and Extraction Facility.								

Attachment C presents land uses associated with the drainage area for each MS4 outfall and receiving water monitoring station based on Riverside County Assessor parcel data. Between 2019 and 2020, slight increases in urban area and decreases in open space were identified (generally 1% per drainage area). Historically (over a longer period of record), land use data have reflected significant variability as the assessor made a series of changes in the zoning designation of land uses that are unrelated to the actual changes. As a result, attempts to directly correlate water quality to land use changes over the historical record are problematic. Therefore, the assessment presented herein considers potential sources in several categories in addition to land use and relates potential sources to pollutants of concern.

Table 3-21 relates current year water quality results that exceeded the WQO and/or CTR WQO for at least one wet or dry weather sample (**Section 11-3.2** and **Section 11-3.3**), land uses, and potential associated pollutant sources. As an ephemeral watershed, large and/or high intensity precipitation is needed to generate flow in the SAR receiving waters. SAR receiving waters are typically dry or ponded (VNS), except where permitted discharges (such as POTWs) generate localized flows, suggesting that water quality issues are limited in geospatial extent. Therefore, the analysis presented in **Table 3-21** focuses on the land uses in closest proximity to the monitoring station location. Based on data exported from the State Board's Storm Water Multiple Application & Report Tracking System (SMARTs database at: https://smarts.waterboards.ca.gov/smarts/faces/Reports/SwIndustrialReports.xhtml), this table also identifies industrial facilities in Level 1 or Level 2 for SAR pollutants of concern (e.g., pH, nitrate + nitrite, ammonia, phosphorus, copper, lead, and zinc) within the monitored drainage areas. Industrial facilities that are in Level 1 and/or Level 2 have measured water quality data for pH exceeded either the instantaneous numeric action level (NAL) range twice in a single monitoring year; or, for other pollutants, the average annual concentration for all monitored stations at the site exceeded the average annual NAL for the site. SMARTs records for 2019 showed increases over the previous year in the number of Level 1 and Level 2 facilities in two of the receiving water station drainage areas.

Table 3-21: 2019-2020 Water Quality and Land Use/Sources Comparison

Receiving Water	**Temescal Creek Reach 1a**		**PBMZ**	**Santa Ana River**			**San Jacinto River Reach 3**			**Salt Creek**
				Reach 3	**Reach 4**					
Station *Station Type*	**801CRN040** *MS4 Outfall*	**801TMS746** *Receiving Water*	**801NNR707** *MS4 Outfall*	**801MAG364** *MS4 Outfall*	**801UNV702** *MS4 Outfall*	**801AHG857** *Receiving Water*	**802SNY316** *MS4 Outfall*	**802PLJ752** *MS4 Outfall*	**802NVO325** *Receiving Water*	**802HMT318** *MS4 Outfall*
2019-2020 Parameters that Did Not Meet WQO and/or CTR WQOs										
Copper, dissolved	● --	● --	● --	● --	● --	--	● --	● --	--	● --
Lead, dissolved	--	--	--	--	--	--	--	--	--	--
Zinc, dissolved	● --	--	● --	--	● --	--	--	--	--	● --
E. coli	UAA	UAA	● ♦	● ♦	● ♦	--	● --	● ♦	● --	● --
pH	● --	--	● ♦	● ♦	● --	--	● --	--	--	--
TIN/ Nitrogen	--	● --	● ♦	● --	--	--	--	--	--	--
DO	--	--	-- ♦	--	-- ♦	--	--	--	--	--
TDS	--	--	-- ♦	--	--	--	--	--	--	--
Hardness	--	--	-- ♦	--	--	--	--	--	--	--
Boron	--	--	--	--	--	--	--	-- ♦	--	--
Selenium	--	--	-- ♦	--	--	--	--	--	--	--
4,4'-DDT	--	--	-- ♦	-- ♦	--	--	--	-- ♦	--	--
2020 Land Uses by Drainage Area										
% Urban	92%	21%	56%	71%	44%	21% *	49%	50%	40%	86%
% Open	0%	15%	3%	4%	11%	21% *	22%	29%	17%	3%
Proximate 1 sq. mi.	IND, COM	COM, RES	RES	RES	COM, RES	RES, AG	RES, COM	RES	IND	COM, IND
Potential Source of Pollutants of Concern										
POTW	--	X	--	--	--	X*	--	--	X	--
Brine Line Connection	Indirect	Direct/ Indirect	--	Indirect	--	Direct/ Indirect	--	--	--	--
Industrial WDIDs with HPOC in Level 1 or 2 *'15*	--	2	--	--	1	1*	--	--	--	--
'16	--	7	--	--	0	--	--	--	1	--
'17	--	5	--	--	0	--	--	--	2	--
'18	--	12	--	--	0	--	--	--	1	--
'19	--	29	--	--	5	5*	--	--	3	--
Urban Landscaping	--	X	X	X	X	*	X	X	--	X
Nursery	1	>25	1	--	--	*	--	--	4	--
Vehicles	X	X	X	X	X	X*	X	X	X	X

Table 3-21: 2019-2020 Water Quality and Land Use/Sources Comparison

Receiving Water	**Temescal Creek Reach 1a**		**PBMZ**	**Santa Ana River**			**San Jacinto River Reach 3**			**Salt Creek**
				Reach 3	**Reach 4**					
Station *Station Type*	**801CRN040** *MS4 Outfall*	**801TMS746** *Receiving Water*	**801NNR707** *MS4 Outfall*	**801MAG364** *MS4 Outfall*	**801UNV702** *MS4 Outfall*	**801AHG857** *Receiving Water*	**802SNY316** *MS4 Outfall*	**802PLJ752** *MS4 Outfall*	**802NVO325** *Receiving Water*	**802HMT318** *MS4 Outfall*
Atmospheric Deposition	CA-91	I-15 CA-91	--	--	I-215 CA-60 CA-91	*	--	--	--	--

AG – agriculture land uses
CA – California State Route
COM – commercial type land uses
HPOC – historic pollutant of concern
I – Interstate Highway System
IND – industrial type land uses
RES – single or multi-family residential land uses
UAA – use attainability analysis
WDID – Waste Discharge Identification

Current Year Exceedance of WQO and/or CTR WQO
● – Wet Weather
♦ – Dry Weather
Gray shading – Historical Pollutant of Concern per **Table 3-12**

* Only 43,942 acres of the tributary area is in Riverside County. The Santa Ana River is a perennial stream at the County boundary in large part due to permitted effluent from the Rialto POTW and the Colton/San Bernardino RIX.

11-4.0 REGIONAL MONITORING AND SPECIAL STUDIES

Special studies are intended to address specific research or management strategies that are not addressed by the Permit-prescribed monitoring program. The Permittees participate in the Southern California SMC through a cooperative agreement with its member agencies and by providing in-kind support. The bioassessment component of the CMP receiving water monitoring program was fulfilled through the SMC Regional Monitoring Program. An overview of the current program and a summary of the results is discussed in **Section 11-4.1**.

The Permittees also participate in TMDL task forces, regional monitoring programs, and have provided funds for specific studies, as discussed below. Efforts by Permittees conducted with the MSAR Bacterial Indicator TMDL and Lake Elsinore and Canyon Lake Nutrient TMDL Task Forces are summarized in **Section 11-4.2** and **Section 11-4.3**, respectively. The Permittees continue to take interest in these special efforts to have a better understanding of the watershed's characteristics, as well as to leverage support for improving the science, monitoring methods, and protection of the water quality.

11-4.1 SOUTHERN CALIFORNIA STORMWATER MONITORING COALITION

11-4.1.1 SMC Regional Program Description

Southern California Stormwater Monitoring Coalition

SMC mission statement

To solve stormwater management challenges across southern California by building regional consensus around best-in-class tools, methods and monitoring strategies.

SMC vision statement

The SMC's collaborative investments in regional stormwater research and monitoring will lead to the development of effective, sustainable solutions for protecting watershed health and managing water resources in southern California.

Through the Southern California SMC, the SAR MS4 Permittees participate in the Regional Watershed Monitoring Program (RWMP). Participation is facilitated by the District as the Principal Permittee participating on behalf of the Permittees for the three MS4 Permit compliance programs in Riverside County. The District's Monitoring Program Manager, Rebekah Guill, is currently serving as the Chair of the SMC's Steering Committee.

The SMC is a regional monitoring consortium that consists of Southern California agency members. The consortium includes SCCWRP; the Los Angeles, Santa Ana, and San Diego Regional Water Quality Control Boards; Principal Permittees in Southern California (Counties of Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura); the Cities of Los Angeles, San Diego, and Long Beach; as well as the California Department of Transportation (Caltrans) and the State Board. The SMC is a unique regional partnership made up of regulated and regulatory stormwater management agencies working to develop actionable solutions to vexing regional stormwater management challenges. Since its founding in 2001, the SMC has conceptualized, developed and collaboratively funded research and monitoring projects of mutual interest that advance regional management priorities. SMC projects have influenced the development of NPDES permits, 303(d) listings and TMDLs, watershed plans and monitoring designs.

The overall goal of the RWMP is to increase the compliance and effectiveness of existing NPDES monitoring programs by integrating information among Permittees and Surface Water Ambient Monitoring Program (SWAMP) to achieve a large-scale assessment of the watershed condition. Additionally, the program focuses on improvement of stormwater monitoring science, development and improvement of monitoring standards and techniques, coordination among data collection programs, and evaluation of the effects of stormwater discharges to receiving waters. SMC annual reports may be viewed and/or downloaded at: http://socalsmc.org/services/annual-reports/. Additional information regarding completed SMC projects may be viewed and/or downloaded at: http://socalsmc.org/completed-projects/. These projects include the following:

Regional Collaboration

Collaboration by SMC member agencies creates unparalleled opportunities to work toward consensus on pressing stormwater management issues. SMC members benefit from the joint efforts in:

- Generating high-quality, comparable data sets
- Developing standardized methods for data collection and analysis
- Discussing project findings in a neutral forum
- Agreeing upfront on targeted outcomes when investing in program survey elements.

- Stormwater Research Needs in California
- Regional Hydromodification Study
- Regional Bioassessment Program
- Low Impact Development Manual for Southern California
- Barriers to Low Impact Development Study
- Toxicity Testing Laboratory Intercalibration
- Effects of Wildfires on Contaminant Runoff and Emissions

Through the SMC, the Permittees are participating in the RWMP to address three key questions regarding the health of receiving waters in Southern California:

- What is the condition of streams in Southern California?
- What are the major stressors to aquatic life?
- Are conditions in locations of special interest getting better or worse?

Each of these questions is answered by a different component of the monitoring program. Together, these components determine the spatial and temporal extent of impacts, their magnitude, and potential causes. The indicators selected for answering these questions under the study design included the following:

- California Rapid Assessment Method (CRAM), which provides an observational approach looking at riparian wetlands for characteristics of the landscape, hydrology, physical structure, and biotic structure;
- Benthic Macroinvertebrates (aquatic invertebrates that live on the bottom of streams), as measured by the California Stream Condition Index (CSCI); and
- Benthic Algae (assemblages attached to substrata); the algal Index of Biotic Integrity (IBI) evaluates the health of algal communities and is a good indicator because algae represent a primary food source for the benthic community and is sensitive to change.

11-4.1.2 SMC Regional Bioassessment Program Study Design

During the 2019-2020 monitoring year, to address the bioassessment requirement of the 2010 MS4 Permit's MRP (Section III.E.5), the Permittees continued to participate in and coordinate with the SMC regional bioassessment monitoring. The Spring 2020 Bioassessment monitoring effort followed the existing study design for the 2015-2019 program. The five-year SMC RWMP, *Bioassessment Survey of the Stormwater Monitoring Coalition, Workplan for Years 2015 through 2019, Version 1.0* (SMC Workplan) (SCCWRP, 2015) may be viewed and/or downloaded at:
http://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/849_SMCWorkplan2015.pdf.

The SMC's Regional Bioassessment Technical Workgroup, in support of the RWMP, is currently in the process of developing the study design for the next five-year period, which will be modified based on lessons learned from the previous five-year period of the regional monitoring program, as well as to meet the priorities of the SMC member agencies. Once approved by the Executive Steering Committee, this new study design will be can incorporated into regional monitoring, presumably with the 2021 SMC survey. The Permittees will continue to participate in the SMC Regional Bioassessment during the 2020-2021 year.

11-4.1.2.1 2020 SMC Participation and Preliminary Results

District participation in the SMC RWMP for 2020 included monitoring four sites, including two trend sites and two condition sites which are listed in **Table 4-1**. In accordance with the 2015-2019 SMC Workplan, trend sites have been monitored annually through 2020 to evaluate changes over time in the SAR and regionally. Condition sites vary from year to year and are selected from a probabilistic sample draw to estimate prevailing regional conditions. The two SAR trend sites are located in Strawberry Creek and Cucamonga Channel, and the condition sites monitored in 2020 were both located in different reaches of the North Fork of the San Jacinto River.

Table 4-1: 2020 SMC Program Condition and Trend Sites

Station Type	Station Code	Stream Name	Watershed	Land Use	Latitude, Longitude	Date Assessed
Trend	SMC09698	Strawberry Creek	San Jacinto	Open Space (San Jacinto Mountains)	33.74903, -116.70739	6/10/2020
	SMC11581	Cucamonga Channel	Middle Santa Ana	Developed	33.95218, -117.60630	6/10/2020
Condition	802M16999	North Fork of San Jacinto (upper)	San Jacinto	Open Space (San Jacinto Mountains)	33.741380, -116.79244	6/9/2020
	802M17015	North Fork of San Jacinto (lower)	San Jacinto	Open Space (San Jacinto Mountains)	33.73090, -116.80940	6/8/2020

Each SMC station was evaluated using three major metrics. The CRAM score evaluates physical habitat quality for riverine wetlands (Collins et al., 2013). The CSCI score evaluates benthic macroinvertebrates (BMI) community health (Mazor et al., 2016). The CSCI combines a predictive multi-metric index (pMMI) with a predictive observed to expected (O/E) ratio index, and also incorporates local watershed geology and climate factors. The algal IBI is composed of three separate indices that evaluate the health of the algal community: the D18, S2, and H20. The diatom community

is analyzed using the D18, the soft algae and cyanobacteria communities are analyzed using the S2, and the soft algae and diatoms are evaluated together in a hybrid index, the H20. Preliminary algae data have been received and IBI metrics determined using the IBI calculation tool.[11] The tool output showed that S2 and H2O metrics could not be calculated at the Strawberry Creek trend site (SMC09698) and at the condition site on the upper North Fork of San Jacinto (802M16999) due to inadequate soft algae counts. Both sites are fairly well-shaded cold-water mountain streams, where very little soft algae might be expected. These data are considered preliminary until data quality assurance (QA) is complete; algal data QA is being performed by California State University San Marcos, and data are anticipated by January 2021. The 2020 dry weather flows and calculated metrics for each SMC station are summarized in **Table 4-2**.

Table 4-2: SMC Bioassessment Monitoring Results

Station Type	Station Code	Stream Name	Date	Flow (cfs)	Habitat	BMI	Algae
					CRAM Score	CSCI Score	Algal IBI Score (H20)
Condition	802M16999	North Fork of San Jacinto (upper)	6/9/2020	0.49	90	1.24	*
	802M17015	North Fork of San Jacinto (lower)	6/8/2020	0.38	73	0.97	68 Higher Quality
Trend	SMC09698	Strawberry Creek	6/10/2020	1.27	72	0.97	*
	SMC11581	Cucamonga Channel	6/10/2020	2.13	27	0.58	14 Lower Quality

*Inadequate microalgal entity count to calculate IBI. See Attachment I for details.

The riverine wetland physical habitat assessment represents a possible range of 25 to 100 CRAM points, with higher scores indicating higher quality conditions. A CRAM score of 27 at Cucamonga Channel is in the lower portion of the poor range for physical habitat quality and suggests that BMI community quality may have been affected by physical habitat limitations independent of water quality. Poor physical habitat scores are common for engineered channels like Cucamonga Channel. The other trend station, Strawberry Creek, received a CRAM score of 72, indicating fair quality physical habitat. The CRAM score for the North Fork San Jacinto River at Control Rd (upper) site was 90, which indicates very good physical habitat quality. The North Fork San Jacinto River at Highway 74 (lower) condition site received a CRAM scores that indicated fair physical habitat quality.

CSCI scores are used to indicate benthic communities that are very likely altered (scores of 0.00 to 0.62), likely altered (0.63 to 0.78), possibly altered (0.79 to 0.91), or likely intact (at least 0.92). The 2020 CSCI score for the engineered channel at Cucamonga Channel was in the very likely altered range. The Strawberry Creek trend site and both of the North Fork San Jacinto River condition sites were in the likely intact range, suggesting the BMI community at these sites are similar to reference state conditions.

[11] SCCWRP. 2014. algaeMetrics: a calculator for southern California algal Indices of Biotic Integrity (IBIs) for wadeable streams.

Water quality grab samples were also collected at each SMC station. Water quality samples were tested for field measurements and submitted for laboratory analysis for ammonia, total nitrogen, nitrate-nitrite, orthophosphate, total phosphorus, hardness, alkalinity, chloride, sulfate, and total suspended solids (TSS). Qualifying depositional sediment material was not observed at any of the SAR SMC sites in 2020, and no sediment samples were collected. Data collected for the SMC Regional Monitoring Program are submitted to SCCWRP at the conclusion of surveys. A more detailed discussion of the locations, methods, and results are provided in the 2019-2020 Bioassessment Monitoring Report (**Attachment I**).

This was the sixth year of bioassessment monitoring at the two trend sites. These stations were also initially assessed under a previous five-year cycle study design. The six years of trend site data, and the earlier year of monitoring as probabilistic sites, are presented in **Table 4-3.** At Strawberry Creek CSCI scores have ranged from Possibly Altered to Likely Intact, with the exception of 2019 when the site scored Very Likely Altered. The Strawberry Creek CSCI score in 2019 may have been temporarily depressed due to the Cranston Fire that occurred in portions of the upper watershed in July of 2018. Further discussion of both the fire and late season rain events, which may have impacted CSCI scores, was provided in 2019 Bioassessment Monitoring in the SAR Report. The Cucamonga Channel trend site has consistently scored in the Likely to Very Likely Altered categories for each of the six survey years. CRAM scores have indicated physical habitat quality that is fair to good at Strawberry Creek and consistently poor at Cucamonga Channel.

Table 4-3: Comparison of Historical Trend Site Bioassessment Data

Year	Flow (cfs)	CRAM	CSCI	Algae IBI
Strawberry Creek (SMC09698)				
2010 (baseline)	--	--	0.86 Possibly Altered*	--
2015	0.06	Fair	1.0 Likely Intact	Lower Quality
2016	0.26	Fair	0.97 Likely Intact	Higher Quality
2017	1.44	Good	0.88 Possibly Altered	Lower Quality
2018	0.08	Good	0.80 Possibly Altered	Higher Quality
2019	2.01	Fair	0.59 Very Likely Altered	Higher Quality
2020	1.27	Fair	0.97 Likely Intact	NA**
Cucamonga Channel (SMC11581)				
2009 (baseline)	--	--	0.56 Very Likely Altered*	--
2015	25	Poor	0.56 Very Likely Altered	Lower Quality
2016	1.2	Poor	0.66 Likely Altered	Lower Quality
2017	0.84	Poor	0.66 Likely Altered	Lower Quality

Table 4-3: Comparison of Historical Trend Site Bioassessment Data

Year	Flow (cfs)	CRAM	CSCI	Algae IBI
2018	19.03	Poor	0.38 Very Likely Altered	Lower Quality
2019	15.66	Poor	0.33 Very Likely Altered	Lower Quality
2020	2.13	Poor	0.58 Very Likely Altered	Lower Quality**

NA – Inadequate soft algae entity count to calculate algal IBI. See Attachment 4I.
*Average CSCI result obtained from SMC site draw tables.
**Algae data are considered preliminary until data quality assurance (QA) is complete; algal data QA is being performed by California State University San Marcos, and data are anticipated by January 2021.

11-4.1.3 Other SMC Special Studies: Looking ahead at the SMC 5-year Research Agenda

The Permittees also fund additional special studies for the benefit of their local and regional program efforts. The SMC Research Agenda is the primary document that the SMC Steering Committee relies upon to decide its research directions for the coming fiscal year. Developed by an independent expert advisory panel, the SMC Research Agenda is a forward-looking document that lays out SMC research priorities over a five-year period. Thus, each Research Plan serves as a roadmap and a guide to help Steering Committee members decide which projects to prioritize and fund over the coming five years.

The development of the SMC Research Agenda starts when the SMC assembles a panel of independent technical experts with backgrounds in hydrology, civil engineering, chemistry, ecology, toxicology and modeling. The expert panel discusses a broad universe of research needs and priorities that the SMC could pursue, then comes to consensus on a set of projects and programs that the panel believes the SMC should prioritize over the coming five years. SMC member agencies are invited and encouraged to provide input and offer perspectives during the panel's deliberations.

The SMC has recently renewed its commitment to solving regional stormwater management challenges collaboratively with the development of the 2019-2024 Research Agenda. This agenda is being used by the SMC to prioritize, design and execute regional stormwater research projects that the SMC's member agencies have collectively agreed to fund. The Research Agenda spans 24 priority research projects that are organized into six thematic areas:

- Microbiology and Human Health Risk
- BMP Monitoring, Implementation and Effectiveness
- Innovative Technology and Science Communication
- Expanding the Utility of Biomonitoring
- Improving Stormwater Monitoring Effectiveness
- Emerging Challenges

In June 2020, the SMC Steering Committee unanimously approved initiating four new projects for the fiscal year 2020-2021 from the new five-year Research Agenda.

The District will continue to participate in the SMC and support the 2019-2024 Research Agenda on behalf of the Permittees.

2020-2021 SMC projects

The following projects were selected from the Research Agenda to be initiated in the next fiscal year:

- Human Fecal Indicators and Health Risk (Project 2.4)
- BMP Regional Monitoring (Project 3.4)
- Streamlined Annual Reporting (Project 4.2)
- Laboratory Intercalibration (Project 6.5)

Link: 2019-2024 Research Agenda

11-4.1.3.1 2021-2024 SMC Monitoring Workplan

Looking ahead, the SMC Regional Bioassessment Technical Workgroup will develop monitoring study concepts for approval by the Executive Steering Committee for inclusion in the 2021 regional monitoring season. A new workplan for monitoring during 2021-2024 is currently under development by the SMC and is anticipated to begin implementation during the 2020-2021 monitoring season. Additionally, the Executive Steering Committee is currently working on forming a panel of stormwater professional experts to aid in the development of project concepts for the next five-year SMC Research Agenda. The Permittees will continue to participate in the SMC during the 2020-2021 monitoring year.

11-4.2 MSAR Bacterial Indicator TMDL Monitoring

The MSAR Bacterial Indicator TMDLs became effective on May 16, 2007, and include the following waterbodies:

- Santa Ana River Reach 3 – Prado Dam to Mission Boulevard Bridge (excludes PBMZ)
- Chino Creek Reach 1 – Santa Ana River confluence to beginning of concrete-lined channel south of Los Serranos Road
- Chino Creek Reach 2 – Beginning of hard lined channel south of Los Serranos Road to confluence with San Antonio Creek
- Mill Creek (Prado Area) – Natural stream from Cucamonga Creek Reach 1 to Prado Basin
- Cucamonga Creek Reach 1 – Confluence with Mill Creek to 23rd Street in City of Upland
- Prado Park Lake

The MSAR Bacterial Indicator TMDL Task Force, which includes the responsible parties named in the TMDL, collaboratively implements requirements defined in the TMDL. The Santa Ana Watershed Project Authority (SAWPA) serves as administrator of the Task Force. In this role, SAWPA provides all Task Force meeting organization/facilitation, secretarial, clerical and administrative services, management of Task Force funds, annual reports of task force assets and expenditures, and hiring of Task Force authorized consultants.

11-4.2.1 Comprehensive Bacteria Reduction Plan

Through the MSAR Bacterial Indicator TMDL Task Force, the Permittees implement the Comprehensive Bacteria Reduction Plan (CBRP). The CBRP is a long-term plan that achieved compliance with the urban wasteload allocation (WLA) during the dry season (April 1 to October 31) by the compliance date of December 31, 2015. The CBRP was developed and finalized in June 2011. The Regional Board approved the CBRP in February 2012. The CBRP includes an implementation

schedule with contingencies built in to allow consideration of new data, modified regulations, changed priorities, or new technologies. The CBRP implementation includes the following:

- Tier 1 monitoring: A 10-week monitoring program implemented at selected major outfalls to the Santa Ana River to evaluate bacterial indicator sources.
- Establishment of a risk-based framework for evaluating water quality data obtained from the Tier 1 monitoring. Based on data from Tier 1 efforts, the major outfalls were prioritized for focused source assessments.
- Tier 2 source assessments: A follow-up to the Tier 1 monitoring. Detailed source assessments in prioritized Tier 1 outfalls. The methods developed for these source assessments are based on the IC/ID procedures (CMP Volume IV, **Attachment A**).
- Synoptic Study: A 6-week monitoring program implemented in 2019-2020 monitoring year, at selected major outfalls to the Santa Ana River to re-evaluate bacterial indicator sources.
- The CBRP, MSAR Bacterial Indicator TMDL compliance monitoring, as described in the approved Monitoring Plan and QAPP, and related evaluation plans and data reports are available for viewing on the SAWPA website at: https://sawpa.org/task-forces/regional-water-quality-monitoring-task-force/#.

Monitoring associated with the MSAR Bacterial Indicator TMDLs is coordinated and administered through the MSAR TMDL Task Force, led by SAWPA staff. Results of the 2019-2020 monitoring effort are provided in **Attachment K**.

The District is moving forward with several projects to divert dry weather flows to the sanitary sewer system from MSAR outfalls in an effort to address the TMDL. The proposed dry weather flow diversion projects include Phoenix Storm Drain in the City of Riverside and Eastvale Master Drainage Plan (MDP) Lines D and E in the City of Eastvale. The District has partnered with the City of Riverside and finalized design plans for the Phoenix Storm Drain diversion. The project was awarded to a construction company and groundbreaking is expected to begin in November 2020. The District continues to work with the Jurupa Community Services District for Eastvale MDP Lines D and E and has completed water quality monitoring as well as continuous flow monitoring to determine if low flows meet target limits for diversion to sewer. The District also conducted two follow-up investigations coordinated with the City of Riverside and the County of San Bernardino based on water quality data from both the 2019 Synoptic Study and 2012 Tier I monitoring. Both studies took place in the 2020-2021 monitoring year and results will be reported in that annual report next year.

11-4.2.2 Triennial Review and Regional Monitoring Program

The integrated analysis of the long-term CBRP monitoring efforts presented in the 2016 Triennial Review and was included in the 2017-2018 Annual Monitoring Report. Based on the findings of the 2016 Triennial Review, the Task Force developed a Regional Monitoring Program (RMP) to facilitate the TMDL implementation process and track progress toward attainment of applicable water quality standards. The RMP was submitted to the Regional Board in February 2016 and was approved on March 11, 2016. The June 2017 Work Plan and QAPP leverages information from the risk-based approach ("Tier" system) defined in the February 2016 Basin Plan to prioritize MSAR waterbodies as follows:

- Tier A/Priority 1: Priority monitoring to establish that these locations are "safe" where people engage in REC-1 activities.

- Priority 2: Second priority monitoring to evaluate progress towards existing TMDL WLAs and water quality standards.
- Priority 3: Third priority monitoring for 303(d) listed waterbodies where a TMDL has not yet been established, and periodic sample collection is conducted annually.
- Priority 4: Data collected to evaluate waterbodies with a REC-2 designated beneficial use to evaluate compliance with the anti-degradation targets. Data would also be used to assess status and trend of bacteria indicator water quality as part of the Triennial Review process.

To address Priority 4 listed above, a synoptic study design was implemented in the 2019-2020 monitoring year. On May 30, 2019, the Santa Ana Regional Board approved the Task Force's request to defer the Triennial Report for one year to evaluate the new monitoring data collected in 2019-2020. This report incorporating the Synoptic Study results was submitted to the Santa Ana Regional Board in February 2020.

Further information including historical background, monitoring results, annual reports and the currently implemented Workplan and QAPP may be viewed on the SAWPA website at: https://sawpa.org/task-forces/regional-water-quality-monitoring-task-force.

11-4.3 LAKE ELSINORE AND CANYON LAKE NUTRIENT TMDL MONITORING

The Lake Elsinore and Canyon Lake Nutrient TMDL for nitrogen and phosphorus has been in place since September 2005 and includes the following waterbodies:

- Canyon Lake (Railroad Canyon Reservoir)
- Lake Elsinore

The responsible parties named in the TMDL created a formal cost sharing body, or Task Force, to collaboratively implement a number of requirements defined in the TMDL. The Lake Elsinore and San Jacinto Watersheds Authority (LESJWA) serves as administrator of the Task Force. In this role, LESJWA provides: all Task Force meeting organization/facilitation; secretarial, clerical and administrative services; management of Task Force funds; annual reports of task force assets and expenditures; and hiring of Task Force authorized consultants.

Through the Lake Elsinore and Canyon Lake Nutrient TMDL Task Force, the Permittees implement the CNRP, a long-term plan designed to achieve compliance with WLAs established in the Lake Elsinore and Canyon Lake Nutrient TMDLs. CNRP implementation includes the following:

- Funding continued operation of the aeration and mixing system in Lake Elsinore.
- Implementation of the Canyon Lake Alum Treatment Project. Alum treatments are applied to Canyon Lake twice per year (February and September) to sequester excessive phosphorus levels. This project includes effectiveness monitoring to quantify the benefits of alum additions to water quality in the lake.
- Lake Elsinore and Canyon Lake Nutrient TMDL compliance monitoring, as described in the approved Monitoring Plan and QAPP, can be viewed or downloaded at https://sawpa.org/task-forces/lake-elsinore-and-canyon-lake-tmdl-task-force/#monitoring-program. Monitoring is handled through the Lake Elsinore and Canyon Lake Nutrient TMDLs Task Force, led by the LESJWA staff.

Two monitoring programs were initiated to track the progress of the CNRP, one specific to Lake Elsinore and Canyon Lake, and one watershed-wide program; some program revisions were made over the years. In April 2015, the Task Force submitted the Lake Elsinore & Canyon Lake Nutrient TMDL Compliance Monitoring Workplan to the Regional Board, which addresses the compliance monitoring requirement of the Lake Elsinore and Canyon Lake Nutrient TMDL and the 2010 MS4 Permit. The Task Force prepared the Compliance Monitoring Workplan to reassess the current conditions and establish a monitoring framework to assess trends towards meeting TMDL targets. Implementation of the San Jacinto River Watershed Monitoring Program Phase II resuming in-lake monitoring of Lake Elsinore and Canyon Lake began in July 2015. It is a high priority for the Santa Ana Regional Water Board to reconcile all the comments and response to comments in the Technical Report. Their goals are to focus on ensuring a complete understanding of the TMDL history. New in-lake modeling simulations are currently being developed for future analyses as the prior model has reached its terminal date. A fisheries management study was conducted within Lake Elsinore and found the fish community significantly different than prior studies. Details of this study and results of the 2019-2020 compliance monitoring effort have been provided in **Attachment K**.

11-4.4 HYDROMODIFICATION MANAGEMENT PROGRAM

The Watershed Action Plan (WAP) and its supporting documents, including the Hydromodification Management Plan (HMP), was approved in April 2017 and can be downloaded from http://rcflood.org/downloads/NPDES/Documents/SA_WAP/WatershedActionPlan.pdf.

The SAR HMP Evaluation Program is an extension of the HMP and can be downloaded from http://rcflood.org/downloads/NPDES/Documents/SA_WAP/AppG_HydromodificationManagementPlanEvaluationProgram.pdf. The HMP Evaluation Program extends through fiscal year 2021-2022; this period of time is necessary to implement monitoring, analyze data from the approved sites, and account for spatial and temporal variability of the conditions in the SAR amongst other metrics. Data is being collected from the two approved monitoring sites within the watershed area. Assessment field survey data is being gathered at each site and will be used to track site geomorphic evolution and assess what types of impacts may have occurred.

Based on the hydrology assessment and analysis of the San Jacinto River, it has been determined that the San Jacinto River is a natural resistant feature that shows no signs of it being a hydrologic condition of concern. The assessment is included as **Attachment A** to the Hydromodification Susceptibility Documentation Report and Mapping within the WAP.

During the 2019-2020 monitoring year, field surveying, CRAM, and field observations for both approved HMP sites was completed.

At the first site, Sunnyslope Channel, the District is partnering with the Riverside County Parks and Open Space District as well as the Santa Ana Watershed Association (SAWA) in order to help further habitat conservation efforts and encourage public education within the area. This effort is particularly important as the endangered Santa Ana River sucker fish have previously been observed in this natural stream segment. Conservation efforts have included streambed emplacement of coarse gravel for habitat enhancement and stream stabilization. Since the upstream drainage system is engineered and the watershed area predominantly urbanized, there is little opportunity outside of the development cycle for addressing hydromodification impacts. Hydromodification impact monitoring for this site began

during FY 2017-18 and is, therefore, expected to provide valuable information on the efficacy of small scale in-stream mitigative interventions in critical stream habitat.

The second site is located in a tributary upstream of San Timoteo Creek, which flows to the Santa Ana River, is identified in the HMP as a potentially susceptible stream. Monitoring at this location aligns with Permit Provision XII.B.5.b., since this natural channel is located downstream of significant new development subject to hydromodification mitigation requirements. The stream falls principally under the ownership of the Riverside County Regional Park and Open Space District (Parks District) who has agreed to provide the District with right-of-entry in order to conduct the five-year monitoring assessment. This site is located along a tributary to San Timoteo Creek and presents an excellent opportunity to monitor and observe whether the new development's incorporation of practices to mitigate for hydromodification impacts are protective of the natural stream bed over the next five years. The new development consists of an industrial park where site drainage will flow to the existing Caltrans culvert and drain north to the San Timoteo Creek tributary. As the development upstream is not yet completed, there is the opportunity to establish a baseline and compare the effects, if any, that urbanization has on stream stability at this location. The full analysis and results of the five-year monitoring assessment is expected in 2022.

11-4.5 LID BMP SPECIAL STUDY

11-4.5.1 Participation in SMC California LID Evaluation and Analysis Network (SMC CLEAN) Project

The SMC has taken a lead role in gathering and evaluating available Low Impact Development (LID) BMP data. The SMC's California LID Evaluation and Analysis Network (CLEAN) project is designed to develop an understanding of the effectiveness of LID BMPs in Southern California, "both in the short term for use in calibration of watershed programs and the long term for modification of LID design, construction, and maintenance, through coordination with project partners and others performing LID monitoring and serving as a clearinghouse for LID monitoring information" (SCCWRP, 2017). The District, on behalf of the Co-permittees, collaborates with the SMC CLEAN project and supports its mission by providing quantification of LID BMP performance and serving as a participating agency for LID monitoring information.

The District coordinated with SAWPA on a Proposition 84 grant to construct a LID Testing and Demonstration Facility at the District's 15-acre headquarters in Riverside, California. The LID Testing and Demonstration Facility monitors and evaluates LID BMPs with respect to Southern California's semi-arid environment (**Figure 4-1**). In accordance with the District's LID Monitoring Plan and QAPP, the facility collects volume and pollutant data to gauge BMP performance and effectiveness. Findings from the District's LID BMP facility will support the development of technical guidance regarding LID BMP design, implementation, and maintenance for systems within semi-arid environments for the foreseeable future. In time, the results from the District's monitoring program and those of other partner agencies will be used to establish more effective water quality treatments that will help in crediting flow reductions to developments that implement BMPs.

Figure 4-1: Photographs of the LID Integrated Management Plan Testing and Demonstration Facility

In accordance with SMC CLEAN's short term goal, the District collects flow data along with influent and effluent samples from its monitored BMP sites. The 2019-2020 wet season saw a total of two sampled events. The date of the sampled event, stations sampled, and the total rainfall of the events are shown in **Table 4-4** below.

Table 4-4: LID Storm Events Sampled

Date	Stations Sampled	Rainfall Depth
12/04/2019	606 & 608	0.83"
03/10/2020	606 & 608	0.84"

606 – Bioretention Basin Influent | 608 – Bioretention Basin Effluent

The District also monitored an additional nine storm events in an effort to focus solely on the hydrology of its monitored BMPs. The date of the storm events, stations monitored, and the total rainfall are shown per **Table 4-5.** Flow data for both the sampled storm events and the monitored storm events are still in review and are not presented in this report. The District plans in continuing its efforts in the evaluation of flow data and the volume reduction potential of its monitored BMPs.

Table 4-5: LID Storm Events Monitored

Date	Stations sampled	Rainfall depth
12/23/2019	606 & 608	0.57"
3/12/2020	606 & 608	1.42"
3/13/2020	606 & 608	0.12"
03/16 – 17/2020	606 & 608	0.16"
03/18 – 19/2020	606 & 608	0.20"
03/22 – 23/2020	606 & 608	0.87"
04/06 – 07/2020	606 & 608	1.06"
04/07 – 08/2020	606 & 608	0.51"
04/09 – 10/2020	606 & 608	1.02"

606 – Bioretention Basin Influent | 608 – Bioretention Basin Effluent

Collected influent and effluent samples are composited and then processed to determine pollutant concentrations. Analytes that were tested for in the 2019-2020 wet season are shown per **Table 4-6**. The District plans in continuing its efforts in the evaluation of its analyte concentrations and the pollutant removal effectiveness between the monitored BMPs.

Table 4-6: Analytical Constituents

Category	Analyte(s)
Cations	Hardness as CaCO3
Cations	Calcium
Cations	Magnesium
Anions	Nitrate
Solids	Total Dissolved Solids
Solids	Total Suspended Solids
Aggregate Organic Compounds	Organic Carbon (Total)
Aggregate Organic Compounds	Organic Carbon (Dissolved)
Aggregate Organic Compounds	Oil & Grease
Nutrients	Nitrite
Nutrients	Ammonia
Nutrients	Total Kjeldahl Nitrogen
Nutrients	Total Nitrogen
Nutrients	Inorganic Nitrogen
Nutrients	Ortho Phosphorus
Nutrients	Phosphorus (Total)
Nutrients	Phosphorus (Dissolved)
Metals and Metalloids	Cadmium (Total)
Metals and Metalloids	Chromium (Total)
Metals and Metalloids	Copper (Total)
Metals and Metalloids	Iron (Total)
Metals and Metalloids	Lead (Total)
Metals and Metalloids	Manganese (Total)
Metals and Metalloids	Nickel (Total)
Metals and Metalloids	Zinc (Total)
Metals and Metalloids	Cadmium (Dissolved)
Metals and Metalloids	Chromium (Dissolved)
Metals and Metalloids	Copper (Dissolved)
Metals and Metalloids	Iron (Dissolved)
Metals and Metalloids	Lead (Dissolved)
Metals and Metalloids	Manganese (Dissolved)
Metals and Metalloids	Nickel (Dissolved)
Metals and Metalloids	Zinc (Dissolved)
Multiple Tube Fermentation - Multiple Dilution - SM 9221 B, E, F series	*E. coli*
Multiple Tube Fermentation - Multiple Dilution - SM 9221 B, E, F series	Total Coliform
Multiple Tube Fermentation - Multiple Dilution - SM 9221 B, E, F series	Fecal Coliform

In 2017, after a total of five years since implementation of the LID Testing and Demonstration Facility, the District reviewed the data collected to determine if conclusions can be made regarding performance and design. Based on the trends in the data and in line with SMC CLEAN's long-term goal of LID design, construction, and maintenance, the District revitalized several of its systems to improve volume reduction and pollutant removal performance. Improvements were based on scientific studies and guidance from leading authorities on Green Infrastructure.

Starting in the 2017-2018 wet season, the District equipped its planter box with a raised outlet aiming to improve the system's pollutant removal effectiveness. Recommendation for this improvement was

based on a scientific report[12] describing nitrogen removal in a saturated anaerobic zone. As detailed in report, the saturated anaerobic zone, created by the raised outlet, allows for denitrification processes to happen more efficiently. The denitrification process converts nitrate to gaseous forms of nitrogen, which removes it from the water completely. Both the original configuration and the raised outlet configuration are shown per **Figure 4-2.** The District plans a possible upgrade to this BMP in the near future; planned improvements may consist of an upgraded impermeable barrier and/or improved vegetation and soil mix. The District also expects to continue its review of the BMP's performance and evaluating the resulting data.

Figure 4-2: Planter Box – Before and After

Following the 2017–2018 wet season, the District also sought to improve its Bioretention Basin. The District developed a new soil mix comprised of silica sand, coconut pith, topsoil, and biochar, based on a report prepared for Kitsap County Public Works[13] that showed high pollutant removal. With guidance from technical memoranda[14] and the Central Coast Water Board[15], the District replaced the old vegetation with new plant species designed to achieve LID goals. The plants: *Carex pansa*, *Carex praegracilis*, and *Juncus patens*; were selected based on their ability to withstand long periods of inundation and drought. Additionally, they were also chosen as a tool to aid in the system's pollutant removal effectiveness and provide maintenance to its hydraulic conductivity. Moreover, a new grade design to the soil media was also implemented. The original design, a shallow valley, developed short-circuiting problems, which drastically reduced travel distance and contact time for treatment within the soil media. The soil media was graded with an inverted valley layout allowing water to pond along the sides of the Bioretention Basin. This design forces the water to follow a longer path to the center subdrains thus allowing for more time under treatment by the newly engineered soil mix and the

[12] Zinger, Yaron, Godecke-Tobias Blecken, Tim D. Fletcher, Maria Viklander, and Ana Deletić. 2013. "Optimising Nitrogen Removal in Existing Stormwater Biofilters: Benefits and Tradeoffs of a Retrofitted Saturated Zone." *Ecological Engineering* 51: 75–82.
[13] Herrera Environmental Consultants, Inc. (2015). Analysis of Bioretention Soil Media for Improved Nitrogen, Phosphorous and Copper Retention.
[14] Monash University. (2015). Adoption Guidelines for Stormwater Biofiltration Systems (Version 2).
[15] Central California Coast. (n.d.). LID Plant Guidance for Bioretention.

associated plant roots. These changes, as well as the rest of the LID Testing and Demonstration Facility, will continue being monitored to learn how these systems perform over time.

Due in part to the results and the efforts to make various improvements such as the change in drainage design, improved soil type, and the implementation of specialized vegetation, the Bioretention Basin's retrofit won the California Stormwater Quality Association 2019 Award for Outstanding Stormwater BMP Implementation Project as shown per **Figure 4-3.** The District's retrofitted Bioretention Basin was evaluated on several criteria such as: how well the BMP effectively integrated into a target site or program, the BMP's targeting of priority pollutants or pollutants of concern, the BMP's achievement of objectives and producing of valuable results, its inclusion of outstanding elements which distinguish it from other BMPs, and whether the project has been promoted via professional publications. The District's retrofitted BMP along with its original design is shown per **Figure 4-4.** The District will continue to monitor and sample its Bioretention Basin as well as its other BMPs to further study nutrient and pollutant behavior in relation to SMC CLEAN's short-term and long-term goals for Green Infrastructure.

Figure 4-3: CASQA 2019 Award – Outstanding Stormwater BMP Implementation Project

Figure 4-4: Bioretention Basin – Before and After

11-4.6 PARTICIPATION IN OTHER REGIONAL MONITORING EFFORTS

The Permittees, individually or jointly, participate in the regional efforts outlined below:

MSAR TMDL Task Force

The Riverside and San Bernardino County Permittees developed the CBRPs for those Permittees named in the MSAR Bacterial Indicator TMDL and submitted the final drafts for approval by the Regional Board on June 28, 2011. The CBRP was approved at the Regional Board meeting on February 10, 2012. The Permittees continue to implement the CBRP and will update as needed upon an approved MS4 Permit. In 2016, the Task Force developed and is currently implementing a RMP to facilitate the TMDL implementation process and track progress toward attainment of applicable water quality standards for bacterial indicators (see **Section 11-4.2.2**).

Lake Elsinore/San Jacinto Watershed Authority

As part of the Proposition 13 funding of $15,000,000, a Joint Powers Authority, LESJWA, was formed in April 2000. Members of LESJWA include the Elsinore Valley Municipal Water District, the City of Lake Elsinore, the County of Riverside, the City of Canyon Lake, and SAWPA. The purpose of LESJWA is to bring together member agencies and stakeholders in an effort to identify solutions to water and habitat problems that no single agency could effectively address before. Projects that LESJWA has funded include fishery management (e.g., carp), Lake Elsinore Island well improvements, and the installation and operation of the Lake Elsinore Aeration and Mixing System.

Lake Elsinore and Canyon Lake Nutrient TMDLs Task Force

The Lake Elsinore and Canyon Lake Nutrient TMDLs Task Force acts as a technical advisory group to LESJWA. Since the TMDL was adopted on December 20, 2004, the Permittees have continued to provide input on Task Force products such as the proposed Task Force agreement for TMDL implementation, and a cost-sharing framework for stakeholders to share implementation costs. In June 2004, the Permittees also supported recommendations to retain consultant services to examine options for an alternative monitoring approach. The Task Force continues to implement these monitoring studies for Canyon Lake, Lake Elsinore, and the San Jacinto River Watershed.

The Task Force, composed of stakeholders in the San Jacinto River Watershed, met on a regular basis throughout the 2019-2020 monitoring year. The Watershed model results and the technical aspects of the TMDL Load Allocations (LAs) and WLAs were discussed as standing Task Force meeting agenda items. The Task Force has focused on providing support and direction for the development implementation of the CNRP, as described in **Section 11-4.3**.

San Jacinto River Watershed Council

The San Jacinto River Watershed Council (SJRWC) is a non-profit organization of community groups; tribal, farming, and dairy representatives; water agencies; government agencies; businesses; and all interested stakeholders working cooperatively to address water quality concerns in the San Jacinto River Watershed. The goal of the group is to provide educational, scientific, and technical assistance that will help sustain, restore, and enhance the natural resources of the San Jacinto River Watershed while promoting long-term social and economic vitality to the region. The Permittees coordinate with the SJRWC to collect data on Canyon Lake and within the San Jacinto River Watershed.

Stormwater Quality Standards Task Force

The Stormwater Quality Standards Task Force (SWQSTF) is a partnership with an aim is to review the REC-1 designations, the associated WQOs, and the permit implementation approaches for the major waterbodies and their tributaries within the SAR. The SWQSTF uses a Delphi decision-making process, which allows the stakeholders to participate equally and minimizes bias. The following are the project goals of the SWQSTF:

- Revise Santa Ana River (and tributaries) REC-1 designations to more accurately reflect the true nature of recreational uses occurring throughout the watershed.
- Update WQOs to consider USEPA guidance on bacterial indicators and other relevant scientific research.
- Develop MS4 Permit implementation and monitoring strategies to ensure cost-effective compliance with WQOs.

The SWQSTF's analyses and recommendations of modifications to the REC-1 and REC-2 beneficial uses and maximum expected single values for *E. coli* were incorporated into the Basin Plan in February 2016. Approval of this Basin Plan Amendment by the EPA successfully brought to completion and conclusion the efforts of the SWQSTF and put stakeholders on the clock to establish a comprehensive monitoring program to support implementation of the changes to the Basin Plan.

Southern California Water Committee

The Southern California Water Committee (SCWC) is a non-profit, non-partisan, public education partnership dedicated to informing Southern Californians about their water needs and the State's water resources. Through measured advocacy, SCWC works to ensure the health and reliability of Southern California's water supply. The District is a Founding Member and actively participates in several Task Forces. SCWC holds workshops and events throughout the year for members, regional and statewide leaders and stakeholders to discuss California's critical water issues and inform solutions to our toughest challenges.

During fiscal year 2019-2020, a new webinar series entitled "What Matters" was established and designed to provide online exchanges of best practices as water leaders, non-profits, businesses and stormwater managers grapple with changes to the way we live, work and deliver services. SCWC developed a regional consensus-based strategy and recommendation for utilizing stormwater as a new local water supply, while reducing urban runoff water pollution within the coastal plains of Ventura, Los Angeles, Orange and San Diego counties, as well as the Santa Ana River watershed portion of San Bernardino and Riverside counties. Among many featured activities in the Annual Report, the Stormwater Task Force hosted a workshop in September 2019 that focused on stormwater capture projects and how they relate to water quality and flood control functions and regulations in Southern California.

Santa Ana Technical Advisory Committee Meetings

The Santa Ana Technical Advisory Committee (TAC) met 10 times during the fiscal year to coordinate the implementation of the DAMP, LIP, Water Quality Management Plan, and the overall MS4 Permit compliance program. The District, as the Principal Permittee, chairs and provides staff support to the TAC. Areas of focus for the TAC are providing technical support to the Permittees to facilitate coordination and collaboration with related water quality management programs, monitoring program development, and response to new legislative and regulatory initiatives. Meetings have also focused on the implementation of the requirements of the 2010 MS4 Permits and coordination of associated compliance program elements. A portion of each meeting reviewed the highlights from the MSAR Bacterial Indicator and Lake Elsinore and Canyon Lake Nutrient TMDLs, WQMP implementation, and the ongoing discussion of pursuing alternate means of program funding. The TAC consists of representatives formally appointed by the city manager or equivalent of each Permittee.

11-5.0 FINDINGS

The 2019-2020 monitoring year water quality data, in conjunction with historical monitoring results, were used to evaluate the five management questions from the Model Monitoring Program for Municipal Separate Storm Sewer Systems in Southern California (MMP) (SMC, 2004). In part, this section also addresses the MRP objective to assess the effectiveness of water quality controls. Note that in this evaluation, sample results from the MS4 outfall stations were compared to WQO and CTR WQO criteria for comparison purposes only, as these objectives are applicable to receiving waters not the MS4 (State Board, 2005). The Permittees will consider exploring alternative approaches for benchmark comparisons in future years in order to more appropriately assess MS4 outfall runoff data.

MMP Question #1: Are conditions in receiving waters protective, or likely to be protective, of beneficial uses?

This question is addressed using the monitoring results from the three receiving water stations. Overall, only three exceedances of applicable WQOs were measured at SAR receiving water stations during the 2019-2020 monitoring year. All three exceedances occurred during wet weather; there were no exceedances during dry weather. There was no toxicity observed during wet weather monitoring at the receiving water stations. During dry weather, no acute toxicity was observed in either dry weather sample, but chronic toxicity to *P. subcapitata* growth was observed in both dry weather samples at Santa Ana River at Hargrove. Historically, toxicity has been infrequent in dry and wet weather.

San Jacinto River Receiving Water

The Perris Valley Channel at Nuevo Road receiving water station characterizes conditions of San Jacinto River Reach 3. This receiving water has no listed water quality impairments. It is the only monitored receiving water station with MS4 outfall stations located upstream (i.e., Perris Line J Outfall, and further upstream, Sunnymead Outfall). The relative contributions from the MS4 to the receiving water may be directly evaluated for San Jacinto River Reach 3 only (See MMP Question #3).

Based on applicable WQO and CTR WQOs for the monitoring data, the intermittent beneficial uses of the receiving water were protected during the 2019-2020 monitoring year, with the exception of REC-1 during wet weather. *E. coli* levels exceeded the STV WQO from the Statewide Bacteria Provisions for one of two wet weather events (March 10, 2020) at the receiving water station. The high flow suspension criteria were met for the first wet weather event. Perris Valley Channel also has limited access, with a subsection of bike trail along one side. No aquatic toxicity was observed at the Perris Valley Channel at Nuevo Road receiving water station and, unlike the upstream MS4 station, there were no exceedances of pH or metals at this receiving water station. There is typically insufficient water in this reach during dry weather events for sampling and both dry weather events were VNS due to dry conditions observed.

Temescal Creek Receiving Water

The Temescal Channel at Main receiving water station characterizes conditions in Reach 1a of Temescal Creek. This reach is a concrete-lined trapezoidal channel. The three beneficial uses assigned to this waterbody include REC-2, WARM, and WILD, and it is exempt from the MUN beneficial use. By means of a UAA, the REC-1 beneficial use was determined unattainable and only the dry weather anti-degradation targets associated with REC-2 are applied to this receiving water. pH is considered a historical pollutant of concern for Temescal Creek Reach 1a based on a pH listing of waterbody impairment from 2010. However, the 2014/2016 Section 303(d) List updated the listing from Temescal

Reach 1a to the PBMZ due to a mapping change. Lines of evidence for this listing include samples collected in the Temescal Creek receiving water above Main Street at Corona (approximate location of 801TMS746). The beneficial use associated with this impairment is WARM.

During 2019-2020 wet weather monitoring, both pH measurements taken at the Temescal Channel at Main receiving water station were within the Basin Plan WQO range, and no statistically significant trend for pH was identified. Since the inception of monitoring at the Temescal Channel at Main receiving water station, only two wet weather pH measurements have been slightly less than the WQO lower limit of 6.5 units (historical exceedance frequency of 15%). The results from the current year monitoring data suggest that the WARM beneficial use of this waterbody is not impacted by pH during wet weather conditions.

The only parameters that exceeded applicable WQOs or CTR WQOs during wet weather monitoring were dissolved copper and total nitrogen. Dissolved copper exceeded the WQO and the CTR WQO (CMC) during one event on December 4, 2019. This event also had a lower hardness than the other two wet weather events at this receiving water station. This resulted in a lower CTR WQO threshold and exceedance of the WQO at a lower concentration. A discussion of the relationship between hardness and the CTR WQO thresholds is provided in response to MMP Question 4 in this report section. Total nitrogen exceeded the Basin Plan WQO on November 27, 2019. No acute or chronic toxicity was observed in wet weather samples from this receiving water station during the 2019-2020 monitoring year. Although pesticides are historically associated with aquatic toxicity and associated beneficial use impairments, detections at the Temescal Channel at Main receiving water station are infrequent. Based on these results, wet weather conditions in the Temescal Creek receiving water may be considered protective of applicable beneficial uses with the exception of WARM and WILD, which may potentially be impacted by dissolved copper and total nitrogen levels.

In accordance with the CMP, dry weather events were not monitored at the Temescal Channel at Main receiving water station because this station is assigned for wet weather monitoring only. Therefore, the REC-2 beneficial use does not apply.

Santa Ana River Receiving Water

Santa Ana River Reach 3 is regulated by the MSAR Bacterial Indicator TMDL, and Santa Ana River Reach 4 is included on the Section 303(d) List as impaired for bacterial indicators, suggesting regional impairment to the REC-1 beneficial use. The Basin Plan generally recognizes that access to the receiving water is prohibited in some portions, limiting the likelihood of this type of recreational activity. In 2016, the MSAR Bacterial Indicator TMDL Task Force developed, and is currently implementing, an RMP to facilitate the TMDL implementation process and track progress toward attainment of applicable WQOs. The findings were presented in the 2016 Triennial Review. The June 2017 Work Plan and QAPP of the TMDL MRP leverages information from the risk-based approach ("Tier" system) defined in the February 2016 Basin Plan to prioritize MSAR waterbodies. The Santa Ana Regional Board approved the Task Force's request to defer the next Triennial Report for one year to evaluate the new monitoring data collected in 2019-2020. The Synoptic Study/ Triennial Report was submitted in February 2020 and is included in **Attachment K**.

The Santa Ana River at Highgrove receiving water station is located at the County line and characterizes the impact of perennial dry weather flows from San Bernardino County POTWs into Santa Ana River Reach 4. Perennial flow at the Santa Ana River at Highgrove receiving water station

was sampled during two dry weather events to characterize inputs to the SAR from San Bernardino County; wet weather monitoring is not required at this location.

During the 2019-2020 monitoring year, *E. coli* was below the WQO for both dry weather samples collected at this receiving water station. Furthermore, no other parameters exceeded applicable WQOs or CTR WQOs. When detected at this receiving water station, pollutants of concern have infrequently exceeded WQOs (6% historical frequency of exceedance for *E. coli*, and 13% for pH, TIN, and 4-4' DDT). Dissolved copper, dissolved lead, dissolved zinc, boron, TDS, and DO have not exceeded applicable WQOs or CTR WQOs during the sampling period of record. No acute toxicity was observed in either dry weather sample. Chronic toxicity to *P. subcapitata* growth was observed in both dry weather samples. These results are not typically enough to suggest performing a TIE as the standard is to conduct a TIE upon repeated toxicity and for a sample with at least a 50% effect. Only one of 30 tests (10 dry weather samples tested with three species), showed toxicity during the previous five years of toxicity testing at this receiving water station.

These integrated assessment results suggest that ephemeral dry weather flow entering the County via Reach 4 is likely protective of receiving water beneficial uses.

MMP Question #2: What is the extent and magnitude of the current or potential receiving water problems?

As an ephemeral watershed, large and/or high intensity precipitation is needed to generate flow in the receiving waters within the SAR, which are typically dry or ponded during dry weather. The effect of water quality exceedances identified during MS4 outfall monitoring is limited in geospatial extent because flows generally do not reach SAR receiving waters. The key exception is where permitted discharges (such as POTWs) generate localized flows. The CMP has incorporated dry weather receiving water monitoring to evaluate these non-jurisdictional flows.

E. coli and dissolved copper concentrations at receiving water and MS4 outfall stations across the SAR were measured above receiving water WQOs and/or CTR WQOs. *E. coli* is not persistent at either of the receiving water stations with wet weather monitoring but was found to be persistent at four of the seven MS4 outfall stations during wet weather. **Figure 5-1** displays the magnitude of exceedances for *E. coli* during the 2019-2020 monitoring events as a ratio plot with all stations shown. A ratio of greater than one indicates the *E. coli* result exceeded the WQO, except when site conditions met high flow suspension criteria, in which case the WQO is not applied to the measured wet weather result. These events are flagged with a (*). A ratio of less than one indicates the *E. coli* result was below the WQO. The y-axis of the plot is at a log-scale to clearly illustrate both types of ratios. In terms of receiving water monitored during 2019-2020, Perris Valley Channel at Nuevo Road (802NVO325) had a wet weather exceedance ratio of 24 times the WQO for the second event and a non-exceedance due to meeting the high flow suspension criteria for the first event. The Temescal Channel at Main receiving water station is not shown due to the UAA that excludes the REC-1 beneficial use.

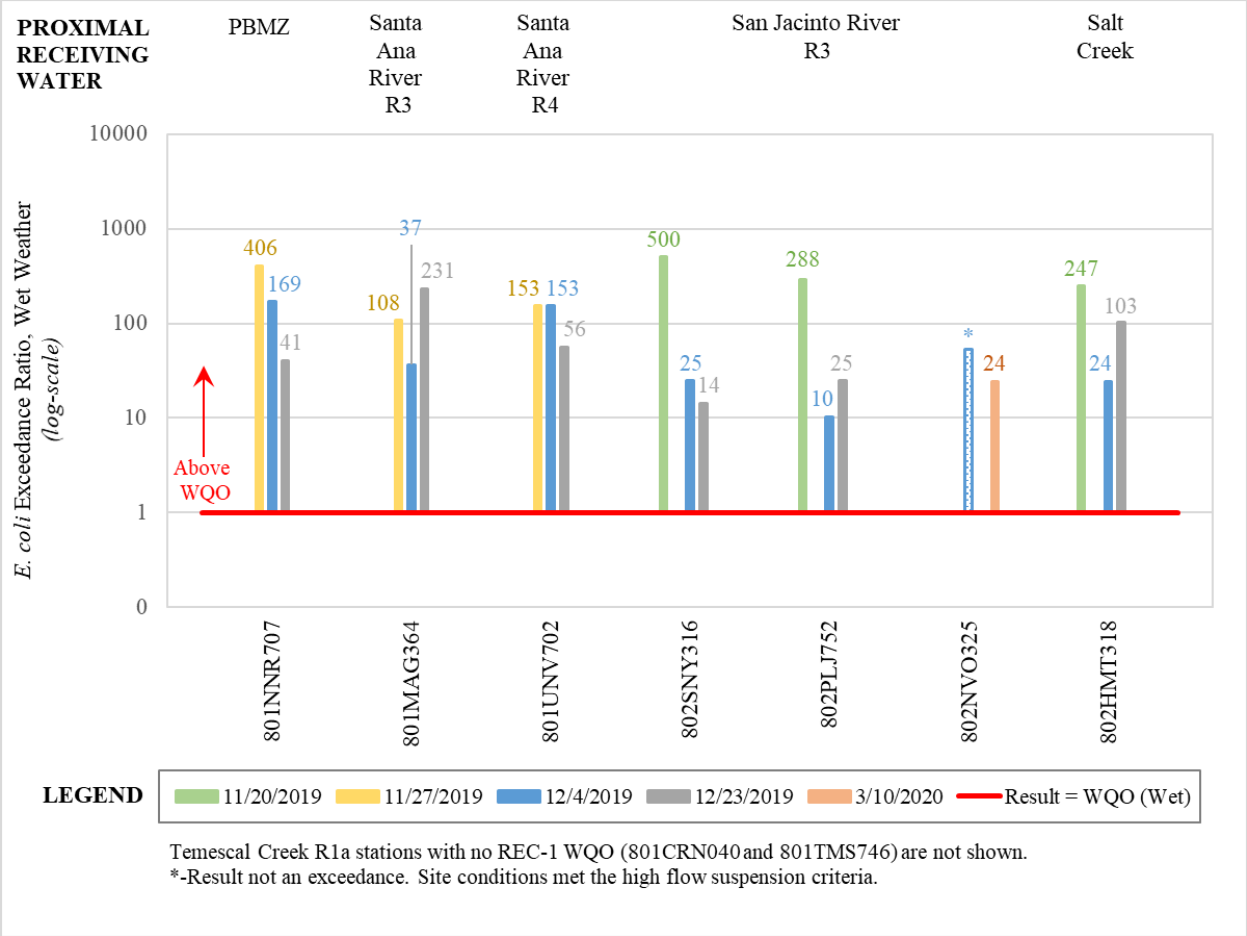


Figure 5-1: Exceedance Ratio Plots for E. coli at SAR Monitoring Stations

Similarly, the magnitude of dissolved copper exceedances can be ascertained by calculating the ratio of the result to the receiving water WQOs. **Figure 5-2** plots the ratio of the results to either the site-specific WQO or the CTR WQO. The plot is based on the greater ratio (typically the site-specific WQO from the Basin Plan is more conservative, if applicable, due to the water effects ratio [WER] coefficient). A ratio below one indicates the result is below the receiving water WQO. Overall, the ratios were 1 to 3 times the WQO, but dissolved copper did not exceed WQOs at the Perris Valley Channel at Nuevo Road (802NVO325) receiving water station during the 2019-2020 monitoring year. No acute or chronic toxicity was observed in wet weather event samples from receiving water stations. In accordance with the MMP criteria, the 2019-2020 assessments determined dissolved copper was not a persistent exceedance at any monitoring station except the Corona Outfall monitoring station.

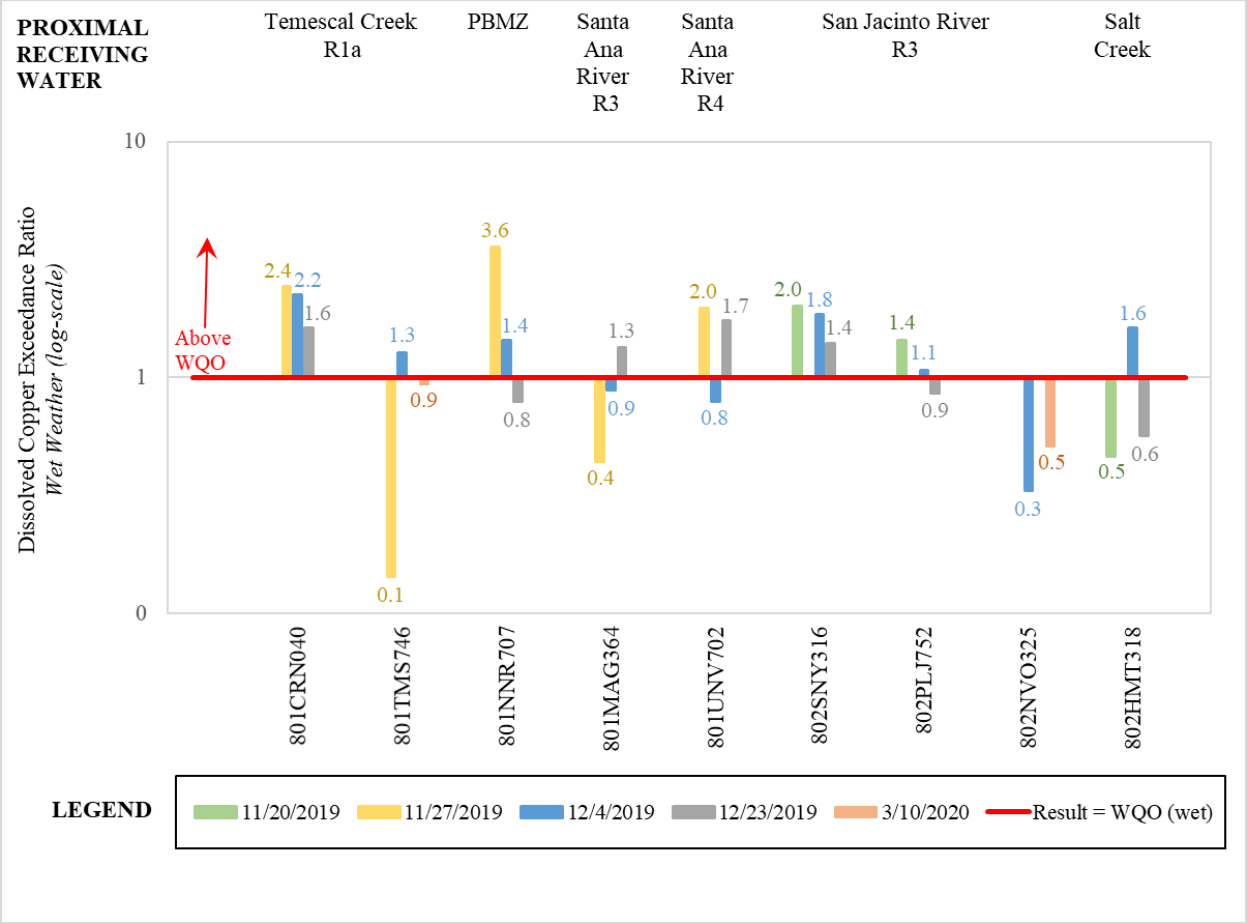


Figure 5-2: Exceedance Ratio Plots for Dissolved Copper at SAR Monitoring Stations

MMP Question #3: What is the relative urban runoff/MS4 discharge contribution to the receiving water problem(s)?

Conditions in the SAR are typically ephemeral, except near the County line (Santa Ana River at Highgrove receiving water station), which limits the geospatial extent of flows across the watershed and region. A review of flow observations for the nine monitoring years under the 2010 MS4 Permit shows that five of seven MS4 outfall stations were VNS during dry weather for seven of the nine years (**Figure 3-2**). This represents more frequent VNS results compared to the mid-1990s. Observed dry weather flows at MS4 outfall locations are often less than one cfs. Based on field observations made at MS4 outfall stations, and as corroborated by IC/ID field investigations of major outfalls (IC/ID Monitoring Results Database), dry weather low flows tend to evaporate and/or infiltrate without reaching receiving waters.

Figure 5-3 and **Figure 5-4** present a spatial overview of 2019-2020 monitoring results for wet and dry weather, respectively, at all monitoring stations. Only parameters with concentrations exceeding receiving water WQOs or CTR WQOs are shown on these figures. For these parameters, statistically significant long-term trends and results that persistently exceed WQOs or CTR WQOs are also presented as symbols on the maps. In general, a greater number of exceedances occur at MS4 outfall stations than at receiving water stations, but sample results from the MS4 outfall stations have been

evaluated with these criteria for comparison purposes only, as WQOs and CTR WQOs are applicable to receiving waters not the MS4 (State Board, 2005).

Perris Valley Channel at Nuevo Road (802NVO325) is the only receiving water station with monitored MS4 outfall stations located upstream. The Perris Line J Outfall and Sunnymead Outfall are located 0.2 mile and 9.5 miles upstream of the receiving water station, respectively. Therefore, monitoring data for these stations may be used to understand the relative contribution of MS4 discharge to receiving water problems. Only wet weather contributions can be evaluated, as this receiving water station was VNS during dry weather. The Perris Line J Outfall had a wet weather exceedance for pH and both MS4 outfall stations had wet weather exceedances for *E. coli* and dissolved copper during 2019-2020, whereas the receiving water station had only exceedances for *E. coli*. In fact, Perris Valley Channel at Nuevo Road has a 0% historical exceedance frequency for dissolved copper, despite upstream MS4 outfall exceedance frequencies of 45% and 86% for Perris Line J Outfall and Sunnymead Outfall, respectively, during wet weather. Further, no aquatic toxicity was observed at the Perris Valley Channel at Nuevo Road receiving water station. San Jacinto River Reach 3 is not listed as impaired for any monitored parameters, which is consistent with the 2019-2020 monitoring year receiving water results.

For the remainder of the wet weather monitoring data, the relative contributions from the MS4 to the receiving water cannot be directly assessed because the receiving water station is either located upstream of, or in a different receiving water from MS4 outfall stations. The Corona Outfall discharges to Temescal Creek Reach 1a downstream of the Temescal Channel at Main receiving water station (801TMS746). The Hemet Outfall does not have an associated receiving water monitoring station and is located approximately 14.5 miles upstream of Canyon Lake. Observed wet weather flows would likely pond, evaporate, and infiltrate prior to reaching the lake, which is subject to the Lake Elsinore and Canyon Lake Nutrient TMDLs. The North Norco Outfall is tributary to the PBMZ, an artificial inland wetland and groundwater management area formed by the Prado Dam. Flow through the dam structure is managed by the Santa Ana River Waterkeeper in accordance with the Prado Settlement. The Magnolia Center Outfall (801MAG364) and the University Wash Outfall are not associated with monitored receiving water stations during wet weather.

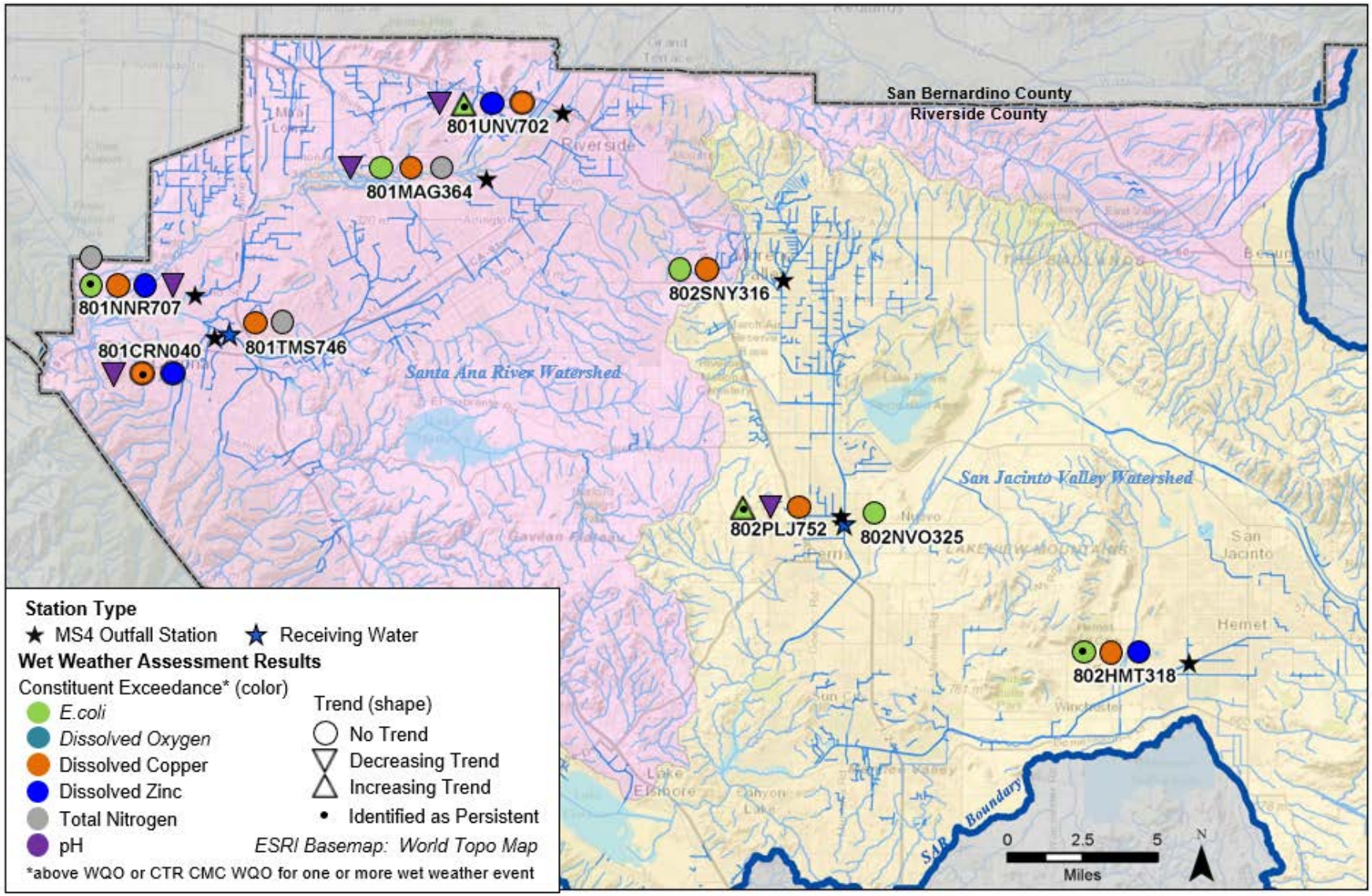


Figure 5-3: 2019-2020 Wet Weather Monitoring Results by Monitoring Station

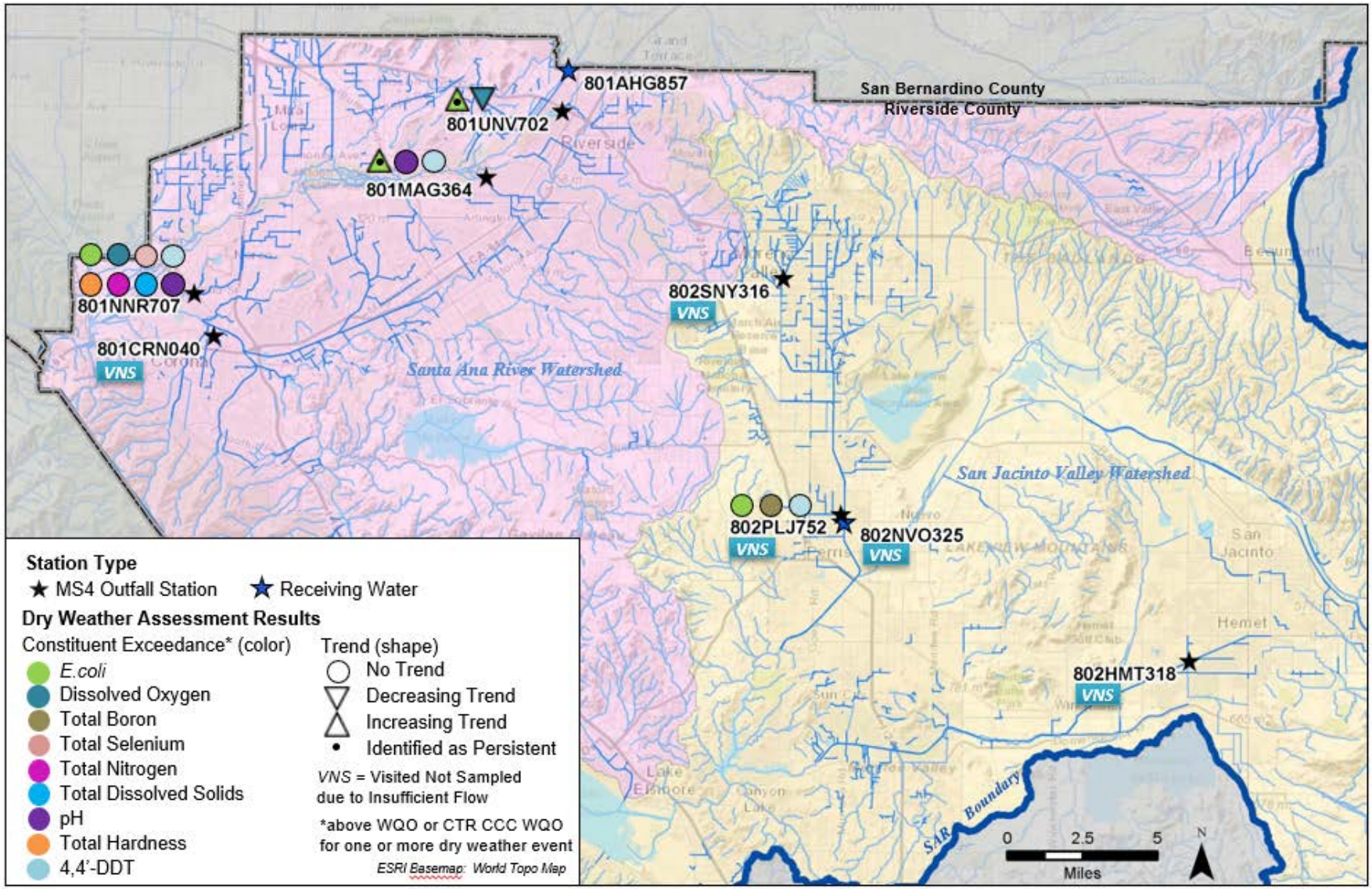


Figure 5-4: 2019-2020 Dry Weather Monitoring Results by Monitoring Station

MMP Question #4: What are the sources of MS4 discharge that contribute to receiving water problem(s)?

Potential sources of SAR pollutants of concern vary by land use and facilities in monitored drainage areas, as discussed in **Section 11-3.4.5** and illustrated in **Table 3-20** and **Table 3-21**. Based on monitoring results during the 2010 MS4 Permit term, the most prevalent water quality issues are *E. coli* and dissolved copper during wet weather, with the potential to impact REC-1 and WARM beneficial uses. While the response to MMP Question #4 focuses on sources of bacteria and metals, particularly copper. pH exceedances of the receiving water WQO range (6.5 – 8.5) were also observed at some MS4 outfall stations, as well as a few exceedances of dissolved zinc and 4-4' DDT.

For *E. coli*, objectives of the MSAR Bacterial Indicator TMDL Monitoring Program include source identification and assessment. Human sources of bacteria pose the highest risk. The Annual Monitoring Report for this project is provided in **Attachment K**. In, addition, 126 IC/ID reports were received and reviewed by the District for the 2019-2020 reporting period, of which 103 required follow-up investigation and/or field visits by District staff. Four of the reported incidents that occurred in the SAR watershed during the 2019-2020 monitoring year may have impacted water quality results for *E. coli.* The Permittees expect that future monitoring and source identifications will foster better understanding of the natural and urban sources of priority water quality conditions, as well as further improvement of water quality. In accordance with the findings of the CBRP, mitigation of dry weather flows within Phoenix Storm Drain and Eastvale MDP Line D and Line E is expected to help address the MSAR Bacterial Indicator TMDL. The District is actively investigating potential BMPs to address this MS4 discharge (**Section 11-4.2.1**).

For dissolved copper, brake pads and air deposition are known sources of copper, and true source control is underway to address this source of copper through enacted brake pad legislation (SB 346). Dissolved copper exceedances have occurred historically at the Temescal Channel at Main receiving water station, but not at the Perris Valley Channel at Nuevo Road receiving water station. This clear difference supports the assertion that the dissolved copper concentration is from proximal transportation land use as Temescal Channel runs parallel to the Highway 91 freeway (Hwy 91) crossing under the large interchange of Hwy 91 and Interstate 15 (I-15). In contrast Perris Valley Channel is a few miles east of the main freeway and drains mostly residential or commercial land uses. In addition to sources, stormwater hardness may also play a role due to the close relationship between hardness and dissolved copper WQOs. For both MS4 outfall and receiving water stations, **Figure 5-5** presents the relationship between dissolved copper results, calculated CTR CMCs and site-specific WQOs, and hardness results, and demonstrates that low hardness increases exceedance frequencies. Total hardness ranged from 54 to 310 mg/L at the Temescal Channel at Main receiving water station during three wet weather events, and was below 100 mg/L during most MS4 station wet weather events, resulting in a low concentration threshold for exceedance of dissolved copper (**Figure 5-5**). Low hardness values may result in WQO criteria that are overprotective of beneficial uses, particularly when these WQOs are being applied to MS4 outfall stations (for comparison purposed only). The Permittees may consider approaches used more recently in other stormwater programs, such as applying the proximate receiving water average hardness results for evaluating MS4 discharges, which provide a more direct linkage to water quality affects in the receiving water.

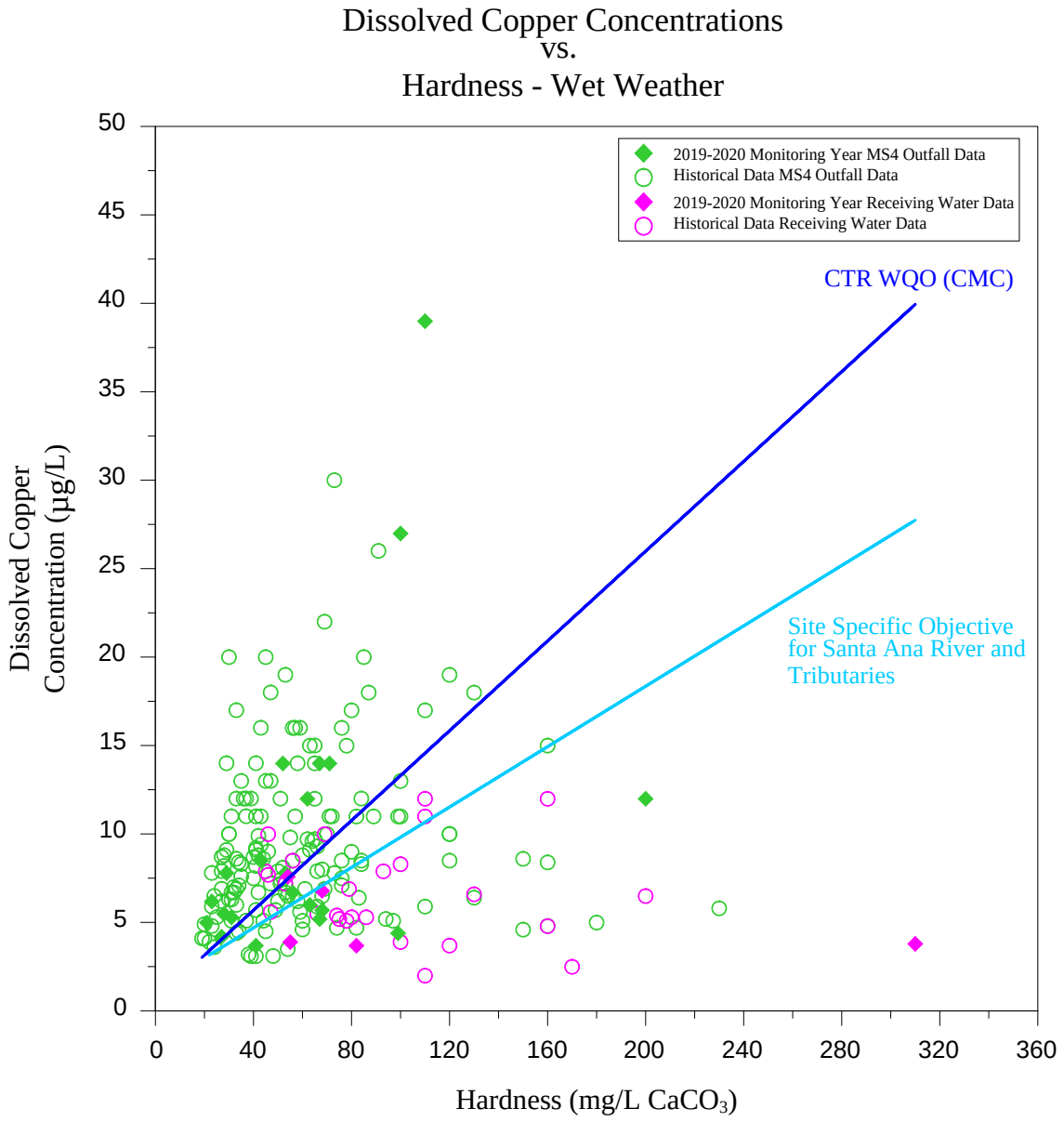


Figure 5-5: MS4 Outfall and Receiving Water Wet Weather Dissolved Copper Concentrations vs. Hardness Measurements

In addition to the prevalence of *E. coli* and dissolved copper, some less frequent water quality results were observed during wet weather 2019-2020 monitoring. Four of the MS4 outfalls had dissolved zinc exceedances of receiving water WQOs during one storm event. According to the CASQA report on zinc sources in California urban runoff (2015), major sources of zinc in urban runoff are outdoor zinc surfaces (especially galvanized surfaces) and tire wear debris. Local zinc sources that could contribute significant quantities of zinc to urban runoff may include zinc containing paint, tire shred and crumb products, industrial air emissions, zinc-rich soils, and mining. In the SAR, outdoor galvanized surfaces and tires in these urbanized MS4 outfall drainage areas are likely sources of the wet weather exceedances. However, there were no exceedances of dissolved zinc at the receiving water monitoring stations.

Field measured pH values were below the acceptable receiving water WQO range (6.5-8.5) at five MS4 outfall stations during wet weather and above the range at two MS4 outfall stations during dry weather. None of the low values were below 5.0 nor were the higher values above 9.0. pH values outside of the WQO range can result from a variety of factors including levels of alkalinity which serve to buffer or neutralize an acid. Rainfall typically measures below 6.0 (with regional variations), and CO_2 levels influences pH, where higher CO_2 levels can reduce the pH of rain (Fondriest, 2013). Further, natural changes can occur due to interactions with surrounding rock, particularly carbonate forms and other materials. The pH of runoff that resides in concrete channels can be increased due to the interaction with limestone.

During dry weather, the North Norco Outfall location demonstrated exceedance of pH, TDS, total hardness, total selenium, 4,4'-DDT, dissolved oxygen, and total nitrogen. Sources of nutrients may include discharges from POTWs or septic tanks, fertilizers, and emissions from fossil-fuel combustion. A primary source of salts is generally imported water and over-irrigation. As shown in **Attachment 11-D** this drainage area includes approximately 20% rural residential which may be contributing pollutants into this channel. North Norco Outfall discharges to the PBMZ, where TIN and TDS levels are a focus of management actions to protect groundwater. A Basin Plan Amendment was adopted in 2004 and approved by USEPA in 2007, and it incorporated new nitrate-nitrogen and TDS objectives for groundwater sub-basins and required the Permittees to establish baseline dry weather discharge concentrations for TIN and TDS. No baseline concentrations have been established for the North Norco Outfall location because this monitoring station has generally had insufficient water for sampling (VNS) during dry weather monitoring. This station typically exhibits sheet flow conditions with water flowing across the entire 30-foot width of the channel. During the second dry weather event in June 2020 sediment reduced the wetted width by ~66% increasing the depth of the water enough to collect a sample.

Three MS4 outfall stations exhibited exceedances of the CTR CCC for 4,4'-DDT, an organochlorine pesticide, which has been banned since the 1970's. While a legacy pesticide, DDT and its isomers can last for up to and beyond 30 years in soil. The laboratory qualified several of the 4,4'-DDT results, including two values that exceeded the CTR CCC. The qualifier stated that “Calibration Verification recovery was outside method control limits for this analyte due to matrix interference carried over from analytical samples." In follow-up correspondence on the issue, Babcock laboratories indicated that carry over was not an issue for these three samples, which were re-analyzed under a different temperature program meant to confirm/not confirm compounds if there is any question. These runs all confirmed the presence of the 4,4'-DDT in all three samples. The Magnolia Center Outfall has been sampled 17 times during dry weather with no previous exceedances for 4-4' DDT. The source of these recently measured results is unknown.

Local implementation and management programs may be updated, as necessary, to assist Permittees with identification, prioritization, and implementation of actions necessary to prevent degradation of waterbodies within the SAR and to improve water quality conditions, where feasible. It should be noted that MS4 outfall station discharges contain inputs from other, non-urban land uses and permitted discharges; therefore, the sources of pollutants contributing to receiving water exceedances may not be specific to urban runoff. Further, wildfires are prevalent in the SAR and have the potential to impact water quality. Wildfires that have occurred within the last three years are identified in **Section 11-1.4** of this report. Burn areas are present in the drainage areas of monitored stations with the potential to

impact water quality. The large Holy Fire which occurred in July 2018 is within the watershed drainage area of the Temescal Creek at Main receiving water station.

MMP Question #5: Are conditions in receiving waters getting better or worse?

This question can be answered by evaluating status and trends. Based on monitoring data, the condition of SAR receiving waters generally remains unchanged despite increasing population and development, two factors that could negatively impact water quality. Monitored only during wet weather, Temescal Channel at Main receiving water station showed decreasing trends for four metals and an increasing trend for orthophosphorus, while there were no statistically significant trends during wet weather at the Perris Valley Channel at Nuevo Road receiving water station. Santa Ana River at Highgrove Channel, which is monitored only during dry weather had no water quality exceedances for applicable WQOs, although some constituents of historical concern showed increasing trends.

Sample results from the MS4 outfall stations have been compared to receiving water criteria for comparison purposes, and trends are considered at MS4 outfalls in terms of potential to impact receiving waters, while not indicative of actual changes in receiving waters. During dry weather, trends at MS4 outfalls generally indicate increasing concentrations where flow is sampleable; however, VNS events at MS4 stations are more since the 1990's as discharges are eliminated. Further, due to the arid climate, dry weather flow discharges tend to evaporate and/or infiltrate without reaching surface receiving waters. During wet weather, trends at the Corona Outfall and Magnolia Center Outfall generally indicate improving conditions. Trends at the Sunnymead Outfall, Hemet Outfall, and Perris Line J Outfall generally indicate declining water quality conditions. Water quality conditions related to each SAR pollutant of concern are discussed below.

Bacterial Indicators – E. coli

The occurrence of bacterial indicators in receiving waters varies by storm event, site conditions, and receiving water conditions. During the 2019-2020 monitoring year, *E. coli* exceedances were observed during wet weather at every station with a wet weather *E. coli* WQO that was not suspended by high flow conditions. Field-documented wet weather flow conditions did not meet the high flow suspension criteria at any MS4 outfall stations during any storms in the 2019-2020 monitoring year. The Perris Valley receiving water station met the high flow suspension criteria for REC-1 during the storm event on December 4, 2019.

Long-term trend analysis identified statistically significant increasing wet weather trends at two MS4 monitoring stations, University Wash Outfall (associated with Lake Evans and Santa Ana River Reach 4) and Perris Line J Outfall (associated with San Jacinto River Reach 3). In addition, persistent exceedance of *E. coli* WQOs during wet weather was identified at these stations and two other MS4 stations, North Norco Outfall (PBMZ receiving water) and Hemet Outfall (Salt Creek receiving water). A significant decreasing wet weather trend for *E.coli* was identified at Corona Outfall (associated with Temescal Reach 1a, which has a UAA).

For dry weather conditions, increasing *E. coli* trends were observed at the University Wash Outfall and Magnolia Center Outfall, and persistent exceedance was shown at the Magnolia Center Outfall station. Wet and dry weather trend plots for University Wash Outfall are shown in **Figure 5-6**. Work is being done in the 2020-2021 monitoring year in collaboration with the City of Riverside to investigate the exceedances observed in samples taken from the Magnolia Center Outfall during dry weather. Findings, as available, are anticipated to be included in the next year's monitoring annual report.

At the Santa Ana River at Highgrove receiving water station, *E. coli* concentrations were below the WQO. Historically, only two exceedances have been recorded since monitoring began at this receiving water station.

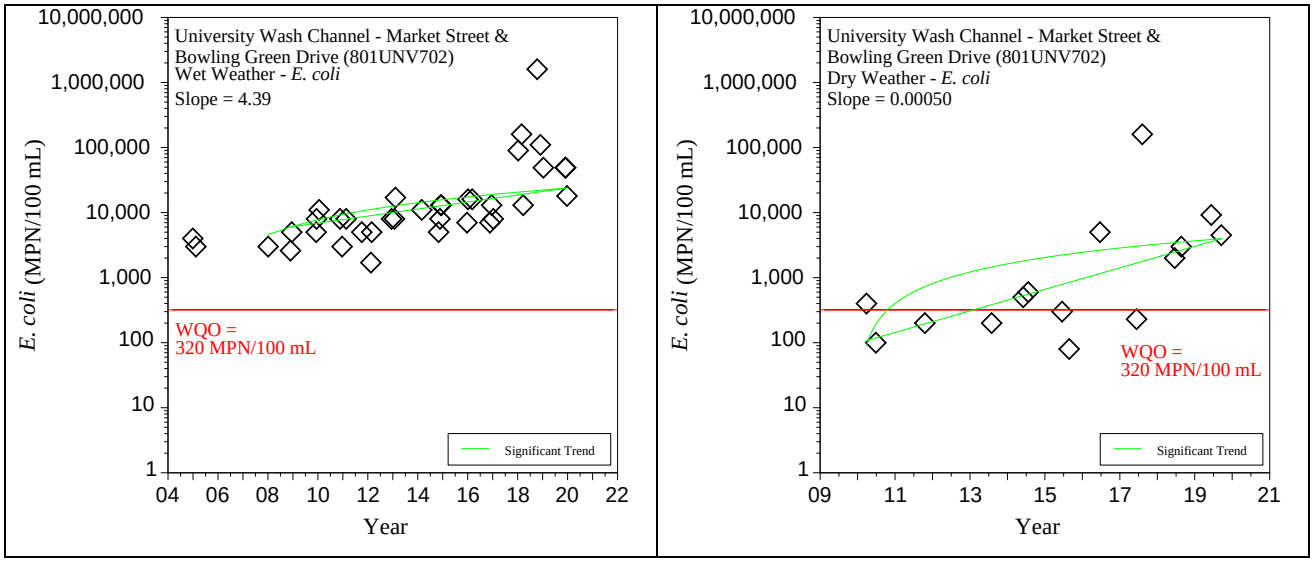


Figure 5-6: Bacterial Indicator (*E. coli*) Long-Term Trend Plots for University Wash Outfall (Left – Wet Weather, Right – Dry Weather)

Metals – Copper

Water quality samples were analyzed for both total metals (required parameter) and dissolved metals. The Permit does not require analysis for dissolved metals. Total metals analyses include all metals bound to particulate matter, whereas dissolved metals analyses represent the bioavailable fraction of metals dissolved in the water column. The Copermittees include testing for the dissolved fraction to determine the portion that is bio-available and to which the CTR WQOs can be applied.

For the purposes of this Monitoring Annual Report, copper is a historical SAR pollutant of concern based on 303(d) listings for copper during wet weather in Santa Ana River Reach 3. The Magnolia Center Outfall is tributary to the Santa Ana River Reach 3. Wet weather trend plots for this station are shown in **Figure 5-7**.

Dissolved copper exceedances of WQOs occurred during wet weather events at every MS4 outfall station and at one of three monitored receiving water stations during the 2019-2020 monitoring year. During the three wet weather events, exceedance ratios at MS4 outfall stations were generally 1.0 to 3.6 times above the WQOs. Samples from MS4 outfall stations are stormwater discharges; therefore, hardness measurements are generally less than 100 mg/L CaCO3, leading to lower thresholds for exceedance because the CTR and SSO WQOs are hardness-based calculations. Natural-bottom surface waterbodies in contact with weathered rock and sediments tend to have higher hardness values. Dissolved copper exceedances occurred during one of three wet weather events at the Temescal Channel at Main receiving water station, which is concrete-lined. No acute or chronic toxicity was observed in samples from this station collected during the 2019-2020 monitoring year. These low thresholds for exceedance may be overprotective of beneficial uses and may be too low for comparison

purposes to stormwater runoff. A better understanding of these copper results will be explored to determine if stormwater hardness is inflating the issue of copper as compared to other priority constituents. The use of receiving water hardness in evaluating copper and other dissolved metals, can be explored in applying the CTR to stormwater.

Statistically significant wet weather trends were identified for total copper at four of the seven MS4 outfall stations. Two of these were decreasing trends for total copper, which indicate improving water quality, including at the Magnolia Center Outfall, which is tributary to Santa Ana River Reach 3 (**Figure 5-7**). The other outfall with a decreasing trend for total copper is the Corona Outfall. Perris Line J Outfall and Hemet Outfall demonstrated an increasing trend for total copper, which indicate a potential decline in water quality for copper. For the receiving water stations, a decreasing trend for total copper was observed at Temescal Channel at Main. There were no trends for dissolved copper during wet weather, but dissolved copper exceedances were found to be persistent during wet weather conditions at the Corona Outfall.

There were no dry weather exceedances of dissolved copper WQOs during the 2019-2020 monitoring year. No statistically significant decreasing dry weather trends for dissolved copper were identified for MS4 outfall stations. At the Santa Ana River at Highgrove receiving water station, there is an increasing trend for dissolved copper (i.e., a potential decline in water quality for copper). No other statistically significant trends were identified for dry weather copper results.

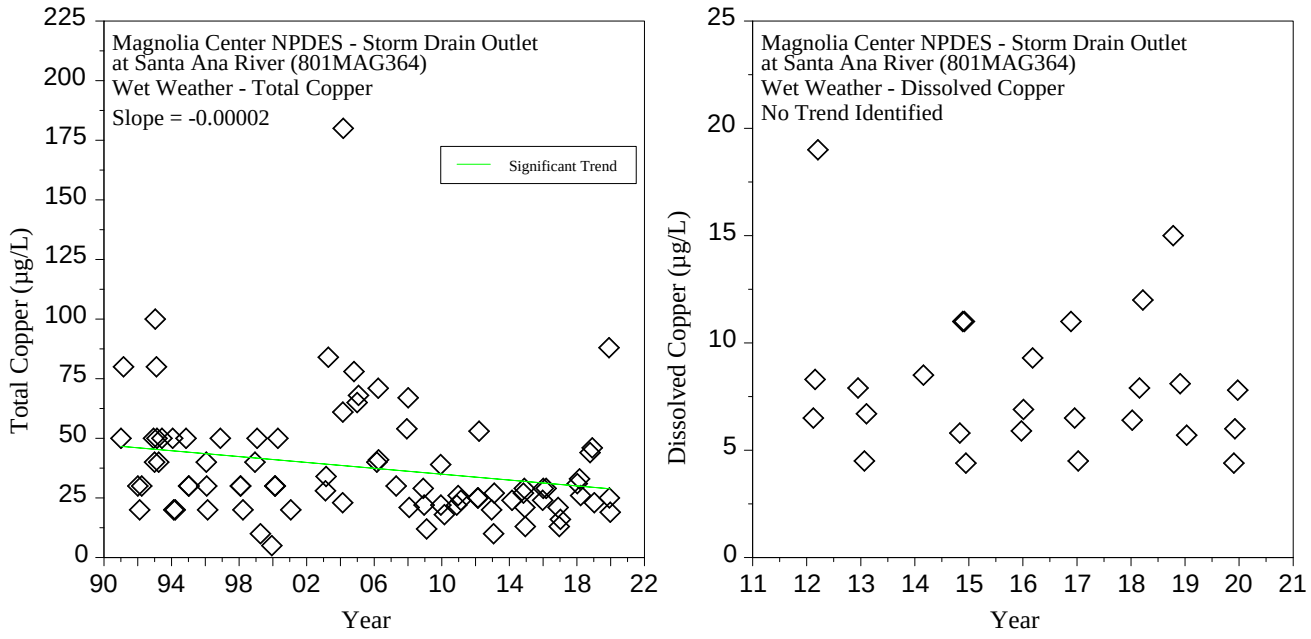


Figure 5-7: Copper Long-Term Trend Plots for Magnolia Center Outfall (Left – Significant Wet Weather Trend for Total Copper, Right – No Trend for Dissolved Copper)

Metals – Lead

There were no exceedances of lead at monitoring stations in the SAR during the 2019-2020 monitoring year. Lead exceedances during wet weather are relatively infrequent across the SAR. The highest historical frequency of exceedance is 35% at the University Wash Outfall and the Corona Outfall. With the exception of one dissolved lead exceedance of the Basin Plan WQO at Temescal Channel at Main

during the 2017-2018 monitoring year, there have been no dissolved lead exceedances reported for receiving water stations since wet weather monitoring began at these locations.

Five decreasing wet weather trends were identified for total or dissolved lead at MS4 outfall stations, including the Magnolia Center Outfall. A decreasing trend for dissolved lead was also identified at the Temescal Channel at Main receiving water station. No increasing trends for lead were identified, and lead exceedances were not found to be persistent during wet weather conditions at any of the SAR monitoring stations. This suggests that lead concentrations in the watershed, although continuing to be detected, may be improving over time.

Since monitoring of dissolved lead began in 2011, concentrations have not exceeded the site-specific WQO or CTR WQO at any MS4 outfall or receiving water station during dry weather. No statistically significant dry weather trends have been identified for total or dissolved lead. Therefore, the SAR Monitoring Program data suggest that lead is not a dry weather pollutant of concern for the SAR.

Metals – Zinc

During the 2019-2020 monitoring year, dissolved zinc concentrations measured at four of the MS4 outfall stations were above receiving water WQOs during wet weather. Historically, dissolved zinc exceedances have occurred for five of 23 samples (22% historical frequency of exceedance) at the Corona Outfall MS4 station, none of 23 samples (0% historical frequency of exceedance) at the North Norco Channel Outfall MS4 station, two of 23 samples (9% historical frequency of exceedance) at the University Wash Outfall MS4 station, and four of 22 samples (18% historical frequency of exceedance) at the Hemet Channel Outfall MS4 station. There were no exceedances for zinc during dry weather.

Nitrogen-Nutrients

Exceedances of nitrogen-nutrient parameters occurred at three stations during the 2019-2020 monitoring year. Total nitrogen was above the WQO during wet and dry weather at the North Norco Outfall and during wet weather at the Magnolia Center Outfall MS4 station and the Temescal Channel at Main receiving water station. In general, during the Permit term, nitrogen-nutrient results at Permit monitoring stations have been measured below WQOs during wet or dry weather at MS4 outfall and receiving water stations. For the period of record, the only SAR monitoring station with historical exceedances of the TIN WQO (where applicable, see **Section 11-2.5**) was the Santa Ana River at Highgrove receiving water station during dry weather (14% exceedance frequency). The only stations with historical exceedances of the total nitrogen WQO (where applicable, see **Section 11-2.5**) were the Corona Outfall during wet weather (3% exceedance frequency), Magnolia Center Outfall during wet weather (8% exceedance frequency) and dry weather (13% exceedance frequency), and North Norco Outfall during wet weather (12% exceedance frequency) and dry weather (44% exceedance frequency based on 16 samples). North Norco Outfall is typically dry during dry weather monitoring events (72% VNS for period of record for total nitrogen data collection).

Both increasing and decreasing wet weather trends were identified for nutrients at MS4 outfalls in the SAR. However, there were generally more trends towards increasing concentrations. At the receiving water stations, the only wet weather trend related to nutrients was an increasing trend for orthophosphorus at Temescal Channel at Main. During dry weather, a decreasing trend was observed for nitrite at Santa Ana River at Highgrove. The receiving water results suggest limited impact to receiving water quality.

There was one dry weather exceedance of the nutrient-associated parameter TDS during the 2019-2020 monitoring year, measured at the North Norco Outfall. Historical exceedance frequencies for TDS are low (0 to 6%) during wet weather. During dry weather, historical exceedance frequencies range from 0 to 93%, with the highest frequency observed from 1995-2005 at the North Norco Outfall. This station has been VNS for many years prior to last year's monitoring event, when three analytes were measured above WQOs in the sample. During the June 2020 monitoring event, eight analytes were measured above WQOs in the sample. Sediment within the channel reduced the flowing width to approximately one-third which caused the flow to be sufficient (instantaneous flow of 0.34 cfs) for dry weather sampling.

One dry DO measurement at the University Wash Outfall was below the lower limit of the Basin Plan WQO range. This result was not associated with elevated nutrient concentrations or other discernable nutrient causes. Most likely, the result is a product of ponded conditions upstream due to sediment, heavy vegetation, and wildlife (e.g., birds, raccoons, and fish).

pH

For the purposes of this Monitoring Annual Report, pH is a historical pollutant of concern for historical Temescal Creek Reach 1 (now associated with Temescal Reach 1a and the PBMZ). During 2019-2020 wet weather monitoring, pH results were outside of the Basin Plan WQO range at multiple MS4 outfall monitoring stations but not at the Temescal Channel at Main receiving water station. Dry weather monitoring is not conducted at the Temescal Channel at Main receiving water station. Since the inception of monitoring at the Temescal Channel at Main receiving water station in 2011, only two wet weather pH measurements have been slightly less than the WQO lower limit of 6.5 units (historical exceedance frequency of 13%). When pH exceedances have occurred during the current Permit term, results were usually only slightly below the acceptable WQO range. The pH WQO range was exceeded at North Norco Outfall, which discharges to the PBMZ, during one wet and one dry event. All MS4 outfall stations demonstrated decreasing trends for pH during wet weather.

Bioassessment

In addition to the parameters described above, trends were evaluated for CSCI scores at SMC Program trend sites using the Mann-Kendall trend test. No trends were identified at Strawberry Creek and Cucamonga Channel.

11-6.0 CONCLUSIONS AND RECOMMENDATIONS

The Permittees' recommended future monitoring actions and updates to monitoring protocols are provided in this section. The Permittees will continue to revise their local programs based on these recommendations, as necessary, to fulfill the requirements of the Permit.

11-6.1 PROGRESS OF THE SAR MONITORING PROGRAM

The SAR Monitoring Program was implemented per the CMP during the 2019-2020 monitoring year. The wet and dry weather monitoring programs, including the dry weather MS4 outfall and receiving water programs, IDDE program, and SMC Regional Monitoring Program efforts were completed as required. An additional wet weather event was monitored at Temescal at Main receiving water station due to a holiday closure of the toxicity testing laboratory during the first flush monitored event in late November 2019. The Permittees have continued ongoing efforts to improve the quality of the SAR Monitoring Program. The current ongoing programmatic improvement effort focuses on regional coordination, fostering a close working relationship with contract laboratories and using new electronic technologies to streamline and improve data tracking protocols. Key ongoing efforts to improve the SAR Monitoring Program are described below.

Regional Coordination

Wet and dry weather monitoring activities were coordinated so that samples were collected at all SAR monitoring stations for the same sampling dates to the maximum extent feasible. This effort ensures that results can be evaluated regionally as required by the CMP and 2010 MS4 Permit.

The Permittees also continue to participate in regional monitoring programs implemented by the SMC and the California Stormwater Quality Association, as well as several technical advisory committees, task forces, and other groups designed to address health within the SAR.

Revisions to the Monitoring Program Parameter Lists

In the 2015 ROWD and 2014-2015 Monitoring Annual Report, the Permittees proposed monitoring lists to be incorporated into the new Permit based on findings of a comprehensive ND analysis and conservative approach to removal of parameters. During this process, the Permittees reviewed the MS4 outfalls and receiving water parameter monitoring lists and created a consistent, comprehensive list that has been used to evaluate SAR monitoring stations. These lists have been used since the 2015-2016 monitoring year. The list includes several parameters, such as dissolved metals, that while are technically not required by the 2010 MS4 Permit, have been monitored in order to better understand water quality conditions across the SAR. The additional parameters are identified with (i) in the results table provided in **Attachment G**. An ND analysis was conducted again during the 2018-2019 monitoring year and reduced lists were proposed in the 2018-2019 Annual Monitoring report. These updated lists are currently in use in the 2020-2021 monitoring year and are included within this report as **Attachment E**. These changes represent the progress made in understanding the water quality conditions in the SAR and help focus resources for water quality improvement.

Implementation of Program-Specific Laboratory Standards to the Maximum Extent Practicable

The District, on behalf of the Permittees, continues to foster a close working relationship with contracted laboratories to communicate program needs in order to improve the quality of water quality analysis. In recent monitoring years, the extensive QA/QC protocols associated with the SAR Monitoring Program identified several field and laboratory errors that were addressed through additional training and discourse to ensure consistent results will be achieved. **Attachment F** provides the QA/QC issues identified during the 2019-2020 monitoring year, and actions taken to address. The District continues to work with the laboratory to provide lower detection limits for monitoring parameters and ensure consistent data reporting techniques are implemented. A new QA check was instituted in May 2020 after multiple samples were found to be either missing required analysis or analyzed for constituents that were neither requested nor required. Laboratory log-in confirmation emails are now reviewed after submission of samples to ensure all required analyses are requested. This approach will continue to be used during the 2020-2021 monitoring year.

Updated Electronic Data Collection and Management Tools

In 2017, the District acquired a new database management system. In the future, the capabilities and use of this system will continue to be tested, refined and expanded (as appropriate), based on lessons learned during each year of use and the needs of the MRP. This includes automated QC checks of RL's, completeness of data, and identification of any results not requested or required.

In September 2020 new water quality meters or sondes were purchased by the District. These new state-of-the-art sondes have the capability to document and record the in-situ measurements taken in the field. This record can be saved to the District files for later review if any questions arise after the monitoring event. This will also provide a backup record of field measurements in case any numbers are recorded incorrectly. As noted in the data evaluation for the 2019-2020 monitoring year, the frequency of field measured pH exceedances was higher. New meters for measuring field parameters including pH will be in use during 2020-2021 monitoring year and data will be reviewed to determine if variations occurred less frequently using the new equipment.

11-6.2 IMPLEMENTATION OF THE 2019-2020 MONITORING YEAR PROGRAM

The 2010 MS4 Permit expired on January 29, 2015. The Regional Board has indicated that the new permit is expected to be issued in 2021 and has provided direction to the Permittees to continue monitoring under the 2010 Permit MRP and CMP for the 2020-2021 monitoring year. **Table 6-1** provides a summary of anticipated monitoring efforts for the 2020-2021 monitoring year. The Permittees have determined that the Perris Valley Channel receiving water monitoring location will need to be relocated upstream due bridge construction on Nuevo Road, which is anticipated until January 2021. Various locations were evaluated and a location approximately 0.25 miles upstream was selected. The temporary relocated receiving water monitoring location will not be downstream of the Perris Line J MS4 outfall station. In a letter dated September 1, 2020, the Regional Board approved the District's request to move the monitoring location until February 2021, when the Nuevo Road bridge project has been completed.

The Permittees will also continue to participate in, and coordinate with the SMC Regional Bioassessment Monitoring Program, as facilitated by the District, on behalf of the Permittees.

Table 6-1: Proposed 2020-2021 Monitoring Program Summary

Monitoring Component	Sampling Frequency	Monitoring Stations (Station ID)	Analytical Requirements
MS4 Outfall Monitoring	2 Dry Events 3 Wet Events	• Corona Outfall (801CRN040) • Sunnymead Outfall (802SNY316) • Hemet Outfall (802HMT318) • Magnolia Center Outfall (801MAG364) • University Wash Outfall (801UNV702) • North Norco Outfall (801NNR707) • Perris Line J Outfall (802PLJ752)	Chemistry, bacterial indicators, field parameters, and flow
IC/ID Monitoring	Dry weather, scheduled per Permittee LIP	Per Permittee LIP	Flow (if present); field parameters (if present)
Receiving Water and Water Column Toxicity	2 Dry Events 2 Wet Events	• Santa Ana River at Highgrove (801AHG857) – dry only • Temescal Channel at Main Street (801TMS746) – wet only • Perris Valley Channel off Murrieta Rd(802NVO325a) – Oct 2020 - Jan 2021 • Perris Valley Channel at Nuevo Road 802NVO325 – return to station Feb 2021	Chemistry, bacterial indicators, field parameters, flow, and toxicity
Bioassessment (SMC Regional Monitoring Program)	1 Dry Event (2021)	TBD*	TBD*

*The 2015-2019 SMC Regional Monitoring Program is complete, and the 2020-2024 Workplan is currently being drafted.

11-6.3 RECOMMENDED CHANGES FOR THE NEXT SAR PERMIT FOR CONSIDERATION BY THE REGIONAL BOARD

The Permittees request that the Regional Board approve one of the program's major accomplishments, standardization of the SAR monitoring parameter lists for MS4 outfall stations and receiving water stations, by adopting **Attachment E** as the basis for water quality analysis under the next Permit. These comprehensive lists include:

- 108 parameters for the SAR receiving water monitoring stations and 105 to 90 parameters for the MS4 outfall stations (lists vary between events and event types).
- Several parameters that were voluntarily added by the Permittees (e.g., dissolved phase metals, nutrients) in order to fill data gaps.
- The results represent extensive analysis that conservatively identified parameters that could be removed from the monitoring program based on Permit criteria (MRP Section III.E.1(b)(iv)). As a result of the 2019 ND analysis, 20 VOCs, 1 OC Pesticide, 41 OP Pesticides, and cyanide were proposed for removal in the 2018-2019 Annual Monitoring Report.
- A standardized monitoring approach has applied across the SAR since the 2015-2016 monitoring year.

- Modified analytical methods for aroclor PCBs and organochlorine pesticides, which allows for results to be compared to the CTR WQOs (Babcock, 2016).
- Incorporated modifications based on guidance from the Regional Board given during the 2014-2015 monitoring year.

The Permittees also request that the Regional Board include the following changes under the next Permit term:

- Removal of data comparison to the USEPA Benchmarks from the MSGP, as these benchmarks do not appear to be appropriate for urban runoff discharges in the SAR, and do not add assessment value. The WQO and CTR WQO provide the water quality standards for protection of beneficial uses in the SAR. The details of this recommendation can be found in the FY 2013-2014 Monitoring Annual Report.

11-6.4 RECOMMENDED MONITORING PROGRAM ENHANCEMENTS FOR THE 2020-2021 MONITORING YEAR

In addition to the efforts and accomplishments described in this Monitoring Annual Report, the Permittees continue to seek out additional means to improve the monitoring program. Looking forward to the 2020-2021 monitoring year and the anticipated Permit renewal, recommended next steps for the SAR Monitoring Program may include, but are not limited to:

- Consideration of modifications to monitoring station locations and/or flexibility in their selection in order to fill data gaps and facilitate assessment of urban runoff as it relates to water quality in receiving waters, which would help fulfil the objectives of the MRP by:
    - Improving the program's ability to evaluate water quality conditions within the SAR. Under the 2010 MS4 Permit, receiving water monitoring stations have met the Permit objectives of proximity to major MS4 outfalls, but may not represent the SAR (e.g., the Santa Ana River at Highgrove receiving water station is at the County line and represents flows from San Bernardino).
    - Improving the monitoring program's ability to determine if urban runoff is causing or contributing to water quality issues in receiving waters. Currently only one receiving water station (Perris Valley Channel at Nuevo Road) is located downstream of monitored MS4 outfalls. During the 2020-2021 monitoring year, this station will be moved upstream temporarily due to bridge construction at Nuevo Road. Therefore, there will be only one MS4 outfall locations monitored upstream of receiving water locations in the upcoming wet season monitoring.
    - Allow receiving water stations to be sited and monitored to evaluate outfalls with sample results above receiving water WQOs in dry and wet weather (e.g., Magnolia Center Outfall MS4 outfall station), thus improving TMDL compliance efforts.
- Evaluate assessment approaches for MS4 outfall data that better identify if discharges have the potential to impact receiving waters. Further assess if stormwater hardness is inflating the issue of copper as compared to other priority constituents. The use of receiving water hardness in evaluating copper and other dissolved metals, can be explored in applying the CTR to stormwater.

- Use available technologies and tools to improve programmatic efficiency and effectiveness through better data management, access, and assessment. For example, the Permittees may consider to expand the use of GIS tools, such as Survey123, to standardize data entry and help facilitate complete and accurate collection of water quality data in the field.

- Continue to work closely with the contracted laboratory(s) to ensure cohesive programmatic implementation from year to year, improve data analysis and reporting, ensure analyses meet applicable reporting limits, and that the program meets the overall data QA/QC goals as established by the QAPP within the CMP.

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