Synoptic Study Findings and Recommendations

Considering the results from the Synoptic Study and other work completed in the MSAR watershed to date, this section provides key findings and recommendations for next steps by the MSAR Task Force or MS4 Permittees.

Synoptic Study Findings

Taking into account the body of research related to TMDL implementation that has been completed to date in the MSAR watershed, key findings include:

1. The MS4 Programs met the CBRP goals to significantly reduce DWF to the waterbodies named in the TMDL, e.g.:
    a. The MS4 Programs have hydrologically-disconnected the majority (66%) of the upper MSAR watershed during dry weather conditions through infiltration in unlined flood control channels, retention basins, and other flow diversion projects. These areas no longer cause or contribute to exceedances of the water quality objectives for pathogen indicator bacteria (evaluated as concentrations of *E. coli*) in the downstream receiving waters during dry weather conditions.
    b. Long-term monitoring data shows DWFs from MS4 conveyance facilities are substantially lower continuing a downward trend that has been observed since 2007 (the first year of TMDL implementation).
    c. The City of Claremont has effectively eliminated dry weather runoff from its jurisdiction and is no longer causing or contributing to downstream exceedances.
2. With the exception of the Chino Creek subwatershed, the MS4 Programs also met the bacteria load reduction goals established in the CBRPs as necessary to assure compliance with the bacteria concentration targets established by the TMDL (in fact, bacterial loads were reduced from MS4 inflows to the Santa Ana River much more than was required by the CBRP). For Chino Creek, the MS4 Programs have achieved approximately 80% of the estimated bacteria load reduction needed to assure compliance with the bacteria concentration targets established by the TMDL.
3. At Prado Park Lake a major engineering project has been completed that repaired and restored the MS4 conveyance system so that it properly bypasses the lake. Data from the watershed-wide compliance site at Prado Park Lake shows that water quality at this site often meets the TMDL *E. coli* targets. When sufficient data have been collected to demonstrate consistent long-term compliance, this site should be considered for de-listing. If not delisted when the MSAR TMDL is revised, no dry weather WLA should be assigned to the MS4s for this waterbody, because no DWF is discharged to this waterbody from an MS4.

4. Unidentified non-point sources now account for the majority (77%) of the total bacteria load in the Santa Ana River. As has been demonstrated, based on source analyses completed in 2007, 2012, and now 2019, the Santa Ana River would be in compliance with the TMDL targets and the state's new water quality standards for pathogen indicator bacteria were it not for the excessive loads from these unknown non-point sources which are not conveyed through the MS4.
5. Sampling data from Reach 4 of the Santa Ana River shows that bacteria loads from unknown non-point sources contribute about 300 billion MPN/day, which is enough to consume nearly 100% of the total allowable load for *E. coli* bacteria in the receiving water.
6. Examples of de minimis discharges within the MS4 network continue to be evident in the watershed. During just the six-week study we observed DWF volume anomalies at two locations (San Antonio Channel and Anza Drain).
7. Quantification of the load of HF183 gene copies in the MS4 provides insight into the extent of human fecal contamination from MS4 sources. The maximum measured load of HF183 from a Tier 1 MS4 site (8,282 gc/day in Week 3 from T1-MCSD) may be associated with approximately 1.5 grams/day of human feces (HF) based on pooled data from multiple studies translating gene copies of HF183 to mass of HF (Ahmed et al. 2016). Thus, a small amount of HF contamination can cause HF183 amplification downstream and contribute to a sharp rise in fecal bacteria concentrations at MS4 outfalls. This finding is important because it shows that source tracking and elimination of isolated cases of HF contamination can be highly effective in improving water quality at MS4 outfalls in the MSAR watershed. Evidence of this has been reported following prior Tier 2 investigations conducted by MS4 Permittees.
8. The maximum load of HF183 from within the mainstem of the Santa Ana River (69,727 gc/day in week 3 from MISSION) is eight times greater than the maximum load of HF183 measured at any of the Tier 1 MS4 outfalls. This much larger human fecal load at the MISSION site was demonstrated to be entirely associated with a source that does not originate from within MS4 drainages, nor could it be attributed to non-viable genetic material from POTW effluent. This finding is important because efforts to mitigate sources of *E. coli* bacteria within MS4 jurisdictions alone will not be enough to attain the *E. coli* water quality objectives at downstream watershed-wide compliance sites.
9. There appears to be lower (less frequent and smaller magnitude) human signal present in 2019 compared to the previous Synoptic Study performed in 2012. This indicates that recent efforts to regulate septic systems and better maintain sewer collection systems have been effective. The relative absence of significant human signal strongly suggests that the *E. coli* observed in the receiving waters is more likely coming from natural background sources (sediment, biofilms, wildlife) than from homeless encampments, water recreation activities, or other controllable anthropogenic sources.

Recommendations

1. *Special Studies* – The Task Force should consider the implementation of the following special studies to gather data to support the upcoming TMDL revision:
    a. *Releases from Naturalized E. coli in Santa Ana River Bottom* – This special study would be designed to collect site-specific data to assess the extent to which naturalized *E. coli* exists in the bottom sediments or biofilms of the Santa Ana River. This study would include collection of surface sediment and/or biofilm samples for enumeration of attached *E. coli* at multiple sites within the Santa Ana River during different seasons. Also, the study design should include collection of data that may facilitate quantification of key factors influencing colony formation and growth (e.g., nutrients, dissolved organic carbon, and temperature), as well as provide information regarding processes that drive the release of *E. coli* colonies to the overlying water.
    b. *Mill Creek Wetlands Special Study* – The purpose of this special study would be to evaluate the performance of Mill Creek Wetlands. Based on available data, it is currently difficult to fully quantify the water quality benefits of this wetlands. Findings from this study can also support development of future agreements regarding operation of the facility.
2. *Tier 2 Source Investigations* – MS4 Programs should initiate Tier 2 source investigations as described below for each subwatershed:
    a. *Santa Ana River Reach 3 Subwatersheds* – Three sites received a high priority ranking in the areas draining to the Santa Ana River watershed-wide compliance sites: Magnolia Center Storm Drain [T1-MCSD], Sunnyslope Channel [T1-SNCH] and ANZA Drain [T1-ANZA]. Of these three sites, it is recommended that a Tier 2 investigation be initiated as soon as possible within Magnolia Center Storm Drain drainage area given the persistent presence of the human marker HF183.
    b. *Cucamonga Creek Subwatershed* - For Cucamonga Creek, it is assumed that the Chris Basin Project (see Section 3.3.3) will address a majority of the bacteria load reaching the Tier 1 CUCAMONGA site. However, it is recommended that a Tier 2 investigation be initiated by the Cities of Ontario and Eastvale in coordination with the implementation of the Chris Basin Project to verify expected bacterial load reductions following completion of that project. Implementation of these studies could also provide additional information from sites not sampled during the Synoptic Study (Eastvale Lines A and B) that may be needed to support the planned TMDL revision for this subwatershed.
    c. *Chino Creek Subwatershed* - Consistent with CBRP implementation, additional Tier 2 investigations are recommended within individual subwatersheds to further identify sources of bacteria and DWF in the MS4 and options to mitigate those sources.
3. *Water Quality Monitoring Program Enhancements* – Add the Santa Ana River MISSION site to the RBMP as part of the TMDL compliance monitoring program. Regular sample

collection from this location will provide data to support the upcoming revision of the TMDL by providing information on bacteria loads in the river that are not derived from an MS4 source.

4. *Preparation for TMDL Revision* – The Task Force should begin work on a strategy for TMDL revision, including developing the approach to revise the WLAs and LAs, identifying the components that should be revised, e.g., dry/wet seasons vs. weather, identifying any additional data needs to effectively revise the TMDL, and an approach for addressing the wet weather component of the TMDL given the allowable high flow suspension in the Basin Plan.