California Water Boards

Los Angeles Regional Water Quality Control Board

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GUIDELINES FOR CONDUCTING REASONABLE ASSURANCE ANALYSIS IN A WATERSHED MANAGEMENT PROGRAM, INCLUDING AN ENHANCED WATERSHED MANAGEMENT PROGRAM

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GUIDELINES FOR CONDUCTING REASONABLE ASSURANCE ANALYSIS IN A WATERSHED MANAGEMENT PROGRAM, INCLUDING AN ENHANCED WATERSHED MANAGEMENT PROGRAM

The Regional Board adopted Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, Order No. R4-2012-0175 (NPDES Permit No. CAS004001). As required in the permit, Part VI.C.5.b.iv.(5), permittees electing to develop a watershed management program (WMP) or enhanced watershed management program (EWMP) are required to submit a Reasonable Assurance Analysis (RAA) as part of their draft E/WMP to provide an *ex ante* demonstration that applicable water quality based effluent limitations (WQBELs) and receiving water limitations (RWLs) shall be achieved through implementation of the watershed control measures proposed in the E/WMP. This guidance document is prepared to provide information and guidance to assist permittees in development of the RAA. This document provides clarification of the permit requirements regarding the RAA along with recommended criteria for the permittees to follow to prepare an appropriate RAA for Regional Board approval.

A. APPLICABLE INTERIM AND FINAL REQUIREMENTS

Permittees shall identify the water quality priorities within each watershed management area (WMA) that will be addressed by the E/WMP in order to achieve applicable water quality limitations (i.e., WQBELs and RWLs) within the timeframes established by the corresponding compliance schedules set forth in Attachments L-R, or the compliance schedule set forth in the E/WMP, where there is no specific compliance schedule contained in Attachments L-R or the compliance deadlines occur outside the permit term. For example, for watershed priorities related to achieving WLAs in USEPA established TMDLs that do not have a companion State-adopted program of implementation, proposed compliance schedules must adhere to the requirements of Part VI.E.3.c.iii-v. For watershed priorities related to addressing exceedances of RWLs in Part V.A and not otherwise addressed by Part VI.E, proposed compliance schedules must adhere to the requirements of Part VI.C.5.c.iii.(3).

Per Part VI.C.5.a of the permit, and based on an evaluation of existing water quality conditions, permittees shall classify and list water body-pollutant combinations into one of the following three categories within their draft E/WMP and include these water body-pollutant combinations it their RAA:

- Category 1 (Highest Priority): Water body-pollutant combinations for which water quality-based effluent limitations and/or receiving water limitations are established in Part VI.E TMDL Provisions and Attachments L through R of the MS4 Permit.
- Category 2 (High Priority): Pollutants for which data indicate water quality impairment in the receiving water according to the State Board's Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List (State Listing Policy) and for which MS4 discharges may be causing or contributing to the impairment.
- Category 3 (Medium Priority): Pollutants for which there are insufficient data to indicate water quality impairment in the receiving water according to the State's Listing Policy, but which exceed applicable receiving water limitations contained in this Order and for which MS4 discharges may be causing or contributing to the exceedance.

Permittees may choose to further subcategorize water body-pollutant combinations within the three main categories above for purposes of sequencing implementation of watershed control measures in the most effective manner possible, taking into consideration compliance deadlines and opportunities to address multiple pollutants within a water body with similar watershed control measures. This is consistent with the permit provisions in Parts

VI.C.2 and VI.C.3, which group pollutants for purposes of complying with the RWLs Provisions according to whether the pollutant is being addressed by a TMDL; is similar in its fate/transport characteristics and effective implementation measures to a pollutant being addressed by a TMDL; is currently listed on the 303(d) list; or exhibits only occasional exceedances in the receiving water. For example, permittees may wish to identify which water body-pollutant combinations in Categories 2 and 3 above are similar to a water body-pollutant combination in Category 1, and could therefore be addressed simultaneously with the water body-pollutant combination in Category 1. Permittees are invited to discuss with Regional Board staff, and solicit early input on, approaches to further subcategorization of water body-pollutant combinations.

Sections B through D of these guidelines discuss the general process and options for estimation of current pollutant loading, required pollutant reductions, and analysis of BMP scenarios to achieve required reductions. There are several important considerations in this process.

- First, the compliance schedules included in the permit (both those based on TMDL implementation schedules and those required to be proposed absent TMDL derived compliance deadlines), anticipate phased pollutant reductions; therefore, the RAA must be adequate to identify the required reduction for each water body-pollutant combination at each compliance deadline and analyze the BMP scenario to achieve that deadline. While many compliance deadlines fall outside of the current permit term, the permit requires in these cases that measurable interim milestones within the permit term are included and analyzed. In some cases, it may be possible to identify a 'limiting pollutant' that can be used as the focus of the analysis – i.e., to estimate necessary pollutant reductions and to analyze the BMP scenario to achieve the required reduction – which will result in achievement of required reductions in other pollutants. Where this approach is taken, adequate justification must be provided. (See **Appendix A** for Interim and Final TMDL Compliance Deadlines through December 28, 2017.)
- Second, because the purpose of the RAA is to provide a demonstration that WQBELs derived from TMDL WLAs will be achieved, and TMDL WLAs are required to consider critical conditions, the RAA must also consider critical conditions consistent with those used in the TMDL(s) in estimating current pollutant loading and required pollutant reductions and analyzing BMP scenarios to achieve applicable WQBELs.

B. CURRENT/EXISTING POLLUTANT LOADING ASSOCIATED WITH CURRENT BEST MANAGEMENT PRACTICES (BMPs)/MINIMUM CONTROL MEASURES (MCMs)

- Permittees shall provide a list and map of known and suspected storm water and non-storm water pollutant sources discharging to MS4 and from the MS4 to receiving waters and any other stressors related to MS4 discharges causing or contributing to the impairments. The map must include all MS4 "major outfalls"[1], major structural controls of storm and non-storm water[2] (including, but not limited to, low flow diversions, urban runoff treatment facilities, detention and retention basins used for storm water treatment, VSS devices, other catch basin inserts/screens) that discharge to receiving waters within the watershed management area. A separate tabular list of major structural controls should also be provided. Permittees shall also provide list of non-structural controls that are currently implemented within the area(s), the results of which will be assumed to be reflected in the baseline pollutant loading.[3]

[1] Per definition in federal regulations.

[2] Spatial metadata must include delineation of drainage area treated where available, maximum volume of non-stormwater/stormwater treated, type of control, pollutants addressed, name and contact information of owner and, if different, operator in charge of O&M.

[3] It is assumed that these BMPs include full implementation of the 2001 Permit Storm Water Management Program elements as well as the structural BMPs identified in the first bullet.

- Permittees shall provide an initial assessment of current/baseline pollutant loading for water body-pollutant combinations identified in Section A. Current/baseline pollutant loading shall based on relevant subwatershed data and the best available representative land use and pollutant loading data collected within the last 10 years. Appropriate data sources for use in assessment of baseline pollutant loading are identified in the tables below. At a minimum, baseline pollutant loadings shall be assessed and reported considering variability in pollutant loading at a spatial and temporal (including critical condition) scale consistent with that used in the TMDL and in the approved monitoring plan (i.e., for each subwatershed that was identified/analyzed/modeled in the TMDL and for each compliance monitoring location identified in the approved monitoring plan).
- Baseline loading shall be estimated using metrics derived from long-term historical data (e.g., rainfall, flow/runoff volume, pollutant loading, pollutant concentrations) using calibrated dynamic model results for each subwatershed area. Such baseline loading estimates shall be generated at a minimum for (1) critical conditions (consistent with applicable TMDLs – see **Appendix B** for a summary of TMDL critical conditions), and (2) may also be generated for average conditions for metrics related to quantity and quality (see examples of metrics, above). Critical conditions for baseline pollutant loading estimates shall be based on the two components listed below:

I. Baseline flow rates/runoff volumes shall be based on one of the following:
   a) 90^{th} percentile of long term estimated/modeled flow rates (per TMDL WLA expression); or
   b) Other established hydrologic critical condition in the applicable TMDL; or
   c) Runoff volume from the 85^{th} percentile, 24-hour rainfall event (for modeled drainage areas where retention based BMPs will capture 100% of the required volume).
   d) Long-term average estimated/modeled flow rates that also incorporates the coefficient of variation so as to take variability in flow rates into account. Consideration of variability must be sufficient to capture the critical condition as expressed in applicable TMDL(s). Where long-term average flow rate is used, critical conditions may be described using the long-term average flow rate with a coefficient of variation (CV) to take the variability in flow rate into account. For this type of critical condition, the reported flow rate/volume for each subwatershed should be established by using a variability factor (VF) for model-predicted flow rates/volumes obtained from the long-term average and CV with the selected probability distribution of the flow rates/volumes. Procedures for the detailed calculation of variability factors for different probability distributions are described in Appendix E of the Technical Support Document for Water Quality-based Toxics Control (EPA/505/2-90-001, March 1991). It is anticipated that log-normal distributions will be assumed. If a different type of critical condition is applied (e.g. 90^{th} percentile wet year), then CV and VF calculations are not required.

II. Baseline pollutant concentration shall be based on one of the following:
   a) 90^{th} percentile of estimated/modeled long term pollutant concentration (considering the most recent 10 years of available data); or
   b) Long-term average pollutant concentration (considering the most recent 10 years of available data) that also incorporates the coefficient of variation so as to take variability into account. Consideration of variability must be sufficient to capture the critical condition as expressed in applicable TMDL(s). Where long-term average pollutant concentration is used, critical conditions may be described using the long-term average concentration with a coefficient of variation (CV) to take the variability of pollutant concentration into account. For this type of critical condition, the reported pollutant loading in each subwatershed should be established by using a variability factor (VF) for model-predicted

concentrations, and/or concentrations obtained from the long-term average and CV with the selected probability distribution of the pollutant concentration. Procedures for the detailed calculation of variability factors for different probability distributions are described in Appendix E of the Technical Support Document for Water Quality-based Toxics Control (EPA/505/2-90-001, March 1991). It is anticipated that log-normal distributions will be assumed. If a different type of critical condition is applied (e.g. 90th percentile as in (a) above), then CV and VF calculations are not required.

c) Until sufficient data are available, pollutant event mean concentrations (EMCs) based on land use types from recommended data sources as referenced in table below may be used to estimate baseline pollutant loading; however, where this option is selected, they must be used in combination with one of the critical conditions for flow rate/runoff volume identified in Part I, above. Once sufficient data are collected, either (a) or (b) should be used in future iterations of the reasonable assurance analysis.

- The estimated pollutant loading and/or concentrations shall be consistent with event mean concentrations (EMCs) obtained from different land use site as referenced in dependable sources, some of which are listed below:

Source No.	Reference
1.	**Sources, patterns and mechanisms of storm water pollutant loading from watersheds and land uses of the greater Los Angeles area, California, USA.** 2007. ED Stein, LL Tiefenthaler, KC Schiff. Technical Report 510. Southern California Coastal Water Research Project. Costa Mesa
2.	**Levels and patterns of fecal indicator bacteria in stormwater runoff from homogenous land use sites and urban watersheds. Request Only.** 2011. LL Tiefenthaler, ED Stein, KC Schiff. Journal of Water and Health 9:279-290
3.	Los Angeles County 2006 EMC Report

- If a permittee(s) selects to use other independent sources of data to calculate pollutant loading in the RAA, the permittee(s) shall assure that the source(s) selected has appropriate documentation, is current, and is publicly available. The permittee(s) shall be required to provide the rationale used to support their selection of baseline data as well as the raw data and all associated QA/QC information for Regional Board review and approval.
- Baseline pollutant loading should be expressed on a pollutant-by-pollutant basis consistent with the relevant averaging period(s) / duration as expressed in the TMDL and Attachments L-R.
- For pollutants included in the RAA but for which there is no TMDL, permittees should consider expressing pollutant loading in terms of averaging periods/duration/critical conditions consistent with those used in TMDLs for that pollutant in order to proactively address the water quality problem in such a way as to avoid the need for a TMDL in the future if possible.

C. ESTIMATED REQUIRED POLLUTANT REDUCTIONS TO MEET THE INTERIM AND/OR FINAL ALLOWABLE POLLUTANT LOADING(S)

- Permittees shall provide estimated allowable loadings from MS4 discharges expressed as concentration-based or mass-based in consideration of critical conditions. Mass-based allowable loading will be calculated based on

a permittee's proportion of the watershed management area for required WQBELs. Mass-based allowable loading should be calculated for each subwatershed area identified in Section B, above.

- The difference between the current and allowable pollutant loading at each implementation deadline is the required pollutant reduction at each implementation deadline. The required pollutant reduction should be calculated based on both long-term average condition and the selected critical condition (as described in Section B). For modeled drainage areas where 100% of the runoff volume from the 85th percentile, 24-hour storm event is not retained, the required pollutant reduction shall be used to set targets/goals for BMPs/watershed control measures within that subwatershed area. The percent reductions to be used to set targets/goals will be dependent on the phase(s) of implementation to be addressed, as described in Section E.
- Estimated allowable loading and required reductions should be expressed on a pollutant-by-pollutant basis consistent with the relevant averaging period(s)/duration (including the selected critical condition) in applicable TMDLs and Attachments L-R.

D. SELECTED IMPLEMENTATION/BMPs OPTIONS

Permittees shall identify strategies, control measures, and BMPs to implement through their selected storm water management programs as listed below. As a starting point, selected control measurements should be designed and maintained to treat storm water runoff from the 85th percentile, 24-hour storm where feasible and necessary to achieve applicable WQBELs and receiving water limitations.

I. ENHANCED WATERSHED MANAGEMENT PROGRAM (EWMP)

a) DETAILED DESCRIPTION OF DRAINAGE AND RETENTION SYSTEMS

If the permittees select to develop a EWMP that includes projects that retain all non-storm water runoff and all storm water runoff from the 85th percentile, 24-hour storm event for the drainage areas tributary to the projects, the permittees are required to provide a detailed description of each regional multi-benefit retention system including type (bioretention system, sub-surface chamber, etc.), drainage area addressed, storage volume, and approximate system size as well as a description and quantification, where possible, of other benefits (e.g., amount of water recharged to groundwater for water supply, etc.).

b) PROPOSED WATERSHED CONTROL MEASURES TO CONTROL STORM AND NON-STORM WATER DISCHARGES

In drainage areas within the EWMP area where retention of 85th percentile, 24-hour storm event is not pursued, the permittees are required to identify watershed control measures that will be implemented in addition to existing BMPs to prevent or eliminate non-storm water discharges that are a source of pollutants to receiving waters, and to achieve all applicable interim and final water quality-based effluent limitations and all receiving water limitations. Watershed control measures may include:

i. Structural and/or non-structural controls and operation and maintenance procedures that are designed to achieve applicable water quality-based effluent limitations and receiving water limitations;

ii. Retrofitting areas of existing development known or suspected to contribute to the highest water quality priorities with regional or sub-regional controls or management measures; and

iii. Stream and/or habitat rehabilitation or restoration projects where stream and/or habitat rehabilitation or restoration are necessary for, or will contribute to, demonstrable improvements in

the physical, chemical, and biological receiving water conditions and restoration and/or protection of water quality standards in receiving waters.

c) STORM WATER MANAGEMENT PROGRAM MINIMUM CONTROL MEASURES (MCMs), NON-STORM WATER DISCHARGE CONTROLS, AND OTHER STRUCTURAL CONTROL MEASURES

Per Part VI.C.5.b.iv.(1), permittees shall assess the MCMs as defined in Part VI.D.4, Part VI.D.5, Part VI.D.6, Part VI.D.8, Part VI.D.9 and Part VI.D.10 of the MS4 Permit and potential modifications that will most effectively address priority issues in each watershed. Based on this assessment, permittees may choose to propose customized actions and corresponding schedules within each of the abovementioned minimum control measure categories. (Alternatively, permittees may choose to implement the baseline provisions within one or more of the abovementioned MCM categories.)

Per Part VI.C.5.b.iv.(2), where non-storm water discharges from the MS4 are identified as source of pollutants, permittees shall identify and list control measures, BMPs, and other strategies to effectively eliminate the source of pollutants consistent with the requirements of Part III.A and Part VI.D.4.d (for the LACFCD) and Part VI.D.10 (for all other permittees).

For TMDL related control measures, per Part VI.C.5.b.iv.(3), permittees shall also compile a list of control measures that have been identified in TMDLs and corresponding implementation plans, and identify those control measures within these TMDLs/implementation plans to be modified, if any, to most effectively address TMDL requirements in Part VI.E and Attachments L-R. If actions identified in the E/WMP are wholly replacing the control measures identified in the TMDL implementation plan, it can be noted as such and this list is not necessary. If not sufficiently identified in previous documents (TMDLs/implementation plans), the permittees shall evaluate and identify the control measures that will be implemented to achieve the applicable WQBELs/WLAs/RWLs associated with these TMDLs. At a minimum where possible, control measures should be designed to address the volume within the drainage area associated with the 85th percentile, 24-hour storm event at the correspondence compliance point.

II. WATERSHED MANAGEMENT PROGRAM (WMP)/INDIVIDUAL WMP

a) PROPOSED WATERSHED CONTROL MEASURES TO ADDRESS CONTRIBUTIONS OF STROM WATER DISCHARGES TO RECEIVING WATER

The permittees are required to identify watershed control measures that will be implemented in addition to existing BMPs to prevent or eliminate non-storm water discharges that are a source of pollutants to receiving waters, and to achieve all applicable interim and final water quality-based effluent limitations and all receiving water limitations. (See section D.I.b. for detail.)

b) STORM WATER MANAGEMENT PROGRAM MINIMUM CONTROL MEASURES (MCMs)

See section D.I.c. for detail.

E. SPECIFIED SCHEDULE OF SELECTED WATERSHED MANAGEMENT STRATEGIES

Permittees shall translate corresponding schedules for selected BMPs into a combined schedule for achievement of the applicable interim and final water quality-based effluent limitations and/or receiving water limitations per the water body classification/prioritization above. Permittees shall align the combined schedule

with interim milestones and interim and final compliance deadlines specified in the permit and demonstrate through the RAA that the required loading reductions will be achieved in the timeline(s) specified.

- Permittees shall identify interim milestones and dates for their achievement to ensure adequate progress toward achieving interim and final water quality-based effluent limitations and/or receiving water limitations deadlines identified in TMDL provisions in Part VI.E and attachments L - R. If selected BMPs will address multiple pollutants then BMPs must be implemented within time frame that is consistent with the most critical/closest deadline.
- Where the TMDL does not include interim or final water quality-based effluent limitations and/or receiving water limitations with compliance deadlines *during the permit term*, Permittees shall identify interim milestones and dates for their achievement and include these in the RAA to ensure adequate progress toward achieving interim and final water quality-based effluent limitations and/or receiving water limitations with deadlines beyond the permit term.
- For interim WQBELs and/or receiving water limitations, the percent reduction based on annual average baseline loading may be used to set targets/goals for BMPs/watershed control measures where such percent reduction based on the annual average baseline loading is consistent with interim requirements as set forth in Part VI.E and Attachments L-R. A gradual phasing of percent load reduction for interim WQBELs/RWLs to final WQBELs/RWLs shall be applied over the course of the implementation schedule. For areas to be addressed through retention of the runoff volume from the 85th percentile, 24-hour storm, volume reductions over time shall be related to the interim and final milestones/deadlines.
- Permittees shall demonstrate that the activities and control measures identified in the Watershed Control Measures will achieve applicable receiving water limitations for water body-pollutant combinations not addressed by TMDLs as soon as possible. Per Part VI.C.5.c.ii and Part VI.C.4.c.iii.(3), Permittees must propose milestones based on measurable criteria and a schedule with dates for achieving the milestones that will allow progress to be measured once every two years.

F. POLLUTANT REDUCTION PLAN

a) COMPLIANCE DETERMINATION

- Compliance points shall be located at all compliance points required in the TMDLs that are within the area covered by the E/WMP.
- For a Permittee implementing an individual WMP, appropriate compliance point(s) within their jurisdiction shall be identified for Regional Board approval.
- Permittees shall include an appropriate compliance point(s) to assess the MS4 discharge(s) from the area covered by the Watershed Management Program to the Receiving Water(s)

b) EVALUATION OF SELECTED MANAGEMENT PROGRAM/BMPs PERFORMANCE

- Permittees shall provide a detailed description of individual BMPs performance and /or suite of selected BMPs performance to reduce pollutant loadings that are used as model inputs. Data on performance of watershed control measures shall be drawn only from peer-reviewed sources.
- The estimated effectiveness of BMPs in pollutant removal and/or reduction will served as a default value that can be updated through the adaptive management process with BMP monitoring data and outfall monitoring data when they become available.

c) ANALYSIS TO DEMONSTRATE SELECTED BMPs HAVE REASONABLE ASSURANCE TO MEET INTERIM/FINAL REQUIREMENTS

Based on the analysis of BMP performance using the selected modeling system, Permittees shall demonstrate that:

- Implementation of current/selected activities and control measures identified in section D above will achieve applicable water quality-based effluent limitations and/or receiving water limitations in Part VI.E and Attachments L-R.

  Although the Permit only requires the RAA to consider WQBELs and receiving water limitations with interim and final deadlines/milestones that fall within the Permit term, it is strongly recommended that the RAA assess WQBELs and RWLs with deadlines occurring between program approval and December 28, 2022. Additionally, where the TMDL does not include interim or final water quality-based effluent limitations and/or receiving water limitations with compliance deadlines *during the permit term*, Permittees must identify interim milestones and dates for their achievement to ensure adequate progress toward achieving interim and final water quality-based effluent limitations and/or receiving water limitations with deadlines beyond the permit term and must include these in the RAA.

- For water-body pollutant combinations not addressed by TMDLs, the activities and control measures identified in the Watershed Control Measures will achieve applicable receiving water limitations per Part V.A.

Permittees shall provide model output for each deadline specified in Attachments L-R within the permit term to demonstrate compliance with each deadline will be achieved.

d) PROCESS OF INCORPORATING ADDITIONAL BMPs IF MILESTONE ARE NOT MET AS SCHEDULED

- Permittees in each WMA shall develop an integrated monitoring program or coordinated integrated monitoring program to assess progress toward achieving the water quality-based effluent limitations and/or receiving water limitations per the compliance schedules, and progress toward addressing the water quality priorities for each WMA.
- Permittees in each WMA shall implement an adaptive management process every two years after program approval to assess progress toward (i) achieving interim and/or final water quality-based effluent limitations and/or receiving water limitations; (ii) achievement of interim milestones; (iii) re-evaluation of the water quality priorities identified for the WMA based on more recent water quality data and reassessment of sources of pollutants in MS4 discharges; and (iv) evaluation of effectiveness of the control measures based on new information and data.
- Permittees shall report and then implement any modifications to the WMP or EWMP based on the results of the adaptive management process to improve the effectiveness of WMP or EWMP in reducing pollutant loading upon approval by the Regional Executive Officer, or within 60 days of submittal if the Regional Water Board Executive Officer expresses no objections.

G. MODELING REQUIREMENTS FOR REASONABLE ASSURANCE ANALYSIS TO SUPPORT ESTIMATION OF CURRENT LOADINGS, REQUIRED LOAD REDUCTIONS AND ANALYSIS OF WATER QUALITY OUTCOMES OF SELECTED BMPs OPTIONS

Permittees shall provide a modeling system to support the estimation of baseline loadings, required load reductions that are used to set targets/goals for selected BMPs/watershed control measures, and to demonstrate that the activities and watershed control measures identified/selected in the E/WMP will achieve applicable water quality-based effluent limitations and receiving water limitations by applicable compliance deadlines.

The models appropriate for conducting the required RAA described above are listed in **Table 1.** These models are selected based on the following model capabilities:

(1) Dynamic continuous long-term simulation for modeling pollutant loadings, flows, and concentrations in receiving water from lands in a watershed system.
(2) Can represent rainfall and runoff processes above soil surface, and baseflow contributions in subsurfaces of urban and natural watershed systems.
(3) Can represent variability in pollutant loadings, based on land use, soil hydrologic group, and slope.
(4) BMP process based approach or empirically based BMP approach.
(5) Decision support to evaluate BMP performance
Permittees may select a combination of the models listed in model type 1.1-1.3 of Table 1 for land/watershed, receiving water, and BMP performance models, or select one of the modeling systems from integrated modeling systems listed in model type 1.4 of Table 1.

Table 1. List of Available Models

Model Type	Available Models
1.1 Land/Watershed Models	
	HSPF, LSPC, SWMM, WARMF
1.2 Receiving Water Models	
	EFDC, CE-QUAL-ICM/TOXI, QUAL2K, WASP, HSPF, LSPC, SWMM
1.3 BMP Performance Models	
* Process based models	SWMM BMP model BASINS BMP model EPA SUSTAIN model
* Empirically based models	International Stormwater BMP Database
1.4 Integrated BMP Modeling Systems	
* Process based models	EPA SUSTAIN model

Model Type	Available Models
* Empirical based models	Los Angeles County WMMS model EPA TMDL Modeling Toolbox City of Los Angeles SBPAT model

The modeling requirements consist of four primary components which are described as in the following Tables. The four components of modeling requirements are general model input data (Table 2), model parameters (Tables 3.1-3.3), BMP performance parameters (Tables 4.1-4.2), and model output (Table 5). For model parameters and BMP performance parameters, two separate tables are provided for a process based BMP model and an empirically based BMP model. It should be noted that the model requirements are the minimum requirements for a BMP performance evaluation since the specific performance measures vary depending on the designated use of the water body and the condition of the water body. Permittees shall cover all necessary requirements for a BMP performance evaluation based on input and recommendations from the TAC as approved by the Regional Board. With regard to the spatial scale, the highest resolution GIS layers should be used to satisfy the homogeneous assumption in a computational/modeled subwatershed. (See **Appendix C** for a technical memorandum on the use of the County of Los Angeles' Proposed HUC-12 Equivalent Boundaries in the RAA.) For temporal scale, the model should use varying time steps with a minimum 1-hour or shorter time step during rainfall events to capture peak flow and a daily or shorter time step between rainfall events.

The RAA associated with the permittee(s) draft E/WMP should include a detailed description/itemization of model inputs and outputs as indicated in Table 2 through Table 5 and should include model input files (in an electronic format that can be manipulated) as part of the draft E/WMP package submitted to Regional Board for review and approval.

Table 2. General Model Input Data for Both Process Based BMP Models and Empirically Based BMP Models

For General Model	Data Source	Data Period
2.1 Geometric Data		
• GIS Data Layer	State of California GeoPortal, Cal-Atlas Geospatial Data Library (previously CalSIL – California Spatial Information Library)/CERES and other public agencies	Most recent
• Topography Layer (DEM Data)	USGS National Elevation Dataset (NED) or locally derived data	Most recent
• Land Use/Land Cover Layer[4]	SCAG Land use data; Multi-Resolution Land Characteristics Consortium (MRLC) National Land Cover Database (NLCD) or locally derived data	SCAG Land use data (2005 or most recent); NLCD (2006 or most recent)
• Stream Network	USGS National Hydrography Dataset (NHD) or locally derived data	Most recent
• Drainage areas	USGS Watershed Boundary Dataset (WBD) or locally derived data	Most recent
2.2 Meteorological Data		
• Precipitation	NOAA National Climatic Data Center (NCDC) or locally derived data	at least 10 years hourly
• Evaporation	NCDC or locally derived data	at least 10 years daily/monthly
2.3 Soil Hydrologic Data		
• Hydrologic soil groups	USDA/NRCS - Soil Survey Geographic Database (SSURGO)/ STATSGO2 or locally derived data	Most recent
• Percent of area distribution for	SSURGO or	Most recent

[4] Satellite imagery may be utilized but is not required.

For General Model	Data Source	Data Period
different soil groups.	locally derived data	
• Fraction of sand, silt, and clay for different soil groups.	SSURGO or locally derived data	Most recent
• Average Slope	SSURGO or locally derived data	Most recent
• Vegetative cover for different soil groups.	SSURGO or locally derived data	Most recent
2.4 Hydrologic Data		
• In-stream Flow	USGS and locally derived data	Daily/monthly/hourly based on availability
• In-stream Depth	USGS and locally derived data	Daily/monthly/hourly based on availability
2.5 Point Source Data		
• Point Source Location	EPA STORET data CIWQS/SMARTS or local sampling	All available data
• Point Source Discharge	EPA STORET data CIWQS/SMARTS or local sampling	Daily/monthly
• Point Source Concentration	EPA STORET data CIWQS/SMARTS or local sampling	Daily/monthly

To demonstrate the ability to predict the effect of watershed processes and management on land, soil, and receiving water body, model calibration and validation are necessary and critical steps in model application. The acceptable model calibration criteria as listed in Table 3.0 are provided to ensure the calibrated model properly assesses all the model parameters and modeling conditions that can affect model results. In addition, some valuable sources of initial starting values for many of the key calibration parameters are provided in Table 3.1 through Table 4.2 to facilitate model calibration efforts.

Model calibration is necessary to ensure that the calibrated model properly assesses all the variables and conditions in a watershed system. Calibration should result in model parameter values that produce the best overall agreement between simulated and observed values throughout the calibration period. Table 3.0 is a list of model calibration tolerances for different levels of agreement or accuracy based on extensive past experience with the HSPF model. The

lower bound of "fair" level of agreement listed in Table 3.0 is considered a target tolerance for the model calibration process. If model calibration results do not satisfy the target tolerances, additional efforts should be completed to investigate possible errors in, and the accuracy of, input data, model formulations, and field observations. The findings of this investigation should be presented in the RAA description, along with any immediate remedial actions to address the issues and/or recommended approaches to improve the calibration in the future. Permittees are strongly encouraged to engage Regional Board staff prior to the draft E/WMP submittal, in order to facilitate review and approval.

Table 3.0 Model Calibration Criteria

Model parameters	**% Difference between simulated and observed values**		
	Very Good	**Good**	**Fair (lower bound, upper bound)**
Hydrology/Flow	<10	10-15	15-25
Sediment	<20	20-30	30-45
Water Temperature	<7	8-12	13-18
Water Quality/Nutrients	<15	15-25	25-35
Pesticides/Toxics	<20	20-30	30-40

Based on HSPF experience by A.S. Donigian, Jr., prepared for USEPA (2000)

Table 3.1 Model Parameters for Process Based BMP Models

Model Parameters	Data Source[5]	Range of Initial Values
3.1.1 Hydrology Parameters		
• Fraction forest cover	EPA BTN#6	0-0.95
• Interception storage capacity (in)	EPA BTN#6	0.01-0.40
• Retention storage capacity (in)	EPA BTN#6	0.01-0.30
• Manning's n for overland flow	EPA BTN#6	0.01-0.15
• Upper zone nominal soil moisture storage (in)	EPA BTN#6	0.05-2.0

[5] EPA BTN # : EPA Basins Technical Note #

• Saturated hydraulic conductivity (in/hr)	Green-Ampt Parameters	0.01-4.74
• Wetting front suction head (in)	Green-Ampt Parameters	1.93-12.6
• Upper zone soil porosity (fraction)	Green-Ampt Parameters	0.398-0.501
• Field capacity (fraction)	Green-Ampt Parameters	0.062-0.378
• Wilting point (fraction)	Green-Ampt Parameters	0.024-0.265
• Temp below which ET is reduced by half (^{o}F)	EPA BTN#6	32.0-48.0
• Temp below which ET is set to zero (^{o}F)	EPA BTN#6	30.0-40.0
• Fraction of GW inflow to deep recharge	EPA BTN#6	0.0-0.50
• Fraction of remaining ET from baseflow	EPA BTN#6	0.0-0.20
• Fraction of remaining ET from active GW	EPA BTN#6	0.0-0.20
• Lower zone nominal soil moisture storage (in)	EPA BTN#6	2.0-15.0
• Interflow inflow parameter	EPA BTN#6	1.0-10.0
• Interflow recession parameter	EPA BTN#6	0.3-0.85
• Lower zone ET parameter	EPA BTN#6	0.1-0.9
3.1.2 Water Quality Parameters		
• Initial storage of water quality constituent on land surface (lb)	LA County Report[6]	0.0-0.0005
• Wash-off potency factor for sediment associated constituent (lb/ton)	EPA BTN#6	0.0-10.0
• Scour potency factor for sediment associated constituent (lb/ton)	EPA BTN#6	NA
• Accumulation rate of water quality constituent of land surface(lb/acre/day)	EPA BTN#6	0.0-0.0005
• Maximum storage of water quality • constituent on land surface(lb/acre/day)	EPA BTN#6	0.0-0.0005
• Rate of surface runoff that removes 90% of stored water quality constituent (in/hr)	EPA BTN#6	0.0-0.5
• General first order in-stream loss rate of constituent (1/day)	SUSTAIN manual	0.2-0.2

[6] LA County Report*: "Evaluation of Existing Watershed Models for the County of Los Angeles", August 29, 2008

3.1.3 Sediment Parameters		
• For pervious land		
• Coefficient in the soil detachment equation	EPA BTN#8	0.05-0.75
• Exponent in the soil detachment equation	EPA BTN#8	1.0-3.0
• Coefficient in the sediment wash-off equation	EPA BTN#8	0.1-10.0
• Exponent in the sediment wash-off equation	EPA BTN#8	1.0-3.0
• Coefficient in the sediment scour equation	EPA BTN#8	0.0-10.0
• Exponent in the sediment scour equation	EPA BTN#8	1.0-5.0
• For impervious land		
• Coefficient in the solids wash-off equation	EPA BTN#8	0.1-10.0
• Exponent in the solids wash-off equation	EPA BTN#8	1.0-3.0
• Solids accumulation rate on the land surface (lb/ac-day)	EPA BTN#8	0.0-30.0
• Fraction of solids removed from land surface per day (1/day)	EPA BTN#8	0.01-1.0

Table 3.2 Model Parameters for Empirically Based BMP Models

Model Parameters	Data Source	Range of Values
3.2.1 Hydrology Parameters		
• Interception storage capacity (in)	EPA BTN#6	0.01-0.40
• Retention storage capacity (in)	EPA BTN#6	0.01-0.30
• Manning's n for overland flow	EPA BTN#6	0.05-0.5
• Upper zone nominal soil moisture storage (in)	EPA BTN#6	0.05-2.0
• Saturated hydraulic conductivity (in/hr)	Green-Ampt Parameters	0.01-4.74
• Wetting front suction head (in)	Green-Ampt Parameters	1.93-12.6
• Upper zone soil porosity (fraction)	Green-Ampt Parameters	0.398-0.501
• Field capacity (fraction)	Green-Ampt Parameters	0.062-0.378
• Wilting point (fraction)	Green-Ampt Parameters	0.024-0.265
• Temp below which ET is reduced by half (^{o}F)	EPA BTN#6	32.0-48.0
• Temp below which ET is set to zero (^{o}F)	EPA BTN#6	30.0-40.0
• Fraction of remaining ET from baseflow	EPA BTN#6	0.0-0.20
• Lower zone nominal soil moisture storage (in)	EPA BTN#6	2.0-15.0
• Interflow inflow parameter	EPA BTN#6	1.0-10.0
• Interflow recession parameter	EPA BTN#6	0.3-0.85
• Lower zone ET parameter	EPA BTN#6	0.1-0.9
B.3.2.2 Water Quality Parameters		
• Event Mean Concentration (EMC)	SBPAT User's Guide	See Table 3.3
B3.2.3 Sediment Parameters		
For pervious land		
• Coefficient in the soil detachment equation	EPA BTN#8	0.05-0.75
• Exponent in the soil detachment equation	EPA BTN#8	1.0-3.0

• Coefficient in the sediment wash off equation	EPA BTN#8	0.1-10.0
• Exponent in the sediment wash-off equation	EPA BTN#8	1.0-3.0
• Coefficient in the sediment scour equation	EPA BTN#8	0.0-10.0
• Exponent in the sediment scour equation	EPA BTN#8	1.0-5.0
For impervious land		
• Coefficient in the solids wash-off equation	EPA BTN#8	0.1-10.0
• Exponent in the solids wash-off equation	EPA BTN#8	1.0-3.0
• Solids accumulation rate on the land surface (lb/ac-day)	EPA BTN#8	0.0-30.0
• Fraction of solids removed from land surface per day (1/day)	EPA BTN#8	0.01-1.0

Table 3.3 Suggested Average[7] EMC by land use for selected pollutants

Land Use	Nitrate (mg/L)	Total Copper (µg/L)	Total Lead (µg/L)	Total Zinc (µg/L)	Fecal Coliform (MPN/100ml)	TSS (mg/L)
Agriculture	34.4	100.1	30.2	274.8	6.03E+4	999
Commercial	0.55	31.4	12.4	237.1	7.99E+4	67.0
Educational	0.61	19.9	3.6	117.6	7.99E+4	99.6
Industrial	0.87	34.5	16.4	537.6	3.76E+3	219
Transportation	0.74	52.2	9.2	292.9	1.68E+3	77.8
Open Space	1.17	10.6	3.0	26.3	6.31E+3	216.6
SF Residential	0.78	18.7	11.3	71.9	3.11E+4	124.2
MF Residential	1.51	12.1	4.5	125.1	1.18E+4	39.9

Source: Technical Appendices "A User's Guide for the Structural BMP Prioritization and Analysis Tool (SBPAT v1.0)" for Los Angeles City, County, and Heal the Bay, December 2008

Note: These suggested average EMC values can be adjusted based on calibration studies by using more recently collected Southern California data.

[7] The average values are based on arithmetic statistics. The related log-form statistics are referred to in Appendix C of the SBPAT technical report.

Table 4.1 Suggested BMP Performance Parameters for Process Based BMP Model

4.1 BMP Performance Parameters	Rain Barrel	Bio-Retention	Porous Pavement	Dry Infiltration Basin
• Media final constant infiltration rate (in/h)	NA	0.5-0.5	0.5-1.0	1.0-1.0
• Substrate layer porosity	NA	0.4-0.5	0.45-0.5	0.3-0.4
• Substrate layer field capacity	NA	0.25-0.3	0.055-0.2	0.06-0.3
• Substrate layer wilting point	NA	0.1-0.15	0.05-0.05	0.02-0.15
• Underdrain gravel layer porosity	NA	0.5	0.5	0.5
• Vegetative parameter, A	NA	0.6-1.0	1.0	0.6
• Underdrain background infiltration Rate (in/hr)	NA	0.1-0.3	0.1	0.25-0.3
• TSS 1st order decay rate (1/day)	0.2-0.8	0.2-0.8	0.2-0.8	0.2-0.8
• Fecal Coliform 1st order decay rate (1/day)	0.5	0.5	0.5	0.5
• TSS Filtration removal rate (%)	NA	85	60	85

Source: PA Report "SUSTAIN-A Framework for Placement of Best Management Practices in Urban Watersheds to Protect Water Quality, September 2009, EPA/600/R-09/095

Note that values in this Table can be adjusted based on calibration studies with recently collected Southern California data.

Table 4-2: Suggested BMP Performance Parameters for Empirically Based BMP Model

Median (95% Conf. Interval) Statistics of BMP Effluent Concentration.	Bio-Retention	Bio-Swale	Detention Basin	Filter Strip	Manu-fractured Device	Media Filter	Porous Pavement	Retention Pond	Wetland Basin	Wetland Channel
Fecal Coliform # Per 100 mL	NA	2600-6200	500-1900	300-39600	(10,20)-D (200-3000)-F (1400-5000)-P	200-625	NA	200-1160	230-11800	NA
Enterococcus # Per 100 mL	58-437	NA	NA	NA	(10,10)-D (1750-	NA	NA	NA	56-300	NA

Median (95% Conf. Interval) Statistics of BMP Effluent Concentration.	Bio-Retention	Bio-Swale	Detention Basin	Filter Strip	Manu-fractured Device	Media Filter	Porous Pavement	Retention Pond	Wetland Basin	Wetland Channel
					12000)-FNA-P					
E. Coli # Per 100 mL	6-137	1200-5900	82-720	NA	NA	NA	NA	31-387	199-1160	NA
TSS (mg/L)	5.0-9.0	11.8-15.3	19.0-26.0	16.0-21.5	15.0-19.9	7.4-10.0	11.0-14.4	12.0-15.0	7.0-10.9	10.0-16.0
Total Phosphorus (mg/L)	0.07-0.1	0.17-0.20	0.19-0.24	0.15-0.20	0.10-0.13	0.08-0.10	0.08-0.09	0.12-0.14	0.07-0.09	0.13-0.17
Dissolved Phosphorus (mg/L)	0.05-0.18	0.05-0.11	0.08-012	0.16-0.26	0.04-0.07	0.06-0.09	0.04-0.05	0.06-0.07	0.03-0.06	0.07-0.10
Total Nitrogen (mg/L)	0.74-0.99	0.63-0.82	1.75-2.69	1.0-1.23	1.90-2.41	0.68-0.99	1.28-1.65	1.19-1.36	1.04-1.21	1.05-1.56
Total Kjeldahl Nitrogen (mg/L)	0.46-0.72	0.50-0.70	1.16-1.78	0.97-1.12	1.32-1.55	0.50-0.61	0.74-0.90	0.98-1.10	0.92-1.09	1.10-1.30
NOx(NO2+NO3,anddNO3) (mg/L)	0.19-0.25	0.20-0.28	0.24-0.45	0.24-0.31	0.35-0.44	0.46-0.57	0.59-0.77	0.15-0.20	0.05-0.11	0.15-0.22
Total Copper (µg/L)	4.6-9.85	5.7-7.7	4.0-6.80	6.4-7.9	7.94-11.0	5.1-6.6	6.8-8.1	4.06-5.0	3.0-4.0	3.61-5.20
Total Lead (µg/L)	2.5-2.5	1.8-2.29	2.15-4.3	1.3-2.2	3.8-5.16	1.3-2.0	1.38-2.21	2.0-3.0	1.0-1.55	1.40-3.11
Total Zinc (µg/L)	7.7-25.0	20-26.6	17.1-38.2	16.0-26.0	52.8-63.5	15.0-20.0	12.5-16.8	20.0-23.0	16.7-24.3	11.0-20.0
Total Arsenic (µg/L)	NA	0.95-1.30	1.29-1.80	0.55-1.20	1.0-2.4	0.61-1.0	2.5-2.5	0.54-1.15	NA	NA
Total Cadmium (µg/L)	0.25-1.0	0.27-0.34	0.25-0.35	0.09-0.20	0.20-0.31	0.1-0.2	0.25-0.25	0.20-0.29	0.10-0.20	0.19-0.50

Median (95% Conf. Interval) Statistics of BMP Effluent Concentration.	Bio-Retention	Bio-Swale	Detention Basin	Filter Strip	Manu-fractured Device	Media Filter	Porous Pavement	Retention Pond	Wetland Basin	Wetland Channel
Total Nickel (µg/L)	NA	2.3-4.2	2.2-3.75	2.4-3.1	3.11-5.0	2.0-2.6	1.40-1.80	2.0-2.60	NA	2.0-2.40

Source: International Stormwater BMP Database (BMPDB), July 2012
Note that for bacteria, manufactured devices are broken down into three subcategories: disinfection devices (Manufactured Device – D), inlet insert/filtration devices (Manufactured Device – F), and physical settling/straining devices (Manufactured Device – P)
Note that values in this Table can be adjusted based on calibration studies with recently collected Southern California data.

Table 5: Model Output for both Process Based BMP Models and Empirically Based BMP Models

Model Output	Output Content	Output Format
5.1 Current/Existing Pollutant Loadings		
	Current pollutant loadings at each modeled sub-watershed and each land use, under range of temporal conditions (i.e., average and critical conditions)	Tables
5.2 Load Reduction Output		
	Pollutant load reduction at each modeled sub-watershed for each BMP scenario (corresponding to applicable compliance deadlines) in dry and wet weather conditions (i.e., average and critical conditions)	Tables
	Time series plots of pollutant load reduction for each BMP scenario at compliance points	Graphics
5.3 Surface Runoff Output		
	Surface runoff volume at each modeled subwatershed for each BMP scenario in dry and wet weather conditions (i.e., average and critical conditions)	Tables
	Absolute and percent reduction in runoff volume at each modeled subwatershed for each BMP scenario	Tables
5.4 Hydrographs and Pollutographs		
	Flow hydrographs at compliance points within the EWMP/WMP for each BMP scenario	Graphics

Model Output	Output Content	Output Format
	Pollutographs at compliance points within the EWMP/WMP for each BMP scenario	Graphics
5.5 BMP Performance Summary		
	Load comparison for with and without BMPs and graphs for each BMP scenario	Tables and Graphics
	BMP storage distribution for each BMP scenario	Tables and Graphics

APPENDIX A

Appendix A
Interim and Final TMDL Compliance Deadlines
(Through December 28, 2017)

TOTAL MAXIMUM DAILY LOADS (TMDL)	Final Compliance date has Passed	Interim Deadlines prior to Permit effective date (Dec. 28, 2012)	Interim Deadline within 6 months of Permit effective date (June 28, 2013)	Interim Deadline within 12 months of Permit effective date (Dec. 28, 2013)	Interim Deadline within 18 months of Permit effective date (June 28, 2014)	Interim Deadline within 22 months of Permit effective date (Oct. 28, 2014)	Interim Deadline within 28 months of Permit effective date (April 28, 2015)	Interim Deadline within 36 months of Permit effective date (Dec. 28, 2015)	Interim Deadline within 40 months of Permit effective date (April 28, 2016)	Interim Deadline within 48 months of Permit effective day (Dec. 28, 2016)	Interim Deadline within 60 months of Permit effective date (Dec. 28, 2017)
Santa Clara River Nitrogen Compounds TMDL	March 23, 2004										
Upper Santa Clara River Chloride TMDL	April 6, 2010										
Lake Elizabeth, Munz Lake, and Lake Hughes Trash TMDL (Lake Elizabeth only)		March 6, 2012	March 6, 2013		March 6, 2014		March 6, 2015		March 6, 2016*		
Santa Clara River Estuary and Reaches 3, 5, 6, and 7 Indicator Bacteria TMDL											
Dry Weather									March 21, 2016		
Wet Weather									March 21, 2016		
Santa Monica Bay Beaches Bacteria TMDL											
Summer Dry Weather	July 15, 2006										
Winter Dry Weather	July 15, 2009										
Wet Weather - 10%, 25% Reduction (respectively)											
Jurisdictional Groups 1 and 4		July 15, 2009		July 15, 2013							
Jurisdcitional Groups 2 and 3		July 15, 2009		July 15, 2013							
Jurisdictional Groups 5 and 6		July 15, 2009		July 15, 2013							
Jurisdictional Group 7											
Santa Monica Bay Nearshore and Offshore Debris TMDL									March 20, 2016		March 20, 2017
Santa Monica Bay TMDL for DDTs and PCBs	March 26, 2012										
Malibu Creek and Lagoon Bacteria TMDL											
Summer Dry Weather	January 24, 2009										
Winter Dry Weather	January 24, 2012										
Wet Weather											
Malibu Creek Watershed Trash TMDL				July 7, 2013		July 7, 2014		July 7, 2015		July 7, 2016	July 7, 2017*
Malibu Creek Watershed Nutrients TMDL	March 21, 2003										
Ballona Creek Trash TMDL		September 30, 2012		September 30, 2013		September 30, 2014		Septmeber 30, 2015*			
Ballona Creek Estuary Toxic Pollutants TMDL			January 11, 2013				January 11, 2015				January 11, 2017
Ballona Creek, Ballona Estuary and Sepulveda Channel Bacteria TMDL											
Dry Weather	April 27, 2013										
Wet Weather											
Ballona Creek Metals TMDL											
Dry Weather		January 11, 2012			January 11, 2014				January 11, 2016*		
Wet Weather		January 11, 2012							January 11, 2016		
Ballona Creek Wetlands TMDL for Sediment and Invasive Exotic Vegetation	March 26, 2012										
Marina del Rey Harbor Mothers' Beach and Back Basins Bacteria TMDL											
Dry Weather	March 18, 2007										
Wet Weather											
Marina del Rey Harbor Toxic Pollutants TMDL - TMDL Specific Implementation					March 22, 2014				March 22, 2016*		
Marina del Rey Harbor Toxic Pollutants TMDL - Integrated Resources Approach			March 22, 2013				March 22, 2015				March 22, 2017
Los Angeles Harbor Bacteria TMDL	March 10, 2010										
Machado Lake Trash TMDL		March 6, 2012	March 6, 2013		March 6, 2014		March 6, 2015		March 6, 2016*		
Machado Lake Nutrient TMDL		March 11, 2009			March 11, 2014						
Machado Lake Pesticides and PCBs TMDL											
Dominguez Channel and Greater LA and LB Harbor Waters Toxic Pollutants TMDL		March 23, 2012									
Los Angeles River Watershed Trash TMDL		September 30, 2012		September 30, 2013		September 30, 2014		September 30, 2015		September 30, 2016*	
Los Angeles River Nitrogen Compounds and Related Effects TMDL	March 23, 2004										
Los Angeles River and Tributaries Metals TMDL											
Dry Weather		January 11, 2012									
Wet Weather		January 11, 2012									
Los Angeles River Watershed Bacteria TMDL											
Dry Weather (Interim Compliance dates range from 10 to 25 years)											
Wet Weather (March 23, 2037)											
Legg Lake Trash TMDL		March 6, 2012	March 6, 2013		March 6, 2014		March 6, 2015		March 6, 2016*		
Long Beach City Beaches and Los Angeles River Estuary Bacteria TMDL	March 26, 2012										
Los Angeles Area Lakes TMDLs	March 26, 2012										
San Gabriel River and Impaired Tributaries Metals and Selenium TMDL	March 26, 2007										
Los Cerritos Channel Metals TMDL	March 17, 2010										
Colorado Lagoon OC Pesticides, PCBs, Sediment Toxicity, PAHs, and Metals TMDL		July 28, 2011									

Final Compliance Date has Passed

7 Trash TMDLs

USEPA established TMDLs

* Final Complinace Date

APPENDIX B

Appendix B
Summary of TMDL Critical Conditions Relevant to MS4 Discharges

TMDL Name	Type of Pollutant(s)	Critical Condition	Critical Condition Metric	WLA Expression
SANTA CLARA RIVER WATERSHED MANAGEMENT AREA				
Santa Clara River Nitrogen Compounds	Nutrients	Low flow condition (driest 6 months of the year)	Flow 7Q10	Daily maximum and thirty-day average
Upper Santa Clara River Chloride	Chloride	Low flow/drought condition; when water supply in Castaic Lake is >=80 mg/L	Flow	Daily maximum; monthly-average (3-month or 12-month average depending on specific reach)
Lake Elizabeth, Munz Lake, and Lake Hughes Trash	Trash	Major rain event; National Weather Service wind advisories; and high visitation conditions	>0.25 inch rain event; NWS wind advisories	Zero trash (annual discharge)
Santa Clara River Estuary and Reaches 3,5,6, and 7 Indicator Bacteria	Bacteria	90th percentile year in term of wet days (1995; 81 wet days)	# wet days in year (>=0.1 inch of precip + 3 days following event)	Exceedance day (daily); geometric mean
SANTA MONICA BAY WATERSHED MANAGEMENT AREA				
Santa Monica Bay Beaches	Bacteria	90th percentile year in term of wet days (1993; 75 wet days and 290 dry days)	# wet days in year	Exceedance day (daily); geometric mean
Santa Monica Bay Nearshore and Offshore Debris	Debris	Major rain event; NWS wind advisories; and high visitation conditions (weekends/holidays from Apr 15 - Oct 15)	>0.25 inch rain event; NWS wind advisories	Zero trash (annual discharge)/Zero plastic pellets
Santa Monica Bay DDT and PCBs	DDTs and PCBs	30-year long term condition/critical consumption rate 116g/d	excess cancer risks over a life time	annual load
Malibu Creek and Lagoon Bacteria	Bacteria	90th percentile year in terms of wet days (1993; 75 wet-weather days and 290 dry-weather days)	# wet and dry days in year	exceedance day (daily); geometric mean (6 weeks)
Malibu Creek Watershed Trash	Trash	Major rain event; NWS wind advisories; and high visitation conditions	>0.25 rain event; NWS wind advisories	Zero trash (annual discharge)

Appendix B
Summary of TMDL Critical Conditions Relevant to MS4 Discharges

TMDL Name	Type of Pollutant(s)	Critical Condition	Critical Condition Metric	WLA Expression
Malibu Creek Nutrient	Nutrients	Summer months from April 15 to November 15	Median summer flow value for 1998-2001 period (5.2 cfs)	Summer - daily load/ winter - concentration based
BALLONA CREEK SUBWATERSHED				
Ballona Creek Trash	Trash	Major rain event	>0.25 inch rain event	annual load
Ballona Metals	Metals in water	dry: median dry weather flow (17 cfs/6.3 cfs); wet: load duration curve	flow	daily load
Ballona Toxic Pollutants	Toxics (metals and organics) in sediment	long term average sediment deposition (10-year, 1991-2001)	sediment deposition	annual load
Ballona Bacteria	Bacteria	90th percentile year in terms of wet days (1993; 75 days)	# wet days in year	exceedance day (daily); geometric mean (6 weeks)
Ballona Creek Wetlands Sediment and Invasive Exotic Vegetation	Sediment and Invasive Exotic Vegetation	Not specified for purpose of meeting allocations	NA	annual and average daily mass load
MARINA DEL REY SUBWATERSHED				
Marina del Rey Harbor Mother's Beach and Back Basin Bacteria	Bacteria	90th percentile year in terms of wet days (1993; 75 days)	# wet days in year	exceedance day (daily); geometric mean (6 weeks)
Marina del Rey Harbor Toxic Pollutants	Toxics (metals, PCBs, and sediment)	Long-term average rainfall (1948-2000)	TSS average annual load	annual load
DOMINGUEZ CHANNEL WATERSHED MANAGEMENT AREA				
Los Angeles Harbor Bacteria	Bacteria	90th percentile year in terms of wet days (1993; 75 days)	# wet days in year	exceedance day (daily); geometric mean (6 weeks)
Machado Lake Trash	Trash	Major rain event; NWS wind advisories; and high visitation conditions (May 15-Oct 15)	>0.25 inch rain event; NWS wind advisories	Zero trash (annual load)
Machado Lake Nutrient	Nutrient	winter and spring in conjunction with storm events	Not specified	concentration-based (monthly average)

Appendix B
Summary of TMDL Critical Conditions Relevant to MS4 Discharges

TMDL Name	Type of Pollutant(s)	Critical Condition	Critical Condition Metric	WLA Expression
Machado Lake Pesticides and PCBs	Pesticides and PCBs	Wet-weather events	Not specified	concentration based (three-year average)
Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants	Toxics (metals, chlordane, dieldrin, toxaphene, Dodd, PCBs, PAHs, benthic, and toxicity)	Wet-weather events	90th percentile of annual flow rates from the estimated modeled flow rates (62.7 cfs for Dominguez Channel)	daily (Dominguez Channel freshwater/metals only) or annual load
LOS ANGELES RIVER WATERSHED MANAGEMENT AREA				
Los Angeles River Trash	Trash	major rain event	>0.25 inch rain event	annual discharge
Los Angeles River Nitrogen Compounds and Related Effects	Nutrients	Low flow condition during summer (driest 6 months of the year)	Not specified	Daily maximum and monthly average concentration
Los Angeles River Metals	Metals in water	1) Dry weather: dry-weather non-WRP flow; 2) Wet weather	Flow (wet weather is >=500 cfs)	daily load
Los Angeles River Bacteria	Bacteria	90th percentile year in terms of wet days in storm year - Nov 1 to Oct 31 (1993; 75 days)	# wet days in year	Annual allowable exceedance days (dry weather/wet weather)
Legg Lake Trash	Trash	Major rain event; NWS wind advisories; and high visitation on weekends and holiday from May 15 to October 15	>0.25 inch rain event; NWS wind advisories	Zero trash (annual discharge)
Long Beach City Beaches and Los Angeles River Estuary Bacteria	Bacteria	90th percentile year in terms of wet days (1993; 75 days)	# wet days in year	exceedance day (daily); geometric mean (rolling 30-day)
Los Angeles Area Lakes TMDLs	Nitrogen, phosphorus, mercury, trash, OC pesticides, and PCBs	refer to EPA TMDL for specific pollutant and waterbody	refer to EPA TMDL for specific pollutant and waterbody	refer to EPA TMDL for specific pollutant and waterbody
SAN GABRIEL RIVER WATERSHED MANAGEMENT AREA				
San Gabriel River and Impaired Tributaries Metals and Selenium	Metals and selenium	1) Dry weather: dry-weather non-WRP flow; 2) Wet weather (SGR R2 >=260 cfs; Coyote Ck >=156 cfs)	Flow	daily load

Appendix B
Summary of TMDL Critical Conditions Relevant to MS4 Discharges

TMDL Name	Type of Pollutant(s)	Critical Condition	Critical Condition Metric	WLA Expression
Los Angeles Area Lakes TMDLs	Nitrogen, phosphorus, mercury, trash, OC pesticides, and PCBs	refer to EPA TMDL for specific pollutant and waterbody	refer to EPA TMDL for specific pollutant and waterbody	refer to EPA TMDL for specific pollutant and waterbody
LOS CERRITOS CHANNEL AND ALAMITOS BAY WATERSHED MANAGEMENT AREA				
Los Cerritos Channel Metals	Metals	Wet weather (max daily flow >=23 cfs/90th percentile flow)	Flow	Daily load (based on Load duration curve)
Colorado Lagoon OC Pesticides, PCBs, Sediment Toxicity, PAHs, and Metals	OC Pesticides, PCBs, Sediment Toxicity, PAHs, and Metals	Not specified	Not specified	Concentration-based monthly average and mass-based annual load

Note: This is for informational purposes only; please consult the LA County MS4 Permit and the applicable Basin Plan TMDL language for regulatory requirements regarding critical conditions and application of waste load allocations.

APPENDIX C

CALIFORNIA
Water Boards

EDMUND G. BROWN JR.
GOVERNOR

MATTHEW RODRIQUEZ
SECRETARY FOR
ENVIRONMENTAL PROTECTION

Los Angeles Regional Water Quality Control Board

To: Los Angeles County MS4 Permittees

FROM: Renee Purdy RAP
Section Chief
Regional Programs

DATE: March 24, 2014

SUBJECT: LOS ANGELES COUNTY HUC-12 EQUIVALENT TECHNICAL MEMORANDUM

As discussed at the October 23, 2013 Technical Advisory Committee meeting of the LA County MS4 Permit, the County of Los Angeles has refined the USGS Watershed Boundary Dataset (WBD) hydrologic unit delineations within Los Angeles County based on local data and has developed HUC-12 equivalent boundaries that are more hydrologically accurate. The California Regional Water Quality Control Board, Los Angeles Region (Regional Board) has reviewed the County's proposed HUC-12 equivalent boundaries relative to the national HUC-12 boundaries. The Regional Board has also reviewed the two sets of boundaries in comparison with the watershed group boundaries that have been established by the MS4 Permittees in their notifications of intent to develop a WMP or EWMP.

Through this memorandum, the Regional Board hereby accepts the use of the HUC-12 equivalent boundaries for purposes of conducting reasonable assurance analysis (RAA) and monitoring pursuant to requirements of the LA County MS4 Permit with the following conditions. First, Permittees must use either the national HUC-12 boundaries or the County's HUC-12 equivalent boundaries for both their RAA and monitoring program. Second, Permittees must clearly state in their draft WMP/EWMP whether their RAA and monitoring program is based on the national HUC-12 boundaries or the County's HUC-12 equivalent boundaries. Third, where Permittees elect to use the HUC-12 equivalents, they must coordinate with the neighboring WMP/EWMP groups to ensure that there are no gaps in the geographic areas addressed in the RAA or monitoring programs.

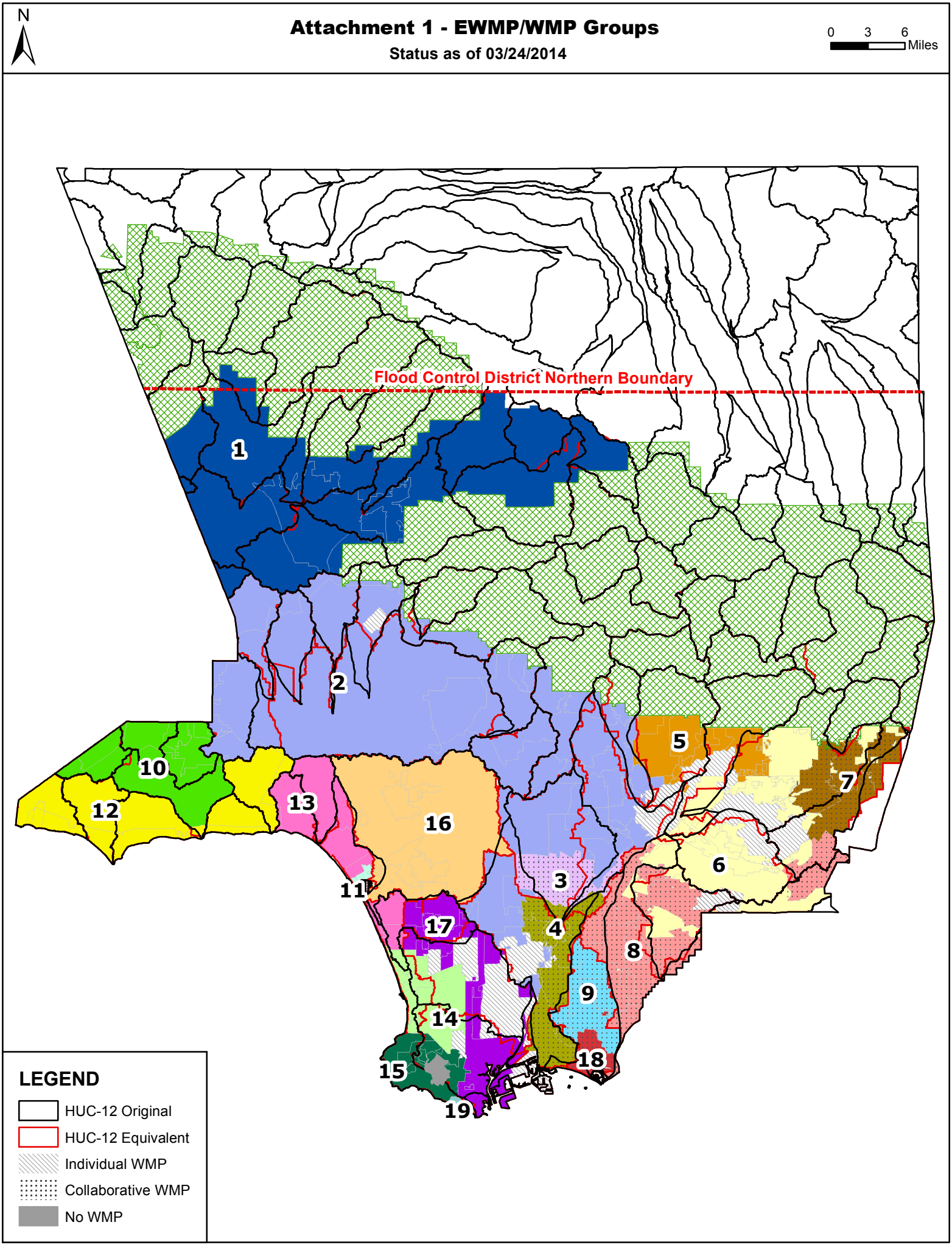
Regarding the third condition, the Regional Board notes that there are discrepancies in the areal coverage between the original HUC-12 and the HUC-12 equivalent areas that could lead to gaps in geographic coverage if neighboring WMP/EWMP groups are not using the same boundaries (see Attachment 1). Therefore, Permittees in the following WMP/EWMP groups (see Attachment 2) must coordinate to ensure coverage of all areas in the RAA:

1. Groups 2, 11, 13, 14, 16, 17, 19 and individual WMPs
2. Groups 3, 4, 8, 9 and 18
3. Groups 5, 6, 7 and individual WMPs

The boundaries of Groups 1, 10, 12, and 15 do not appear to be impacted by the use of the HUC-12 equivalent boundaries; however, groups should confirm this. There are subwatershed boundary changes within each of the groups, which may need to be considered in the RAA and in the development of CIMPs.

Should you have any questions, please do not hesitate to call me at (213) 576-6622 or Ivar Ridgeway at (213) 620-2150.

cc: Jun Zhu, RWQCB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Attachment 1 - EWMP/WMP Groups
Status as of 03/24/2014
0 3 6
Miles
Flood Control District Northern Boundary
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
LEGEND
HUC-12 Original
HUC-12 Equivalent
Individual WMP
Collaborative WMP
No WMP

Attachment 2 - WMP/EWMP GROUPS and INDIVIDUAL CITIES

Status as of 03/24/2014

Bold = Lead/Coordinator

	Group Name	Cities/Permittees Involved	Selected Plan	SD
1	Upper Santa Clara River Watershed	**Santa Clarita**, County, LACFCD	EWMP	5
2	Upper Los Angeles River Watershed Group	Alhambra, Burbank, Calabasas, Glendale, Hidden Hills, La Canada Flintridge, **Los Angeles**, Montebello, Monterey Park, Pasadena, Rosemead, San Gabriel, San Marino, South Pasadena, Temple City, County, LACFCD	EWMP	1, 2, 3, 5
3	Los Angeles River Upper Reach 2 Sub Watershed	Bell, Bell Gardens, Commerce, Cudahy, Maywood, **Huntington Park**, Vernon, LACFCD	WMP	1
4	Lower Los Angeles River Watershed	Downey, Long Beach, Lynwood, Paramount, Pico Rivera, **Signal Hill**, South Gate, LACFCD	WMP (w/ option to switch to EWMP)	1, 2, 4
5	Rio Hondo/San Gabriel River Water Quality Group	Arcadia, Azusa, Bradbury, Duarte, Monrovia, **Sierra Madre**, County, LACFCD	EWMP	1, 5
6	Upper San Gabriel River	Baldwin Park, Covina, Glendora, Industry, La Puente, **County,** LACFCD	EWMP	1, 4, 5
7	East San Gabriel Valley Watershed Management Area	Claremont, **La Verne**, Pomona, San Dimas	WMP	1, 5
8	Lower San Gabriel River	Artesia, Bellflower, Cerritos, Diamond Bar, Downey, Hawaiian Gardens, La Mirada, Lakewood, Long Beach, **Norwalk**, Pico Rivera, Santa Fe Springs, Whittier, LACFCD	WMP (w/ option to switch to EWMP)	4
9	Los Cerritos Channel Watershed Group	Bellflower, Cerritos, Downey, Lakewood, **Long Beach**, Paramount, Signal Hill, LACFCD	WMP (w/ option to switch to EWMP)	4
10	Malibu Creek Watershed Group	Agoura Hills, **Calabasas**, Hidden Hills, Westlake Village, County, LACFCD	EWMP	3
11	Marina del Rey	Culver City, Los Angeles, **County**, LACFCD	EWMP	2, 3, 4
12	North Santa Monica Bay Coastal Watersheds	**Malibu**, County, LACFCD	EWMP	3
13	Santa Monica Bay Watershed Jurisdictions 2 & 3	El Segundo, **Los Angeles,** Santa Monica, County, LACFCD	EWMP	3, 4
14	Beach Cities Watershed Management Group	Hermosa Beach, Manhattan Beach, **Redondo Beach**, Torrance, LACFCD	EWMP	4
15	Peninsula EWMP Agencies	Palos Verdes Estates, **Rancho Palos Verdes**, Rolling Hills Estates, County, LACFCD	EWMP	4
16	Ballona Creek	Beverly Hills, Culver City, Inglewood, **Los Angeles**, Santa Monica, West Hollywood, County, LACFCD	EWMP	2, 3, 4
17	Dominguez Channel Watershed Management Area Group	El Segundo, Hawthorne, Inglewood, **Los Angeles**, County, LACFCD	EWMP	2, 4
18	Alamitos Bay/Los Cerritos Channel Group	**County**, LACFCD	WMP	4
19	Santa Monica Bay Watershed Jurisdiction 7	**Los Angeles**, LACFCD	WMP	4

	City	Watershed Management Area	Compliance Method	SD
a	Carson	Dominguez Channel WMA	Individual WMP	2
b	Compton	LA River (Compton Creek) & Dominguez Channel	Individual WMP	2
d	El Monte	LA River and San Gabriel River	Individual WMP	1
e	Gardena	Dominguez Channel WMA	Individual WMP	2
g	Irwindale	LA River and San Gabriel River	Individual WMP	1
h	La Habra Heights	San Gabriel River	Individual WMP	4
i	Lawndale	Dominguez Channel WMA	Individual WMP	2
j	Lomita	Dominguez Channel WMA (Machado Lake)	Individual WMP	4
k	Rolling Hills	Dominguez Channel WMA (Machado Lake, LA Harbors) & Santa Monica Bay Watershed Jurisdiction 7	No WMP	4
l	San Fernando	Los Angeles River	Individual WMP	3
m	South El Monte	LA River and San Gabriel River	Individual WMP	1
n	Walnut	San Gabriel River	Individual WMP	1
o	West Covina	San Gabriel River	Individual WMP	1

National Forest Area