TO: Technical Advisory Committee (TAC) Representatives and Alternates
Los Angeles County MS4 Permit

FROM: Renee Purdy
Section Chief
REGIONAL PROGRAMS

DATE: July 19, 2013

SUBJECT: INVITATION TO INITIAL MEETING OF TECHNICAL ADVISORY COMMITTEE FOR DEVELOPMENT OF WATERSHED MANAGEMENT PROGRAMS UNDER THE LOS ANGELES COUNTY MS4 PERMIT

As you know, the Los Angeles Regional Water Quality Control Board (Los Angeles Water Board) issued a new NPDES permit for municipal separate storm sewer system (MS4) discharges within the coastal watersheds of Los Angeles County in November 2012. The new permit became effective on December 28, 2013.

The new permit provides Permittees with the opportunity to develop Watershed Management Programs, or enhanced Watershed Management Programs, as a way to integrate the requirements of the permit and achieve compliance. One of the provisions of the new permit regarding watershed management programs calls for a permit-wide watershed management program technical advisory committee (TAC). The purpose of the TAC is to discuss and provide input on key technical issues related to the development of the Watershed Management Programs and enhanced Watershed Management Programs from June 28, 2013 through the date of program approval. A permit-wide TAC will help promote consistency among the permittee watershed groups in terms of technical approaches, including the reasonable assurance analysis that is required as an element of a Watershed Management Program or enhanced Watershed Management Program.

You have been designated by your watershed management program group, or by the Regional Board, as a representative (or alternate) to the TAC. As decided at the June 12, 2013 EWMP coordinators meeting, the first meeting of the TAC will be held on July 24, 2013. Details are provided below.

Wednesday, July 24, 2013, 1 to 3 p.m.
County of Los Angeles Department of Public Works
Alhambra Room
900 S. Fremont Ave., Alhambra, CA

Representatives and alternates are encouraged to attend the initial meeting of the TAC. The purpose of the initial meeting will be to discuss and identify the key technical issues on which

the TAC will focus, establish a schedule of future meetings, and discuss meeting management and ground rules for the TAC.

If you have any questions, please do not hesitate to call me at (213) 576-6622 or e-mail me at Renee.Purdy@waterboards.ca.gov.

TAC Commitee
July 24, 2013

Group Name	Representative	Sign In	Alternate	Sign In
Alamitos Bay/Los Cerritos Channel Group	Jolene Guerrero County		Genevieve Osmena, County	
Ballona Creek	Hubertus Cox City of Los Angeles		Lauren Amimoto, Inglewood	
Beach Cities Watershed Management Group	Elaine Jeng Redondo Beach		Kathleen McGowan, GeoSyntec John Dettle, Torrance	
Building Industry Association	Holly Schroeder			
City of Lawndale	Nasser Abbaszadeh		Julie Hegvold Ray Tahir	
City of Long Beach	Anthoney Arevalo		Ana De Anda	
City of Walnut	Alicia Jensen		Cody Howing RKA Consulting	
Council for Watershed Health	Mike Antos			
Dominguez Channel Watershed Management Area Group	Vijay Desai, City of Los Angeles		Jolene Guerrero County	
East San Gabriel River Watershed Group	JR Ranells La Verne		Latoya Cyrus, San Dimas	
EPA	Peter Kozelka		Cindy Lin	
Heal the Bay	Kirsten James		Peter Shallenberger	
LA Waterkeeper	Liz Crosson			
Los Angeles River Upper Reach 2 Sub Watershed	Desi Alvarez Huntington Park		Gina Nila, Commerce	
Los Cerritos Channel Watershed Group	Lisa Rapp Lakewood		Deborah Chankin Bellflower	
Lower Los Angeles River Watershed	Steve Myrter Signal Hill		Chris Cash Paramont	
Lower San Gabriel River	Mike O'Grady Cerritos		Adriana Figueroa Norwalk	
Malibu Creek Watershed Group	Joe Bellomo		Giles Coon County	

City of Los Angeles
City of Los Angeles

Wing Tam
Stormwater Management

WT
SM

Wing.Tam@lacity.org

TAC Commitee
July 24, 2013

Marina del Rey	Bruce Hamamoto County	[signature]	Steve Finton, Culver City	[signature]
North Santa Monica Bay Coastal Watersheds	Jennifer Brown City of Malibu	[signature]	Rob DuBoux Malibu	
NRDC	Noah Garrison	[signature]		
Peninsula EWMP Agencies	John Hunter, JLHA Consultants		Kathleen McGowan, GeoSyntec	
Regional Water Quality Control Board	Renee Purdy		Ivar Ridgeway	
Rio Hondo/San Gabriel River Water Quality Group	James Carlson Sierra Madre	[signature]	Rafael Casillas Duarte	[signature]
Santa Monica Bay Jurisdictions 2 & 3	Hamid Tadayon City of Los Angeles	[signature]	Joshua Carvalho, Santa Monica	
Upper Los Angeles River Watershed Group	Alfredo Magallanes City of Los Angeles		Alvin Cruz, Burbank	[signature]
Upper San Gabriel River	Vivian Castro Covina	[signature]	Jolene Guerrero, County	
Upper Santa Clara River Watershed	Heather Merenda Santa Clarita	[signature]	Giles Coon County	[signature]

Kimberly Colbert [signature]
ANGELA GEORGE [signature]
Chien-Pei M Yu
Ray Tahir
City of Vernon Kevin Wilson
City of Lawndale Nasser Abbaszadeh
CITY OF BURBANK ALVIN CRUZ
City OF GLENDORA JERRY BURKE
Tess Environmental Sal Ramirez sramirez@tessenv.com
City of Inglewood Lauren Amimoto

COUNCIL FOR
WATERSHED HEALTH

BLAKE WHITTINGTON (ALT) BW

TECHNICAL ADVISORY COMMITTEE (TAC) MEETING

LA COUNTY MS4 PERMIT WATERSHED MANAGEMENT PROGRAM DEVELOPMENT

JULY 24, 2013

1:00 - 3:00 PM

COUNTY OF LOS ANGELES DEPARTMENT OF PUBLIC WORKS

ALHAMBRA ROOM

900 S. FREMONT AVE.

ALHAMBRA, CA

AGENDA

Welcome/Introductions	Sam Unger	1:00 - 1:15
Overview of purpose of TAC	Sam Unger / Renee Purdy	1:15 - 1:30
TAC roles and responsibilities	Group	1:30 - 1:55
TAC Meeting Structure -Representatives/alternates -Leadership -Facilitation -Meeting frequency -Subcommittees	Group	1:55 - 2:15
Key technical issues for TAC input	Group	2:15 - 2:45
Wrap-up	Group	2:45 - 3:00

Los Angeles County Municipal Stormwater NPDES Permit
Order No. R4-2012-0175
NPDES Permit No. CAS004001

Watershed Management Programs
Technical Advisory Committee Guidelines

I. Introduction

The Los Angeles County Municipal Stormwater NPDES Permit (Order No. R4-2012-0175) requires the formation of a Technical Advisory Committee (TAC) to assist in the development of the Watershed Management Programs (WMP) and Enhanced Watershed Management Programs (EWMP), pursuant to Part VI.C.1.f.v.:

> "*Provide appropriate opportunity for meaningful stakeholder input, including but not limited to, a permit-wide watershed management program technical advisory committee (TAC) that will advise and participate in the development of the Watershed Management Programs and enhanced Watershed Management Programs from month 6 through the date of program approval. The composition of the TAC may include at least one Permittee representative from each Watershed Management Area for which a Watershed Management Program will be developed, and must include a minimum of one public representative from a non-governmental organization with public membership, and staff from the Regional Water Board and USEPA Region IX.*"

The guidelines contained herein are intended to help in the formation of the TAC and provide clarification on the TAC's role and responsibilities.

II. Formation and Composition

A single TAC will be established for the entire Los Angeles region pursuant to the Permit. The Los Angeles County Flood Control District (LACFCD) will provide logistical support for the formation of the TAC. [1]

Permittees within each watershed group that intends to develop a WMP or EWMP may elect a representative (and an alternate) to participate in the TAC. As of June 2013, 18 watershed groups have been identified. In accordance with the Permit, the composition of the TAC may include representatives from each watershed group, Regional Board, USEPA Region 9, and non-governmental organizations. The representatives shall have a technical background in stormwater and/or water supply management and project

[1] In assuming these duties, the LACFCD does not assume responsibility for compliance with the Permit for any individual Permittee or group of Permittees.

implementation. Members of the TAC or their alternates are expected to attend all scheduled meetings and may be required to prepare meeting summaries.

At the kickoff meeting the TAC will elect a chairperson and vice chairperson. The chairperson is responsible for:

- Scheduling each TAC meeting,
- Providing an agenda for each TAC meeting,
- Facilitating TAC discussions to assist watershed groups in making decisions on pertinent matters,
- Coordinating with TAC members to form subgroups, as needed, to assist in plan development, and
- Ensuring a meeting summary is prepared.

The chair may delegate the above duties to a member of the TAC. The vice chairperson shall be responsible for the above duties in the absence of the chairperson.

III. Role and Responsibilities

The TAC is a forum for meaningful stakeholder input and open exchange of ideas for the successful development of WMP and EWMP plans. The TAC is not a voting or decision-making body. From month 6 of the Permit's effective date through approval of WMP and EWMP plans, the TAC will:

- Meet regularly to provide feedback on proposed WMP and EWMP program elements and projects.

- Provide opportunity for constructive exchange of ideas among all members.

- Facilitate and encourage a common planning process across various watersheds.

- Provide peer review and comment on the WMPs and EWMPs so that they are based on reasonable and sound technical principles, assumptions, and analyses.

- Assist in addressing technical challenges.

- Perform outreach to potential stakeholders that may be interested in participating in the planning process.

The TAC is not intended to replace other watershed-specific stakeholder outreach efforts. Each watershed group should solicit meaningful stakeholder and public input within its watershed during its planning process as described in the Permit.

IV. Meetings

The TAC shall meet, at minimum, once every other month starting July 2013 to discuss pertinent items related to WMP/EWMP program development. Each meeting should be long enough, at a minimum one-half day, for in-depth discussions of key issues and to ensure that members have adequate opportunity to provide input. The meeting frequency and duration may be modified as needed by the TAC. The TAC shall have the discretion to utilize a professional facilitator to guide the meeting discussions and prepare meeting summaries.

GENERAL REQUIRED INFORMATION FOR REASONABLE ASSURANCE ANALYSIS FOR EACH WATER BODY-COMBINATION ADDRESSED BY THE WATERSHED MANAGEMENT PROGRAM

A. APPLICABLE INTERIM AND FINAL REQUIREMENTS:

Permittees shall classify and list water body-pollutant combinations into one of the following three categories:

- 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'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.

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

- Permittees shall provide 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 also includes all MS4 major outfalls, major structural controls of storm and non-storm water that discharge to receiving water within the watershed management areas
- Permittees shall provide initial assessment of current/baseline pollutants loading for identified water body-pollutant combinations based on relevant sub-watershed data collected within the last 10 years including land use and pollutant loading data.

- Permittees shall provide list of BMPs/MCM that are currently implemented and the results are reflected in the current loading.

C. ESTIMATED REQUIRED POLLUTANT REDUCTIONS TO MEET THE FINAL LOADING (IF APPLICABLE FOR THE PERMIT CYCLE)

- Permittees shall provide estimated allowable loadings from MS4 discharges expressed as concentration-based or mass-based. Mass-based allowable loading will be calculated based on its share on an area basis of the required WLAs.
- The different between the current and allowable pollutant loading is the required pollutant reduction. The required pollutant reduction shall be used to set targets/goals for BMPs/Watershed management stratergies.
- Estimated pollutant loading may vary using a single fixed value based on annual average loading or may be estimated based on pollutant load reduction from year-to-year based on watershed/climate/rainfall conditions.

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:

I. ENHANCE WATERSHED MANAGEMENT PROGRAM (EWMP)

a) DETAIL DESCRIPTION OF DRAINAGE AND RETENTION SYSTEM

If the permittees select to develop a EWMP that wherever feasible retain all storm and non-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 detail description of the selected detention system including type (bioretention system, above ground ponds, subsurface piping, and sub-surface chamber, etc.), storage volume, approximate system size, number headers, header diameter, excavation (width, length, disturbed surface area, excavation, 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 feasible, the permittees are required to provide (i) list of current BMPs that have been implemented to control storm and non-storm water discharge; (ii) list of selected watershed control measures that are planned to be implemented in addition to the existing BMPs. Watershed control measures shall be selected to prevent or eliminate non-storm water

discharges, achieve all applicable interim and final water quality-based effluent 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, receiving water limitations in Part VI.E and/or Attachments L through R;
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. [Can be removed if found unnecessary]

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

Permittees shall identify MCMs as defined in Part VI.D.4 to Part VI.D.10 of the MS4 Permit and potential modifications that will address priority issues in each watershed.

If non-stormwater discharges from the MS4 were identified as source of pollutants, permittees shall include list of contrail measures, BMPs, or strategies to effectively eliminate the source of pollutants.

Permittees shall also compile list of control measures that have been identified in TMDLs and corresponding implementation plans, and /or identified control measures to be modified to effectively address TMDL requirements.

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 provide (i) list of current BMPs that have been implemented to control storm and non-storm water discharge; (ii) list of selected watershed control measures that are planned to be implemented in addition to the existing BMPs. Watershed control measures shall be selected to prevent or eliminate non-storm water discharges, achieve all applicable interim and final water quality-based effluent 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, receiving water limitations in Part VI.E and/or Attachments L through R;

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Permittees shall also compile list of control measures that have been identified in TMDLs and corresponding implementation plans, and /or identified control measures to be modified to effectively address TMDL requirements.

E. SELECTED MODEL USED TO SUPPORT SELECTED BMPS OPTIONS, CURRENT LOADINGS, AND REQUIRED LOAD REDUCTIONS

Permittees shall provide a modeling system to support the estimated cutrrent loadings, required load reduction that are used to set targets/goals for selected BMPs/Watershed management stratergies, and to demonstrate that the activities and control measures identified/selected in the Watershed Control Measures and/or EWMP will achieve applicable water quality-based effluent limitations and/or receiving water limitations. Permittees shall select modeling system to support selected BMPs using the modeling systems categorized below:

I. U.S. EPA ENDORSED MODELING SYSTEMS [C.P. INSERT]

II. PROCESS-BASED MODELING SYSTEMS [C.P. INSERT]

III. STATIC/EMPIRICAL MODELING SYSTEMS [C.P. INSERT]

IV.

F. SPECIFIED SCHEDULE OF SELECTED WATERSHED MANAGEMENT STRATERGIES

Permittees shall translate corresponding schedule of selected BMPs into a combined schedule for achievement of the interim and final water quality-based effluent limitations and/or receiving water limitations. Permittees shall align schedule with milestones and final compliance dates specified in the permit and demonstrate that the required loading reduction and timeline specified are expected to be achieved.

- 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 and R. If selected BMPs will address multiple pollutants then BMPs must be implemented within time frame that is consistent with the most critical/closet deadline.
- Where the TMDL do 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 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.
- 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.

G. POLLUTANT REDUCTION PLAN

a) EVALUATION OF SELECTED MANAGEMENT PLAN/BMPs PERFORMANCE

- Permittees shall provide detail description of individual BMPs performance and /or suite of selected BMPs performances to reduce pollutants 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 BMPs in pollutant removal and/or reduction will be served as default value that can be replaced with BMP monitoring data when they are become available.

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

Based on BMPs performance analysis using selected modeling system, permittee 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.
- 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.
- Interim milestones and dates for achievement of interim and final water quality-based effluent limitations and/or receiving water limitations with deadlines beyond the permit term.

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

- Permittees in each WMA shall develop an 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 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 from sources other than the Permittee's monitoring program within the watershed management area.
- Permittees shall report and 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.

Los Angeles County MS4 Permit
Watershed Management Programs Technical Advisory Committee (TAC)

Meeting Notes: July 24, 2013

(Compiled by Alicia Jensen, City of Walnut and James Carlson, City of Sierra Madre; consolidated and edited by Renee Purdy, LA Regional Board)

Regional Board (RB) Staff convened meeting at 1:00 pm

Introductions Made (see attached sign-in sheet)

Overview of Purpose / Role of TAC

- RB Executive Officer Sam Unger introduced the discussion. TAC is advisory in nature; the TAC as envisioned should provide input on the suite of models/technical approaches (including the range of data input values) used to develop WMPs/EWMPs, including requirements and expectations of the Reasonable Assurance Analysis ("RAA")
- RB Staff ("Board Staff") Renee Purdy followed up by adding that one of the purposes of the TAC was to help promote consistency with the large number of WMP/EWMP plans that are to be submitted
- Discussion -- A WMP/EWMP Representative ("Rep") asked for clarification on the roles and provided an example that if an EWMP wants to choose and "alternative path" and the TAC disagrees, then how would it be mediated? RB Staff reminded everyone that RB staff is a member of the TAC. RB Staff indicated that there would always be an effort to strive for a consensus, but there may end up being a decision that would have to be made by the Regional Board. The Rep followed up by asking if it would be possible that the Regional Board would say "no" at a later date even if the TAC agreed on a particular technical issue, and RB Staff responded that it is possible but not very likely since RB staff as members of the TAC would likely indicated their disagreement through the TAC meetings. Ultimately, the Regional Board does have the final decision as the agency approving the WMPs/EWMPs.
- RB Staff indicated that the TAC is not the end-all/be-all of stakeholder of public input and that each WMP/EWMP group should have its own stakeholder process.
- A Rep asked for further clarification that the TAC is intended to focus on science and not legal or compliance opinions, which was confirmed by RB Staff. RB staff ended the topic by stating that the "TAC is as its name indicates, it is technical not legal".
- A Rep asked whether a member of the EPA is going to be attending. RB Staff indicated that they were unable to attend this meeting but understand that they are committed to this process going forward.

TAC Meeting Structure

RB Staff introduced this topic by pointing to the draft guidelines that were distributed, specifically page 2 that recommended a Chair and Vice Chair for the TAC.

Chair:

- Discussion (RB Staff indicated that the RB Staff would be willing to act as Chair. When a Rep asked why this would be a good idea, there was discussion that RB Staff have broad interests that would not be associated to just one watershed. A Rep confirmed that RB Staff would be the best to chair the TAC, and pointed out that their position as Chair should not be overwhelmed by "side-arguments"; that they would lead and keep the discussions focused. There was discussion that RB Staff however could not be expected to be an "on-the-spot" decision maker.
- ACTION: Group agreed to have RB Staff serve as Chair of TAC

Vice Chair:

- Discussion on filling the role of Vice Chair. Initial thoughts were to have Vice Chair share Chair responsibilities.
- Rotation discussed, but TAC will exist only until all WMPs/EWMPs are reviewed and submitted to the Regional Board so there is not really enough time to rotate the position in a meaningful way
- Interested persons may e-mail their names to RB Staff (Renee). Nominations will be accepted (if nominee is in agreement)
- Suggestion made to have RB Staff serve as Vice Chair
- Suggestion made to forgo the Vice Chair position
- ACTION: TAC to consider at next meeting (to be placed on agenda)

Notes:

- No volunteers
- Alternative suggestions were to rotate the task among the representatives
- Suggestion made that all who take notes should submit them to RB Staff (Renee) to be condensed into a meeting summary
- ACTION: TAC to consider at next meeting (to be placed on agenda)

Facilitator:

- Suggestion made from group member to have a facilitator to keep group on track and avoid confrontation
- Discussion among group. Suggestions made included 1) it should be a neutral person with no bias, and 2) preferably someone with a background in storm water
- ACTION: Conclusion reached that RB Staff will look for a potential Facilitator to have available should there be a need based on 1) technical topics, and/or 2) tone of discussions. State Water Board would be a possible source.

Representatives & Alternates

- Discussion concerning how the role of representatives and alternates would be determined. Discussion regarding need to keep the "working group" a manageable size to have productive dialogue and decision making ability.
- Agreed that each entity with a representative have a single person "at the table" -- Representatives are to attend, Alternates to attend in their absence

- If neither Representative nor Alternate can attend, the entity they represent will forgo input at that meeting (no proxy will be permitted)
- Generally agreed that there should be space for "observers", which could be the alternate, consultants, or other interested parties. However, observers may not participate in discussions or vote
- One representative pointed out that there could be many occasions in which a representative "at the table" would want or need information from their consultant regarding the discussion. A number of possibilities were discussed regarding this point including "ceding" time to a consultant or basically informally asking the other members at the table if a consultant could be asked to provide information or clarification. ACTION: to be addressed at the next meeting.

Subcommittees:

- Discussion
- Subcommittees could be formed by topic
- Results of Subcommittee to be presented to entire TAC group
- Representatives and Alternates interested in a particular Subcommittee could both serve
- Experts (i.e. consultants) could be brought in to the Subcommittee to provide input/advice
- Subcommittees could be formed on an as-needed basis

Consultants:

- Discussion on whether or not to include consultants in TAC meetings during technical reviews
- If to include, how might the TAC include them on behalf of a group during technical discussions.
    - TAC may consider putting consultants on the agenda or having them address the group on an as-needed basis
- TAC to consider at next meeting (to be placed on agenda; See also above on "Representatives & Alternates")

Key Technical Issues:

- RB Staff suggested three primary issues for the TAC
    1. Reasonable Assurance Analysis guidance and modeling
    2. Criteria for the comprehensive identification/evaluation of opportunities for multi-benefit regional projects in EWMPs
    3. Monitoring Programs (there was some discussion if this would be an appropriate TAC area for comment/review, since the permit language directs the TAC to review only the WMPs/EWMPs and not IMPs or CIMPs)
- Discussion -- The attendees discussed a number of topics that could be considered "key" for the TAC's work. There was general agreement that the RAA (which will have many questions regarding modeling and BMP performance input values), EWMPs and their "comprehensive evaluation of opportunities for multi-benefit regional retention projects", monitoring and MCMs (the balance between allowing customization and

preserving group consistency) were all mentioned. Also, a couple of representatives asked that there possibly be the use of templates across the board of major submittals, which would also assist in WMP development and ultimately the review process. A representative from the County also asked that the mapping and "HUD12" questions be addressed by the TAC in future review.

- ACTION: TAC will begin to discuss RAA at next meeting

Meeting Frequency:

- Discussion -- Representatives agreed that early in the development of WMPs/EWMPs was important for the TAC to meet frequently so that technical input, models and acceptable criteria are available to agencies as soon as possible
- ACTION: Agreement to meet approximately monthly at this point in time, more frequently if and when needed
- Room availability is a question. Those with conflicts or day/time exclusions should e-mail RB Staff (Renee). RB Staff will work with LACDPW staff to coordinate meeting space.
- ACTION: County will confirm meeting space, and email the information regarding future meeting dates / times to the representatives and alternates.
- **August meeting tentatively set for Wednesday, August 28 at 12:30-3:00 PM at LA County Department of Public Works. However, RB will confirm August meeting day/time/location with TAC**

Adjournment: 3:00 pm

TAC Commitee
August 28, 2013

Group Name	Representative	Sign In	Alternate	Sign In
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Thanhloan Nguyen	RWQCB			

TAC Commitee
August 28, 2013

Marina del Rey	Bruce Hamamoto County		Steve Finton, Culver City	
North Santa Monica Bay Coastal Watersheds	Jennifer Brown City of Malibu		Rob DuBoux Malibu	
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Peninsula EWMP Agencies	John Hunter, JLHA Consultants		Kathleen McGowan, GeoSyntec	
Regional Water Quality Control Board	Renee Purdy		Ivar Ridgeway	
Rio Hondo/San Gabriel River Water Quality Group	James Carlson Sierra Madre		Rafael Casillas Duarte	
Santa Monica Bay Jurisdictions 2 & 3	Hamid Tadayon City of Los Angeles		Joshua Carvalho, Santa Monica	
Upper Los Angeles River Watershed Group	Alfredo Magallanes City of Los Angeles		Alvin Cruz, Burbank	
Upper San Gabriel River	Vivian Castro Covina		Jolene Guerrero, County	
Upper Santa Clara River Watershed	Heather Merenda Santa Clarita		Giles Coon County	

City of Walnut — Alicia Jensen — Alicia Jensen — Cody Hawing RKA consulting

City of L.A. — Mou Shan Chan

Tetra Tech

Pavlova Vitale
RWQCB

~~Ashli Dessai~~
LWA

ADR
Rebecca Batchelder
LA County DPW

Sol Ramirez
Regional Bd
C.P. Lai
Ashli Dessai
Richard Haimann
Geosyntec
Elaine Kunitake

Deb Smith
Shahram Kharaghani, LA City
Wing Tam, LA City
Noah Garrison - NRDC
Ivar K. Ridgeway - RWQCB-LA

TECHNICAL ADVISORY COMMITTEE (TAC) MEETING

LA COUNTY MS4 PERMIT WATERSHED MANAGEMENT PROGRAM DEVELOPMENT

AUGUST 28, 2013

12:30 - 2:30 PM

COUNTY OF LOS ANGELES DEPARTMENT OF PUBLIC WORKS

ALHAMBRA ROOM

900 S. FREMONT AVE.

ALHAMBRA, CA

AGENDA

Welcome/Introductions	Sam Unger	12:30 - 12:45
Follow-up from July Meeting • Vice chair position • Responsibility for note-taking • Participation by experts / consultants in discussions • Subcommittee formation • Schedule of future meetings • Facilitation	Group	12:45 - 1:15
Kick-off Discussion of Reasonable Assurance Analysis	RB Staff / Group	1:15 - 2:15
Wrap-up	Group	2:15 - 2:30

GUIDANCE ON CONDUCTING REASONABLE ASSURANCE ANALYSIS

Los Angeles County MS4 Permit

TAC Meeting

August 27, 2013

RB-AR 977

OBJECTIVES OF REASONABLE ASSURANCE ANALYSIS

RB-AR 978

OVERARCHING PURPOSE

- USEPA: Need to have adequate demonstration that, *"…where a BMP-based approach to permit limitations is selected, the BMPs required by the permit will be sufficient to implement applicable WLAs."* (USEPA 2010)
- Regional Board: *"Permittees shall conduct a Reasonable Assurance Analysis for each water body-pollutant combination addressed by the Watershed Management Program … The objective of the RAA shall be to demonstrate the ability of Watershed Management Programs and EWMPs to ensure that Permittees' MS4 discharges achieve applicable water quality based effluent limitations and do not cause or contribute to exceedances of receiving water limitations."* (Part VI.C.5.b.iv.(5), pp. 63-64)

RB-AR 979

SPECIFIC OBJECTIVES FOR RAA GUIDANCE

- Ensure appropriate and robust analysis
- Provide clear direction to WMP/EWMP groups and their consultants regarding requirements/expectations
- Promote consistency among WMP/EWMP groups
- Facilitate agency and public review of draft WMPs/EWMPs

TECHNICAL OBJECTIVES OF RAA GUIDANCE

MODELING

- Identify required scope of RAA
- Identify acceptable models for RAA
- Establish simulation time period(s)
- Establish standardized criteria for model input
- Establish standardized model output requirements
- Establish standardized criteria for sensitivity analysis

SELECTED WATERSHED CONTROL MEASURES

- Identify acceptable BMP performance databases/literature for model input
- Identify acceptable statistical thresholds for BMP performance for model input
- Identify key hydrologic and physiographic parameters that impact BMP performance and ensure that these parameters are accurately represented in the model
- Identify O&M practices that impact BMP performance and ensure that model assumptions are carried out in Permittees' O&M procedures

RB-AR 981

SPECIFIC PERMIT REQUIREMENTS RELATED TO RAA

RAA PERMIT REQUIREMENTS (PART VI.C.5.b.iv.(5), pp.63-64)

- Quantitative
- Performed using peer-review model(s) in the public domain
  - Watershed Management Modeling System (WMMS)
  - Structural BMP Prioritization and Analysis Tool (SBPAT)
  - Hydrologic Simulation Program-FORTRAN (HSPF)*
  - Others? (e.g., SUSTAIN)
- Includes all available, relevant subwatershed data collected within the last 10 years that meets QA/QC criteria for use in RAA
  - land use
  - pollutant loading
- BMP performance data from peer-reviewed sources
- Use of best statistical estimate of BMP performance for the pollutants to be addressed

RB-AR 983

REQUIRED SCOPE OF RAA

- WATER BODY-POLLUTANT COMBINATIONS
  - Category 1
    - Analysis of water body-pollutant combinations with interim or final TMDL compliance deadlines during the permit term (through December 28, 2017)*
    - Analysis of water body-pollutant combinations with TMDL compliance deadlines beyond the permit term (after December 28, 2017) [based on proposed interim milestones to ensure progress during permit term]
  - Categories 2 & 3 (Part VI.C.5.a.ii, p. 59)
    - Analysis of water body-pollutant combinations not addressed by TMDLs [to ensure progress to controlling MS4 discharges within a timeframe that is as short as possible such that they do not cause or contribute to exceedance(s) of RWLs]

RB-AR 984

STEPS IN RAA

- Permittees shall classify and list water body-pollutant combinations into one of the following three categories:
  - Category 1: Water body-pollutant combinations subject to a TMDL
  - Category 2: Water body-pollutant combinations identified on the 303(d) List
  - Category 3: Water body-pollutant combinations with exceedances of receiving water limitations

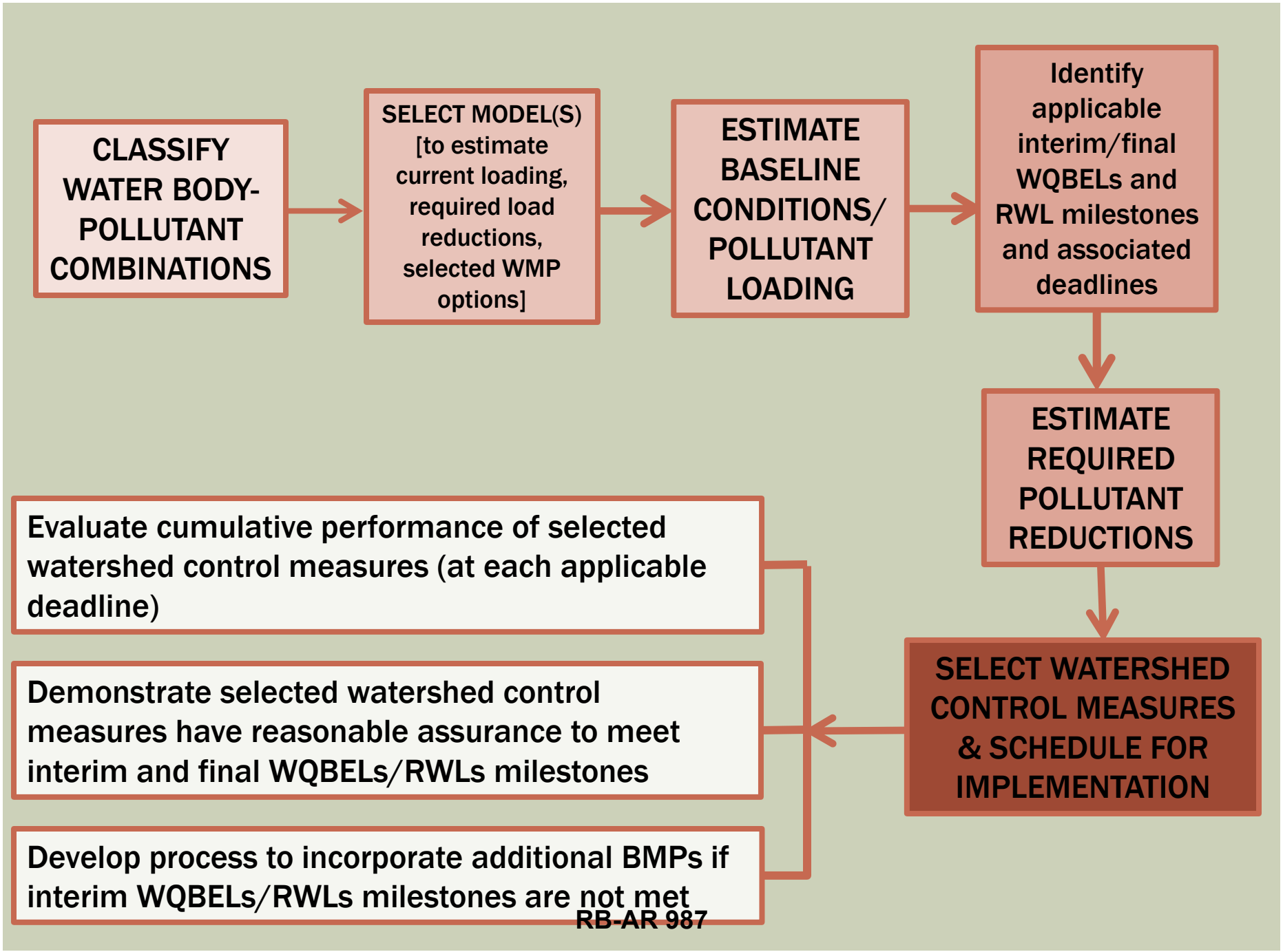
RB-AR 985

STEPS IN RAA (CONT.)

QUANTIFY

- Current/baseline pollutant loading and runoff volume from MS4
- Allowable MS4 pollutant loading (allocation/WQBEL)
- Required pollutant reduction to attain applicable interim/final WQBEL(s)
- Pollutant removal/effectiveness for individual watershed control measures selected for implementation
- The full suite of watershed control measures to be implemented to attain applicable WQBELs/milestones
- The water quality outcomes associated with implementation of the full suite of watershed control measures, above
  - That is, the cumulative effectiveness of the watershed control measures implemented in the subwatershed area

RB-AR 986


CLASSIFY WATER BODY-POLLUTANT COMBINATIONS
SELECT MODEL(S) [to estimate current loading, required load reductions, selected WMP options]
ESTIMATE BASELINE CONDITIONS/ POLLUTANT LOADING
Identify applicable interim/final WQBELs and RWL milestones and associated deadlines
ESTIMATE REQUIRED POLLUTANT REDUCTIONS
SELECT WATERSHED CONTROL MEASURES & SCHEDULE FOR IMPLEMENTATION
Evaluate cumulative performance of selected watershed control measures (at each applicable deadline)
Demonstrate selected watershed control measures have reasonable assurance to meet interim and final WQBELs/RWLs milestones
Develop process to incorporate additional BMPs if interim WQBELs/RWLs milestones are not met

MODELING

RB-AR 988

EXPECTED MODEL CAPABILITIES

- Dynamic continuous long-term simulation for modeling runoff and pollutant loadings and concentrations in discharges and receiving waters from lands in a watershed system
- Can represent rainfall, runoff, and groundwater processes of urban and natural watershed systems
- Can represent variability in pollutant loadings, based on land use, soil hydrologic group, and slope among other parameters
- Employs a BMP process based approach or empirically based BMP approach
- Includes decision support to evaluate cumulative BMP performance on a watershed scale

MODEL TYPE	MODEL NAME
E.1 Land/Watershed Models	
	HSPF, LSPC, SWMM, SWAT, WARMF
E.2 Receiving Water Models	
	HSPF, LSPC, SWMM, EFDC, CE-QUAL-ICM/TOXI, QUAL2K, WASP
E.3 BMP Performance Models	
* Process based models	SWMM BMP module
	BASINS BMP module
	EPA TMDL Modeling Toolbox
* Empirically based models	International Stormwater BMP Database
E.4 Integrated BMP Modeling Systems	
* Process based models	EPA SUSTAIN model
	Los Angeles County WMMS model
* Empirically based models	City of Los Angeles SBPAT model

AVAILABLE PUBLIC DOMAIN MODELS FOR RAA

Models in E.1 - E.3 must be used in combination

Models in E.4 may be used as single, integrated model system

PRIMARY COMPONENTS OF MODELING REQUIREMENTS

- Model input data
- Model parameters
- BMP performance parameters
- Model output

MODEL OUTPUT REQUIRE-MENTS

MODEL OUTPUT	CONTENT	FORMAT
5.1 Current/Baseline Pollutant Loadings and Runoff Volume		
	Current pollutant loadings and runoff volume (by subwatershed)	Tables
5.2 Surface Runoff Output		
	Surface runoff (by subwatershed for each BMP scenario under representative conditions)	Tables
	Percent reduction (by subwatershed for each BMP scenario)	Tables
5.3 Load Reduction Output		
	Pollutant load reductions (by subwatershed for each BMP scenario/phase under representative conditions)	Tables
	Time series plots of pollutant load reductions for each BMP scenario at compliance points	Graphics
5.4 Hydrographs and Pollutographs		
	Flow hydrographs at compliance points for each BMP scenario	Graphics
	Pollutographs at compliance points (outfall and/or receiving water) for each BMP scenario	Graphics
5.5 BMP Performance Summary		
	Load comparison for with and without BMP and graphs for each BMP scenario/phase	Tables/Graphics
	BMP retention volume for each BMP scenario/phase	Tables/Graphics

MODEL TYPE /MODEL NAME	MODEL FACT SHEETS
E.1 Land/Watershed Models	
HSPF	Hydrological Simulation Program-Fortran , Model Distribution Coordinator: USEPA Center for Exposure Assessment Modeling Model is available at http://www2.epa.gov/exposure-assessment-models/surface-water-models
LSPC	Loading Simulation Program in C++, Model Distribution Coordinator: USEPA Ecosystems Research, Athens, GA Model is available at http://www.epa.gov/athens/wwqtsc/html/lspc.html
SWMM	Storm Water Management Model, Model Distribution Coordinator: USEPA Ecosystems Research, Athens, GA, Model is available at http://www.epa.gov/athens/wwqtsc/html/lspc.html
SWAT	Soil and Water Assessment Tool , Model Distributor Coordinator: USDA Agriculture Department, Model is available at http://swat.tamu.edu/software/
WARMF	Watershed Analysis Risk Management Framework, Model Distribution Coordinator: USEPA Ecosystems Research, Athens, GA , Model is available at http://www.epa.gov/athens/wwqtsc/html/lspc.html

MODEL TYPE /MODEL NAME	MODEL FACT SHEETS
E.2 Receiving Water Models	
HSPF	Hydrological Simulation Program-Fortran , Model Distribution Coordinator: USEPA Center for Exposure Assessment Modeling Model is available at http://www2.epa.gov/exposure-assessment-models/surface-water-models
LSPC	Loading Simulation Program in C++, Model Distribution Coordinator: USEPA Ecosystems Research, Athens, GA Model is available at http://www.epa.gov/athens/wwqtsc/html/lspc.html
SWMM	Storm Water Management Model, Model Distribution Coordinator: USEPA Ecosystems Research, Athens, GA, Model is available at http://www.epa.gov/athens/wwqtsc/html/lspc.html
EFDC	Environmental Fluid Dynamic Code , Model Distribution Coordinator: USEPA Ecosystems Research, Athens, GA, Model is available at http://www.epa.gov/athens/wwqtsc/html/lspc.html
CE-QUAL-ICM/TOXI	A Multi-Dimensional, Water Quality Model for Surface Water Model Distribution Coordinator: US Army Corps of Engineer Environmental Laboratory, Model is available at http://el.erdc.usace.army.mil/products.cfm?Topic=model&Type=watqual

MODEL TYPE /MODEL NAME	MODEL FACT SHEETS
E.2 Receiving Water Models	
QUAL2K	River and Stream Water Quality Model , Model Distribution Coordinator: USEPA, Ecosystems Research, Athens, GA Model is available at http://www.epa.gov/athens/wwqtsc/html/lspc.html
WASP	Water Quality Analysis Simulation Program, Model Distribution Coordinator: USEPA Ecosystems Research, Athens, GA Model is available at http://www.epa.gov/athens/wwqtsc/html/lspc.html

MODEL TYPE /MODEL NAME	MODEL FACT SHEETS
E.3 BMP Performance Models	
SWMM BMP model	Storm Water Management Model (SWMM) Version 5.0.022 with Low Impact Development (LID) Controls , Model Distribution Coordinator: USEPA Risk Management Research, Model is available at http://www.epa.gov/nrmrl/wswrd/wq/models/swmm/
BASINS BMP model	BASINS (Better Assessment Science Integrating point & Non-point Sources), Model Distribution Coordinator: USEPA Water Science Technology, Model is available at http://water.epa.gov/scitech/datait/models/basins/index.cfm
EPA TMDL Modeling Toolbox	EPA TMDL Modeling Toolbox contains BMP assessment tools, watershed models, receiving water models, Model Distribution Coordinator: USEPA Ecosystems Research, Athens, GA, Model is available at http://www.epa.gov/athens/wwqtsc/Toolbox-overview.pdf

MODEL TYPE /MODEL NAME	MODEL FACT SHEETS
E.4 Integrated BMP Modeling Systems	
EPA SUSTAIN model	System for Urban Stormwater Treatment and Analysis IntegratioN Model, Model Distribution Coordinator: USEPA Risk Management Research, Model is available at http://www.epa.gov/nrmrl/wswrd/wq/models/sustain/
Los Angeles County WMMS model	The Los Angeles County Watershed Management Modeling System, Regional Optimization, Model Distribution Coordinator: Los Angeles County Flood Control District. Model is available at http://dpw.lacounty.gov/wmd/wmms/
City of Los Angeles SBPAT model	Structural BMP Prioritization and Analysis Tool. Model Distribution Coordinator: City of Los Angles and County of Los Angeles. Model is available at http://www.sbpat.net/downloads.html
	RB-AR 997

MODEL REFERENCES

MODEL TYPE /MODEL NAME	MODEL LINK
E.1 Land/Watershed Models	
HSPF	Hydrological Simulation Program-Fortran, Model Distribution Coordinator: USEPA Center for Exposure Assessment Modeling. Model is available at http://www2.epa.gov/exposure-assessment-models/surface-water-models
LSPC	Loading Simulation Program in C++, Model Distribution Coordinator: USEPA Ecosystems Research, Athens, GA. Model is available at http://www.epa.gov/athens/wwqtsc/html/lspc.html
SWMM	Storm Water Management Model, Model Distribution Coordinator: USEPA Ecosystems Research, Athens, GA. Model is available at http://www.epa.gov/athens/wwqtsc/html/lspc.html
SWAT	Soil and Water Assessment Tool, Model Distributor Coordinator: USDA Agriculture Department. Model is available at http://swat.tamu.edu/software/
WARMF	Watershed Analysis Risk Management Framework, Model Distribution Coordinator: USEPA Ecosystems Research, Athens, GA. Model is available at http://www.epa.gov/athens/wwqtsc/html/lspc.html

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SWMM	Storm Water Management Model, Model Distribution Coordinator: USEPA Ecosystems Research, Athens, GA. Model is available at http://www.epa.gov/athens/wwqtsc/html/lspc.html
EFDC	Environmental Fluid Dynamic Code , Model Distribution Coordinator: USEPA Ecosystems Research, Athens, GA. Model is available at http://www.epa.gov/athens/wwqtsc/html/lspc.html
CE-QUAL-ICM/TOXI	A Multi-Dimensional, Water Quality Model for Surface Water Model Distribution Coordinator: US Army Corps of Engineer Environmental Laboratory. Model is available at http://el.erdc.usace.army.mil/products.cfm?Topic=model&Type=watqual

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WASP	Water Quality Analysis Simulation Program, Model Distribution Coordinator: USEPA Ecosystems Research, Athens, GA. Model is available at http://www.epa.gov/athens/wwqtsc/html/lspc.html

MODEL TYPE /MODEL NAME	MODEL LINK
E.3 BMP Performance Models	
SWMM BMP module	Storm Water Management Model (SWMM) Version 5.0.022 with Low Impact Development (LID) Controls, Model Distribution Coordinator: USEPA Risk Management Research, Model is available at http://www.epa.gov/nrmrl/wswrd/wq/models/swmm/
BASINS BMP module	BASINS (Better Assessment Science Integrating point & Non-point Sources), Model Distribution Coordinator: USEPA Water Science Technology. Model is available at http://water.epa.gov/scitech/datait/models/basins/index.cfm
EPA TMDL Modeling Toolbox	EPA TMDL Modeling Toolbox contains BMP assessment tools, watershed models, receiving water models, Model Distribution Coordinator: USEPA Ecosystems Research, Athens, GA. Model is available at http://www.epa.gov/athens/wwqtsc/Toolbox-overview.pdf

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City of Los Angeles SBPAT model	Structural BMP Prioritization and Analysis Tool. Model Distribution Coordinator: City of Los Angles and County of Los Angeles. Model is available at http://www.sbpat.net/downloads.html

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Water Resources Applications Software

Geochemical || Ground Water || Surface Water || Water Quality || General

Summary of HSPF

NAME

hspf - Hydrological Simulation Program--Fortran

ABSTRACT

HSPF simulates for extended periods of time the hydrologic, and associated water quality, processes on pervious and impervious land surfaces and in streams and well-mixed impoundments.

HSPF uses continuous rainfall and other meteorologic records to compute streamflow hydrographs and pollutographs. HSPF simulates interception soil moisture, surface runoff, interflow, base flow, snowpack depth and water content, snowmelt, evapotranspiration, ground-water recharge, dissolved oxygen, biochemical oxygen demand (BOD), temperature, pesticides, conservatives, fecal coliforms, sediment detachment and transport, sediment routing by particle size, channel routing, reservoir routing, constituent routing, pH, ammonia, nitrite-nitrate, organic nitrogen, orthophosphate, organic phosphorus, phytoplankton, and zooplankton. Program can simulate one or many pervious or impervious unit areas discharging to one or many river reaches or reservoirs. Frequency-duration analysis can be done for any time series. Any time step from 1 minute to 1 day that divides equally into 1 day can be used. Any period from a few minutes to hundreds of years may be simulated. HSPF is generally used to assess the effects of land-use change, reservoir operations, point or nonpoint source treatment alternatives, flow diversions, etc. Programs, available separately, support data preprocessing and postprocessing for statistical and graphical analysis of data saved to the Watershed Data Management (WDM) file.

METHOD

The model contains hundreds of process algorithms developed from theory, laboratory experiments, and empirical relations from instrumented watersheds.

HISTORY

The model was developed in the early 1960's as the Stanford Watershed Model. In the 1970's, water-quality processes were added. Development of a Fortran version incorporating several related models using software engineering design and development concepts was funded by the Athens, Ga., Research Lab of EPA in the late 1970's. In the 1980's, preprocessing and postprocessing software, algorithm enhancements, and use of the USGS WDM system were developed jointly by the USGS and EPA. The current release is Version 11. An interactive version (see HSPEXP) was developed by the USGS in the 1990's.

DATA REQUIREMENTS

Meteorologic records of precipitation and estimates of potential evapotranspiration are required for watershed simulation. Air temperature, dewpoint temperature, wind, and solar radiation are required for snowmelt. Air temperature, wind, solar radiation, humidity, cloud cover, tillage practices, point sources, and (or) pesticide applications may be required for water-quality simulation. Physical measurements and related parameters are required to describe the land area, channels, and reservoirs.

OUTPUT OPTIONS

Output is either printed tables at any time step, a flat file, or the WDM file. The postprocessing software uses data from the WDM file. Hundreds of computed time series may be selected for the output files.

SYSTEM REQUIREMENTS

HSPF is written in Fortran 77 with the following extension: use of include files. The HSPF, HSPNODSS, WDM, ADWDM, and UTIL libraries from LIB are required to recompile. For more information, see System Requirements in LIB.

APPLICATIONS

There have been hundreds of applications of HSPF all over the world. The largest application is the 62,000 square mile tributary area to the Chesapeake Bay. The smallest application has been experimental plots of a few acres near Watkinsville, Ga. The most significant applications within the USGS have been in the Seattle area, Chicago area, Patuxent River, Md., Truckee-Carson Basins, Nev., and watersheds in Pennsylvania.

DOCUMENTATION

Bicknell, B.R., Imhoff, J.C., Kittle, J.L., Jr., Donigian, A.S., Jr., and Johanson, R.C., 1997, Hydrological Simulation Program--Fortran: User's manual for version 11: U.S. Environmental Protection Agency, National Exposure Research Laboratory, Athens, Ga., EPA/600/R-97/080, 755 p.

RELATED DOCUMENTATION

Flynn, K.M., Hummel, P.R., Lumb, A.M., and Kittle, J.L., Jr., 1995, User's manual for ANNIE, version 2, a computer program for interactive hydrologic data management: U.S. Geological Survey Water-Resources Investigations Report 95-4085, 211 p.

REFERENCES

Dinicola, R.S., 1990, Characterization and simulation of rainfall-runoff relations for headwater basins in western King and Snohomish Counties, Washington: U.S. Geological Survey Water-Resources Investigations Report 89-4052, 52 p.

Donigian, A.S., Jr., Imhoff, J.C., Bicknell, Brian, Kittle, J.L., Jr., 1984, Application guide for Hydrological Simulation Program--Fortran (HSPF): U.S. Environmental Protection Agency, Environmental Research Laboratory, Athens, Ga., EPA-600/3-84-065, 177 p.

Johanson, R.C., Imhoff, J.D., and Davis, H.H., Jr., 1980, Users manual for hydrological simulation program - Fortran (HSPF): Environmental Research Laboratory, EPA-600/9-80-015, Athens, Ga., April 1980.

TRAINING

Watershed Systems Modeling I (SW2008TC), offered annually at the USGS National Training Center.

Watershed Systems Modeling II (SW3018TC), offered upon request at the USGS National Training Center.

River Basin Water-Quality Modeling (ID2146TC), offered annually at the USGS National Training Center.

Occasionally, EPA, Aqua Terra Consultants, and Hydrocomp, Inc., offer training courses.

CONTACTS

Operation and Distribution:
U.S. Geological Survey
Hydrologic Analysis Software Support Program
437 National Center
Reston, VA 20192

h2osoft@usgs.gov

Official versions of U.S. Geological Survey water-resources analysis software are available for electronic retrieval via the World Wide Web (WWW) at:

http://water.usgs.gov/software/

and via anonymous File Transfer Protocol (FTP) from:

water.usgs.gov (path: /pub/software).

The WWW page and anonymous FTP directory from which the HSPF software can be retrieved are, respectively:

http://water.usgs.gov/software/hspf.html
--and--
/pub/software/surface_water/hspf

SEE ALSO

annie(1) - Program to list, table, plot data in a WDM file
dr3m(1) - Distributed Routing Rainfall-Runoff Model --version II
dr3m-qual - Multi-event urban runoff quality model
hspexp(1) - Expert system for calibration of HSPF
iowdm(1) - Program to store time-series data in a WDM file
prms(1) - Precipitation-Runoff Modeling System

The URL for this page is: http://water.usgs.gov/cgi-bin/man_wrdapp?hspf
Send questions or comments to h2osoft@usgs.gov

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EPA United States Environmental Protection Agency

Loading Simulation Program in C++ (LSPC)

LSPC is the Loading Simulation Program in C++, a watershed modeling system that includes streamlined Hydrologic Simulation Program Fortran (HSPF) algorithms for simulating hydrology, sediment, and general water quality on land as well as a simplified stream transport model. LSPC is derived from the Mining Data Analysis System (MDAS), which was developed by EPA Region 3 and has been widely used for mining applications and TMDLs. A key data management feature of this system is that it uses a Microsoft Access database to manage model data and weather text files for driving the simulation. The system also contains a module to assist in TMDL calculation and source allocations. For each model run, it automatically generates comprehensive text-file output by subwatershed for all land-layers, reaches, and simulated modules, which can be expressed on hourly or daily intervals. Output from LSPC has been linked to other model applications such as EFDC, WASP, and CE-QUAL-W2. LSPC has no inherent limitations in terms of modeling size or model operations. The Microsoft Visual C++ programming architecture allows for seamless integration with modern-day, widely available software such as Microsoft Access and Excel.

WWQTCS Info

- WWQTCS Home
- Technical Support
- Tools
  - Watershed Models
    - Basins
    - LSPC
    - WAMView
    - SWMM
    - WARMF
  - Water Quality Models
    - WASP
    - QUAL2K
    - Aquatox
    - EPD-RIV1
  - Hydrodynamic Models
    - EFDC
    - EPD-RIV1
  - Database
- Training

Key Considerations in the Design of LSPC

LSPC was designed to handle very large-scale watershed modeling applications. The model has been successfully used to model watershed systems composed of over 1,000 subwatersheds. Using the WCS extension increases the efficiency of model setup and execution by eliminating unnecessary, repetitive user-input, hence minimizes the chance of human error. The system is tailored for source representation and TMDL calculation. The highly adaptable design and programming architecture allows for future modular additions and/or improvements. Furthermore, the entire system is designed to simplify transfer of information between models and users. The LSPC GIS interface, which is compatible with ArcView shapefiles, acts as the control center for launching watershed model scenarios. This stand-alone interface easily communicates with both shapefiles and the Microsoft Access database, but does not directly rely on the main programs. Therefore, once a watershed application is created, it is easily transferable to users who may not have ArcView or MS Access installed on their computers.

LSPC Components

There are seven basic components of the LSPC system. They include: (1) a WCS extension for efficient model setup; (2) an interactive, stand-alone GIS control center; (3) data management tools; (4) data inventory tools; (5) data analysis tools; (6) a dynamic watershed model tailored for TMDL calculation; and (7) model results analysis.

Download LSPC (EXE)

Download LSPC Manual (ZIP)

LSPC Tool Information Sheet (PDF) (PDF, 2 pp., 890 KB, about PDF)

Technical Support Center fact sheet (PDF) (2 pp., 733 KB, about PDF)

TMDL fact sheet (PDF) (2 pp., 697 KB, about PDF)

WCMS
Last updated on Thursday, January 10, 2013

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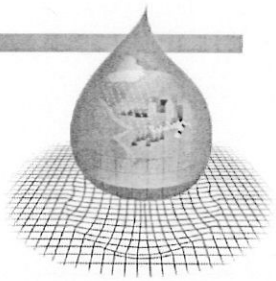
Storm Water Management Model (SWMM)

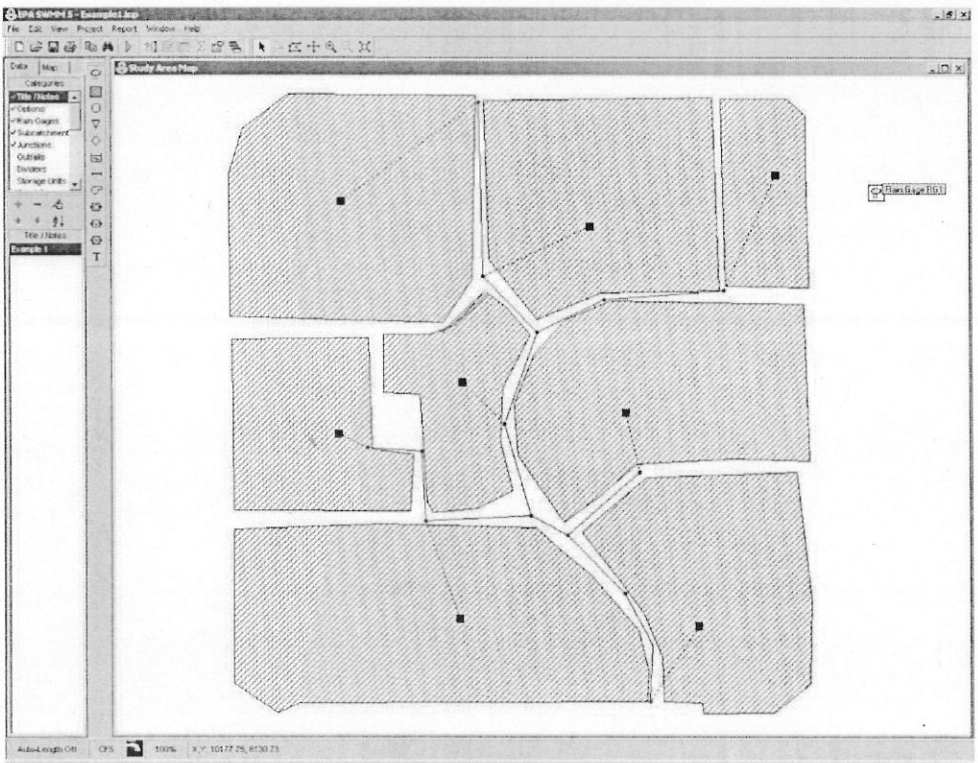


The EPA Storm Water Management Model (SWMM) is a dynamic rainfall-runoff simulation model used for single event or long-term (continuous) simulation of runoff quantity and quality from primarily urban areas. The runoff component of SWMM operates on a collection of subcatchment areas on which rain falls and runoff is generated. The routing portion of SWMM transports this runoff through a conveyance system of pipes, channels, storage/treatment devices, pumps, and regulators. SWMM tracks the quantity and quality of runoff generated within each subcatchment, and the flow rate, flow depth, and quality of water in each pipe and channel during a simulation period comprised of multiple time steps.

SWMM was first developed back in 1971 and has undergone several major upgrades since then. The current edition, Version 5, is a complete re-write of the previous release. Running under Windows, EPA SWMM 5 provides an integrated environment for editing drainage area input data, running hydraulic and water quality simulations, and viewing the results in a variety of formats. These include color-coded drainage area maps, time series graphs and tables, profile plots, and statistical frequency analyses.

This latest re-write of EPA SWMM was produced by the Water Supply and Water Resources Division of the U.S. Environmental Protection Agency's National Risk Management Research Laboratory with assistance from the consulting firm of CDM, Inc.

Visit the
Watershed & Water Quality Modeling
Technical Support Center Website
http://www.epa.gov/athens/wwqtsc/index.html



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SWAT Soil & Water Assessment Tool

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SWAT Model Software

The objective of the SWAT Model is to predict the effect of management decisions on water, sediment, nutrient and pesticide yields with reasonable accuracy on large, ungaged river basins.

Download SWAT2012 Executable *(rev. 591, April 15, 2013)*

The SWAT2012 **source code** and **input/output documentation** is also available.
Read the **SWAT changes** from revision 481 to revision 535.

Download the **SWAT executable for Linux** (rev. 583, January 17, 2013).

Other Versions of the SWAT Model

SWAT2009

SWAT2005

SWAT2000

SWAT99.2

SWAT98.1

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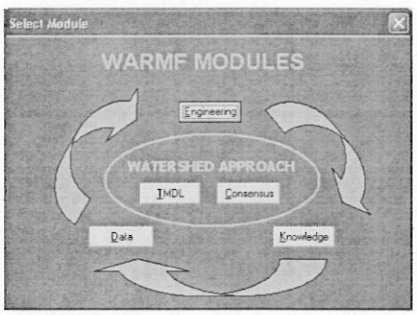
Watershed Analysis Risk Management Framework (WARMF)

To facilitate TMDL analysis and watershed planning, WARMF was developed as a decision support system. The system provides a road map to calculate TMDLs for most conventional pollutants (coliform, TSS, BOD, nutrients). It also provides a road map to guide stakeholders to reach consensus on an implementation plan. The scientific basis of the model and the consensus process have undergone several peer reviews by independent experts under EPA guidelines. WARMF is now compatible with the data extraction and watershed delineation tools of EPA BASINS. WARMF is organized into five (5) linked modules under one, GIS-based graphical user interface (GUI). It is a very user friendly tool suitable for expert modelers as well as general stakeholders.

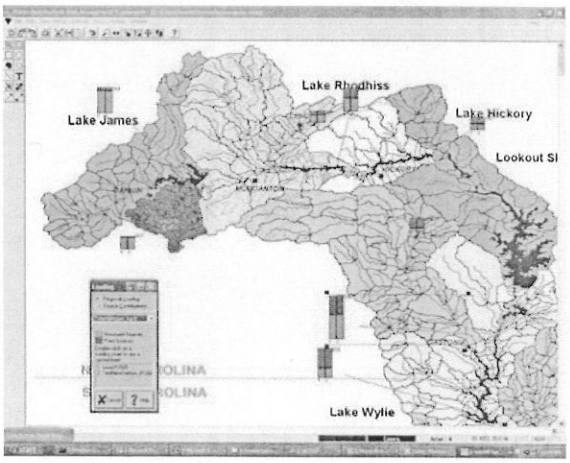


WARMF Components

The Engineering Module is a GIS-based watershed model that calculates daily runoff, shallow ground water flow, hydrology and water quality of a river basin. A river basin is divided into a network of land catchments (including canopy and soil layers), stream segments, and lake layers for hydrologic and water quality simulations. Land surface is characterized by land use / land cover and precipitation is deposited on the land catchments to calcuate snow and soil hydrology, and resulting surface runoff and groundwater accretion to river segments. Water is then routed from one river segment to the next, from river segments to reservoirs, and then from a reservoirs to river segments, until watershed terminus is reached. Instead of using export coefficients, a complete mass balance is performed starting with atmospheric deposition and land application as boundary conditions. Pollutants are routed with water in throughfall, infiltration, soil adsorption, exfiltration, and overland flow. The sources of point and nonpoint loads are routed through the system with the mass so the source of nonpoint loading can be tracked back to land use and location. WARMF provides several options for modeling reservoirs using 1D or 2D approaches. The algorithms of WARMF were derived from many well established codes such as ILWAS, SWMM, ANSWERS, WASP.

The Data Module contains meteorology, air quality, point source, reservoir release, and flow diversion data used to drive the model. It also contains observed flow and water quality data used for calibration. The data is accessed through the map-based interface and can be viewed and edited in both graphical and tabular format. The Knowledge Module stores supplimental watershed data, documents, case studies, or reports of past modeling activities for easy access by model users.

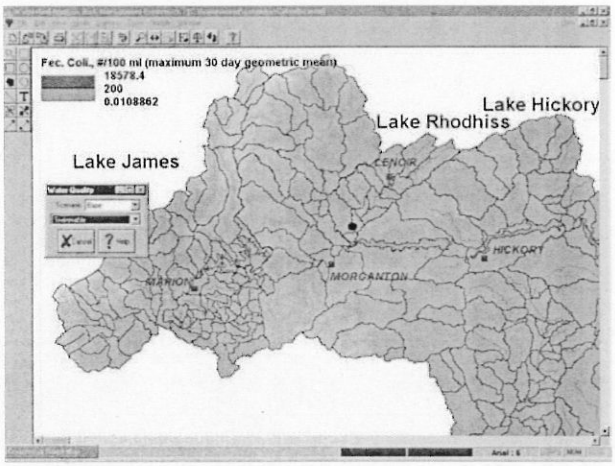
At the center of WARMF are the two watershed approach modules for Consensus building and TMDL calculation. These two modules are roadmaps that provide guidance for stakeholders during the decision making process. The Consensus Module of WARMF provides information in a series of steps for stakeholders to learn about the issues, formulate and evalute alternatives, and negotiate a consensus. Outputs are displayed in colored maps and graphs. A GIS map is used to show the bar charts of pollution loads from various sub regions of the river basin. Another GIS map is used to show the consequence of the pollution loads, in which water bodies suitable for a designated use are shaded green and those not suitable are shaded red. Through the TMDL Module, calculations are made for a series of control points from the upstream to the downstream of a river basin. A road map is provided for the step-by-step procedure. An iterative set of simulations are performed to calcuate various combinations of point and nonpoint loads that the waterbody can accept and meet the water quality criteria of the designated uses. The water quality criteria can be specified for multiple parameters and based on percent compliance.



WARMF Features

WARMF can help answer water resource and water quality questions such as:

- What are the cumulative water quality impacts under various watershed management scenarios?
- What are the trade-offs with sewer extension vs. onsite wastewater systems?
- How will regional growth affect water quality?
- How will increased water diversions affect hydrology and water quality?
- Will BMPs such as buffer strips or livestock fencing be effective for nonpoint load reduction?
- What is the TMDL for a 303d listed stream?



The advantages of WARMF include:

- Integrates models, databases, and graphical software into a map-based stand alone tool that does not require ArcView
- Links catchments, river segments, and lakes to form a seamless river basin model which computes soil and surface hydrology, pollutant build up and washoff based on physical principles instead of SCS curve numbers and run off coefficients
- Contains a user friendly GUI and unique decision support tools that allow a variety of stakeholders (including modelers and lay persons) to run the model and to take ownership of their watershed by learning about the science behind their water quality issues
- Calculates TMDLs to meet water quality criteria for beneficial uses
- Uses readily available data from NOAA, EPA, and USGS to predict hydrology and water quality of rivers and lakes
- Models flow, temperature, nutrients, bacteria, dissolved oxygen, sediment transport, periphyton, phytoplankton, and loading from onsite wastewater systems
- Provides several options for modeling reservoirs including 1D, psuedo 2D and CE-QUAL-W2
- Displays sources of point and nonpoint loading using easy-to-understand GIS maps
- Displays water quality status in terms of suitability for fish habitat, swimming, water supply, and other uses with red and green color codes
- Simulates the impact of controls on atmospheric deposition, point source loads, and BMPs for nonpoint source loads such as buffer strips, street sweeping, livestock exclusion, and fertilizer reduction
- Evaluates cost sharing schemes for pollution trading and determines the failure risk of a management plan

WARMF has been applied to over 15 watersheds in the United States and internationally. The studies have addressed the TMDLs of nutrients, sediment, fecal coliform, and the impact of onsite wastewater systems on a watershed scale. The size of river basin applications ranges from the small Mica Creek research watershed in Idaho (10.8 mi^2) to the large San Juan Basin of Colorado and New Mexico (16,000 mi^2). There is no limit on the size or scale of a potential WARMF application as long as adequate topography data are available.

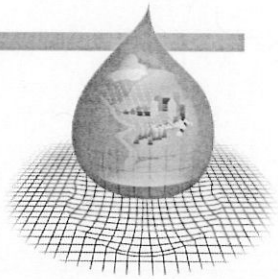
References

Chen, C.W., J. Herr, L. Weintraub, 2004. "Decision Support System for Stakeholder Involvement", Journal of Environmental Engineering, ASCE, Vol 130, No. 6, June 2004, pp.714-721.

Chen, C.W., J. Herr, and L. Weintraub. 2001. "Watershed Analysis Risk Management Framework (WARMF): Update One – A Decision Support System for Watershed Analysis and Total Maximum Daily Load Calculation, Allocation and Implementation" Publication No. 1005181, Electric Power Research Institute, Palo Alto, CA.

Keller, A. 2000. 2000. "Peer Review of the Watershed Analysis Risk Management Framework (WARMF) – An evaluation of WARMF for TMDL applications by independent experts using USEPA guidelines", Technical Report 2000.1000252, Electric Power Research Institute, Palo Alto, CA.

Environmental Fluid Dynamics Code (EFDC)



The Environmental Fluid Dynamics Code (EFDC) is a state-of-the-art hydrodynamic model that can be used to simulate aquatic systems in one, two, and three dimensions. It has evolved over the past two decades to become one of the most widely used and technically defensible hydrodynamic models in the world. EFDC uses stretched or sigma vertical coordinates and Cartesian or curvilinear, orthogonal horizontal coordinates to represent the physical characteristics of a waterbody. It solves three-dimensional, vertically hydrostatic, free surface, turbulent averaged equations of motion for a variable-density fluid. Dynamically-coupled transport equations for turbulent kinetic energy, turbulent length scale, salinity and temperature are also solved. The EFDC model allows for drying and wetting in shallow areas by a mass conservation scheme. The physics of the EFDC model and many aspects of the computational scheme are equivalent to the widely used Blumberg-Mellor model and U. S. Army Corps of Engineers' Chesapeake Bay model. EFDC's role in the TMDL Toolbox will be to provide necessary hydrodynamic inputs to WASP, the advanced receiving water quality model.

EFDC Preprocessor

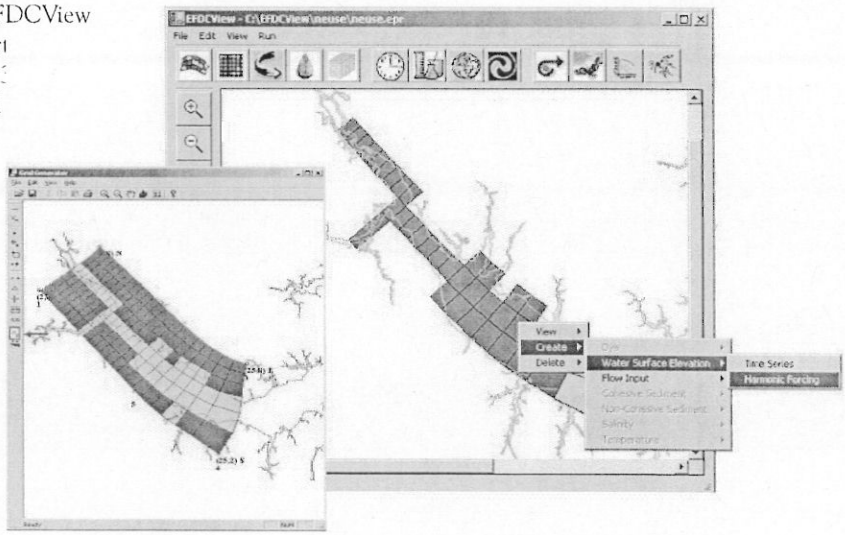
A preprocessor is being developed to facilitate the setup and application of EFDC for a wide range of applications. The preprocessor provides three significant tools to streamline the setup of an EFDC model: the VOGG Curvilinear Grid Generator, the EFDCView Model Interface, and the MOVEM Postprocessor. The VOGG Grid Generator and MOVEM postprocessor are stand-alone applications that may be accessed via the EFDCView environment. EFDCView enables the user to generate curvilinear-ort grids, simulate aquatic systems in 1, 2, or 3 sions, link 2-D grids to 1-D grids, quickly and and change critical modeling parameters, and make use of watershed loading model results and monitoring data for boundary conditions.

The VOGG Curvilinear Grid Generator enables a user to generate curvilinear-orthogonal grids that are required by EFDCView. It significantly decreases the repetitive effort typically required through manual grid generation methods. Grid generation is conducted interactively and intuitively through the interface and associated controls. Key features of the tool include:

- GIS interface
- Model domain designation through user control point designation
- Automatic insertion of grid boundary points based on control point designation
- Automatic curvilinear-orthogonal grid generation
- Model grid conversion to GIS shape file format
- Cell mapping between EFDC and WASP

Once a grid has been generated, it's necessary to set and calibrate pertinent modeling parameters. EFDCView simplifies the setup and application of EFDC through a shapefile format-based graphical interface and associated windows. It supports input of EFDC model run control and model parameter designation, and it links directly to boundary condition/source data, e.g. watershed model output and point source contributions. Key features of the tool include:

- Visual linkage to the model grid
- Visual linkage to point and nonpoint source inputs
- New model parameter addition and accommodation
- Direct linkage to WRDB for boundary condition designation/generation



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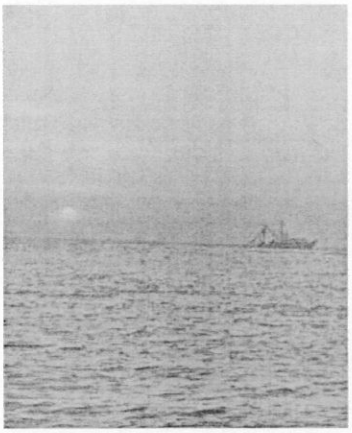


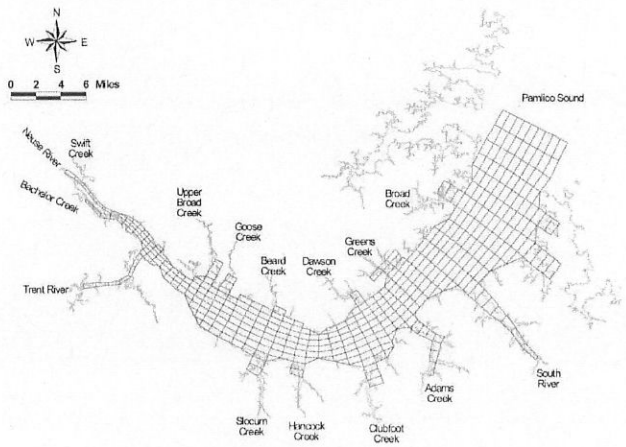
EFDC Application for the Neuse River Estuary, NC

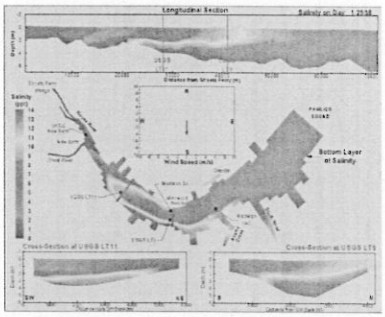
The Neuse River Estuary was included on the State's 303(d) list for nutrients and was scheduled for TMDL development by the spring of 2001. The water quality targets within the system are based ultimately on chlorophyll-a concentrations. The target of 40 mg/L chlorophyll-a will be achieved within the Neuse Estuary through control of point and non-point discharges of nutrients, specifically nitrogen, within the Neuse River watershed and tributaries adjacent to the estuary.

Background

The Neuse River Estuary is located in eastern North Carolina at the confluence of the Neuse River and Pamlico Sound. The Neuse River is 179 miles long and it's watershed drains approximately 5,700 square miles from the coastal plain and piedmont provinces of the state. There have been significant concerns with the water quality in the estuary over the past decade, with a focus on nutrient loadings from surrounding land uses.

The circulation and transport of materials within the Neuse Estuary are highly complex. Water surface elevation fluctuations within Pamlico Sound are on the order of 1 meter and provide a driving mechanism at the mouth of the estuary. These fluctuations are caused primarily by meteorological events creating "sloshing" within the Sound. Salinity intrusion to the system extends nearly 45 miles into the estuary and creates the characteristic residual estuarine circulation pattern of outflow on the surface and inflow at the bottom. Finally, local wind forcing creates conditions where the stratification within the estuary is overturned periodically altering the residual flow patterns.





Water quality within the Neuse Estuary is highly influenced by the complex circulation patterns. System characteristics include seasonal low dissolved oxygen near the bottom, areas of low flow and flushing causing algal blooms, overturning of low dissolved oxygen water where significant wind events follow periods of low energy, and backwater effects caused by set up of water surface elevation within Pamlico Sound.

TMDL Summary

In 1999 the State of North Carolina proposed to EPA Region 4 an initial target of 30 percent reduction in total nitrogen load from the Neuse River to the estuary. This work was Phase I of the Neuse Estuary TMDL. This initial reduction target was not determined through detailed model application and evaluation.

Under Phase II of the Neuse Estuary TMDL development, and in agreement with the State of North Carolina, EPA is utilizing the Environmental Fluid Dynamics Code (EFDC), a three-dimensional hydrodynamic model, linked with the EPA Water Quality Analysis and Simulation Program (WASP) to determine the level of nutrient reduction required for the Neuse Estuary to meet the designated uses. The Hydrological Simulation Program FORTRAN (HSPF) and Nonpoint Source Model (NSPM) were utilized in conjunction with US EPA Region 4's Watershed Characterization System to provide loads directly to the estuary model.

The model was applied over a 3-year period, examining the chlorophyll-a levels in the system, both longitudinally distributed as well as lateral variations. In addition to examining the effects of nutrients on chlorophyll-a concentrations, EPA will be able to determine the frequency of anoxic conditions in the lower waters of the estuary due to nutrient enrichment, and the benefits gained (relative to dissolved oxygen) through nutrient reduction.

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CE-QUAL-ICM/TOXI.

Last Revision Date: 11/16/2009

General Information

Model Abbreviated Name: CE-QUAL-ICM/TOXI

Model Extended Name: CE-QUAL-ICM/TOXI.

Model Overview/Abstract:
The three-dimensional water quality model for surface water, CE-QUAL-ICM, was modified to simulate toxic substances, or contaminants. The original model focuses on nutrients, dissolved oxygen, and phytoplankton as related to eutrophication processes. The new version, referred to as ICM/TOXI, omits the eutrophication state variables and includes process descriptions for simulating trace chemicals in the water column and bottom sediments. The water column process descriptions were taken from the TOXIWASP model of the U.S. Environmental Protection Agency. Transport and fate algorithms for solids and contaminants in the bottom sediments were added. Contaminant concentrations are modeled as total chemical and partitioned between water, up to three classes of sediment, and dissolved organic carbon using linear, equilibrium partitioning.

Keywords:

Model Technical Contact Information:
Dr. Mark Dortch
U.S. Army Corps of Engineers (USACE)
Environmental Research and Development Center (ERDC)
CEERD-EP-W
3909 Halls Ferry Rd
Vicksburg, MS 39180
601-634-3517
mark.s.dortch@erdc.usace.army.mil

Model was developed and is maintained by USACE/ERDC.

Model Homepage: http://el.erdc.usace.army.mil/elmodels/icminfo.html
EXIT Disclaimer

User Information

Technical Requirements

Computer Hardware
PC: 166 MHz Pentium to 400 MHz Pentium II

RAM: 64 MB plus 128 MB virtual/128 MB plus 256 MB virtual

ROM: 300 MB/750 MB

Or a workstation

Compatible Operating Systems
Windows 3.1 or earlier

Windows 95, 98, NT, or later

UNIX

Linux

Other Software Required to Run the Model
Fortran 90

Download Information

The model is publicly available through U.S. Army Corps of Engineers (USACE), Environmental Research and Development Center (ERDC). The Model is on a mainframe and/or workstation(s); but, is remotely accessible through the internet. An ftp site will be set up when model is released. Disks/CDs can be made available upon request.

Using the Model

Basic Model Inputs
More complex model with greater input requirements, but no substantial modular or sub-model components.

Model uses site-specific inputs for ambient conditions (such as sediment properties), dissolved organic carbon, fraction organic carbon in sediment, etc.

User Support

User's Guide Available?
The model is calibrated to observed in-situ data.

Documentation will be downloadable via the internet. Documentation can be available on disk/CD by request.

Provides: (1) equations, equation solution methodologies, and related simplifying assumptions, (2) example input/output files, (3) input and output variable documentation including definitions, units, temporal/spatial dimensions, temporal/spatial resolution options, and (if applicable such as with FORTRAN) format, (4) guidance on selecting and/or estimating values and/or distributions for input variables (including guidance on calibration and selecting default values and/or distributions).

User Qualifications
User needs high level of technical education (M.S. or higher) and/or modeling experience.

Model Science

Summary of Model Structure and Methods
Simulates formation and fate/transport of daughter products of primary pollutants.

The model uses fixed (SI) units.

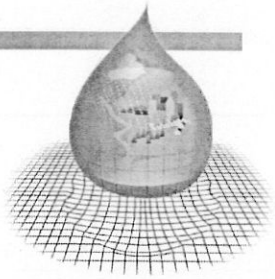
The model provides mathematical guidance to assist the user when selecting modeling parameters.

Governing equations are solved numerically.

Model Evaluation
Partial code verification has been performed.

Model testing (evaluation) has been performed for three sites.

Stream Water Quality Model (QUAL2K)

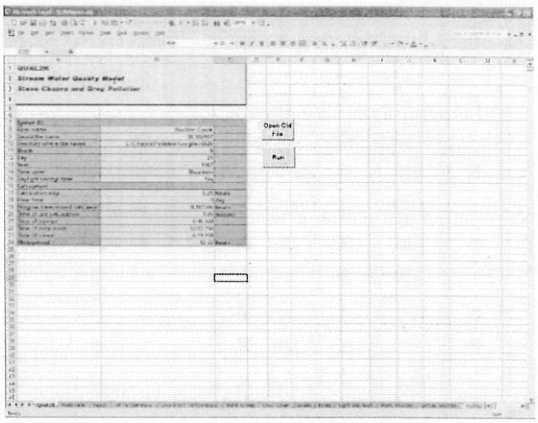


QUAL2K (or Q2K) is a river and stream water quality model that is intended to represent a modernized version of the QUAL2E (or Q2E) model (Brown and Barnwell 1987). Q2K is similar to Q2E in the following respects:

- One dimensional. The channel is well-mixed vertically and laterally.
- Steady state hydraulics. Non-uniform, steady flow is simulated.
- Diurnal heat budget. The heat budget and temperature are simulated as a function of meteorology on a diurnal time scale.
- Diurnal water-quality kinetics. All water quality variables are simulated on a diurnal time scale.
- Heat and mass inputs. Point and non-point loads and abstractions are simulated.

The QUAL2K framework includes the following new elements:

- Software Environment and Interface. Q2K is implemented within the Microsoft Windows environment. It is programmed in the Windows macro language: Visual Basic for Applications (VBA). Excel is used as the graphical user interface.
- Model segmentation. Q2E segments the system into river reaches comprised of equally spaced elements. In contrast, Q2K uses unequally-spaced reaches. In addition, multiple loadings and abstractions can be input to any reach.
- Carbonaceous BOD speciation. Q2K uses two forms of carbonaceous BOD to represent organic carbon. These forms are a slowly oxidizing form (slow CBOD) and a rapidly oxidizing form (fast CBOD). In addition, non-living particulate organic matter (detritus) is simulated. This detrital material is composed of particulate carbon, nitrogen and phosphorus in a fixed stoichiometry.
- Anoxia. Q2K accommodates anoxia by reducing oxidation reactions to zero at low oxygen levels. In addition, denitrification is modeled as a first-order reaction that becomes pronounced at low oxygen concentrations.
- Sediment-water interactions. Sediment-water fluxes of dissolved oxygen and nutrients are simulated internally rather than being prescribed. That is, oxygen (SOD) and nutrient fluxes are simulated as a function of settling particulate organic matter, reactions within the sediments, and the concentrations of soluble forms in the overlying waters.
- Bottom algae. The model explicitly simulates attached bottom algae.
- Light extinction. Light extinction is calculated as a function of algae, detritus and inorganic solids.
- pH. Both alkalinity and total inorganic carbon are simulated. The river's pH is then simulated based on these two quantities.
- Pathogens. A generic pathogen is simulated. Pathogen removal is determined as a function of temperature, light, and settling.



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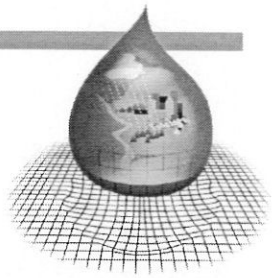
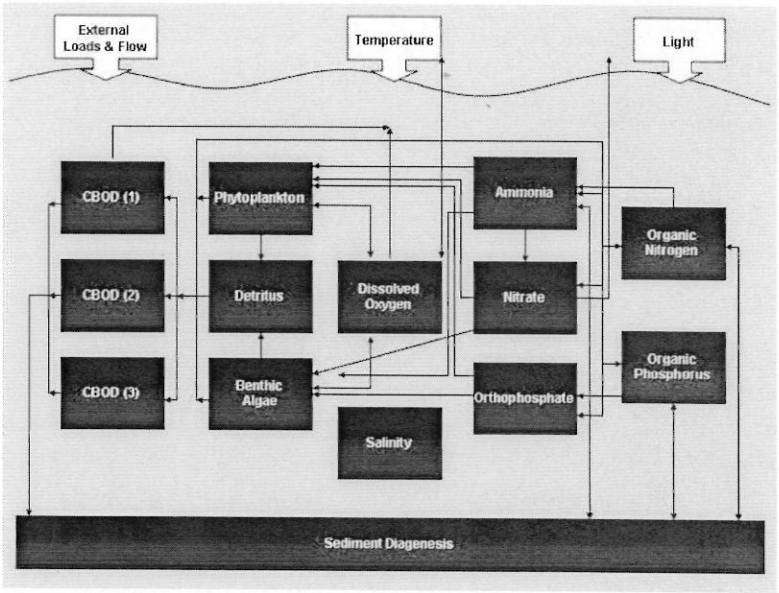
Water Quality Analysis Simulation Program (WASP)



The Water Quality Analysis Simulation Program—(WASP6), an enhancement of the original WASP (Di Toro et al., 1983; Connolly and Winfield, 1984; Ambrose, R.B. et al., 1988). This model helps users interpret and predict water quality responses to natural phenomena and man-made pollution for various pollution management decisions. WASP6 is a dynamic compartment-modeling program for aquatic systems, including both the water column and the underlying benthos. WASP allows the user to investigate 1, 2, and 3 dimensional systems, and a variety of pollutant types. The state variables for the given modules are given in the table below. The time-varying processes of advection, dispersion, point and diffuse mass loading and boundary exchange are represented in the model. WASP also can be linked with hydrodynamic and sediment transport models that can provide flows, depths velocities, temperature, salinity and sediment fluxes.



WASP has been used to examine eutrophication of Tampa Bay, FL; phosphorus loading to Lake Okeechobee, FL; eutrophication of the Neuse River Estuary, NC; eutrophication Coosa River and Reservoirs, AL; PCB pollution of the Great Lakes, eutrophication of the Potomac Estuary, kepone pollution of the James River Estuary, volatile organic pollution of the Delaware Estuary, and heavy metal pollution of the Deep River, North Carolina, mercury in the Savannah River, GA.

Eutrophication Module	Organic Chemical Module	Mercury Module
Dissolved Oxygen	Chemical 1	**Elemental Mercury**
CBOD (1)	Chemical 2	**Divalent Mercury**
CBOD (2)	Chemical 3	**Methyl Mercury**
CBOD (3)	Solids 1	**Sands**
Ammonia	Solids 2	**Fines**
Nitrate	Solids 3	
Organic Nitrogen		
Orthophosphate		
Organic Phosphorous		
Algae		
Benthic Algae		
Detritus		
Sediment Diagenesis		
Salinity		

WASP Preprocessor

The data preprocessor allows for the rapid development of input datasets. The ability to bring data into the model is as simple as cut and paste or queried from a database. The preprocessor provides detailed descriptions of all model parameters and kinetic constants. When linking WASP with hydrodynamic models it is as simple as pointing to the hydrodynamic linkage file.

- Import time series from WRDB, Spreadsheet, Text Files
- Automatically import hydrodynamic model interface information
- Multi-session capable
- Run time diagnosis

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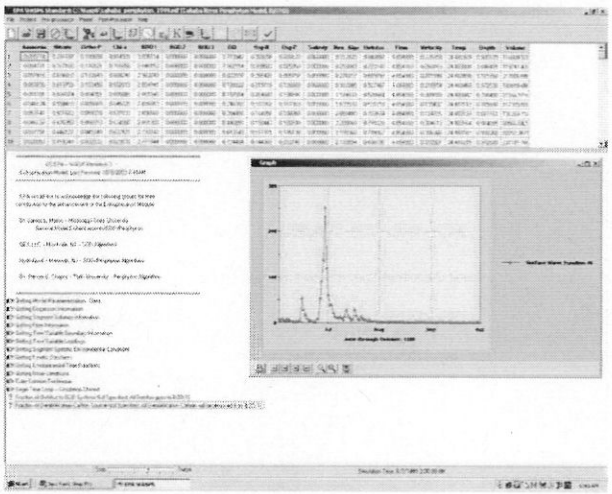
Post Processor

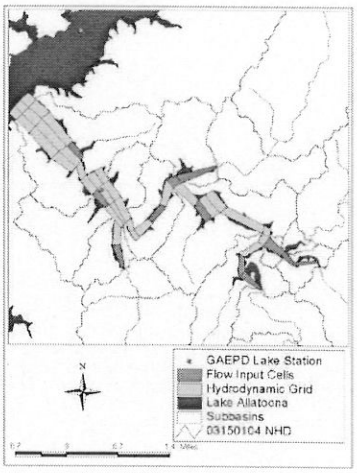
The Post-Processor (MOVEM) provides an efficient method for reviewing model predictions and comparing them with field data for calibration. MOVEM has the ability to display results from all of the WASP models as well as others. MOVEM allows the modeler to displays the results in two graphical formats:



1) Spatial Grid—a two dimensional rendition of the model network is displayed in a window where the model network is color shaded based upon the predicted concentration.
2) x/y Plots—generates an x/y line plot of predicted and/or observed model results in a window.

There is no limit on the number of x/y plots, spatial grids or even model result files the user can utilize in a session. Separate windows are created for each spatial grid or x/y plot created by the user.

WASP Case Study for Little River Embayment, GA



WASP 6.1 was setup and calibrated for the Little River embayment on Lake Allatoona, Georgia to support the development of a nutrient TMDL for the State of Georgia. WASP was applied for three consecutive growing seasons during 2000, 2001, and 2002 to simulate phytoplankton growth due to excess nutrients from point and nonpoint sources. The Little River drains 214 square miles of primarily residential and agricultural land into Lake Allatoona, which is located on the Etowah River approximately 30 miles north of Atlanta, Georgia. The LSPC model was developed to simulate the watershed flows and nutrient constituents to input in the EFDC and WASP models. EFDC was used to simulate the hydrodynamics in the embayment and developed a hydrodynamic linkage file for WASP. The calibrated WASP model was used by the State to develop management strategies to ensure water quality standards are achieved.

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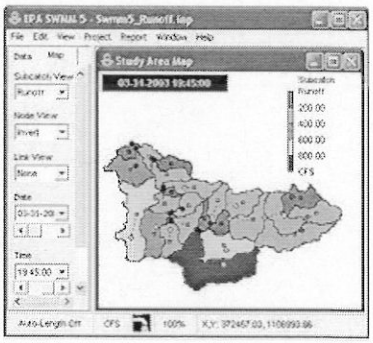
http://www.epa.gov/nrmrl/wswrd/wq/models/swmm/

Storm Water Management Model (SWMM)

Version 5.0.022 with Low Impact Development (LID) Controls



Description

EPA's Storm Water Management Model (SWMM) is used throughout the world for planning, analysis and design related to:

- stormwater runoff,
- combined sewers,
- sanitary sewers,
- and other drainage systems in urban areas
- with many applications in non-urban areas as well.

This general purpose urban hydrology and conveyance system hydraulics software is a dynamic rainfall-runoff simulation model used for single event or long-term (continuous) simulation of runoff quantity and quality from primarily urban areas. The runoff component of SWMM operates on a collection of subcatchment areas that receive precipitation and generate runoff and pollutant loads. The routing portion of SWMM transports this runoff through:

- a system of pipes,
- channels,
- storage/treatment devices,
- pumps, and
- regulators.

SWMM tracks:

- the quantity and quality of runoff made within each subcatchment,
- and the flow rate, flow depth, and quality of water in each pipe and channel

during a simulation period made up of multiple time steps. EPA has recently extended SWMM 5 to explicitly model the hydrologic performance of specific types of low impact development (LID) controls, such as:

- porous pavement,
- rain gardens,
- green roofs,
- street planters,
- rain barrels,
- infiltration trenches, and
- vegetative swales.

The updated model allows engineers and planners to accurately represent any combination of LID controls within a study area to determine their effectiveness in managing stormwater and combined sewer overflows.
Running under Windows, SWMM 5 provides an integrated environment for:

- editing study area input data,
- running hydrologic,
- hydraulic and water quality simulations, and
- viewing the results in a variety of formats.

The formats include:

- color-coded drainage area and conveyance system maps,

- time series graphs and tables,
- profile plots, and
- statistical frequency analyses.

SWMM 5 was produced in a joint development effort with CDM, Inc., a global consulting, engineering, construction, and operations firm.

Capabilities

SWMM accounts for various hydrologic processes that produce runoff from urban areas. These include:

- time-varying rainfall
- evaporation of standing surface water
- snow accumulation and melting
- rainfall interception from depression storage
- infiltration of rainfall into unsaturated soil layers
- percolation of infiltrated water into groundwater layers
- interflow between groundwater and the drainage system
- nonlinear reservoir routing of overland flow
- runoff reduction via Low Impact Development (LID) controls.

Spatial variability in all of these processes is achieved by dividing a study area into a collection of smaller, homogeneous subcatchment areas, each containing its own fraction of pervious and impervious sub-areas. Overland flow can be routed:

- between sub-areas,
- between subcatchments, or
- between entry points of a drainage system.

SWMM also contains a flexible set of hydraulic modeling capabilities used to route runoff and external inflows through the drainage system network of pipes, channels, storage/treatment units and diversion structures. These include the ability to:

- handle drainage networks of unlimited size
- use a wide variety of standard closed and open conduit shapes as well as natural channels
- model special elements such as storage/treatment units, flow dividers, pumps, weirs, and orifices
- apply external flows and water quality inputs from surface runoff, groundwater interflow, rainfall-dependent infiltration/inflow, dry weather sanitary flow, and user-defined inflows
- utilize either kinematic wave or full dynamic wave flow routing methods
- model various flow regimes, such as backwater, surcharging, reverse flow, and surface ponding
- apply user-defined dynamic control rules to simulate the operation of pumps, orifice openings, and weir crest levels

SWMM can also estimate the production of pollutant loads associated with this runoff. The following processes can be modeled for any number of user-defined water quality constituents:

- dry-weather pollutant buildup over different land uses
- pollutant washoff from specific land uses during storm events
- direct contribution of rainfall deposition
- reduction in dry-weather buildup due to street cleaning
- reduction in washoff load due to BMPs
- entry of dry weather sanitary flows and user-specified external inflows at any point in the drainage system
- routing of water quality constituents through the drainage system
- reduction in constituent concentration through treatment in storage units or by natural processes in pipes and channels

Applications

Since its inception, SWMM has been used in thousands of sewer and stormwater studies throughout the world. Typical applications include:

- design and sizing of drainage system components for flood control
- sizing of detention facilities and their appurtenances for flood control and water quality protection
- flood plain mapping of natural channel systems (SWMM 5 is a FEMA-approved model for NFPI studies)
- designing control strategies for minimizing combined sewer overflows
- evaluating the impact of inflow and infiltration on sanitary sewer overflows
- generating non-point source pollutant loadings for waste load allocation studies
- controlling site runoff using Low Impact Development practices
- evaluating the effectiveness of BMPs for reducing wet weather pollutant loadings.

http://water.epa.gov/scitech/datait/models/basins/fs-basins4.cfm

Water: BASINS

BASINS 4.0—Fact Sheet

Fact Sheet; April 2007

EPA has released version 4.0 of the Better Assessment Science Integrating point and Nonpoint Sources (BASINS) software system. The most significant change in BASINS 4.0 is its use of open source GIS software architecture. Analysts can now use BASINS 3.1 or BASINS 4.0 to examine environmental information, analyze environmental systems, and build a framework for assessing management alternatives.

Background

BASINS was originally introduced in 1996, and improved versions were released in 1998, 2001, and 2004. BASINS is a multipurpose environmental analysis system designed for regional, state, and local agencies that perform watershed and water quality-based studies. This system makes it possible to quickly assess large amounts of point and non-point source data in a format that is easy to use and understand. Installed on a personal computer, BASINS allows the user to assess water quality at selected stream sites or throughout an entire watershed. This invaluable tool integrates environmental data, analytical tools, and modeling programs to support cost-effective approaches to watershed management and environmental protection, including the development of Total Maximum Daily Loads (TMDLs).

What's New in BASINS 4.0?

Like version 3.1, BASINS 4.0 includes these valuable features:

- Data Download Tool,
- GIS Project Builder,
- GIS Edit Tools,
- Automatic and Manual Watershed Delineation,
- Watershed Characterization Reports,
- series of Surface Water Models, and
- customized databases.

Unlike previous releases, BASINS version 4.0 runs on a non-proprietary, open source GIS system architecture, providing a cost-saving alternative to expensive GIS software and improving upon the BASINS 3.1 capabilities.

Access to data in BASINS 3.1 and 4.0 is web-based. The user specifies the geographic area, and the software downloads selected data from EPA, USGS, and other Internet locations. After the GIS data are downloaded, they are automatically extracted, projected to a user-specified map, and combined in a project file. The Web Data Download tool allows the user to add data to a BASINS project from a variety of data sources and to check for more recent data and updates.

The Data Download tool provides dynamic downloading of GIS data and access to hydrologic and monitoring data from the BASINS web site and a variety of other sources. It also has a built-in function for installing updates to any of the BASINS components. This feature automatically checks all components of the BASINS application since the last update. If any program components are out of date, this tool gives the user the option to download and install those updates. Through this feature, BASINS users can be assured they are running the most up-to-date version of the software.

BASINS Version 4.0 includes the existing WinHSPF and PLOAD models that BASINS 3.0 uses. WinHSPF estimates land use specific nonpoint source loadings for selected pollutants at a watershed. The new Parameter Estimation (PEST) tool in WinHSPF automates the model calibration process and allows users to quantify the uncertainty associated with specific model predictions. WinHSPF links to the AQUATOX model for integrating watershed analysis with effects on aquatic biota in receiving waters. It also provides access to a new BASINS feature: the Windows-based Climate Assessment Tool for assessing potential impacts of changing climate on stream flows and pollutant loads.

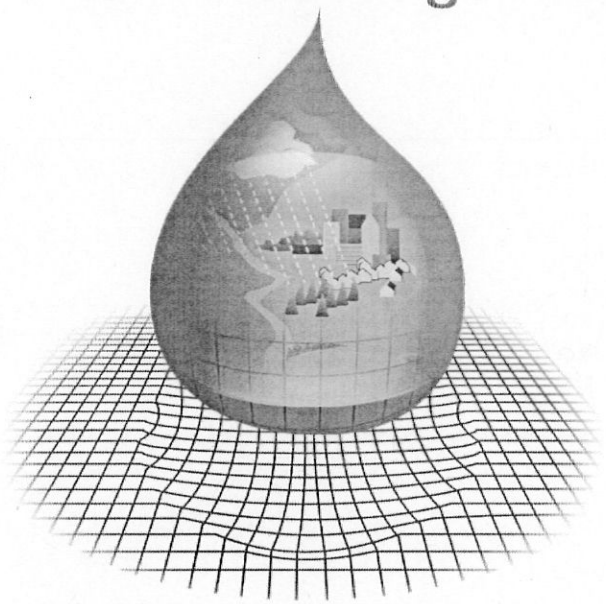
For More Information

For further information about BASINS, send an e-mail to basins@epa.gov.

To keep up with the latest news and updates, join the BASINS Listserver.

Last updated on Wednesday, August 22, 2012

TMDL Modeling Toolbox



What is the Toolbox?

The TMDL Modeling Toolbox is a collection of models, modeling tools, and databases that have been utilized over the past decade in the development of Total Maximum Daily Loads (TMDLs). The Toolbox takes these proven technologies and provides the capability to more readily apply the models, analyze the results, and integrate watershed loading models with receiving water applications. The design of the toolbox is such that each of the models are stand alone applications. The toolbox provides an exchange of information between the models through common linkages. Due to the modular design of the Toolbox, additional models can be added easily to integrate with the other tools. In addition, the toolbox provides the capability to visualize model results, a linkage to GIS and non-geographic databases (including monitoring data for calibration), and the functionality to perform data assessments.

What models are in the Toolbox?

The Toolbox allows for the steady-state/dynamic simulation of mass transport and water quality processes in all types of surface water environments, including overland flow, small creeks, rivers, lakes, estuaries, coastal embayments, and offshore areas. The Toolbox contains assessment tools, watershed models, and receiving water models including the following:

Assessment Tools:

- Water Resources Database (WRDB)
- Watershed Characterization System (WCS)
- WCS Sediment Tool
- WCS Mercury Tool
- WCS LSPC Tool

Watershed Models:

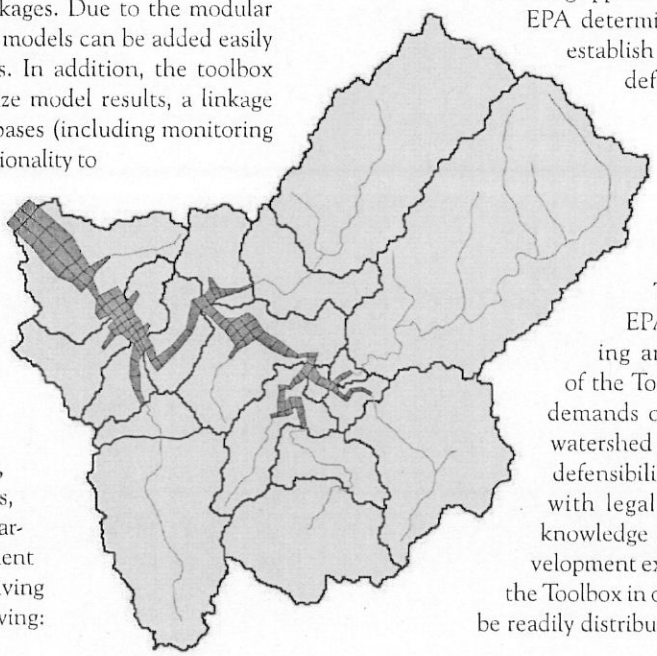
- Loading Simulation Program in C++ (LSPC)
- Watershed Assessment Model (WAMView)
- Storm Water Management Model (SWMM)

Receiving Water Models:

- A Dynamic One-Dimensional Model of Hydrodynamics and Water Quality (EPDRiv1)
- Stream Water Quality Model (QUAL2K)
- CONservational Channel Evolution and Pollutant Transport System (CONCEPTS)
- Environmental Fluid Dynamics Code (EFDC)
- Water Quality Analysis Simulation Program (WASP)

Why is the Toolbox being developed?

With the significant increase in the need for sophisticated modeling approaches for TMDL development, EPA determined that it is necessary to establish a level of consistency and defensibility for TMDL modeling tools. The Toolbox is designed to address a broad range of waterbody types and pollutants. EPA actively supports the components of the TMDL Modeling Toolbox. EPA is committed to enhancing and improving components of the Toolbox to meet the technical demands of the TMDL program and watershed protection. This will ensure defensibility when TMDLs are faced with legal challenges. Additionally, knowledge gained through TMDL development experience and modeling with the Toolbox in one region of the country can be readily distributed throughout others.



EPA United States Environmental Protection Agency

Have any of the Toolbox components been used for TMDL development?

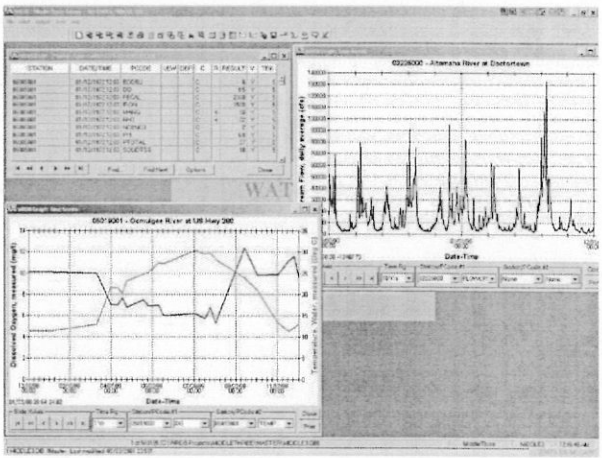
The Toolbox models and databases have been used both independently and collectively to develop defensible TMDLs for a wide array of issues including pathogens, sediment, nutrients, dissolved oxygen, metals, temperature, and toxicants. The WCS Sediment Tool has been applied to sediment-impaired waters throughout the southeast. Mercury TMDLs were developed in Georgia using a combination of the WCS Mercury Tool and WASP. LSPC has been used in Alabama for pathogen TMDLs; Georgia, Tennessee, Kentucky, and Alabama for nutrient and/or dissolved oxygen TMDLs; and Alabama, West Virginia, and Arizona for metals TMDLs. EFDC has been used widely throughout the country to support TMDL development – Washington, California, Oklahoma, Florida, Mississippi, Alabama, North Carolina, West Virginia, Delaware, Pennsylvania, and Massachusetts. Toolbox model linkages have been successful in a number of situations, most notably for TMDL development in the Neuse Estuary NC, Cape Fear River NC, and Fenholloway River Estuary FL (EFDC and WASP) and TMDL development for Mobile Bay AL, Flint Creek AL, Coosa Lakes AL, Lake Allatoona GA, and Alabama River AL (LSPC, EFDC, and WASP).

Is training available for the Toolbox?

A series of training courses is being designed to instruct users on the application of the Toolbox models, databases, and linkages. This training will consist of regularly scheduled training modules throughout the country, self-paced training available on the web, and specialty conferences. Materials from these training modules will be available at the Toolbox homepage.

Is technical support available for the Toolbox and TMDL development?

Yes, technical support and assistance in TMDL development is available from the Watershed and Water Quality Modeling Technical Support Center. The mission of the Center is to provide technical assistance and support to EPA Regions, State, and Local governments in the



application of the Toolbox and development of TMDLs. The Center which is part of EPA's Office of Research and Development (ORD) is committed to providing access to technically defensible tools and approaches that can be used in the development of TMDLs, waste load allocations and watershed protection plans. Contact information for the Center is given below.

Where can I access the Toolbox and training materials?

A website for distribution of the Toolbox modules is supported by EPA. It includes all models and tools, as well as documentation and installation instructions. The Toolbox Website is http://www.epa.gov/athens/wwqtsc/index.html. For additional inquiries and information please contact:

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EPA United States Environmental Protection Agency

International Stormwater BMP Database

www.bmpdatabase.org

The comprehensive website for selection, design, and performance assessment of stormwater best management practices (BMPs).

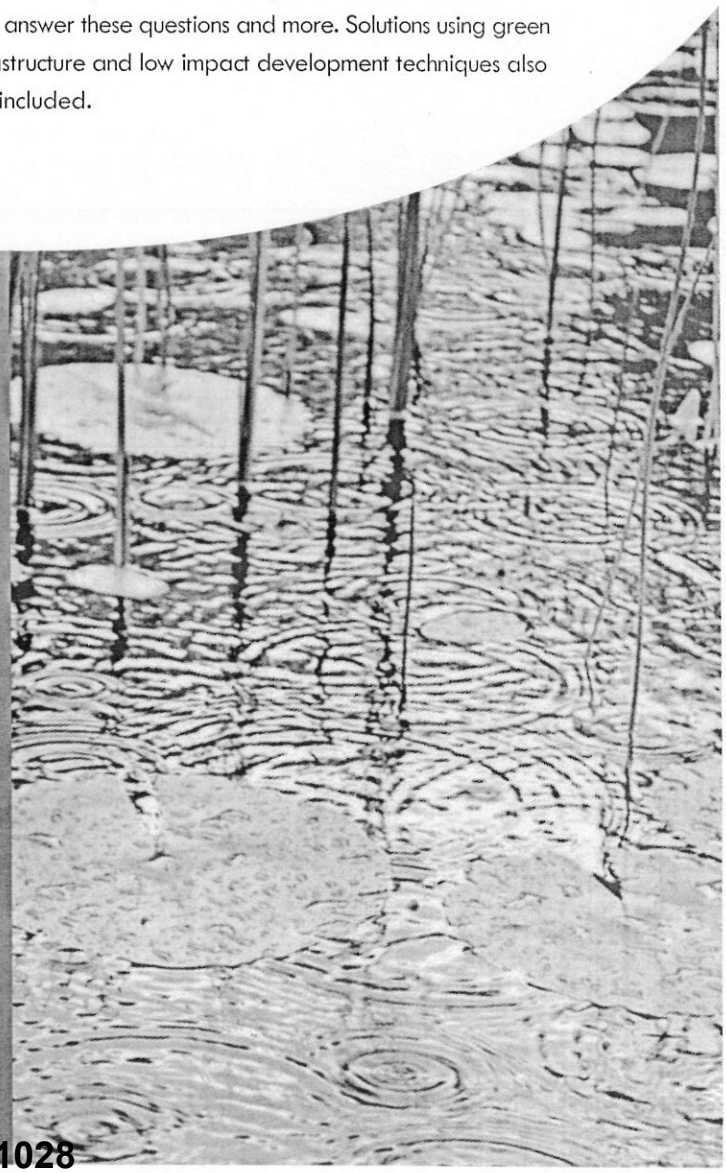
Stormwater is one of the nation's chief causes of water impairment today, and it can be hard to choose the most appropriate techniques to treat and control runoff. With limited available funding, stormwater managers need to be sure they are selecting the best possible practices before beginning implementation.

Offering more than 500 BMP datasets, tools, guidance, and technical summaries, the International BMP Database makes it easy for stormwater managers to assess the statistical performance of BMPs in the field. Want to find out which practice is effective at removing a certain pollutant or how a BMP will impact total loadings? The BMP Database can help answer these questions and more. Solutions using green infrastructure and low impact development techniques also are included.

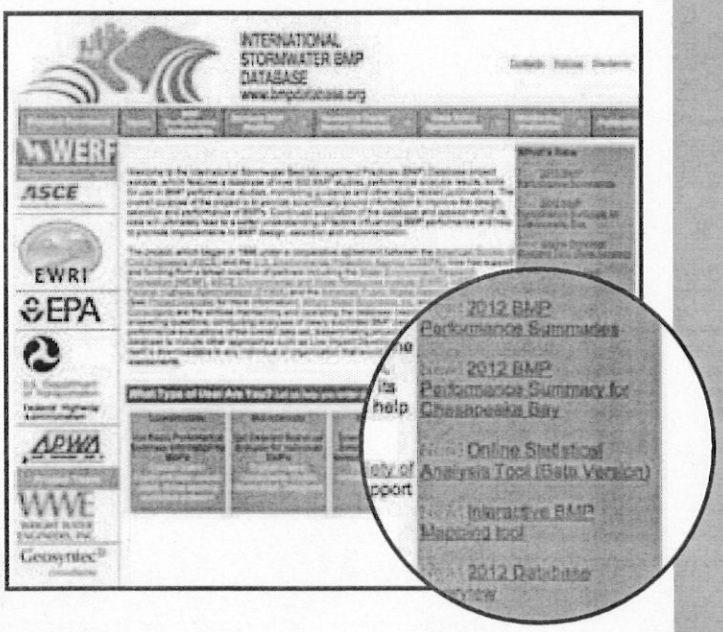
How the Site Can Work for You

Whether you want high-level performance summaries or more detailed BMP analysis, whether you're brand new to BMP monitoring or a researcher looking for particular findings, the BMP Database has custom entry points with relevant information for specific user needs. Here's a look at what the site can help you do.

- Pinpoint specific BMP study locations using an interactive mapping tool
- Search for performance data on an individual BMP site
- Pull overall database statistics by BMP and pollutant category
- Find guidance on monitoring BMPs
- Access protocols for submitting BMP studies to the database
- Download software to store and report your own BMP data



A Closer Look at What's New on the BMP Database Site



With nearly 300,000 water quality records, the BMP Database is the largest of its kind. Continued population and assessment of the database leads to a better understanding of factors influencing BMP performance and helps promote improvements in selection, design, and implementation. To enter your data, visit www.bmpdatabase.org today.

BMP Performance Summaries: Focusing on five pollutant categories – bacteria, nutrients, volume reduction, total suspended solids, and metals – these technical briefs summarize performance of BMPs and green infrastructure based on national data.

Chesapeake Bay Research Portal: A portion of the database dedicated to Chesapeake Bay Watershed findings, this site includes a region-specific BMP performance analysis summary, mapping tool, and other specialized resources.

Online Statistical Analysis Tool: Allowing users to easily search for BMP data using criteria such as BMP type, location, and water quality parameter, this tool pulls statistics in a variety of accessible formats.

Database Overview: A snapshot of the data found in the BMP Database, this document provides information on various BMP categories, such as number of studies, geographic distribution, duration of monitoring periods, and other relevant information.

Agricultural BMP Portal: A portion of the database focused on BMPs for agricultural runoff, this site will act as a clearinghouse for agricultural BMP performance data as well as monitoring and reporting protocols.

WERF Research Digest: A compendium of key information on the BMP database, this document contains distilled analysis results from technical performance summaries, database statistics, a discussion of regulatory context, fate and transport processes, removal mechanisms, and design considerations, and more.

The BMP Database is supported by the Water Environment Research Foundation, the American Society of Civil Engineers, Environmental and Water Resources Institute, the American Public Works Association, the Federal Highway Administration, the U.S. Environmental Protection Agency, and the National Fish and Wildlife Foundation.

This material was produced with a grant from the National Fish and Wildlife Foundation.

WERF
Water Environment Research Foundation

For more information contact:
Jeff Moeller, P.E., WERF Senior Program Director
571-384-2104 | jmoeller@werf.org

WERF Project No. 03SW1COe1

RB-AR 1029

EPA United States Environmental Protection Agency

SUSTAIN

System for Urban Stormwater Treatment and Analysis IntegratioN Model

Description

SUSTAIN is a decision support system was developed to:

- assist stormwater management professionals in developing implementation plans for flow and pollution control to protect source waters and meet water quality goals.
- assist watershed and stormwater practitioners to develop, evaluate, and select optimal BMP combinations at various watershed scales on the basis of cost and effectiveness.

SUSTAIN is a tool for answering the following questions:

- How effective are BMPs in reducing runoff and pollutant loadings?
- What are the most cost-effective solutions for meeting water quality and quantity objectives?
- Where, what type of, and how big should BMPs be?

SUSTAIN was developed by Tetra Tech, an environmental engineering and consulting service.

Capabilities

SUSTAIN has seven modules:

1. Framework Manager
2. BMP Siting Tool
3. Land Module
4. BMP Module
5. Conveyance Module
6. Optimization Module
7. Post-Processor

The modules are integrated under a common ArcGIS platform, which performs hydrologic and water quality modeling in watersheds and urban streams. It searches for optimal management solutions at multiple-scale watersheds to achieve desired water quality objectives based on cost effectiveness.

1. **Framework Manager** - Serves as the command center of *SUSTAIN*. It manages the data exchanges between system components and coordinates external inputs, calls various modeling components (i.e., Land, BMP, conveyance), and provides output information to the post-processor.

2. **BMP Siting Tool** - Supports users in selecting suitable locations for common structural BMPs that meet the defined site suitability criteria such as drainage area, slope, hydrological soil group, groundwater table depth, road buffer, stream buffer, and building buffer.

BMPs are classified and conceptualized in *SUSTAIN* as scale-based and type-based. The scale-based category classifies BMPs according to the size of the application area, such as lot-, community-, and watershed-scales. The type-base category classifies BMPs into three types according to the geometric properties:

- ***Point BMPs***: practices that capture upstream drainage at a specific location and may use a combination of detention, infiltration, evaporation, settling, and transformation to manage flow and remove pollutants.
- ***Linear BMPs***: narrow linear shapes adjacent to stream channels that provide filtration of runoff, nutrient uptake, and ancillary benefits of stream shading, wildlife habitat, and aesthetic value.
- ***Area BMPs***: land-based management practices that affect impervious area, land cover, and pollutant inputs.

The following structural BMP options are currently supported:

BMP Option	BMP Type
Bioretention	Point LID
Cistern	Point LID
Constructed Wetland	Point BMP
Dry Pond	Pont BMP
Grassed Swale	Linear BMP
Green Roof	Area BMP
Infiltration Basin	Point BMP
Infiltration Trench	Linear BMP
Porous Pavement	Area BMP
Rain Barrel	Point LID
Sand Filter (non-surface)	Linear BMP
Sand Filter (surface)	Point BMP
Vegetated Filter strip	Linear BMP
Wet Pond	Point BMP

3. **Land Simulation Module** - Computes runoff and pollutant loads from land in one of two ways:

   1. by default, the land module computes the hydrograph and pollutograph using algorithms adapted from SWMM5 (Storm Water Management Model), and
   2. sediment algorithms adapted from HSPF (Hydrological Simulation Program - FORTRAN).

   The module also supports the import of externally generated time series data.

4. **BMP Simulation Module** - Provides process-based simulation of flow and pollutant transport for a wide rage of structural BMPs. It is designed so that new BMPs and alternative simulation techniques can be added. The table below is a summary of major processes currently included in the module. Option 1 is the default option; however, users can select the preferred simulation method from either option depending on the available data and required level of detail.

Process	Option 1	Option 2
Flow routing	Stage-outflow using weir and/or orifice equations	For swale: kinematics routing by solving the coupled continuity equation and Manning's equation.
infiltration	Green-Ampt method	Holtan-Lope equation

Evapotranspiration	Constant evapotranspiration (ET) rate or monthly average value or daily values	Potential ET using Harmon's method
Pollutant routing	Completely mixed	Continuously stirred tank reactor (CSTRs) in series
Pollutant removal	1st order decay	Kadlec and Knight's (1996) 1st order kinetic method
Buffer strip (sheet flow) flow routing	Kinematics waver overland flow routing	
Buffer strip sediment trapping	University of Kentucky sediment interception simulation method as applied in VFSMOD	
Buffer strip (sheet flow) pollutant removal	1st order decay	

The BMP module includes two additional functionalists:

- ***BMP Cost Estimation*** - The cost database in *SUSTAIN* is expressed in terms of unit costs of individual construction components of a BMP. The unit costs were compiled from wholesale and retail companies that provide raw materials for BMPs, and from multiple sources of BMP implementation at the county, state, and federal levels. The use of this unit cost approach, rather than the entire bulk BMP installation, aims to minimize differences encountered from site or locality factors. Users have the option to override the built-in data with the locally derived information.
- ***Aggregation of Distributed BMPs*** - The aggregate BMP approach allows users to assess the effectiveness of multiple BMPs. It is used to represent the aggregate characteristics of distributed BMPs while reducing the user's effort to model set-up and computation time needed for simulation and optimization. Aggregate BMPs evaluate storage and infiltration characteristics of multiple BMPs simultaneously without explicit recognition of their spatial distribution and flow and pollutant routings.

5. **Conveyance Simulation Module** - Performs routing of flow and pollutants through a conduit. In *SUSTAIN*, conduits are pipes or channels that move water from one node to another in a watershed routing network. The cross-sectional shapes of a conduit can be selected from a variety of standard open and closed geometries. Irregular natural cross-section shapes are supported, as are user-defined closed shapes. Flow and pollutant routing are simulated using transport algorithms in SWMM5, and sediment routing using sediment transport algorithms in HSPF.

6. **BMP Optimization Module** - Identifies cost-effective BMP placement and selection strategies based on a pre-determined list of feasible sites and applicable BMP types and size ranges. This module uses evolutionary optimization techniques to search for cost-effective BMPs that meet user-defined decision criteria. Currently, two search algorithms are implemented in *SUSTAIN*: scatter search and non dominated sorting genetic algorithm-II (NSGA-II).

   Operationally, the optimization module incorporates a tiered approach that allows for cost effectiveness evaluation of both individual and/or multiple nested watersheds to address the needs of both regional- and local-scale applications. Tier-1 performs the optimization search to develop cost effectiveness curves for each tier-1 sub watershed. Tier-2 uses the tier-1 solutions to construct a new optimization search domain and run the transport module, if needed, to develop the combined cost-effectiveness curve for the entire tier-2 watershed.

7. **Post-Processor** - Using Microsoft Excel, the post processor provides a centralized location in *SUSTAIN* for analyzing and interpreting simulation outputs at multiple locations, and for scenarios (e.g., existing development with and without BMPs, and pre-development conditions) and parameters of interest (e.g., inflows, outflows, pollutant loads and concentrations). The simulation outputs contain hourly or sub-hourly data, and can span several years depending on the length of simulation. The post processor allows users to evaluate simulation results that are highly variable in magnitude, duration, intensity, treatment containment volume, attenuation, and pollutant removal effectiveness. This is achieved by using specific graphical and tabular reports, including storm event classification, storm event viewer, storm performance summary, and cost-effectiveness curves.

Applications

Watershed Planning Process	Uses of *SUSTAIN*
Identify Problem(s) & Set Goals	**Generalized assessment of management impacts and load reduction potential**
Develop Plan	Predict load reduction and cost for multiple management alternatives
Implement Plan	Support selection of an optimal implementation plan Evaluate project phases (cost and load reduction at each phase)
Track Progress	Recalibrate *SUSTAIN* based on newly collected data Evaluate future benefits of implementation and/or adaptation of plan
Achieve Management Goals	

Various practitioners, municipalities, and watershed groups at the regional and local level can use the *SUSTAIN* framework to address a variety of planning:

- Developing TMDL implementation plans
- Identifying management practices to achieve pollutant reductions under a municipal separate storm sewer system (MS4) stormwater permit
- Determining optimal green infrastructure strategies for reducing volume and peak flows to combined sewer systems
- Evaluating the benefits of distributed green infrastructure implementation on water quantity and quality in urban streams
- Developing a phased BMP installation plan using the cost effectiveness curve

Support

EPA will provide technical support to users through a contractor for a period of time governed by the availability of funds.

Downloads

Date	Description
01/2013	SUSTAIN Version 1.2 (EXE) (19.9 MB)

Date	Description
06/26/2012	SUSTAIN Version 1.2 Installation Guide (PDF) (5 pp, 296 KB)
10/20/2009	Self-extracting installation program for *SUSTAIN* 1.0 (EXE) (16.7 MB) After running this self-extracting installation program, please find a step-by-step guide under a folder "..\SUSTAIN\Documents" (usually C:\Program Files\SUSTAIN\Documents). Please also try general exercises of SUSTAIN presented at the same folder.
04/02/2012	*SUSTAIN* Engine Version 1.0 (ZIP) (585 KB): Modeling engine source codes
04/02/2012	*SUSTAIN* Interface Version 1.0 (ZIP) (6.19 MB): Program interface source codes
04/02/2012	*SUSTAIN* Siting Tool Version 1.0 (ZIP) (1 MB): BMP siting tool source codes
04/17/2012	Report on Enhanced Framework (SUSTAIN) and Field Applications for Placement of BMPs in Urban Watersheds (150 pp, 5.67 MB) (EPA/600/R-11/144) November 2011 | Abstract
10/27/2009	*SUSTAIN*--A Framework for Placement of Best Management Practices in Urban Watersheds to Protect Water Quality (EPA/600/R-09/095) September 2009 | Abstract
06/24/2007	*SUSTAIN* - An EPA BMP Process and Placement Tool for Urban Watersheds (PDF) (23 pp, 1 Mb) Reprinted with Permission for Proceedings of the TMDL 2007 Specialty Conference, June 24-27, 2007, Bellevue, Washington. Copyright 2007 Water Environment Federation: Alexandria, Virginia.
03/11/2010	Introductory Web cast on *SUSTAIN* - Slides. (PDF) (98 pp, 6 Mb)
	Poster: SUSTAIN - A BMP Process and Placement Tool for Urban Watersheds. (PDF) (1 pg, 1.2 Mb)
The *SUSTAIN* installation requires ESRI's ArcGIS 9.3 and the Spatial Analyst extension. The system also requires Microsoft Excel 2003 which is used as a post-processor for analyzing and interpreting results.	
You will need Adobe Acrobat Reader to view Adobe PDF documents. Read more About Portable Document Format File.	

Contact

Ariamalar Selvakumar, EPA	For information on release and related research
Technical support team	For issues related to installation and use

Last updated on Monday, May 20, 2013

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Department of Public Works
dpw.lacounty.gov

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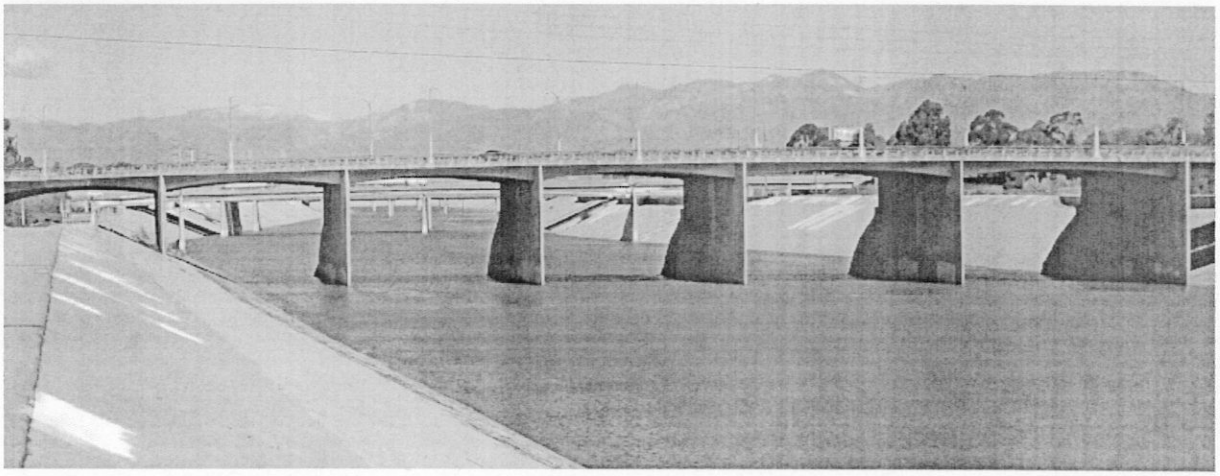
Los Angeles County
WMMS
Watershed Management Modeling System

About

Resources

Download



In an effort to address urban runoff and stormwater quality issues, the Los Angeles County Flood Control District has developed a computer based decision support system, the Watershed Management Modeling System (WMMS). The WMMS was developed for all major watersheds within Los Angeles County and simulates hydrologic and pollutant generation and transport processes and identifies cost-effective pollution reduction measures. The WMMS provides a tool for future planning of multi-benefit projects involving water quality, flood control, water conservation, and open space development. The WMMS can also be used for Total Maximum Daily Load implementation planning.

The WMMS is based on the EPA's watershed models and BMP selection system based on an optimized algorithm. It provides a system for phased BMP implementation with quantified pollutant load reduction to be achieved and allows for an integrated watershed management plan with multi-benefits in addition to water quality. The WMMS has been used to support metals and/or toxics TMDLs for Ballona Creek, Los Angeles River, Marina Del Rey, and Machado Lake watersheds.

If you have any question related to the start-up guide or installation, please contact us at **wmms@dpw.lacounty.gov**

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SBPAT
Stormwater quality planning

Structural BMP Prioritization and Analysis Tool

A tool to support stormwater Reasonable Assurance Analyses and maximize water quality return on investment in urbanized watersheds

About Structural BMP Prioritization and Analysis Tool (SBPAT)

Structural BMP Prioritization and Analysis Tool (SBPAT) is a public domain, "open source" GIS-based water quality analysis tool intended to 1) facilitate the prioritization and selection of BMP project opportunities and technologies in urbanized watersheds, and 2) quantify benefits, costs, uncertainties and potential risks associated with stormwater quality projects. SBPAT was specifically named by the State of California Los Angeles Regional Water Quality Control Board (RWQCB RB4) as a peer-reviewed, public domain, quantitative model that can be used to develop a Reasonable Assurance Analysis (RAA) in support of a Watershed Management Program (NPDES No. CAS004001).

The prioritization methodology is geared toward optimizing the water quality return on investment (ROI) for user-defined priorities and multiple pollutant types. An example application is the integration of stakeholder priorities with technical data to identify priority BMP activities within a watershed.

The quantification/analysis module utilizes land use based Event Mean Concentrations, Environmental Protection Agency Stormwater Management Model (EPA-SWMM), United States Environmental Protection Agency/ American Society of Civil Engineers (USEPA/ASCE) International BMP Database, site data, and a Monte Carlo approach to quantify water quality benefits and uncertainties.

The Los Angeles (LA) County implementation of SBPAT (SBPAT v1.0) was developed in 2008 by Geosyntec and GreenInfo Network for Heal the Bay, City of Los Angeles, and County of Los Angeles Department of Public Works. SBPAT v1.0 requires ArcGIS 9.3 and Windows XP. Development of the original SBPAT model was funded by the California State Water Resources Control Board, Los Angeles Regional Water Quality Control Board, City of Los Angeles, County of Los Angeles and Geosyntec Consultants.

The Orange County Transportation Authority (OCTA) implementation of SBPAT (SBPAT v1.1) was adapted from SBPAT v1.0 and was developed by Geosyntec. SBPAT v1.1 requires ArcGIS 10 and Windows 7. Development of SBPAT v1.1 was funded by OCTA and in collaboration with the County of Orange. The SBPAT v1.1 model facilitated in the development of funding guidelines and scoring criteria for the Measure M2 one-half cent transportation sales tax, Environmental Cleanup Program (ECP). The ECP provides funding, on a competitive basis, to the 34 Orange County cities as well as the County of Orange for water quality improvement projects. Funds for this program are primarily intended for capital improvements and cannot be used to supplant existing requirements or obligations. The SBPAT v1.1 model is also an "open source" program developed to enable applicants to evaluate the effectiveness of their water quality projects.

Los Angeles County MS4 Permit
Watershed Management Programs Technical Advisory Committee (TAC)

Meeting Notes: August 28, 2013

(Compiled by JR Ranells, City of La Verne and Latoya Cyrus, City of San Dimas; consolidated and edited by Renee Purdy, LA Regional Board)

Regional Board (RB) Staff convened meeting at 12:30 pm

Introductions Made (see attached sign-in sheet)

Follow-up from August Meeting

- Vice Chair - RB Staff ("Board Staff") Renee Purdy stated the RB would Chair the TAC; Renee would be attending most meetings in that capacity. In the event that Renee cannot personally attend a TAC meeting, another RB staff would chair the meeting as her replacement. Renee then led a discussion on the need for a Vice Chair position. The group brought forward several issues and decided that because no official role was identified for the Vice Chair, one was not needed at this time. Support services such as room availability, or note taking would be addressed or assigned as needed by the group.
- Meeting Notes - Renee thanked the City of Walnut and the City of Sierra Madre for submitting notes for the last meeting. A discussion ensued on who should take notes and what their content should be. The TAC group discussed the possibility of rotating the note taking at each meeting and starting the rotation alphabetically by watershed group or agency. JR Ranells, with the City of La Verne volunteered to take and submit notes at this meeting as well as to coordinate the next volunteer. The RB will post the compiled meeting notes on the RB website: http://www.waterboards.ca.gov/losangeles/water_issues/programs/stormwater/municipal/watershed_management/tac/index.shtml

- Experts/Consultant Participation – in order to facilitate a productive and orderly discussion, the group decided that all discussion should go through the primary TAC representatives first. For example, a TAC representative would notify the group that their expert/consultant will be addressing the issue at hand on their behalf. Some members of the TAC group stated that an expert/consultant might not be available when these types of items came to the group. As a result, the group decided agenda setting will be key to the TAC process and all issues will be on the agenda in advance of each meeting. TAC representatives should have the appropriate experts/consultants in attendance at the TAC meeting when those types of items are on the agenda.
- Subcommittee formation – Renee suggested forming subcommittees to tackle technical issues requiring in depth discussions; the group discussed governance structure of the subcommittees. Each subcommittee would elect a chairperson at the first meeting. The subcommittee participants would volunteer their time and

need not be TAC representatives or alternates. The TAC group identified at least three (3) subcommittees that might be formed to tackle the following issues:
    - Reasonable Assurance Analysis
    - Monitoring
    - EWMP Multi-benefit Evaluation
- Presentation RAA Guidance – Renee presented a power point entitled: "Guidance on Conducting RAA." The presentation provided a foundation of the RB expectations in developing the RAA. The full presentation can be found on the RB website: http://www.waterboards.ca.gov/losangeles/water_issues/programs/stormwater/municipal/watershed_management/tac/index.shtml
- Open discussion – The TAC members asked for a robust presentation/demonstration of the RAA models currently available. LA County volunteered to demonstrate their WMMS Model and Jennifer Brown will check the availability of GeoSyntec to demonstrate the SBPAT Model. These demonstrations are tentatively scheduled for September 17th in lieu of the originally scheduled TAC Meeting. The RAA models demonstration will take place in conference room B. Following the demonstration, volunteers for the modeling/RAA subcommittee group will meet.
- A number of Permittees that elected to develop an individual WMP do not appear to be represented at the TAC. How will they receive the TAC discussion information? Information, recommendations, or points of consensus will be available on the Regional Board's website. Regional Board Staff will also make an effort to contact those Permittees not represented on the TAC.
- Request for specific items to be place on the next agenda:
    - Guidelines and structure of subcommittee
    - Send additional items to be added to the agenda for the next TAC meeting to Renee before she finalizes the agenda (within the next couple of weeks).

Action Items:

1. Confirm details for the RAA models presentation
2. Each watershed plan representative should inform the Regional Board (Renee) of RAA model selection.
3. Send any comments on the previous meeting summary to Renee.
4. If interested in joining a subcommittee (RAA, Monitoring, EWMP Multi-benefit Evaluation) contact Renee as soon as possible.

Next meeting date, time, and location will be confirmed soon…

Adjournment: 2:30 pm

Los Angeles County MS4 Permit
Watershed Management Programs Technical Advisory Committee (TAC)

	Group Name	Representative		Alternate	
1	Upper Santa Clara River Watershed	Heather Merenda, Santa Clarita	hmerenda@santa-clarita.com	Giles Coon, County	gcoon@dpw.lacounty.gov
2	Upper Los Angeles River Watershed Group	Alfredo Magallanes, City of Los Angeles	alfredo.magallanes@lacity.org	Alvin Cruz, Burbank	ACruz@burbankca.gov
3	Los Angeles River Upper Reach 2 Subwatershed	Desi Alvarez, Huntington Park	mcm_management@verizon.net dalvarez@huntingtonpark.org	Gina Nila, Commerce	ginan@ci.commerce.ca.us
4	Lower Los Angeles River Watershed	Steve Myrter, Signal Hill	smyrter@cityofsignalhill.org	Chris Cash, Paramont	ccash@paramountcity.com
5	Rio Hondo/San Gabriel River Water Quality Group	James Carlson, Sierra Madre	jcarlson@ci.sierra-madre.ca.us	Rafael Casillas, Duarte	rcasillas@accessduarte.com
6	Upper San Gabriel River	Vivian Castro, Covina	vcastro@covinaca.gov	Jolene Guerrero, County	jguerrer@dpw.lacounty.gov
7	East San Gabriel River Watershed Group	JR Ranells, La Verne	jranells@ci.la-verne.ca.us	Latoya Cyrus, San Dimas	lcyrus@ci.san-dimas.ca.us
8	Lower San Gabriel River	Mike O'Grady, Cerritos	mogrady@cerritos.us	Adriana Figueroa, Norwalk	afigueroa@norwalkca.gov
9	Los Cerritos Channel Watershed Group	Lisa Rapp, Lakewood	lrapp@lakewoodcity.org	Deborah Chankin, Bellflower	dchankin@bellflower.org
10	Malibu Creek Watershed Group	Joe Bellomo	jbellomo@willdan.com	Giles Coon, County	gcoon@dpw.lacounty.gov
11	Marina del Rey	Bruce Hamamoto, County	bhamamo@dpw.lacounty.gov	Steve Finton, Culver City	Steven.Finton@CulverCity.org
12	North Santa Monica Bay Coastal Watersheds	Jennifer Brown, City of Malibu	JBrown@malibucity.org	Rob DuBoux, Malibu	RDuboux@malibucity.org
13	Santa Monica Bay Jurisdictions 2 & 3	Hamid Tadayon, City of Los Angeles	Hamid.tadayon@lacity.org	Joshua Carvalho, Santa Monica	joshua.carvalho@smgov.net
14	Beach Cities Watershed Management Group	Elaine Jeng, Redondo Beach	Elaine.Jeng@redondo.org	John Dettle, Torrance	jdettle@torranceca.gov
15	Peninsula EWMP Agencies	John Hunter, JLHA Consultants	jhunter@jlha.net	Kathleen McGowan, GeoSyntec	kmcgowan@geosyntec.com
16	Ballona Creek	Hubertus Cox, City of Los Angeles	Hubertus.cox@lacity.org	Lauren Amimoto, Inglewood	lamimoto@cityofinglewood.org
17	Dominguez Channel Watershed Management Area Group	Vijay Desai, City of Los Angeles	vijay.desai@lacity.org	Jolene Guerrero, County	jguerrer@dpw.lacounty.gov
18	Alamitos Bay/Los Cerritos Channel Group	Jolene Guerrero, County	jguerrer@dpw.lacounty.gov	Genevieve Osmena, County	gosmena@dpw.lacounty.gov
N/A	City of Walnut	Alicia Jensen	ajensen@ci.walnut.ca.us	Cody Howing, RKA Consulting	chowing@rkagroup.com
N/A	City of Long Beach	Anthoney Arevalo	anthony.arevalo@longbeach.gov	Ana De Anda	anadeanda@longbeach.gov
N/A	City of Lawndale	Nasser Abbaszadeh	Nabbaszadeh@lawndalecity.org	Ray Tahir	rtahir@tecsenv.com
N/A	City of La Habra Heights	Shauna Clark	SClark@Lhhcity.org	Catherine Leland	cdleland@gmail.com
N/A	Regional Water Quality Control Board	Renee Purdy	Renee.Purdy@waterboards.ca.gov	Ivar Ridgeway	Ivar.Ridgeway@waterboards.ca.gov
N/A	EPA	David Smith	smith.davidw@epa.gov	Cindy Lin	lin.cindy@epa.gov
N/A	Council for Watershed Health	Mike Antos	mike@watershedhealth.org	Kristy Morris	kristy@watershedhealth.org
N/A	Heal the Bay	Kirsten James	kjames@healthebay.org		
N/A	LA Waterkeeper	Liz Crosson	liz@smbaykeeper.org		
N/A	NRDC	Noah Garrison	ngarrison@nrdc.org		
N/A	Building Industry Association				
N/A	Carson				
N/A	Compton				
N/A	El Monte				
N/A	Gardena				
N/A	Irwindale				
N/A	Lomita				
N/A	San Fernando				
N/A	South El Monte				
N/A	West Covina				

Los Angeles County MS4 Permit
Watershed Management Technical Advisory Committee

LA County Dept of Public Works
900 South Freemont Avenue
Alhambra, CA
Alhambra Room

September 24, 2013
12:30 p.m. – 3:00 p.m.

Chair: Renee Purdy – LARWQCB
Note taker: Jolene Guerrero, LA County

ITEM 1	**INTRODUCTIONS, REVIEW AGENDA, BRIEF ANNOUNCEMENTS**	**Assigned to:**	**Time: 12:30 –12:45 pm**
Title		Renee Purdy Meeting Chairperson	15 min
Purpose:	**Standard meeting management item**		
Desired Outcome	1. Approve agenda 2. Approve last meeting's TAC minutes		
Contact Person	Renee Purdy	(213) 576-6622, Renee.Purdy@waterboards.ca.gov	
Attachments:	TACNotes 8-28-13 draft.pdf		
Notes			

ITEM 2	**REPORT ON RAA SUBCOMMITTEE MTG**	**Assigned to:**	**Time: 12:45 – 1:45 pm**
Title		Ivar Ridgeway	60 min
Purpose	Summarize meeting discussion/outcomes		
Desired Outcome	1. Present and discuss items identified for future discussion by RAA Subcommittee 2. Confirm model selection by WMP/EWMP groups		
Background	First meeting of RAA/modeling subcommittee was held on Sept 17, 2013 in conjunction with this meeting, presentations were given on the WMMS and SPBAT models		
Contact Person	Ivar Ridgeway	(213) 620-2150 Ivar.Ridgeway@waterboards.ca.gov	
Attachments	SBPATforRAA 9-17-13 v2.pdf Microsoft PowerPoint - Guidance on Conduc		
Notes			

ITEM 3	**DISCUSSION OF POSSIBLE FORMATION OF OTHER SUBCOMMITTEES**	Assigned to:	**Time: 1:45 - 2:05 pm**
Title		Renee Purdy	20 min
Purpose	Decide on other subcommittees to be formed. Get consensus on other subcommittees: 1. Purpose 2. Timing 3. Frequency of Meetings		
Background	Previously the TAC discussed forming two other subcommittees related to monitoring and guidelines for evaluating opportunities for regional multi-benefit retention projects.		
Contact Person	Renee Purdy		
Attachments			
Notes			

ITEM 4	**SUBCOMITTEE GUIDELINES**	**Assigned to:**	**Time: 2:05 – 2:20 pm**
Title of Topic:		Renee Purdy	15 min

Purpose:	Discuss guidelines and structure of subcommittees
Desired Outcome:	Open discussion among the TAC members and provide feedback to the TAC
Background:	Action Item from August 28, 2013 TAC Meeting
Attachments:	
Contact Person:	Renee Purdy
Notes:	
Decisions:	
Action Items:	

ITEM 5	**Meeting Evaluation and Wrap-up, Review Program Calendar, Next Meeting Dates and Agenda**	**Assigned to:**	**Time: 2:20-2:30 pm**
Title		Renee Purdy	**10 min**
Purpose	To evaluate meeting, acknowledge key forthcoming dates on the Program Calendar, and discuss potential dates and agenda for future meetings.		
Desired Outcome	Determine details for the next meeting including agenda items and assignments.		
Contact Person	Renee Purdy		
Notes			
Decisions			

ITEM 6	**Information Session on Prop 84 Stormwater Grants**	**Assigned to:**	**Time: 3:00 – 5:00 pm**
Title		Ivar Ridgeway	**120 min**
Purpose	Information session for potential grantees		
Desired Outcome	Disseminate information on prop 84		
Contact Person	Ivar Ridgeway		
Notes			
Decisions			

Los Angeles County MS4 Permit
Watershed Management Programs Technical Advisory Committee (TAC)
Meeting Notes: September 24, 2013

Renee Purdy convened the meeting at about 12:35 pm

Item 1: Introductions, Review Agenda, Brief Announcements

In the interest of time, it was agreed that at this meeting and future meetings, we would not have the self-introductions by all attendees. Such introductions were made at the first two TAC meetings.

Renee agreed to send attachments as separate documents and not embed them into the agenda, as a few people had difficulty opening the embedded documents.

Action Item:

Within one week, let Renee know if you have any comments or suggested revisions to the notes from the August meeting.

Item 2: Report on RAA Subcommittee Meeting

Ivar Ridgeway committed to emailing notes from the RAA Subcommittee Meeting and a copy of the sign-in sheet to the subcommittee members.

Ivar summarized the first RAA subcommittee meeting held on September 17, 2013. There was a presentation by Ken Susilo on SBPAT and T.J. Moon on WMMS. Each presentation was followed by a question and answer period and a discussion. Ivar felt the meeting format worked well and intends to follow the same format for the next meeting.

The Subcommittee agreed to meet monthly for about 2 hours. This was discussed in the main TAC group and the meeting may need to be 3 hours if there are multiple presentations.

The subcommittee brainstormed a list of issues they want to discuss and address:

1. Modeling Implementation
2. Non-Structural BMP Effectiveness (street sweeping, public education)
3. New Development/Re-Development LID
4. Dry Weather Flow
5. Model Input (parameters)
6. BMP Effectiveness (added during the main TAC meeting)

The Subcommittee still needs to prioritize this list and to determine the format of the output that will be generated the Subcommittee. In general, the Subcommittee intends to focus on technical subjects.

At the next meeting, there will be 3 case studies presented, Machado Lake by Torrance, San Diego by Geosyntec and a WMMS project by LA County.

There was a discussion about how difficult it was for off-site attendees to hear and participate in the meeting. Alternate locations were discussed for the meeting.

Action Items:

1. Review the "Model Selection" table provided by Renee and confirm it is accurate. Any corrections should be sent to Renee.
2. For RAA subcommittee members, you will be receiving a Doodle Poll to select the date and time for the next meeting from Ivar.
3. Notify Ivar if you are willing to Co-Chair the Subcommittee
4. Notify Ivar if you have an issue that should be addressed as a priority by the RAA Subcommittee.
5. Regional Board, EPA and County staff will be looking at options to make it easier for off-site attendees to hear and participate in the Subcommittee meeting.

Item 3: Discussion of Possible Formation of Other Subcommittees

Renee explained that based on the feedback during the last meeting, subsequent discussions with a permittee and further consideration, she did not feel that it would be necessary to establish a Monitoring Subcommittee that meets every month. Instead, the subcommittee will meet as needed to discuss specific issues.

Unlike the RAA, the permit contains detailed monitoring requirements. There are also existing monitoring and reporting plans for TMDLs that have been approved by the Regional Board.

A TAC member expressed concern that without the guidance of a subcommittee the CIMPs would lack consistency in approaches towards monitoring.

Another TAC member suggested that the groups opting to deviate from the monitoring requirements in the permit present their monitoring strategy to the Monitoring Subcommittee and elaborate on their technical reasoning for suggesting an alternate monitoring strategy.

County staff has shared a suggested HUC-12 equivalent map with the permittees to get input. It was agreed that the HUC-12 equivalents be presented at the next main TAC meeting.

Regarding the Guidelines for Evaluating Opportunities for EWMP Projects, it was agreed to wait until January to convene meetings for that Subcommittee.

Action Items:

1. Let Renee know if you interested in participating in a subcommittee.
2. Let Renee know if you have any suggested topics for the ad hoc Monitoring Subcommittee.
3. County staff to present HUC-12 equivalents at next TAC meeting.

Item 4: Subcommittee Guidelines

Renee discussed the decision at the prior TAC meeting that the TAC representatives will sit at the main table and will be the only ones who contribute to the discussion, but for the subcommittees, anyone will be able to contribute.

Regarding the format for the deliverable from the RAA Subcommittee, Ivar suggested that the group write up issues and recommendations, but not a long, detailed technical memorandum.

Item 5 – Meeting Evaluation and Wrap-Up, Review Program Calendar, Next Meeting Dates and Agenda

A TAC member asked about the status of the Notices of Intents. Renee explained that letters would be issued shortly. Renee further explained that the groups were notified directly if additional information was needed. A typical request from the Regional Board was to provide more specificity of the 30-month early action project, including quantification of water quality benefits. Renee indicated that the additional information submitted will be posted to the Regional Board website.

Renee and Ivar explained that they are scheduling a workshop on LID Ordinances and Green Street Policies. Ideally, they would like to have the workshop in late October or early November.

There was discussion about the timing of LID Ordinances and Green Street Policies adoption by the permittees. Some permittees have already had their governing boards adopt one or both in order to meet the schedule required by the early action component of their selected permit compliance method. A TAC member indicated that this does not allow for Regional Board input into the details of either. Renee, Ivar, and the permittees agreed that the requirements for permittees' LID Ordinances were very specific in the permit, but that the Green Streets Policy requirements were not as specific in the permit.

Renee mentioned that Regional Board Staff are posting the NOIs and TAC information on their website.

NOIs:
http://www.waterboards.ca.gov/losangeles/water_issues/programs/stormwater/municipal/watershed_management/

TAC:
http://www.waterboards.ca.gov/losangeles/water_issues/programs/stormwater/municipal/watershed_management/tac/index.shtml

The next TAC meeting is Wednesday, October 23, 2013 at 12:30 to 2:30 pm in Conference Room A at the Department of Public Works headquarters at 900 South Fremont Avenue, Alhambra, CA.

The County of Los Angeles will be providing proposed HUC-12 Equivalent boundaries that are more hydraulically accurate based on more specific local data at the next meeting for discussion.

Renee advised that each (E)WMP group was assigned a Regional Board staff member as a main contact person and the groups were encouraged to contact that person as a resource. Pavlova Vitale, is the contact person for several groups and indicated she would be contacting her groups to meet and discuss the next steps. Additionally, Renee announced that any monitoring related questions from any of the groups should be directed to Pavlova Vitale.

Action Item:

Let Renee know if you have any action items for the next agenda.

Renee Purdy ended the meeting at about 2:15 pm

Los Angeles County MS4 Permit
Watershed Management Programs Technical Advisory Committee (TAC)
Model Selection

	Group Name	Model(s)	
1	Upper Santa Clara River Watershed	Not Decided	
2	Upper Los Angeles River Watershed Group	WMMS	
3	Los Angeles River Upper Reach 2 Subwatershed	WMMS	SBPAT
4	Lower Los Angeles River Watershed	Not Decided (between WMMS, SBPAT or both)	
5	Rio Hondo/San Gabriel River Water Quality Group	WMMS	SBPAT
6	Upper San Gabriel River	WMMS	
7	East San Gabriel River Watershed Group	WMMS	
8	Lower San Gabriel River	Not Decided (between WMMS, SBPAT or both)	
9	Los Cerritos Channel Watershed Group	Not Decided (between WMMS, SBPAT or both)	
10	Malibu Creek Watershed Group	WMMS	SBPAT
11	Marina del Rey	WMMS	
12	North Santa Monica Bay Coastal Watersheds	WMMS	SBPAT
13	Santa Monica Bay Jurisdictions 2 & 3	WMMS	SBPAT
14	Beach Cities Watershed Management Group	SBPAT	SWMM
15	Peninsula EWMP Agencies	WMMS	SBPAT
16	Ballona Creek	WMMS	
17	Dominguez Channel Watershed Management Area Group	WMMS	
18	Alamitos Bay/Los Cerritos Channel Group	WMMS	
	Carson		
	Compton		
	El Monte		
	Gardena		
	Irwindale		
	La Habra Heights		
	Lawndale		
	Lomita		
	San Fernando		
	South El Monte		
	Walnut		
	West Covina		

Los Angeles County MS4 Permit
Watershed Management Programs Technical Advisory Committee (TAC)

	Group Name	Representative		Alternate	
1	Upper Santa Clara River Watershed	Heather Merenda, Santa Clarita	hmerenda@santa-clarita.com	Giles Coon, County	gcoon@dpw.lacounty.gov
2	Upper Los Angeles River Watershed Group	Alfredo Magallanes, City of Los Angeles	alfredo.magallanes@lacity.org	Alvin Cruz, Burbank	ACruz@burbankca.gov
3	Los Angeles River Upper Reach 2 Subwatershed	Desi Alvarez, Huntington Park	mcm_management@verizon.net dalvarez@huntingtonpark.org	Gina Nila, Commerce	ginan@ci.commerce.ca.us
4	Lower Los Angeles River Watershed	Steve Myrter, Signal Hill	smyrter@cityofsignalhill.org	Chris Cash, Paramont	ccash@paramountcity.com
5	Rio Hondo/San Gabriel River Water Quality Group	James Carlson, Sierra Madre	jcarlson@ci.sierra-madre.ca.us	Rafael Casillas, Duarte	rcasillas@accessduarte.com
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9	Los Cerritos Channel Watershed Group	Lisa Rapp, Lakewood	lrapp@lakewoodcity.org	Deborah Chankin, Bellflower	dchankin@bellflower.org
10	Malibu Creek Watershed Group	Joe Bellomo	jbellomo@willdan.com	Giles Coon, County	gcoon@dpw.lacounty.gov
11	Marina del Rey	Bruce Hamamoto, County	bhamamo@dpw.lacounty.gov	Steve Finton, Culver City	Steven.Finton@CulverCity.org
12	North Santa Monica Bay Coastal Watersheds	Jennifer Brown, City of Malibu	JBrown@malibucity.org	Rob DuBoux, Malibu	RDuboux@malibucity.org
13	Santa Monica Bay Jurisdictions 2 & 3	Hamid Tadayon, City of Los Angeles	Hamid.tadayon@lacity.org	Joshua Carvalho, Santa Monica	joshua.carvalho@smgov.net
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15	Peninsula EWMP Agencies	John Hunter, JLHA Consultants	jhunter@jlha.net	Kathleen McGowan, GeoSyntec	kmcgowan@geosyntec.com
16	Ballona Creek	Hubertus Cox, City of Los Angeles	Hubertus.cox@lacity.org	Lauren Amimoto, Inglewood	lamimoto@cityofinglewood.org
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18	Alamitos Bay/Los Cerritos Channel Group	Jolene Guerrero, County	jguerrer@dpw.lacounty.gov	Genevieve Osmena, County	gosmena@dpw.lacounty.gov
N/A	City of Walnut	Alicia Jensen	ajensen@ci.walnut.ca.us	Cody Howing, RKA Consulting	chowing@rkagroup.com
N/A	City of Long Beach	Anthoney Arevalo	anthony.arevalo@longbeach.gov	Ana De Anda	anadeanda@longbeach.gov
N/A	City of Lawndale	Nasser Abbaszadeh	Nabbaszadeh@lawndalecity.org	Ray Tahir	rtahir@tecsenv.com
N/A	City of La Habra Heights	Shauna Clark	SClark@Lhhcity.org	Catherine Leland	cdleland@gmail.com
N/A	Regional Water Quality Control Board	Renee Purdy	Renee.Purdy@waterboards.ca.gov	Ivar Ridgeway	Ivar.Ridgeway@waterboards.ca.gov
N/A	EPA	David Smith	smith.davidw@epa.gov	Cindy Lin	lin.cindy@epa.gov
N/A	Council for Watershed Health	Mike Antos	mike@watershedhealth.org	Kristy Morris	kristy@watershedhealth.org
N/A	Heal the Bay	Kirsten James	kjames@healthebay.org	TBD	TBD
N/A	LA Waterkeeper	Liz Crosson	liz@lawaterkeeper.org	Lara Meeker	lara@lawaterkeeper.org
N/A	NRDC	Noah Garrison	ngarrison@nrdc.org	TBD	TBD
N/A	Building Industry Association	TBD	TBD	TBD	TBD
N/A	Carson	TBD	TBD	TBD	TBD
N/A	Compton	TBD	TBD	TBD	TBD
N/A	El Monte	Michelle Marquez-Riley	mmarquez@ci.el-monte.ca.us	Cesar Roldan	croldan@ci.el-monte.ca.us
N/A	Gardena	TBD	TBD	TBD	TBD
N/A	Irwindale	TBD	TBD	TBD	TBD
N/A	Lomita	TBD	TBD	TBD	TBD
N/A	San Fernando	TBD	TBD	TBD	TBD
N/A	South El Monte	TBD	TBD	TBD	TBD
N/A	West Covina	TBD	TBD	TBD	TBD

October 23, 2013 TAC Meeting

Time: 12:30 PM-3:00 PM
Location: LA County DPW

I. Attendees

1 Bruce Hamamoto	8 John Dettle
2 Ivar K. Ridgeway	9 STEVE MYRTER
3 Cody Howing	10 MIKE O'GRADY
4 RAFAEL CASILLAS	11 John Hunter
5 Nasser Abbaszadeh	12 DESI ALVAREZ
6 Kirsten James	13 VIJAY DESAI
7 MIKE ANTOS	14 ALFREDO MAGALLANES

October 23, 2013 TAC Meeting

Time: 12:30 PM-3:00 PM
Location: LA County DPW

I. Attendees

15 Jolene Guerrero	16 Joe Bellomo
17 VIVIAN CASTRO	18 Jennifer Brown
19 Heather Meeder	20 ANTHONY AREVALO, LBPW-SW
21 Hamid Tadayon	22
23	24
25	26
27	28

Los Angeles County MS4 Permit
Watershed Management Technical Advisory Committee

Meeting Location	LA County Department of Public Works - Conference Room A 900 South Freemont Avenue Alhambra, CA
Meeting Date	October 23, 2013
Meeting Time	12:30 - 3:00 p.m.
Chairperson	Renee Purdy, LARWQCB (213) 576-6622 Renee.Purdy@waterboards.ca.gov
Notetaker	Heather Merenda, City of Santa Clarita (661) 284-1413 hmerenda@santa-clarita.com
Call-in phone #	(877) 336-1828 [passcode: 3087482]

ITEM 1	**INTRODUCTIONS, REVIEW AGENDA, BRIEF ANNOUNCEMENTS**	**Assigned to:**	**Time: 12:30 -12:45 p.m.**
Title		Renee Purdy, Chair	15 min
Purpose	**Standard meeting management item**		
Desired Outcome	1. Approve agenda 2. Approve meeting summary from 9-24-13 TAC meeting		
Contact Person	Renee Purdy	(213) 576-6622, Renee.Purdy@waterboards.ca.gov	
Attachments	Notes from 9-24-13 TAC meeting.pdf		
Notes			
Action Items			

ITEM 2	**REASONABLE ASSURANCE ANALYSIS SUBCOMMITTEE UPDATE**	**Assigned to:**	**Time: 12:45 - 1:15 p.m.**
Title		Ivar Ridgeway	30 min
Purpose	Brief TAC on October 17, 2013 RAA subcommittee		
Desired Outcome	Provide update to TAC on RAA subcommittee presentations, discussion and outcomes.		
Background	The second meeting of the RAA/Modeling Subcommittee was held on October 17, 2013; in conjunction with this meeting, several case studies were presented on the use of models to conduct reasonable assurance analyses. Presentations were given on the use of LSPC/SUSTAIN and SBPAT in San Diego watersheds and an application of XPSWMM in the City of Torrance's Machado Lake drainage area.		
Contact Person	Ivar Ridgeway	(213) 620-2150, Ivar.Ridgeway@waterboards.ca.gov	
Attachments			
Notes			
Action Items			

ITEM 3	**DISCUSSION REGARDING THE USE OF HUC-12 EQUIVALENTS**	Assigned to:	**Time: 1:15 - 2:00 p.m.**
Title		TJ Moon, LA County	45 min
Purpose	The County will present a proposal for HUC-12 equivalents		

Desired Outcome	Agreement on the use of HUC-12 equivalents, where appropriate, for E/WMP and monitoring programs.	
Background	LA County has more localized drainage area boundary data as compared to the data on which the HUC-12 system is based and proposes that LA County MS4 Permittees use these "HUC-12 equivalents" in their monitoring programs.	
Contact Person	TJ Moon	(626) 458-4380, tmoon@dpw.lacounty.gov
Attachments	 HUC-12 Equivalent - EWMP & WMP Groups  HUC-12 Equivalent - Old vs. Equivalent.pd	
Notes		
Action Items		

ITEM 4	**MEETING SCHEDULE FOR 2014**	**Assigned to:**	**Time: 2:00 - 2:15 p.m.**
Title		Renee Purdy	15 min
Purpose	Discuss meeting frequency and location for 2014		
Desired Outcome	Tentatively agree to the schedule.		
Background	LA County Public Works is willing to continue hosting TAC meetings in 2014		
Contact Person	Renee Purdy	(213) 576-6622, Renee.Purdy@waterboards.ca.gov	
Attachments	 Proposed Early 2014 Meeting Schedule.pdf		
Notes			
Action Items			

ITEM 5	**MEETING EVALUATION AND WRAP-UP, REVIEW PROGRAM CALENDAR, NEXT MEETING DATES AND AGENDA**	**Assigned to:**	**Time: 2:15 - 2:30 p.m.**
Title		Renee Purdy	15 min
Purpose	To evaluate meeting, acknowledge key forthcoming dates on the Program Calendar, and discuss potential topics for future meetings.		
Desired Outcome	Determine details for the next meeting including agenda items and assignments.		
Contact Person	Renee Purdy	(213) 576-6622, Renee.Purdy@waterboards.ca.gov	
Notes			
Action Items			

Item 1 – Introductions, Review Agenda, Brief Announcements – Regional Board, Renee Purdy

- Agendas will be linked on the TAC information page on Regional Board website, let Ivar or Renee know if problems
- http://www.swrcb.ca.gov/losangeles/water_issues/programs/stormwater/municipal/watershed_management/tac/index.shtml
- Cindy Lin, EPA conference call in
- No changes to agenda
- Monitoring topics will be on next meeting agenda

Item 2 – Reasonable Assurance Analysis Subcommittee Update – Regional Board, Ivar Ridgeway

- 2nd meeting held October 17, 2013
- Co-chair will be Bruce Hamamoto, Los Angeles County
- Presentations of case studies of models
- Will post all presentations to the TAC information website
- Three case studies
    - City of Torrance, Machado Lake, XPSWMM
    - City of San Diego Chollas Creek, Tecolote Creek and San Diego River, WMMS
    - San Diego River Watershed, SBPAT
- XPSWMM City of Torrance highlights
    - Satellite imagery was most cost effective
    - Discrete monitoring points were most cost effective
- LSPC/WMMS/SUSTAIN San Diego highlights
    - Allowable exceedance days to eliminate the largest two storms
    - Model size/resolution
- SBPAT San Diego highlights
    - Nonstructural BMPs
        - Street sweeping in model
        - Irrigation controls
- Next couple of RAA Subcommittee meetings topics to choose from, some issues are higher priority and need to be discussed sooner than others
    - Criteria for allowable assumptions for land use and imperviousness
    - Design storm rationale
    - Nonstructural BMP assumptions
    - Level of acceptable modeling uncertainty initially then calibration and adaptive management

- There could be substantial problems if guidance comes out February or later and substantial work on modeling needs to be done and still meet the June 2013 deadline for WMPs and EWMP work plans
- TAC and Subcommittees consensus process not approval or decision making process, range of options and data sources will be included in group discussion
- Approval of plans is by the Regional Board, not the TAC or Subcommittee
- Action Items
    - Send agendas for the RAA Subcommittee to all TAC members so people can come observe but not participate in the discussion if the RAA Subcommittee agrees
    - Ivar will confirm topics and future meeting dates for next RAA Subcommittee via poll
    - Permittees and watershed groups should provide the most recent information about which models are being used in their plans to Renee and Ivar

Item 3 Discussion Regarding the Use of HUC 12 Equivalents – Los Angeles County, TJ Moon

- Problem is HUC 12 use older contour data that are not as good of resolution and Los Angeles County data, mostly due to urbanization
- HUC 12 contours versus Los Angeles County contours almost exactly match in Santa Clara River and Malibu Creek watersheds
- More urbanized watersheds are less consistent between the two data sets
- Drew new areas by selecting the area where the HUC 12 ended then selected upstream of that point
- Propose using the more detailed Los Angeles County contour data instead of national HUC 12 data
- Example: Dominguez Channel and City of Manhattan Beach shows three HUC 12 areas however, it is one watershed in reality
- Eliminated an area near the ports. The HUC should be omitted because the area is part of many individual drainage areas
- In marine water areas versus freshwater areas in the same HUC, marine characteristics are different, you may have to add sites
- Variability would need additional monitoring sites
- Action items
    - share the data sets for review by the committee then discuss at next meeting
    - share the data with NHD to integrate with the next HUC 12 data release

Item 4 – Meeting Schedule for 2014 - Regional Board, Renee Purdy

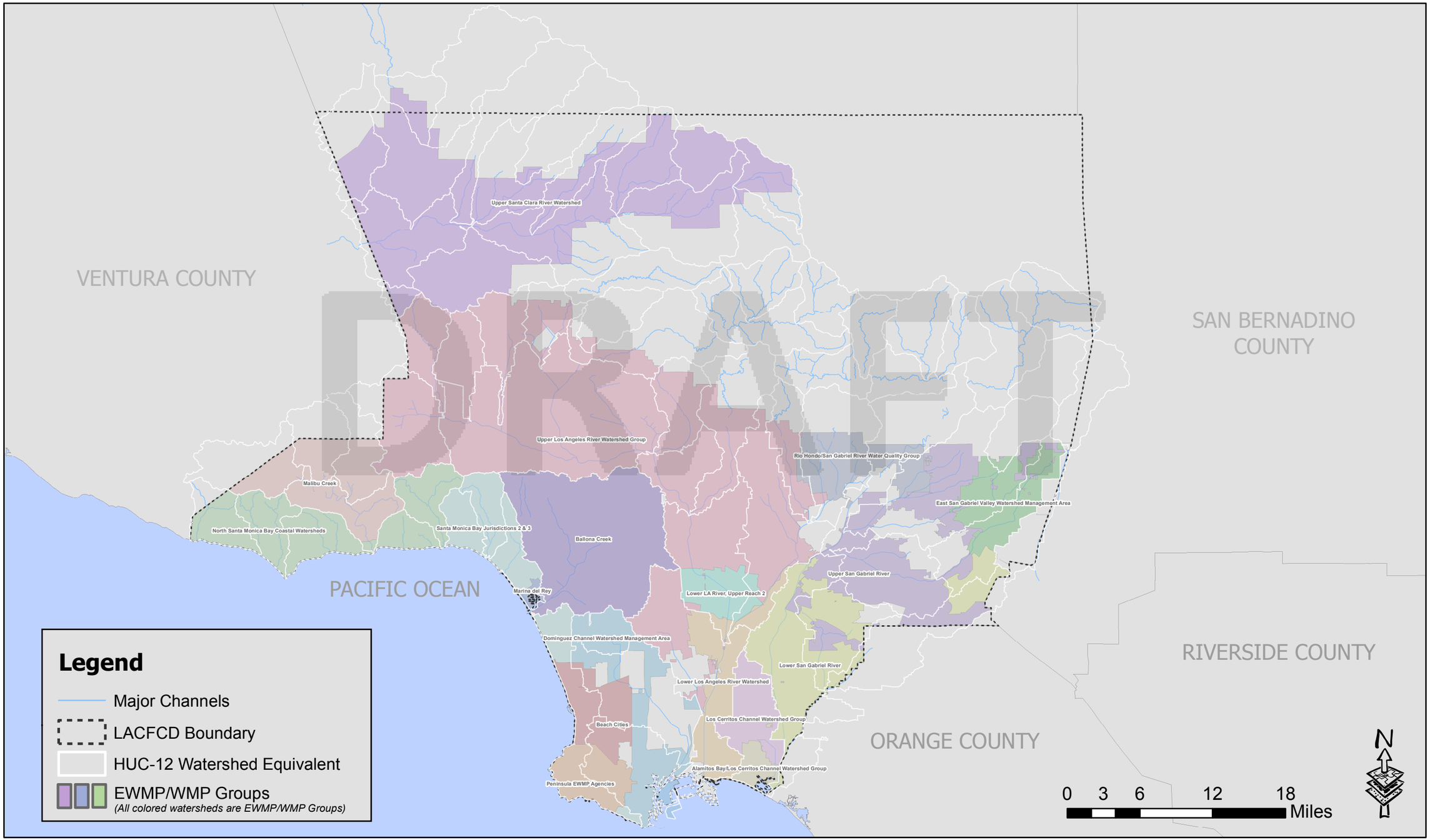
- TAC schedule attached to the agenda through May 2014, generally 4th Wednesday
- Also posted on the TAC website

- Concerns with continued meeting at Los Angeles County
- Rotating location to different areas suggested
- Lyris notice about November 4, 2013 LID Workshop
    - at Regional Board offices from 9 a.m. - 12 noon, Carmel Room
    - about LID and green streets policies submitted as part of NOIs
    - to get input on the policies
    - meet general expectations
    - EPA Manual on Green Streets provides a menu of BMPs that Regional Board expects will be used in implementing Green Streets policies
    - LID ordinance and Green Streets policy must be consistent with permit requirements; Regional Board will evaluate during review and approval of draft E/WMPs
    - Regional Board complete review of draft policy/ordinance in six weeks so permittees developing WMPs know the time constraints with their deadlines, doors are open for feedback
    - Discuss at November 4 workshop
- Green Infrastructure Summit
    - EPA Grant – green opportunities and barriers report out by Council for Watershed Health; posted on Regional Board website
        - http://www.waterboards.ca.gov/losangeles/water_issues/programs/stormwater/municipal/lid_and_greenst/index.shtml
    - Multi-benefit compliance
- Status of NOI
    - Review letters will be sent within two weeks
    - Some are in the mail or already sent

Next meeting November 19, 2013 at 1 PM at Los Angeles County Department of Public Works Room B

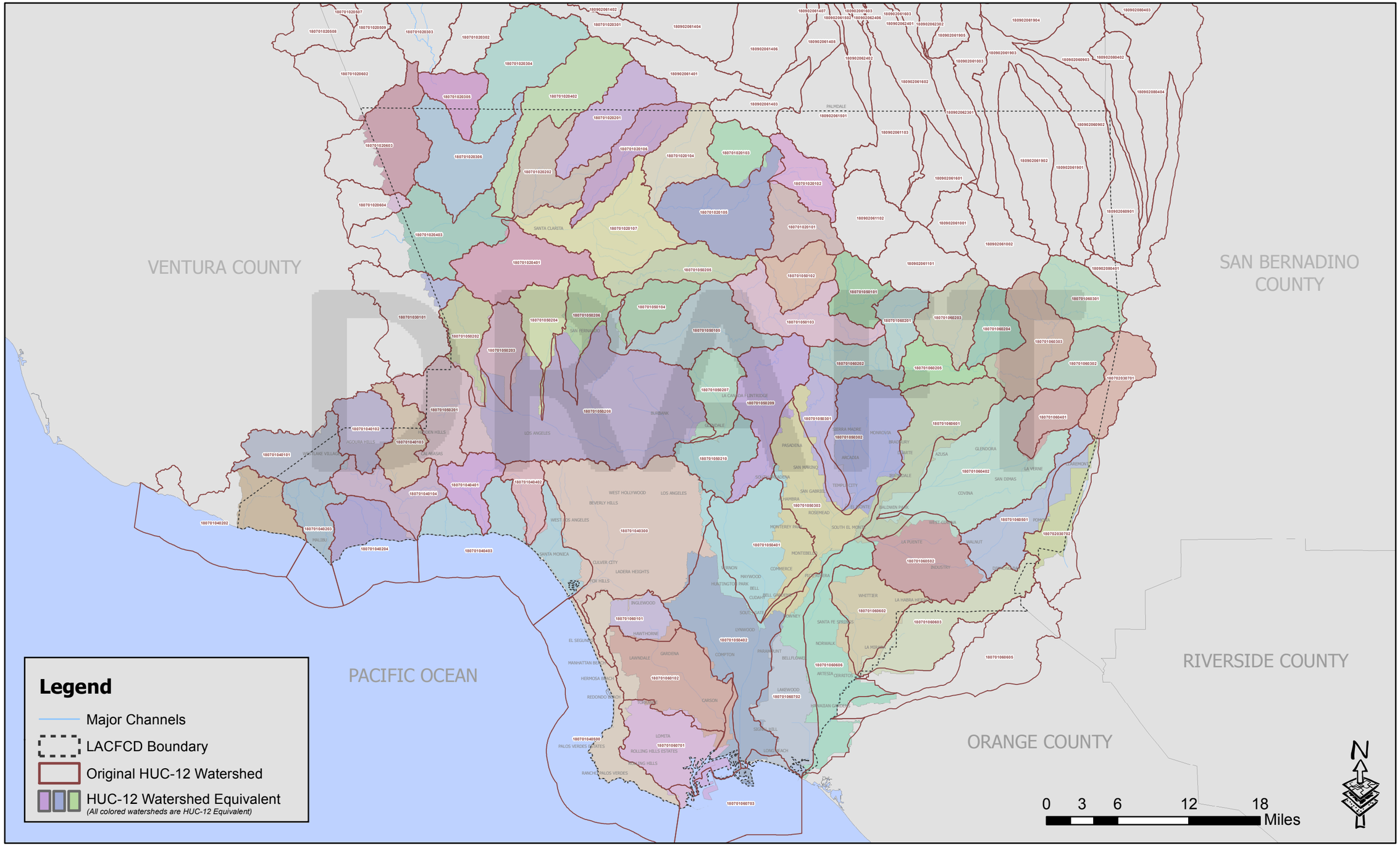
HUC-12 WATERSHED BOUNDARIES

(compared to EWMP/WMP Groups)



HUC-12 WATERSHED BOUNDARIES

(Original HUC-12 vs. Proposed Equivalent)



RB-AR 1058

Proposed Early 2014 Meeting Schedule

Los Angeles County MS4 Permit - Watershed Management Technical Advisory Committee

January 22nd	Wednesday	12:30-2:30	Conference Room A	TAC
February 26th	Wednesday	12:30-2:30	Alhambra Room	TAC
March 26th	Wednesday	12:30-2:30	Conference Room A	TAC
April 23rd	Wednesday	12:30-2:30	Conference Room A	TAC
May 28th	Wednesday	12:30-2:30	Conference Room A	TAC

TETRA TECH

Example Modeling Application: City of San Diego Comprehensive Load Reduction Plans

October 17, 2013

Overview

- Background on TMDL and Approach
- Load Reduction Goals
- Modeling Approach
  - Non-structural BMPs
  - Distributed BMPs
  - Regional BMPs

Comprehensive Load Reduction Plans

- Project I – Beaches and Creeks Bacteria TMDL
  - Adopted February 2010
  - Addresses 13 watersheds in Orange and SD Counties
  - If agencies develop a multi-pollutant TMDL implementation plan, then wet weather implementation schedule extended to 20 years.
- CLRPs
  - "shall demonstrate how the BMPs/water quality projects will address all water quality problems in the impaired waterbody and result in achievement of water quality standards"
  - City of San Diego led CLRPs for 4 watersheds

Modeling Approach

- Watershed Model
  - Loading Simulation Program – C++
  - Peer-reviewed, process-based EPA model
  - Hydrology and water quality of runoff and receiving water
    - Also used to simulate some non-structural BMPs
- BMP Model
  - SUSTAIN – System for Urban Stormwater Treatment Analysis and Integration
  - Peer-reviewed, process-based EPA model
  - Includes cost optimization algorithms

Pollutant Load Reduction Goals – Chollas Creek

Wet Weather

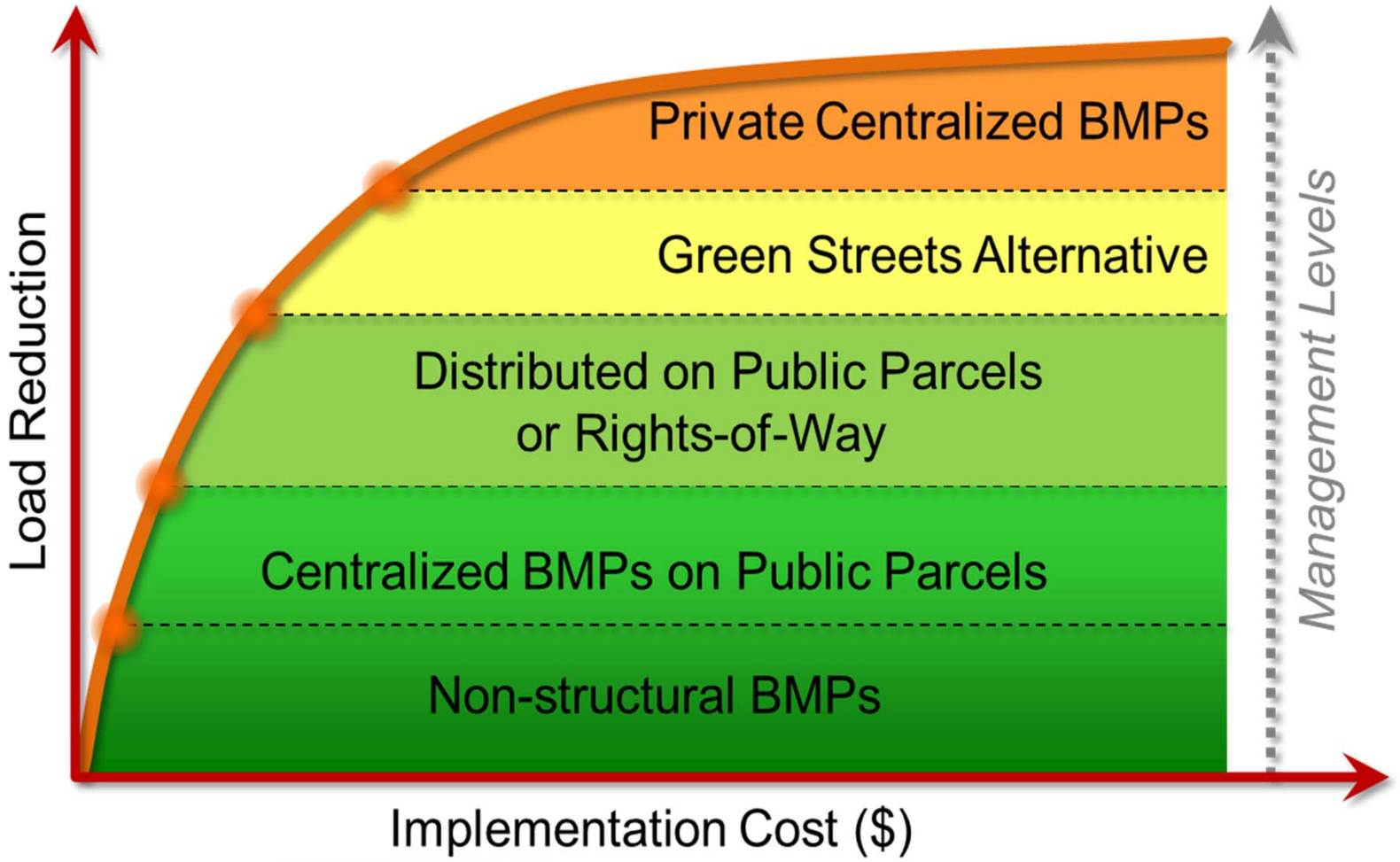
Pollutant	Existing Load	Allowed Load	Allowed Exceedance Day Load	Required Reduction	
Fecal coliform (Billion #/year)	939,537	41,275	628,115	270,147	28.8%
Enterococcus (Billion #/year)	7,280,200	5,532,655	5,532,655	1,741,230	23.9%
Copper (lbs/yr)	1,116.1	299.1	n/a	817.0	73.2%
Lead (lbs/yr)	961.5	961.5	n/a	0	0.0%
Zinc (lbs/yr)	7,220.0	2,557.6	n/a	4,662.4	64.6%
PAHs (g/yr)	33,648.54	14,492.89	n/a	19,155.65	56.9%

Dry Weather

Pollutant	Existing Load	Allowed Load	Required Reduction	
Fecal coliform (Billion #/year)	64,095	769	63,326	98.8%
Enterococcus (Billion #/year)	724,346	5,070	719,276	99.3%
Copper (lbs/yr)	45.0	19.8	25.3	56.1%
Lead (lbs/yr)	39.0	11.5	27.5	70.4%
Zinc (lbs/yr)	293.4	242.2	51.3	17.5%

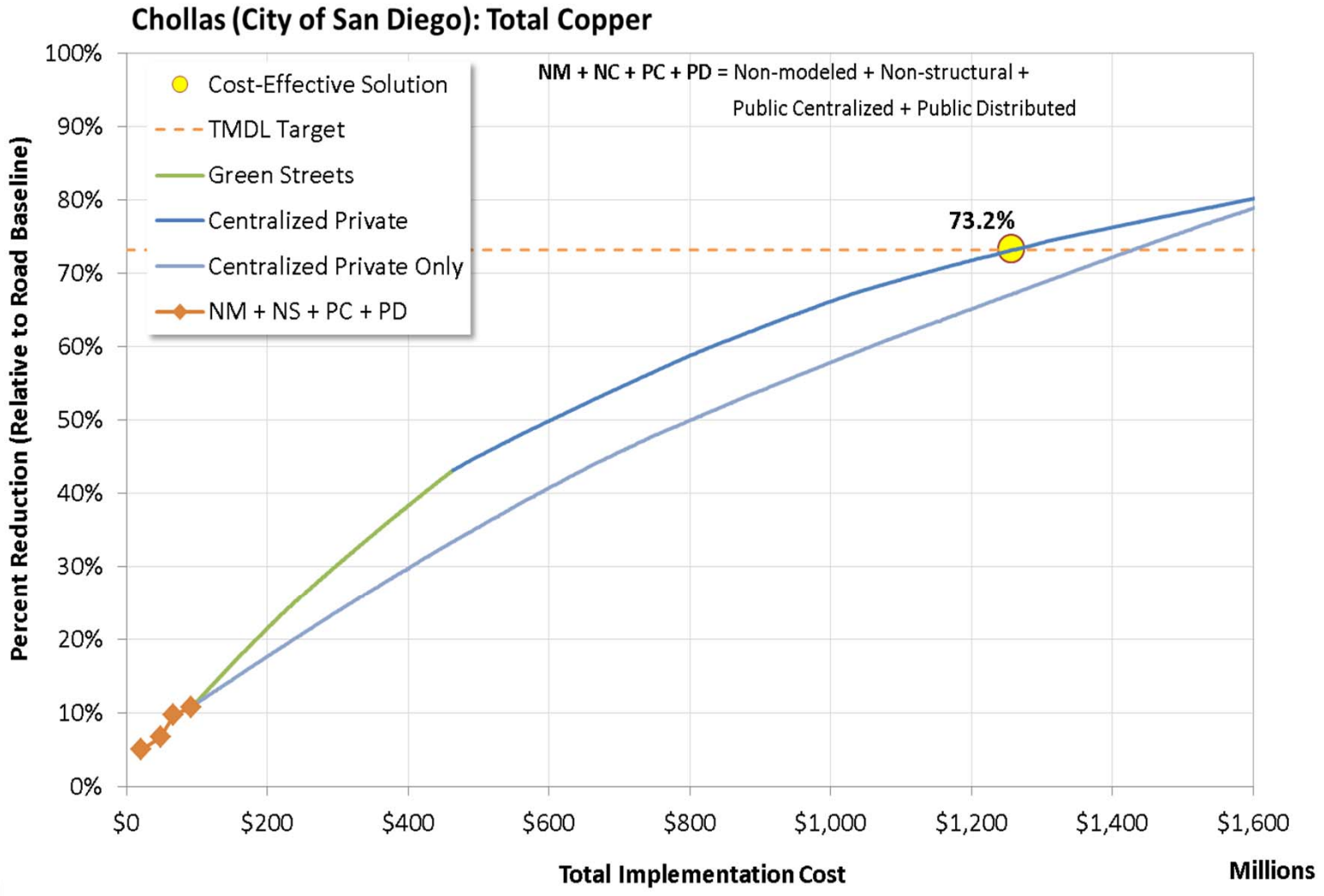
RB-AR 1064

Conceptual Cost-Effectiveness Curve



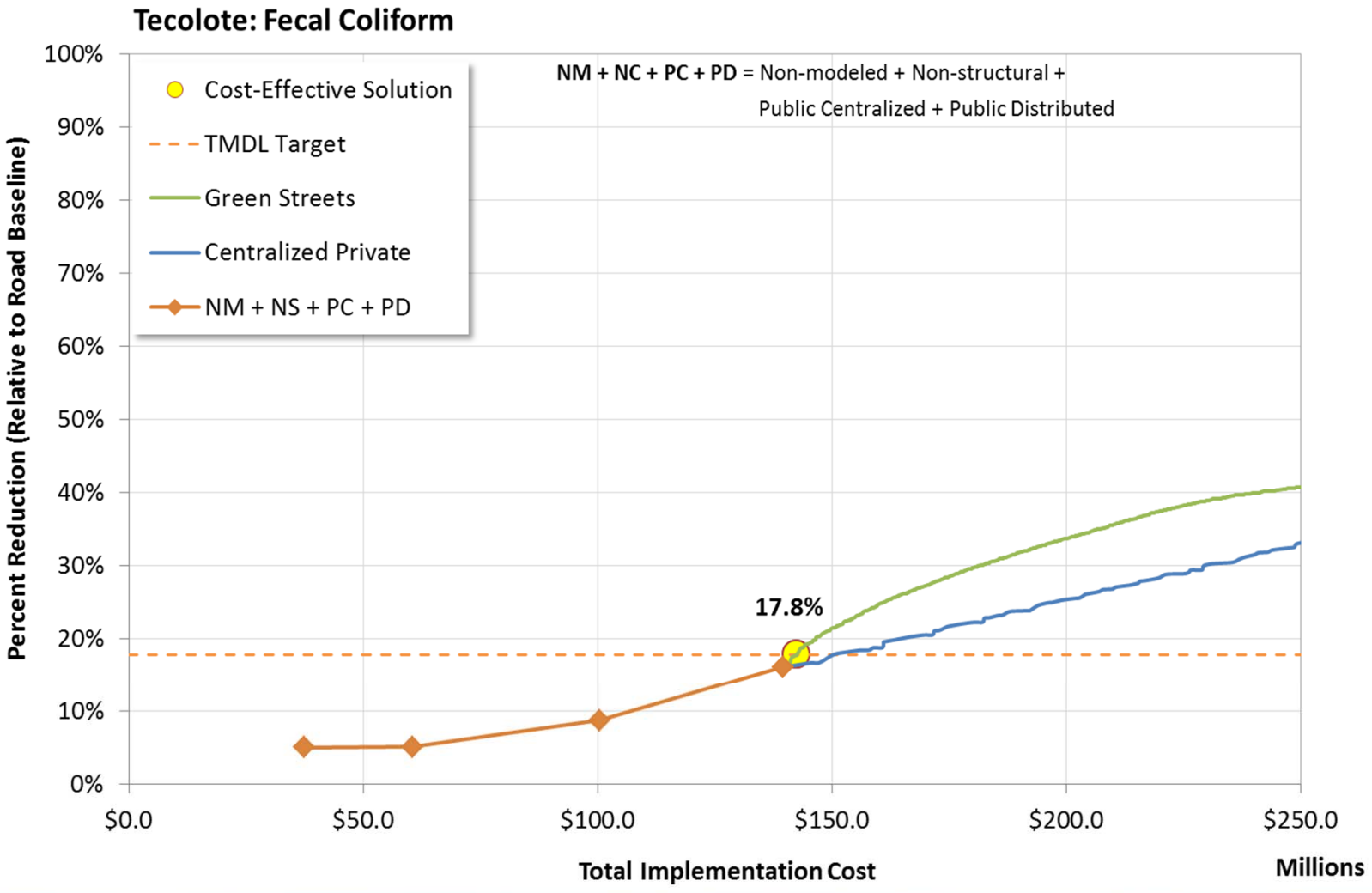
RB-AR 1065

Chollas Creek



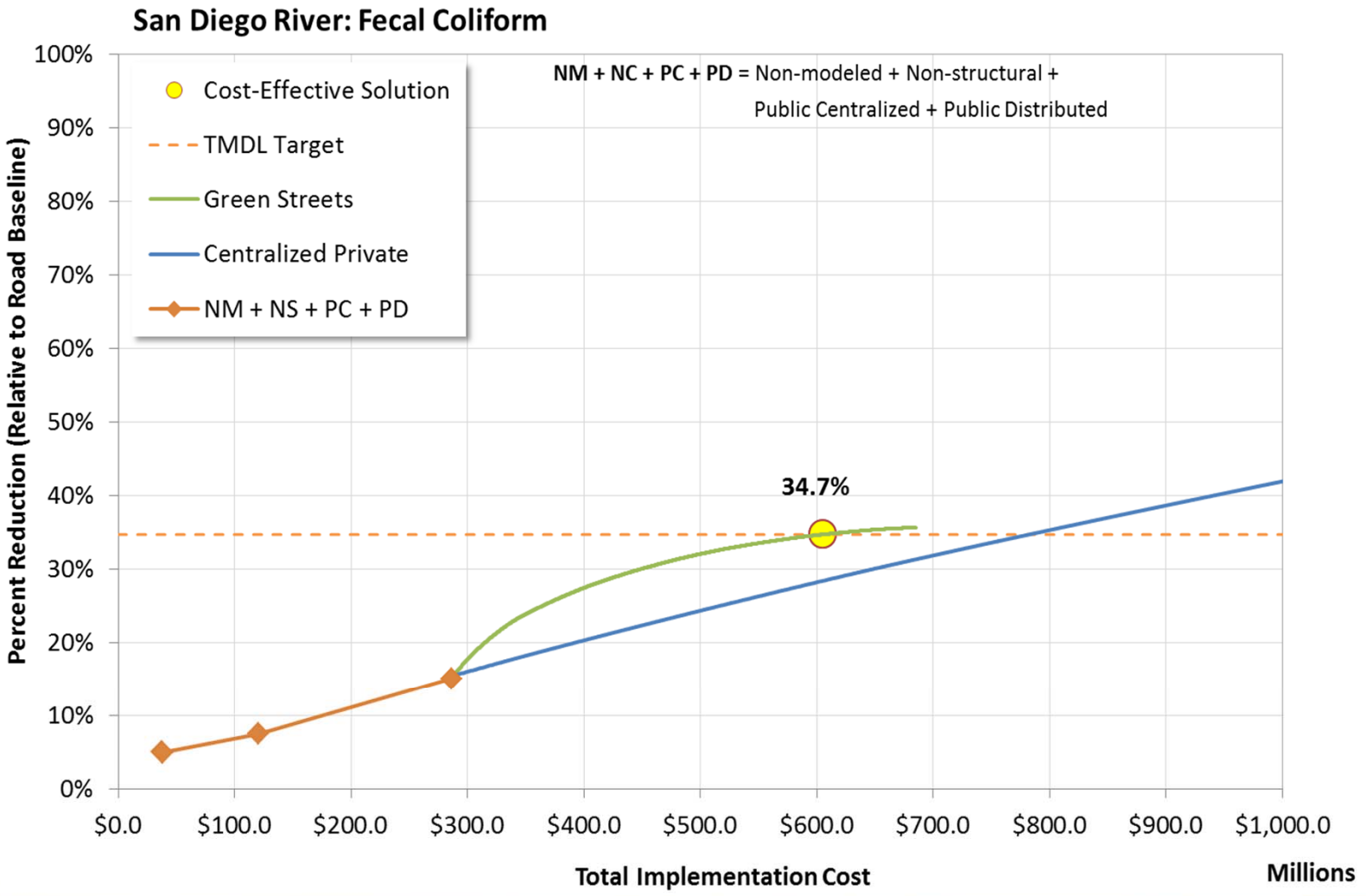
RB-AR 1066

Tecolote Creek



RB-AR 1067

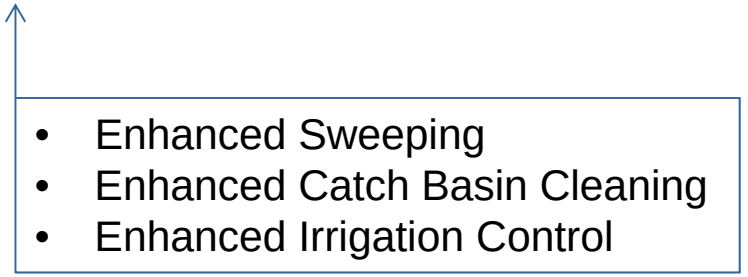
San Diego River



RB-AR 1068

Wet Weather Copper Reduction Achieved

RP	Enhanced Non-structural (not modeled)	Enhanced Non-structural (modeled)	Centralized on Public	Distributed on Public	Green Streets	Centralized on Acquired Private Land	Total*
City of La Mesa	5.00	2.58	0.44	1.68	40.00	23.5	73.20
City of Lemon Grove	5.00	1.65	n/a	1.56	39.58	25.41	73.20
Port of San Diego	5.00	n/a	n/a	68.2	n/a	n/a	73.20
San Diego County	5.00	0.01	n/a	1.27	28.90	38.02	73.20
City of San Diego	5.00	3.15	3.65	1.32	32.36	27.72	73.20
Caltrans	5.00	0.01	68.19	n/a	n/a	n/a	73.20



RB-AR 1069

Dry Weather Copper Reduction Achieved

RP	Enhanced Non-structural (not modeled)	Enhanced Non-structural (modeled)	Centralized on Public	Distributed on Public	Green Streets	Centralized on Acquired Private Land	Total*
City of La Mesa	5.00	58.72	0.15	0.15	35.98	0.00	100.0
City of Lemon Grove	5.00	58.55	n/a	0.19	36.26	0.00	100.0
Port of San Diego	5.00	n/a	n/a	95.00	n/a	n/a	100.0
San Diego County	5.00	59.10	n/a	0.01	35.89	0.00	100.0
City of San Diego	5.00	56.87	1.27	1.28	35.58	0.00	100.0
Caltrans	5.00	0.00	95.00	n/a	n/a	n/a	100.0

- Enhanced Irrigation Control

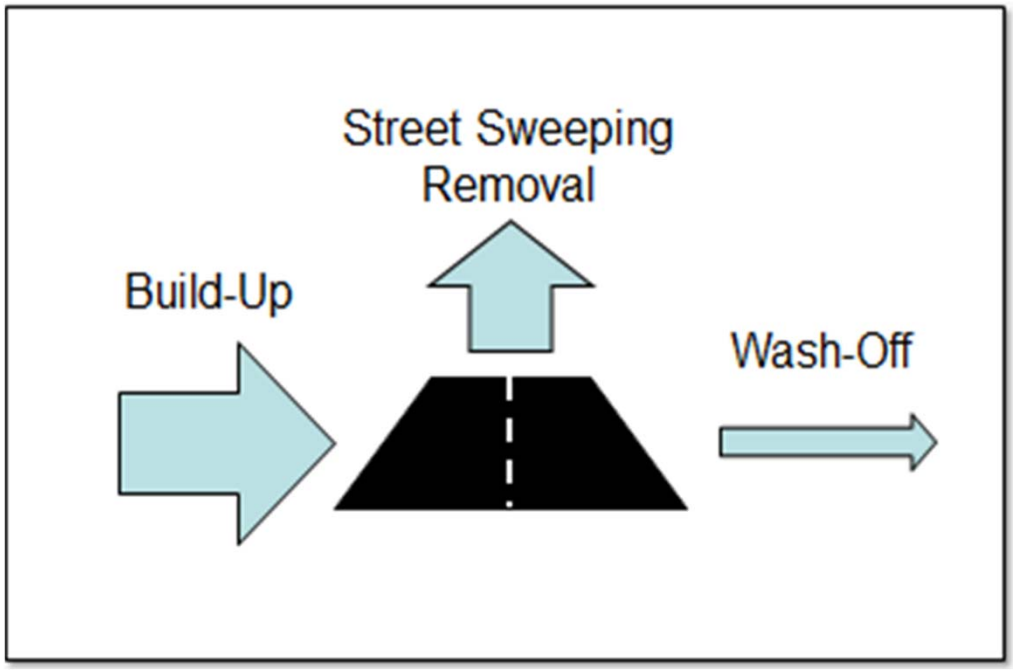
RB-AR 1070

Non-structural BMPs

Enhanced Street Sweeping

RP	Non-structural (modeled)
City of La Mesa	2.58
City of Lemon Grove	1.65
Port of San Diego	n/a
San Diego County	0.01
City of San Diego	3.15
Caltrans	0.01

- Optimization Results
  - Effective on metals
  - Regen-air/max frequency
- Implementation
  - Commercial 2x/week
  - Residential 2x/month
  - Regen-air all

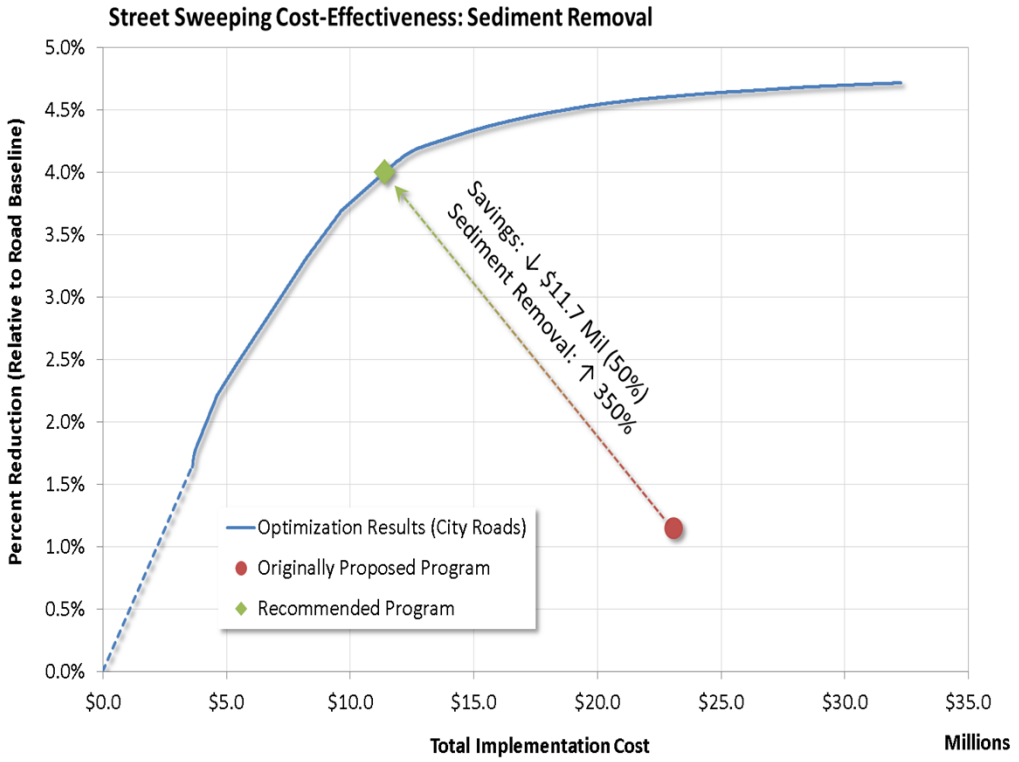


RB-AR 1072

Enhanced Street Sweeping

RP	Non-structural (modeled)
City of La Mesa	2.58
City of Lemon Grove	1.65
Port of San Diego	n/a
San Diego County	0.01
City of San Diego	3.15
Caltrans	0.01

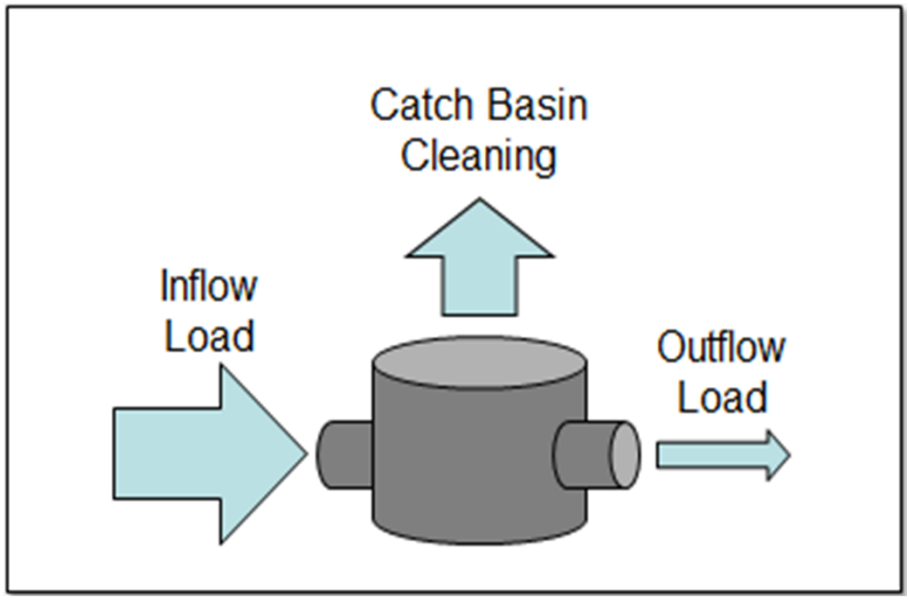
- Optimization Results
  - Effective on metals
  - Regen-air/max frequency
- Implementation
  - Commercial 2x/week
  - Residential 2x/month
  - Regen-air all



RB-AR 1073

Catch Basin Cleaning

RP	Non-structural (modeled)
City of La Mesa	2.58
City of Lemon Grove	1.65
Port of San Diego	n/a
San Diego County	0.01
City of San Diego	3.15
Caltrans	0.01

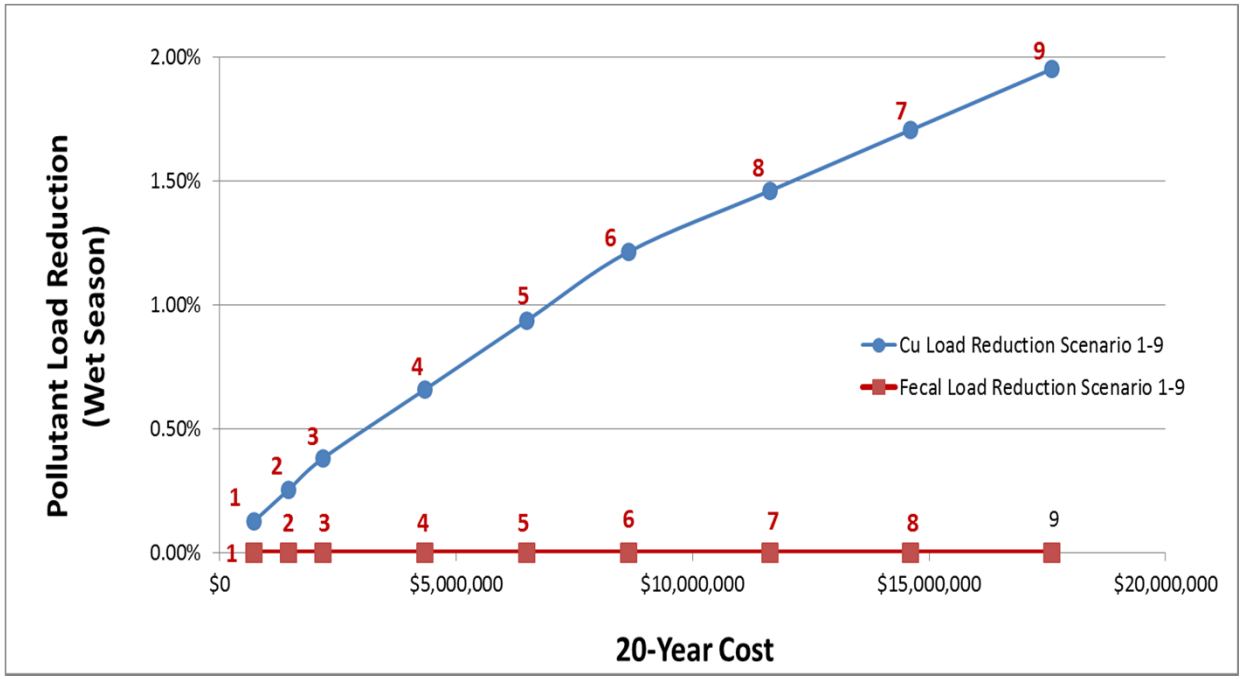


- Optimization results
  - Increase frequency in high-yield areas
  - Clean during wet weather
  - Reduce metals
- Implementation
  - Clean 4x year (wet weather)

RB-AR 1074

Catch Basin Cleaning

RP	Non-structural (modeled)
City of La Mesa	2.58
City of Lemon Grove	1.65
Port of San Diego	n/a
San Diego County	0.01
City of San Diego	3.15
Caltrans	0.01



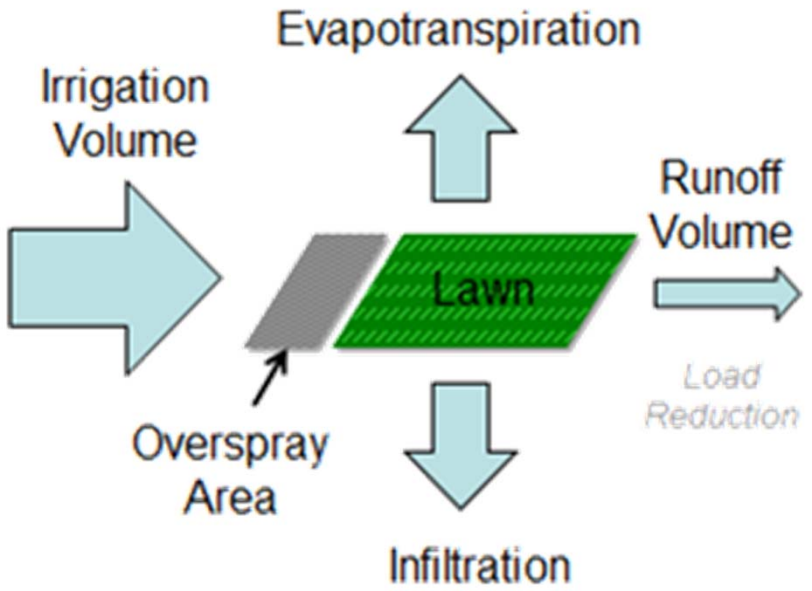
- Optimization results
  - Increase frequency in high-yield areas
  - Clean during wet weather
  - Reduce metals
- Implementation
  - Clean 4x year (wet weather)

RB-AR 1075

Irrigation Control

RP	Non-structural (modeled)
City of La Mesa	58.72
City of Lemon Grove	58.55
Port of San Diego	n/a
San Diego County	59.1
City of San Diego	56.87
Caltrans	0.00

- Goal-oriented:
  - Eliminate overspray
  - 25% irrigation reduction

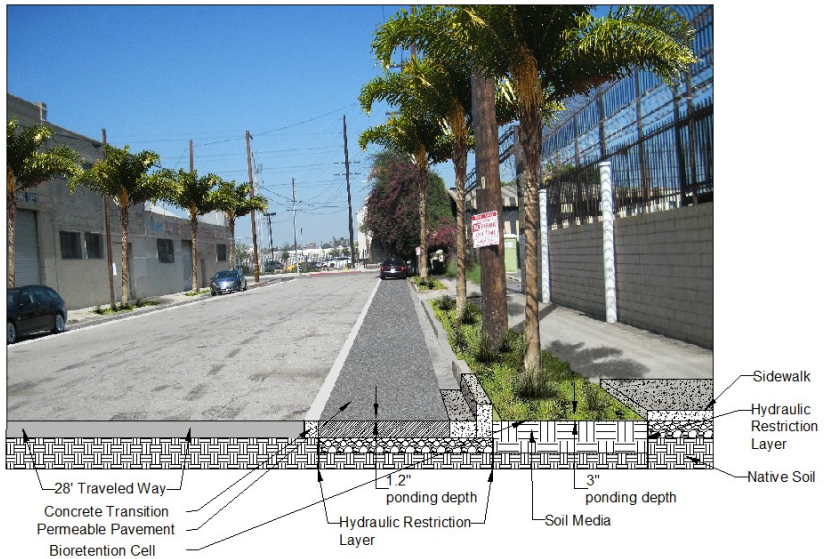


Distributed BMPs

Green Streets

RP	Green Streets
City of La Mesa	40.00
City of Lemon Grove	39.58
Port of San Diego	n/a
San Diego County	28.90
City of San Diego	32.36
Caltrans	n/a

- Candidate Streets
  - Process to screen feasible streets (slopes, utilities, driveways, etc)
- Contributing Areas
  - Land use controls surrounding parcel drainage to ROW
  - 15% drains to Permeable Pavement (Road surface only)
  - 85% drains to Bioretention (Road surface + percentage of parcel)
- Implementation
  - Permeable Pavement in on-street parking stalls
  - Bioretention in parkway (between the back of curb and sidewalk)

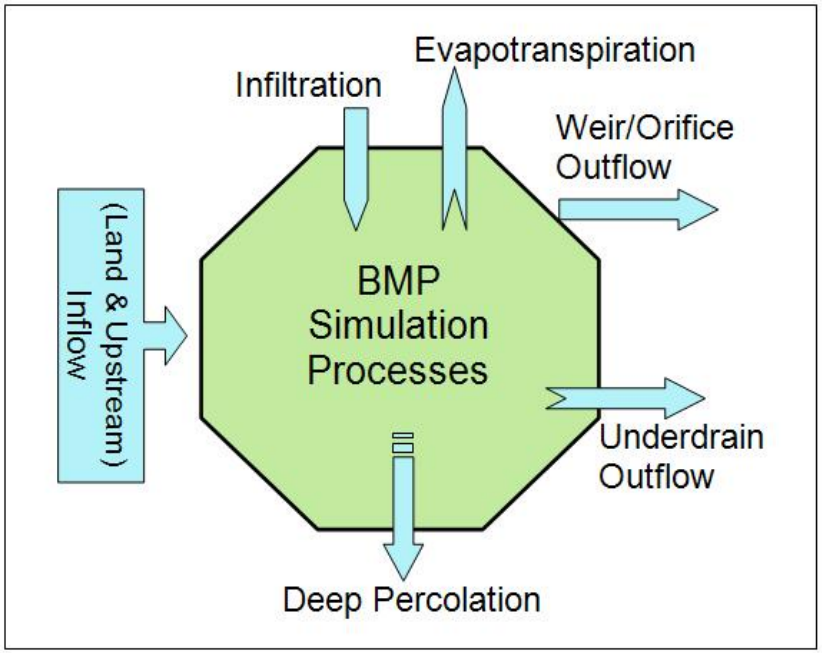


RB-AR 1078

Green Streets

RP	Green Streets
City of La Mesa	40.00
City of Lemon Grove	39.58
Port of San Diego	n/a
San Diego County	28.90
City of San Diego	32.36
Caltrans	n/a

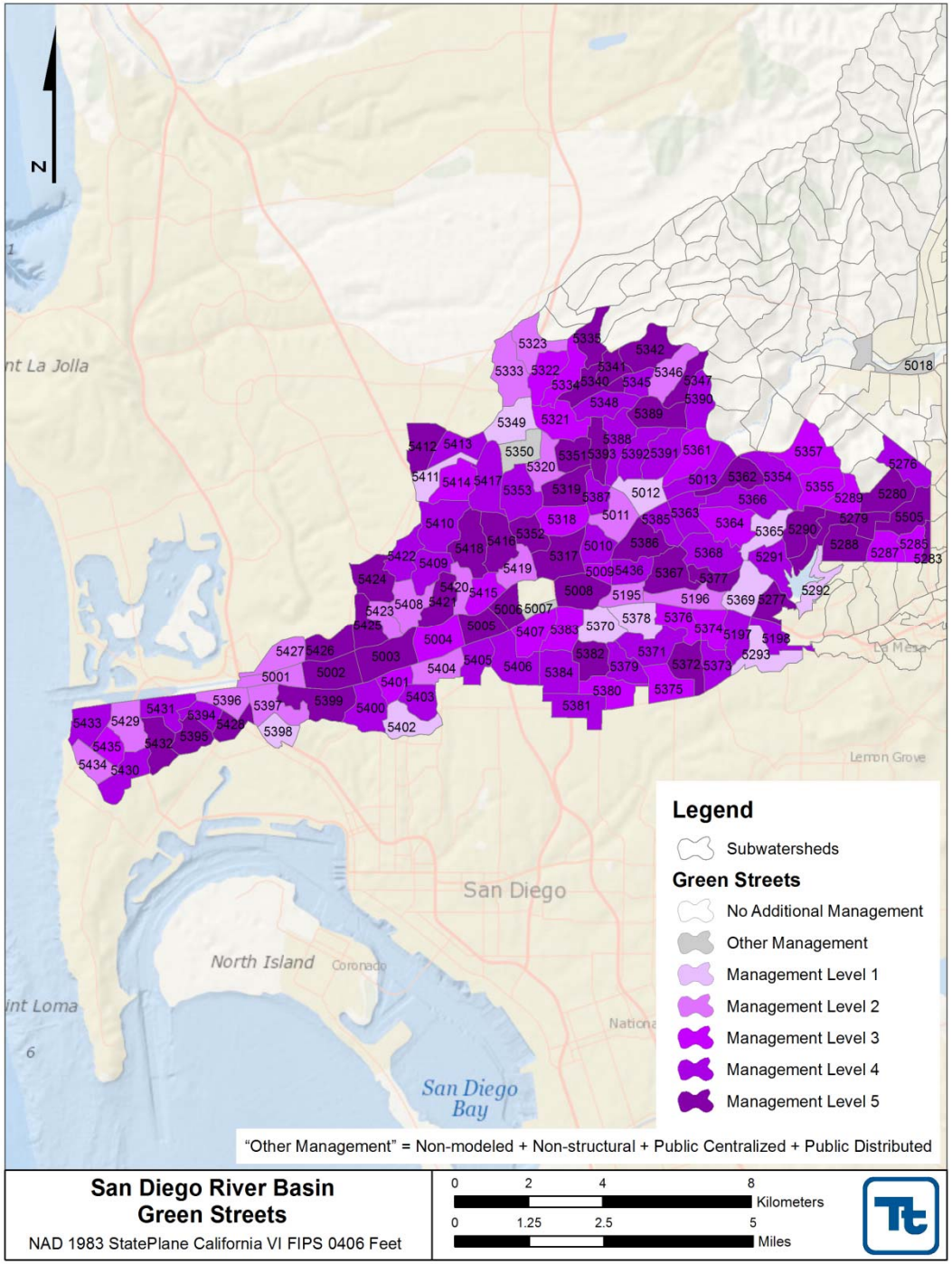
- Candidate Streets
  - Process to screen feasible streets (slopes, utilities, driveways, etc)
- Contributing Areas
  - Land use controls surrounding parcel drainage to ROW
  - 15% drains to Permeable Pavement (Road surface only)
  - 85% drains to Bioretention (Road surface + percentage of parcel)
- Implementation
  - Permeable Pavement in on-street parking stalls
  - Bioretention in parkway (between the back of curb and sidewalk)



RB-AR 1079

Distributed BMP Information

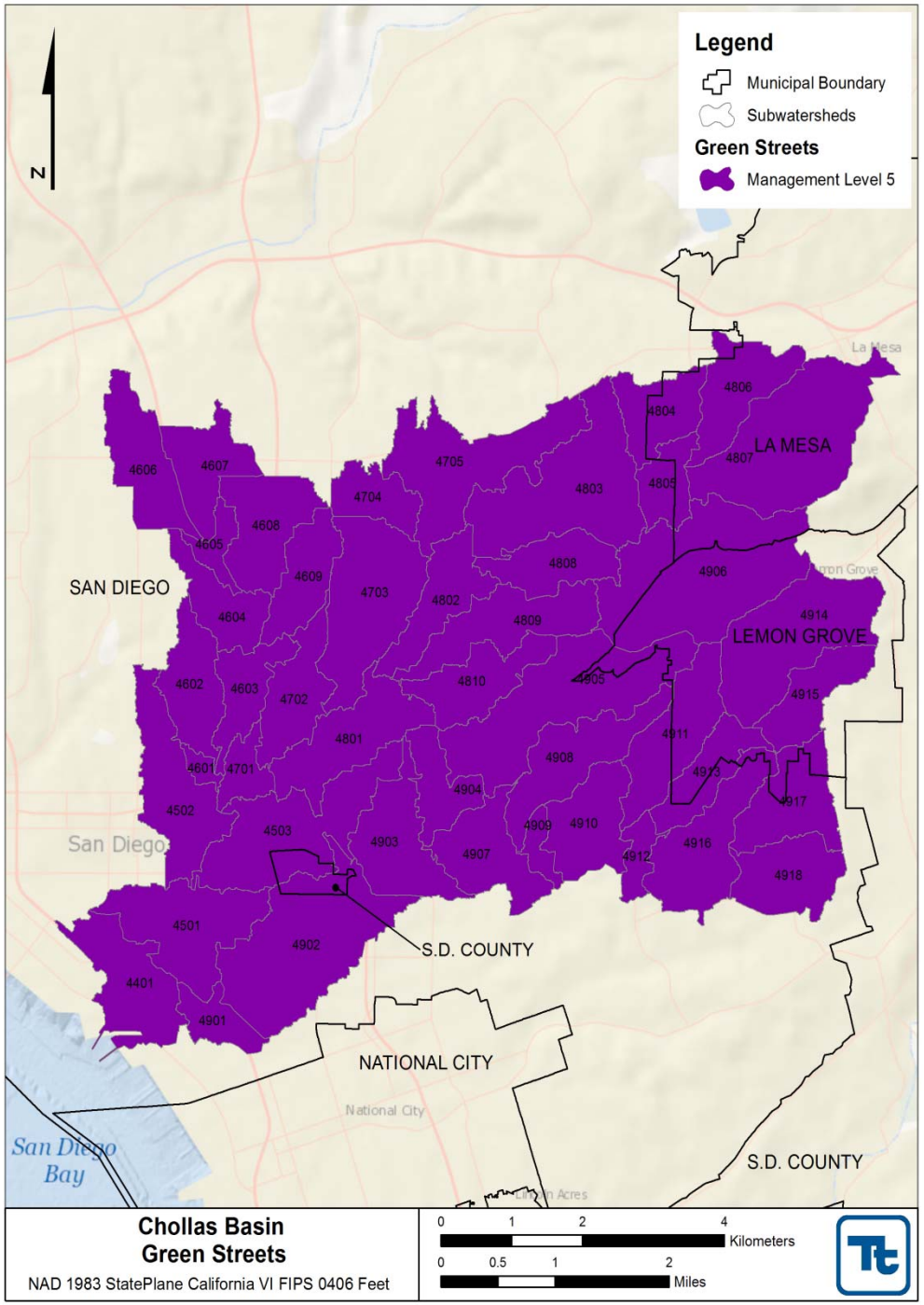
Subwatershed ID	Bioretention (ft)	Permeable Pavement (ft)
5001	1,184	0
5002	2,444	180
5003	5,465	426
5004	2,837	858
5005	2,576	0
5006	1,743	130
5007	0	0
5008	3,497	792
5009	610	221
5010	733	0
5011	60	3
5012	15	0
5013	1,209	0
5017	0	0
5018	0	0
5195	1,572	123
5196	2,032	0
5197	5,871	37
5198	5,714	158
5271	0	0
5276	5,545	353
5277	3,854	509
5279	4,142	838



RB-AR 1080

Distributed BMP Information

Subwatershed ID	Bioretention (ft)	Permeable Pavement (ft)
4401	11,350	8,957
4501	22,832	18,643
4502	17,129	1,560
4503	21,512	17,975
4601	1,142	0
4602	12,973	12,966
4603	6,966	6,918
4604	9,916	9,923
4605	3,307	3,306
4606	19,144	6,985
4607	15,119	14,589
4608	16,447	10,010
4609	11,982	9,694
4701	3,183	689
4702	10,697	10,600
4703	23,252	22,920
4704	10,247	10,219
4705	29,299	27,676
4801	9,516	9,294
4802	13,680	13,680
4803	29,406	23,173
4804	11,514	11,538
4805	9,018	9,018



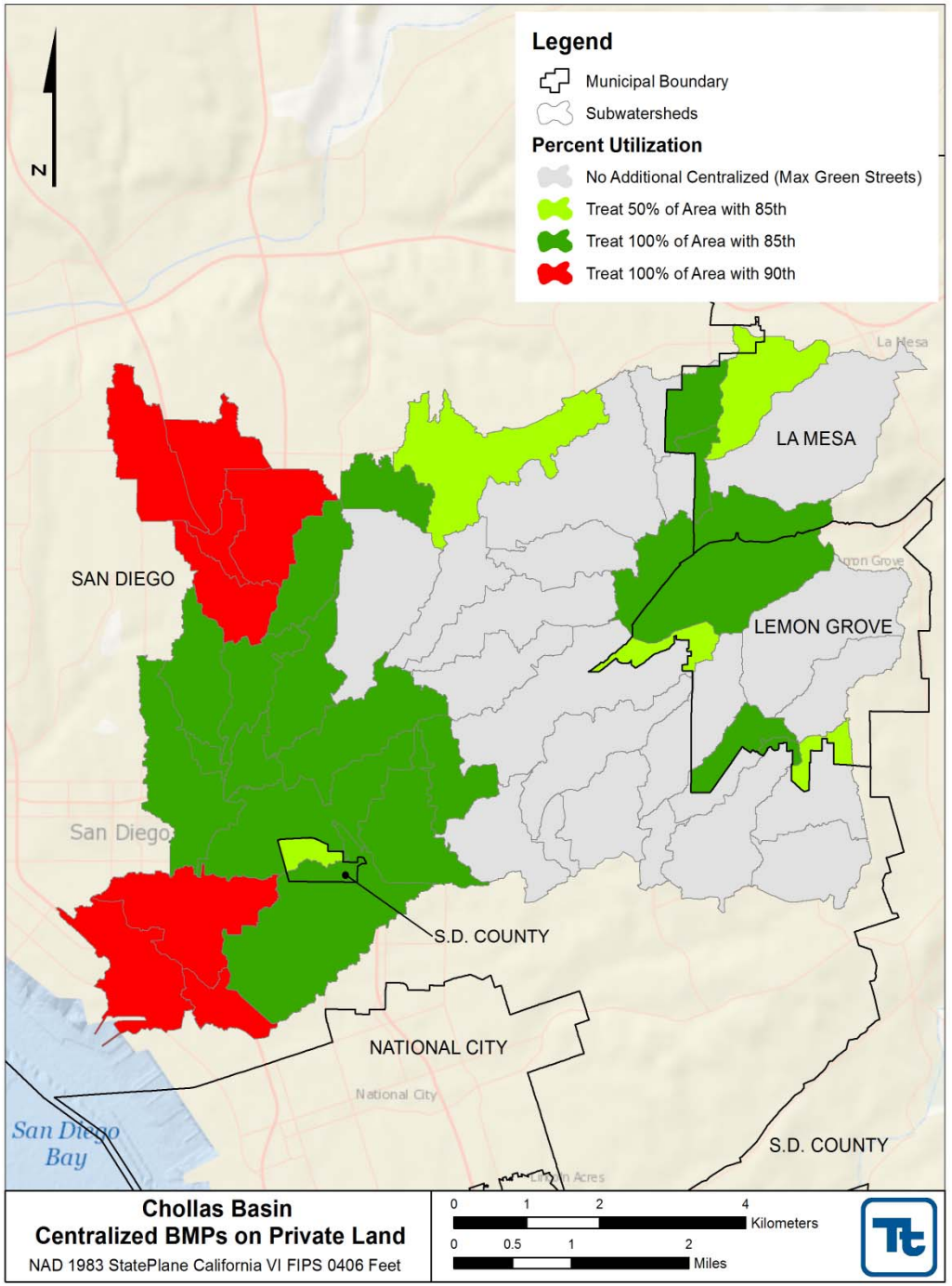
RB-AR 1081

Regional BMPs

San Diego River – Centralized Structural on Private Land

- Spatially optimized
- Priority subwatersheds identified

RP	Centralized on Acquired Private Land
City of La Mesa	23.5
City of Lemon Grove	25.41
Port of San Diego	n/a
San Diego County	38.02
City of San Diego	27.72
Caltrans	n/a



TETRA TECH

RB-AR 1083

Regional Project Information

- Description of project site and features
- Design summary
- Performance
- Costs

Park De La Cruz and Cherokee Point Elementary School Centralized BMP Fact Sheet

Site Overview

Park De La Cruz and Cherokee Point Elementary School (Site) catchment is located in the northwest portion of the Chollas Watershed, just west of State Road 15. The 81-acre drainage area consists of predominantly single-family residential but also includes multi-family residential; an urban, densely-situated shopping district; and educational institutions. The only green space on Site is the athletic field and small adjacent park (Park De La Cruz). Based on NRCS data, the predominant soil type of the Site is urban soils (HSG U); therefore, pending a geotechnical investigation by a licensed geotechnical engineer, a dry extended detention basin (Figure 1) would be appropriate to treat the drainage area. The available BMP area is outlined in Figure 2.

Figure 1. Example of a Dry Extended Detention Basin

Photo Source:
http://www.fixbrowse.com/html/newsletters/July_2010/news_jul10_st.htm

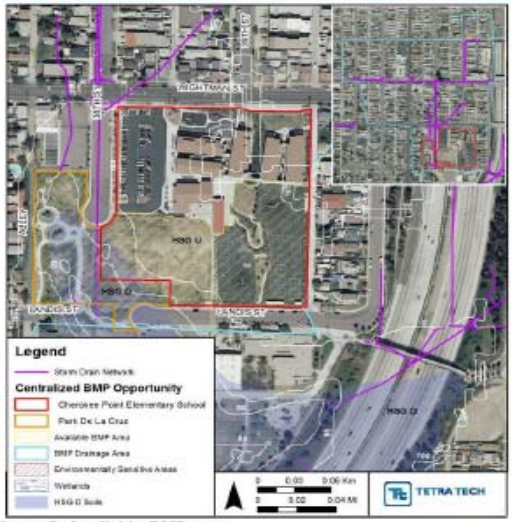


Figure 2. Available BMP area

BMP Design Considerations – Dry Extended Detention Basin

BMP design information for Cherokee Point Elementary School is summarized in Table 1. With this BMP type, flows in the creek could be diverted into the open space area for detention and treatment. There are no apparent environmental concerns in the area, although soil contamination potential should be investigated based on the history of the site and surrounding land uses.

Table 1. BMP Design Information Summary

Dry Extended Detention Basin	
BMP Drainage Area (Acres)	81
Available BMP Area (Acres)	5.5
Treatment Volume Capacity (Ac-Ft)	2.9
BMP Surface Area (Acres)	1.5
Recommended Design Depth (Ft)	2.0

(Note: BMP surface area and depth are recommendations only)

The available BMP area is proposed on public property, and therefore legal maintenance access is not an issue.

BMP Performance and Costs

Expected Pollutant Reductions

Table 2. Expected Pollutant Reductions

Pollutant	Watershed Load (lb, counts, or ft3/yr)	Percent Load Reduction
Enterococcus	5.40E+04	81.0%
Fecal Coliform	6.36E+03	76.6%
Total Coliform	1.39E+05	78.8%
Nitrogen	496.02	65.1%
Phosphorus	83.45	63.8%
Cu	6.5	51.3%
Pb	4.9	50.9%
Zn	41.9	51.5%
Sediment	6,019.8	55.7%
Flow Volume	1,807,986	53.6%

Estimated Costs

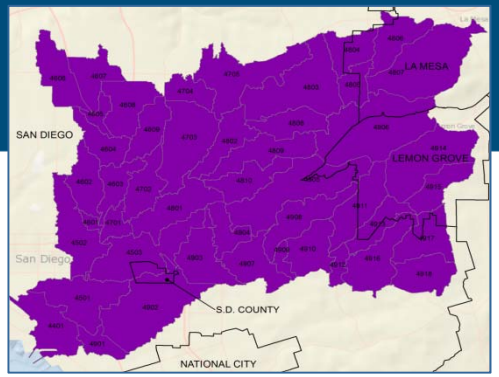
Table 3. Implementation Costs

Cost Estimate	
Planning	$97,200
Design	$276,300
Permits/Studies	$15,000
Construction	$972,113
Annual Operation & Maintenance	$125,814
Total	$1,486,427

Costs are provided in 2013 dollars based on planning level estimates. Assumptions were derived from field visits and previous costing efforts for similar BMPs. Actual cost will vary depending on site conditions and utilities, final design components, and actual sediment/debris loading.

BMP Modeling Output

Cumulative RAA Output



Chollas Creek

Subwatershed ID	Distributed BMPs		Regional BMPs		Nonstructural BMPs		
	Bioretention (ft)	Permeable Pavement (ft)	Treatment area (acres)	Design storm	Enhanced Sweeping	Enhanced Catch Basin Cleaning	Enhanced Irrigation Control
4401	11,350	8,957	457	85th	Yes	Yes	Yes
4501	22,832	18,643	543	85th	Yes	Yes	Yes
4502	17,129	1,560	298	90th	Yes	Yes	Yes
4503	21,512	17,975	123	85th	Yes	Yes	Yes
4601	1,142	0	231	85th	Yes	Yes	Yes
4602	12,973	12,966	464	85th	Yes	Yes	Yes
4603	6,966	6,918	342	85th	Yes	Yes	Yes
4604	9,916	9,923	115	85th	Yes	Yes	Yes
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
4805	9,018	9,018	345	85th	Yes	Yes	Yes

RB-AR 1086


QUESTIONS?

Use of SBPAT for Compliance with San Diego County Bacteria TMDLs:

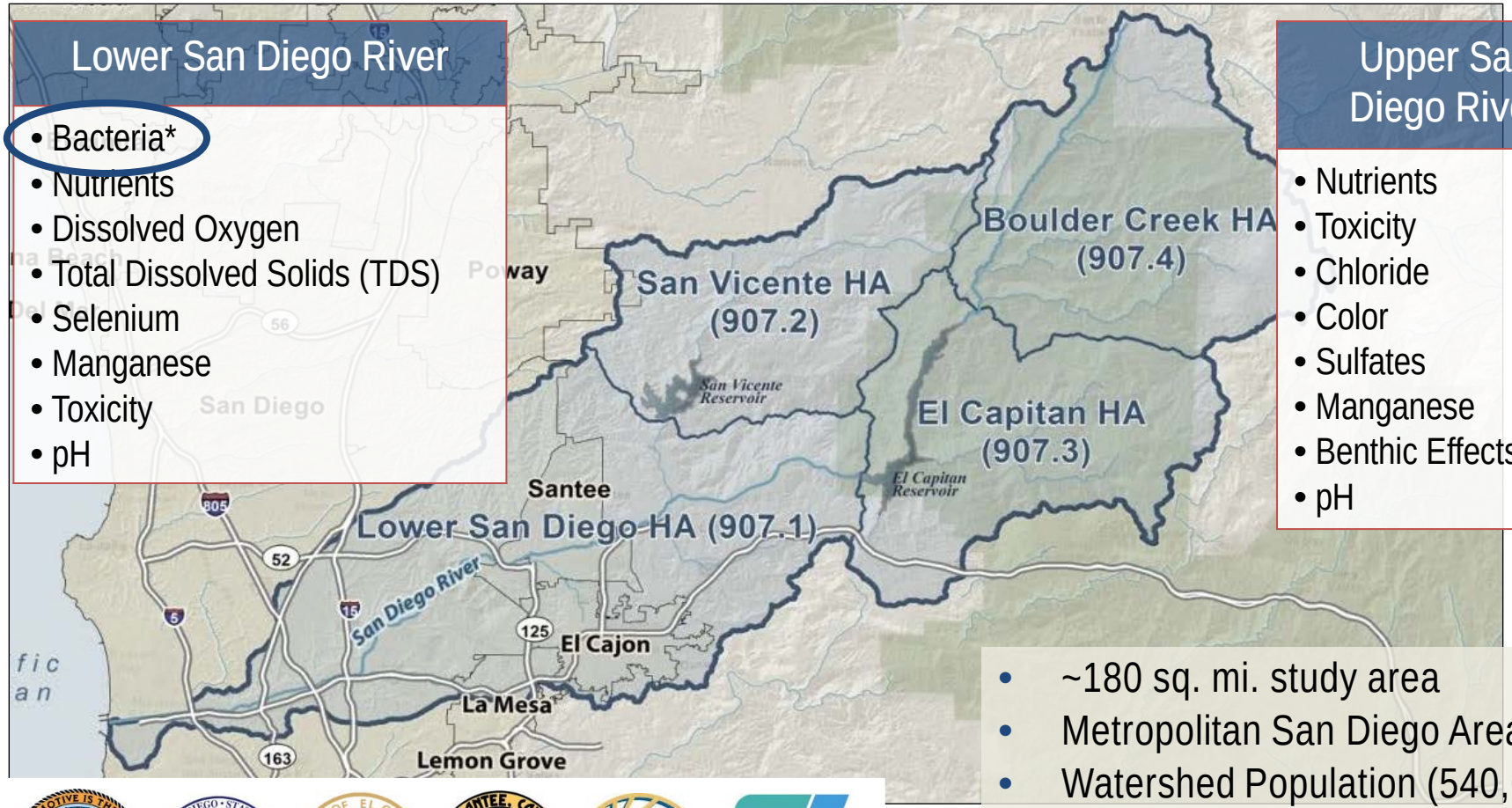
A Discussion on Comprehensive Load Reduction Plans

Presentation to Los Angeles MS4 Permit Group
Watershed Management Program Technical Advisory Committee
Reasonable Assurance Subcommittee

Ken Susilo, Geosyntec Consultants
October 17, 2013
Los Angeles County Department of Public Works, Alhambra, CA

RB-AR 1088

SAN DIEGO RIVER WATERSHED



Lower San Diego River

- Bacteria*
- Nutrients
- Dissolved Oxygen
- Total Dissolved Solids (TDS)
- Selenium
- Manganese
- Toxicity
- pH

Upper San Diego River

- Nutrients
- Toxicity
- Chloride
- Color
- Sulfates
- Manganese
- Benthic Effects
- pH

- ~180 sq. mi. study area
- Metropolitan San Diego Area
- Watershed Population (540,000)
- Large Homeless Population

RB/AR 1089

20 BEACHES AND CREEKS TMDL FOR INDICATOR BACTERIA

- Bacteria TMDL
  - Wet Weather and Dry Weather
  - TMDL Developed 2002, like SMB
  - Compliance year 1993 (90th pctl)
- Compliance Metrics
  - No guidance on compliance metrics (assumed to be AED, like Los Angeles/SMB TMDLs)
  - Subsequent (post-submittal) staff-level direction was AEF
  - Subesquent direction included (with 2013 MS4 Permit) Load Reduction alternative
- Project Schedule (very aggressive)
  - Kickoff June 2011
  - Priorities established; Structural BMPs identified; Baseline Loads; EMCs modified Nov 2011
  - Preliminary CLRP iteration Dec 2011
  - Draft Monsitoring Plan Feb 2012
  - 2nd complete CLRP iteration Mar 2012
  - Final iteration/Agency Draft May 2012
  - Final Agency Draft June 2012 (1 year)
  - Submittals to RWQCB October 2012

Table 6.3
Final Effluent Limitations Expressed as Percent Load Reductions in MS4 Discharges to the Water Body*

Watershed Management Areas	Watershed and Water Bodies	Load-Based Effluent Limitations					
		Dry Weather			Wet Weather		
		Total Coliform	Fecal Coliform	Entero-coccus	Total Coliform	Fecal Coliform	Entero-coccus
San Diego River	Mission San Diego HSA (907.11) and Santee HSA (907.12) - Pacific Ocean Shoreline - Forrester Creek (lower 1 mile) - San Diego River (lower 6 miles)	74.03%	69.44%	93.96%	38.14%	53.22%	42.74% (42.47%)**

RB-AR 1090

COMPREHENSIVE LOAD REDUCTION PLANNING (CLRP) OVERVIEW

OBJECTIVES:

- Provide a decision support tool and roadmap for BMP/CIP planning
- Model watersheds to estimate/predict pollutant loads, targets, and benefits
- Incorporate agency-specific preferences; even if divergent within watershed
- Model implementation activities to assess compliance & costs;
- Understand areas of variability and uncertainty

RB-AR 1091

CLRP APPROACH OVERVIEW

- CLRP is “comprehensive” in that it addresses nitrogen and phosphorous in addition to FIB;
- Process includes opportunities for input in prioritization, opportunity development, and levels of implementation;
- Quantitative analysis allows for updating with new and/or site specific data;
- CLRP presents a suite of BMPs, both non-structural and structural (SBPAT);
- Plan allows for phased implementation over 18.5 year timeframe; and

CONSIDERING POTENTIAL BMPS (NONSTRUCTURAL)

Geosyntec consultants

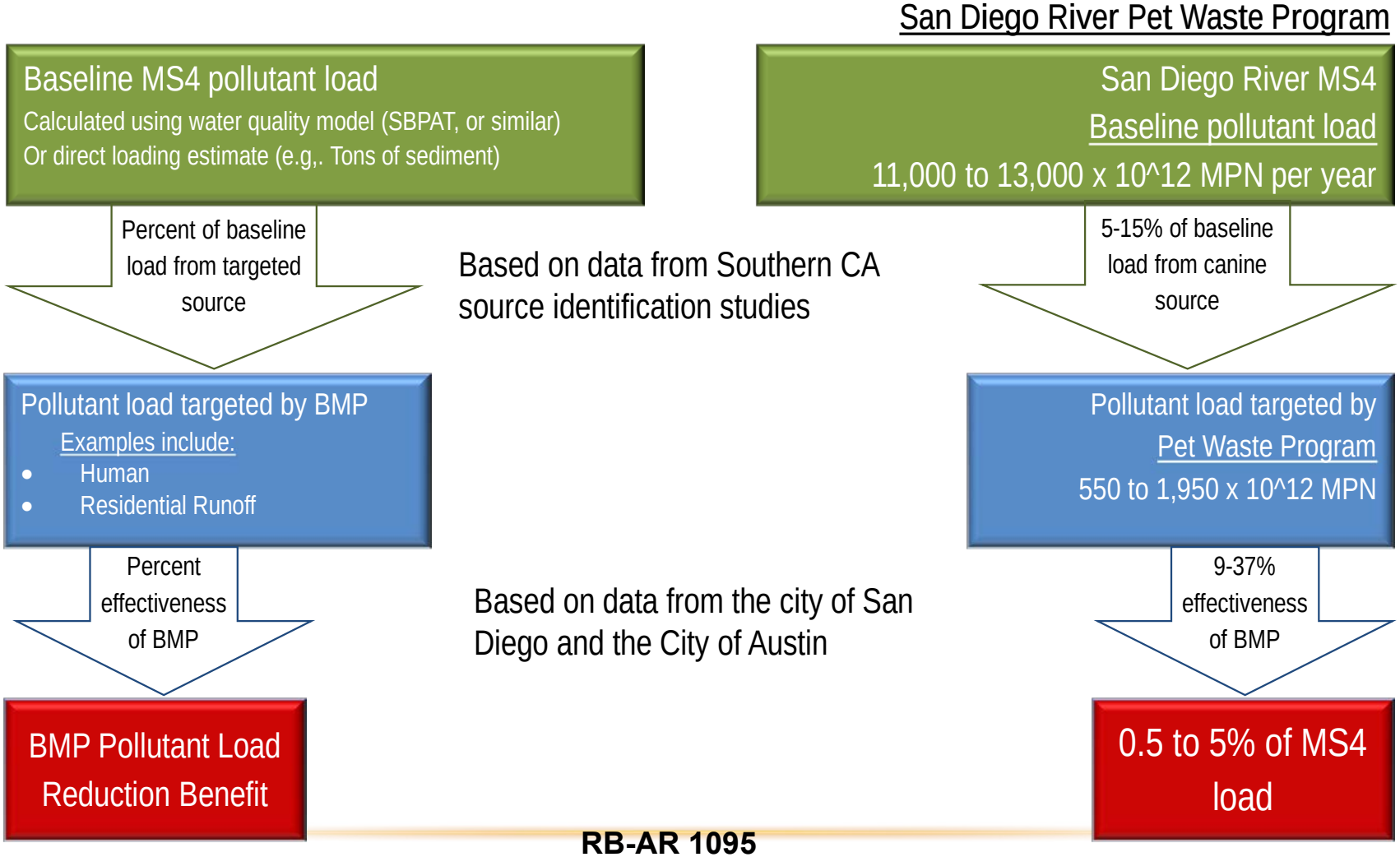
RB-AR 1093

PRIORITY POTENTIAL BMP STRATEGIES (NONSTRUCTURAL)

Non-Structural BMP Types
Identification and control of sewage discharge to MS4
Homelessness Waste Management Program
Onsite Wastewater Treatment System Source Reduction
Irrigation Runoff Reduction & Good Landscaping Practices
Commercial/Industrial Good Housekeeping
Residential/Small-Scale LID Incentive Program
Pet Waste Program
Animal Facilities Management
Street and Median Sweeping
MS4 Cleaning
Redevelopment and LID Implementation

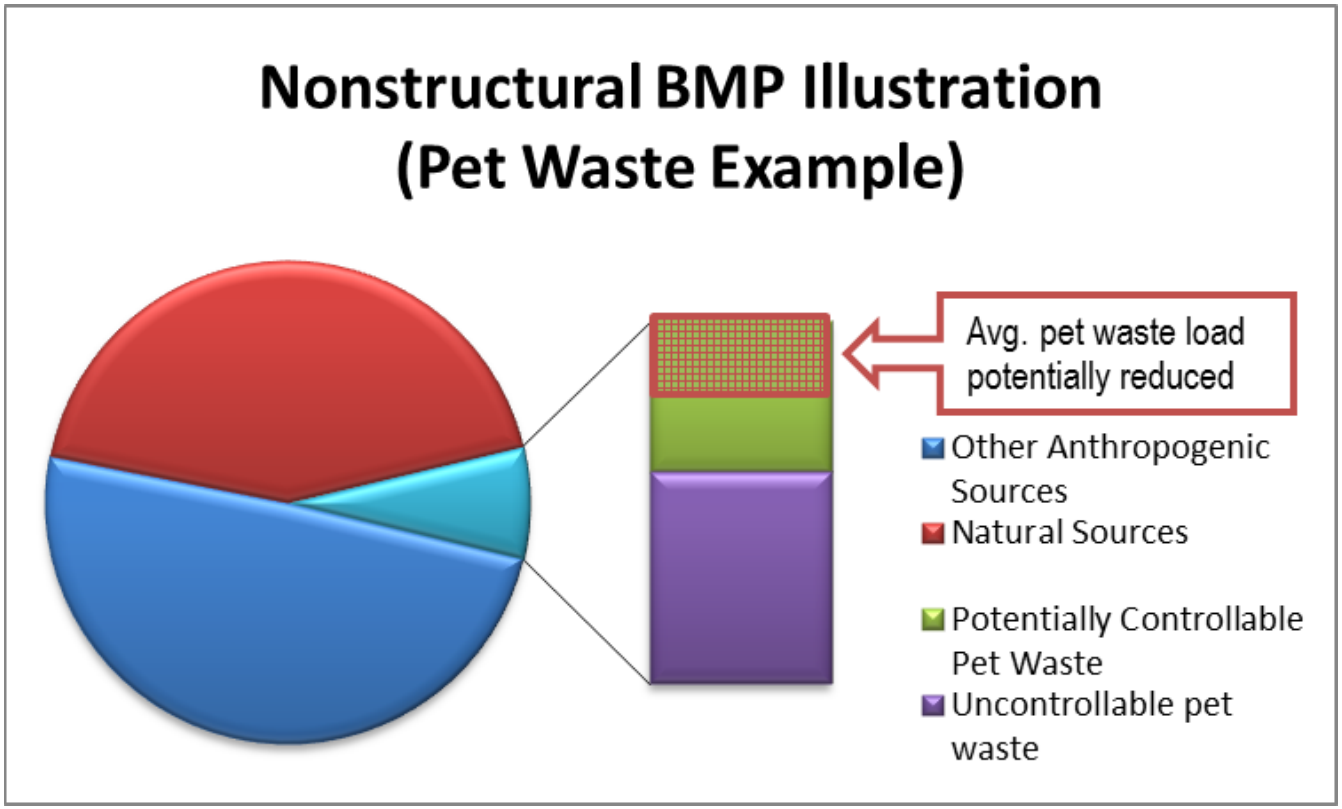
RB-AR 1094

NONSTRUCTURAL BMP QUANTIFICATION (PET WASTE EXAMPLE)



RB-AR 1095

NONSTRUCTURAL BMP QUANTIFICATION (PET WASTE EXAMPLE)



POTENTIAL BMP STRATEGIES (STRUCTURAL)

	Structural BMP Types
Infiltration	Infiltration Basins, Trenches and Galleries
	Bioretention
	Dry Wells or Hybrid Bioretention/Dry Wells
	Permeable Pavements
	Capture and Use Rainwater Harvesting
Natural Treatment or Filtration	Constructed Wetland/Wetpond
	Subsurface Flow Wetlands
	Creek Enhancement
	Biofiltration with or without Underdrain
	Trash Separators
	Planter Boxes
	Green Streets

RB-AR 1097

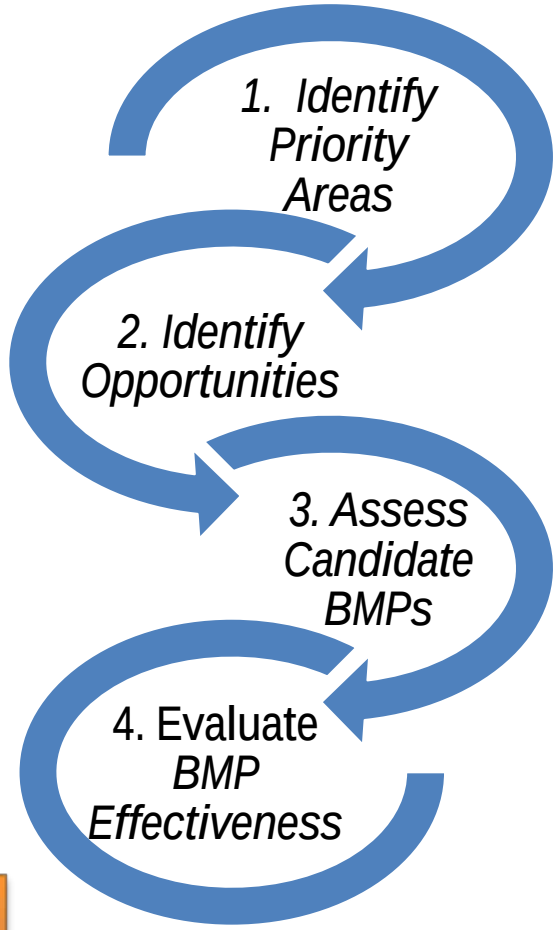
BASIS FOR SELECTING MODELING TOOLS

Modeling tool needs to:

- Allow for accelerated development of draft solutions;
- Be appropriate for levels of data available
- Be easy to update with new data (LU EMCs, Effluent Data, Land Uses)
- Be transparent in both process and analysis;
- Provide output to support risk-based decisions, acknowledging differing compliance risks of individual MS4s;
- Capture uncertainty and variability;
- Have a discharger/permittee/implementation-focus;
- Consider site-specific approaches & estimates

- One tool among many (i.e. Local MS4 input, BPJ).
- Models considered: SBPAT, SUSTAIN, SWMM.

NUMERICAL ANALYSES AND MODELING STRUCTURAL BMPS

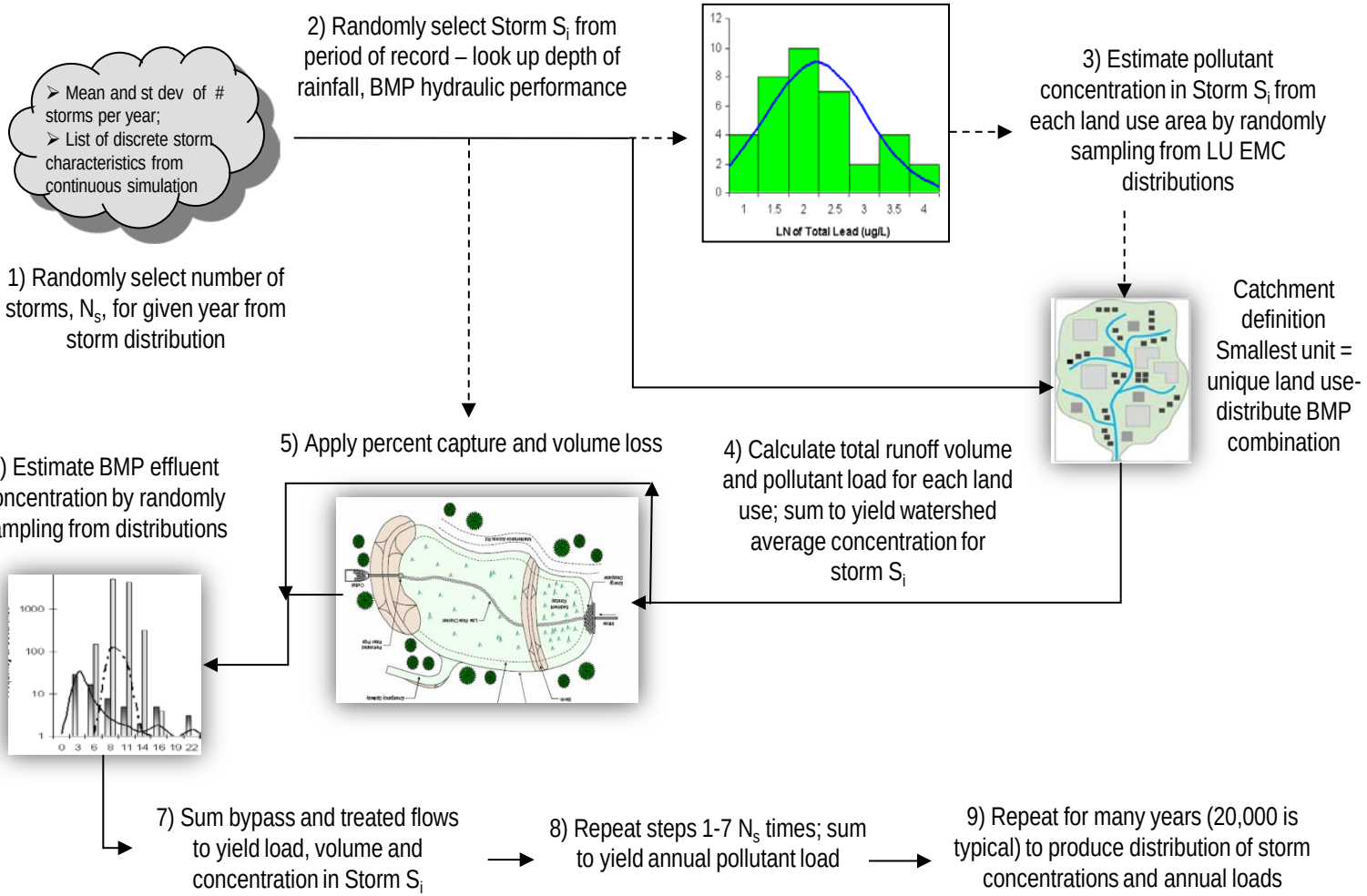


www.sbpat.net

Original funding by agencies, SWRCB and RWQCB

RB-AR 1099

SBPAT MONTE CARLO PROCESS



RB-AR 1100

AGENCY INPUT/PREFERENCES AT KEY MILESTONES IN THE PROCESS

- Water Quality Emphasis/Priorities
  - Bacteria, Nutrients, other
  - TMDL, 303(d)-list, level of emphasis
- BMP Siting Preferences (Land ownership, inter-jurisdictional issues)
- Risk Tolerance
- Financial Constraints
- Coordination with Existing/Current Land Plans

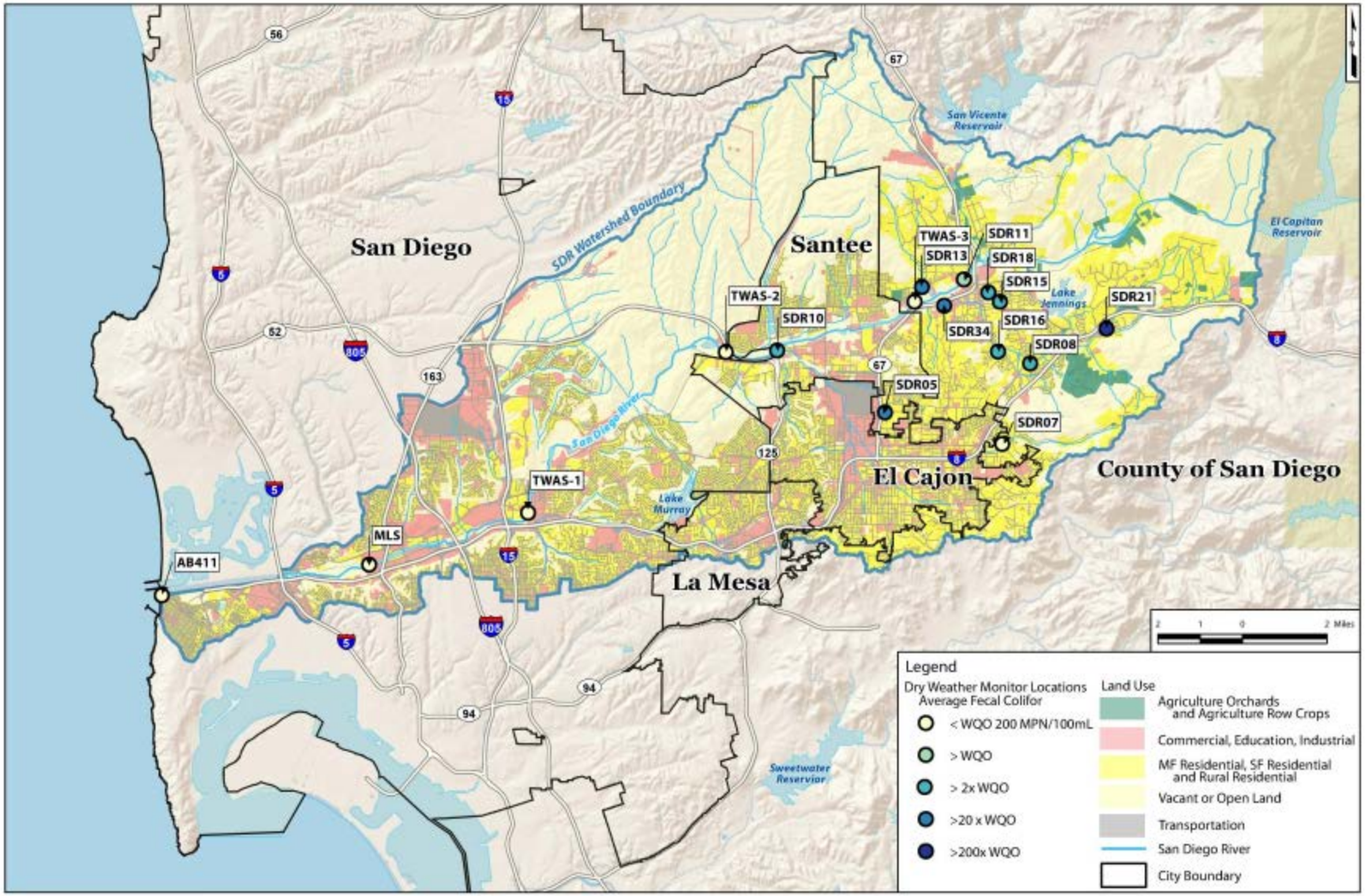
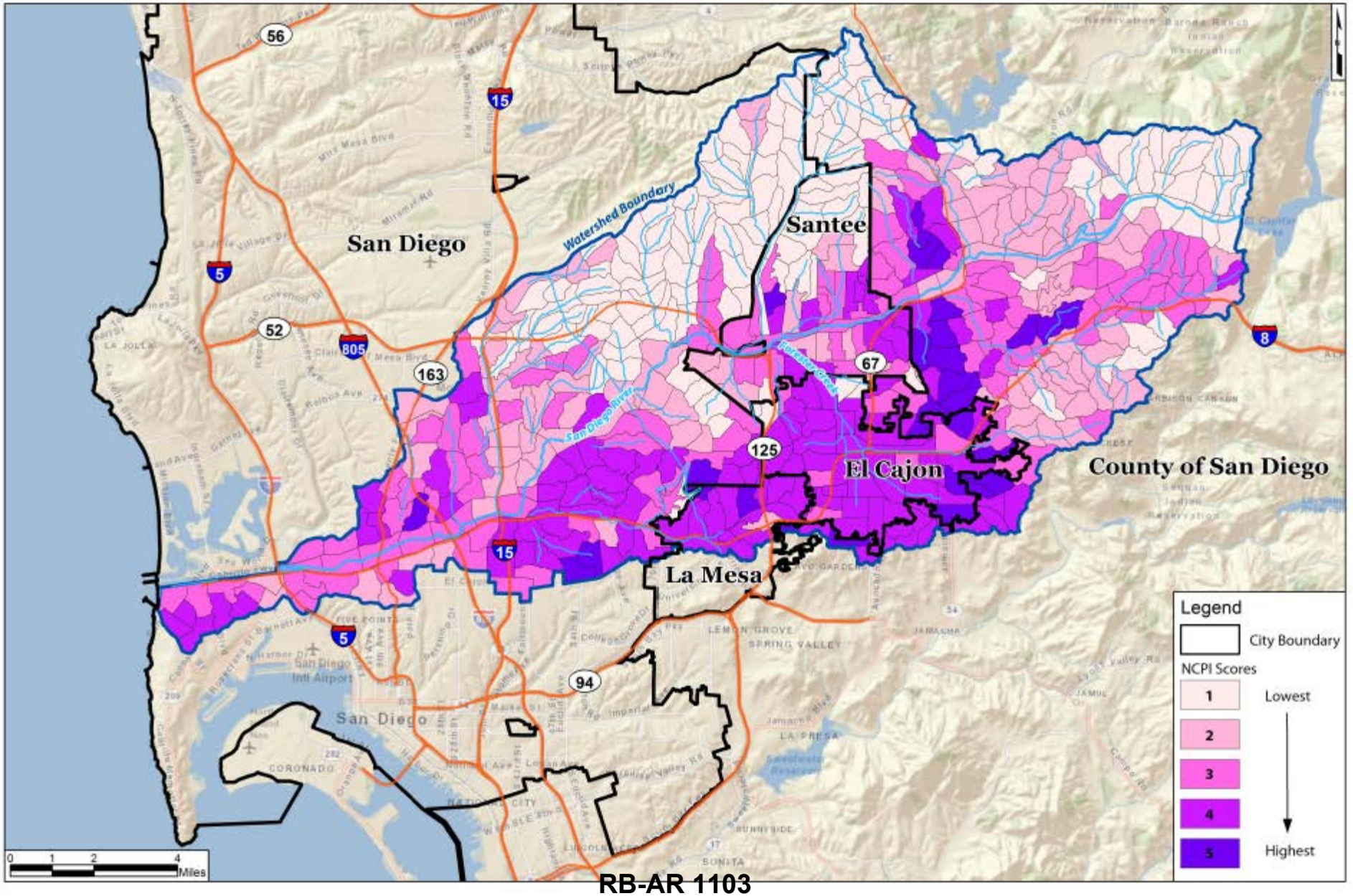


Figure 7. Average fecal coliform results during dry weather in SDR Watershed.

RB-AR 1102



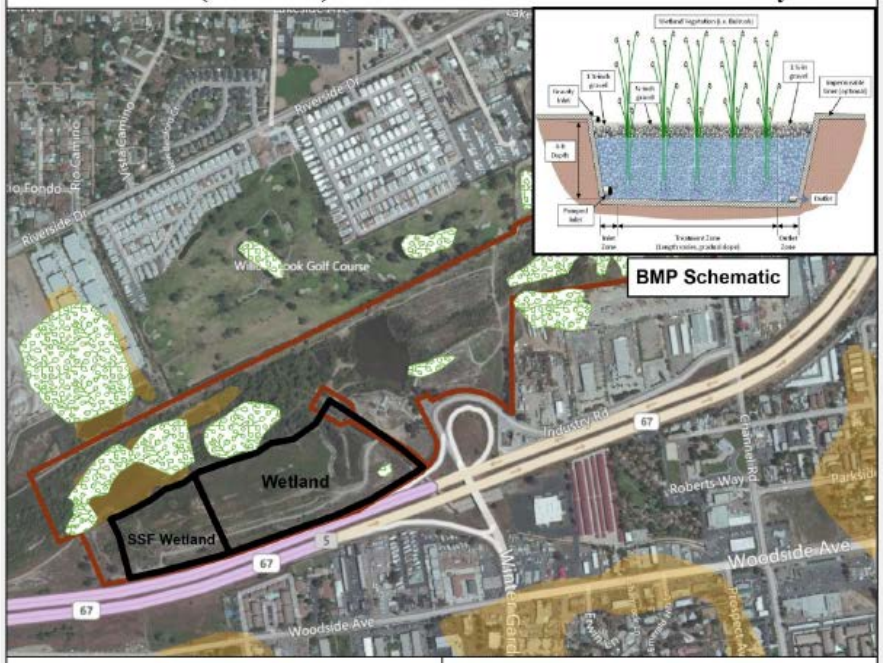
RB-AR 1103

Geosyntec consultants

San Diego River Watershed
Comprehensive Load Reduction Plan
Regional BMP Identification and Constraints

SDCo-R-D-1(NCPI=2)

July 2012



Parcel Information
Owner : Lakesides River Park Conservancy
Jurisdiction: County of San Diego
Constraints in Parcel: Wetlands, Low Permeable Soils
Current Land Use: Vacant - Open Space
Note: Concrete lined channel within the BMP footprint will be removed during BMP Implementation

Project Name: TBD

BMP Information
BMP Proposed: 66% Wetpond and 33% SSF Wetland
Constraints in Footprint: Wetlands, High Groundwater
Tributary Area: ~ 29,850 acres;
BMP Footprint Area: ~30 acres
Wet Pond: Volume: 2,308,680 cubic feet; HRT: 24 hours
SSF Wetland: Treatment Flow Rate: 6 cfs; HRT: 24 hours

LEGEND
BMP Footprint
Parcel Boundary
Storm Drains/Streams
Wetlands (National Wetlands Inventory)
Low Permeability Soils (NRCS Type D)

N

800 400 0 800 Feet

DATA SOURCES: ESRI; SANDAG; SANGIS; USGS

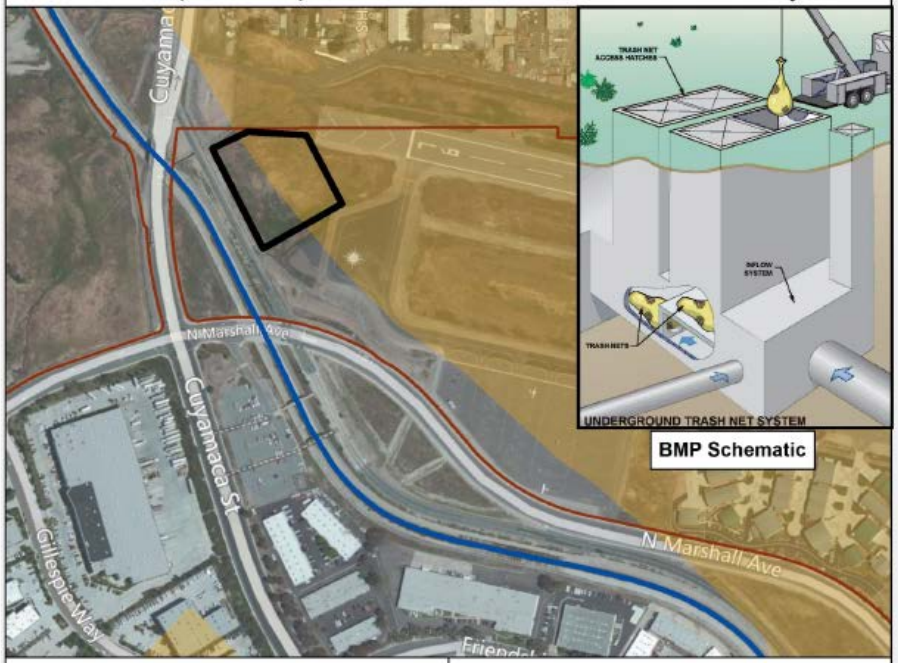
Figure 15. Design criteria for SDCo-R-D-1

Geosyntec consultants

San Diego River Watershed
Comprehensive Load Reduction Plan
Regional BMP Identification and Constraints

MJ-R-D-1 (NCPI=4)

July 2012



Parcel Information
Owner : County of San Diego
Jurisdiction: City of El Cajon
Constraints in Parcel: Low permeable soils
Current Land Use: Vacant Space

Project Name: TBD

BMP Information
BMP Proposed: Gross Solids and Trash Removal
Constraints in Footprint: Low permeable soils
Tributary Area: ~ 14,509 acres;
BMP Footprint Area: ~ 2.5 acres
Diversion Flow Rate: 100 cfs
Treatment Flow Rate: 100 cfs

LEGEND
BMP Footprint
Parcel Boundary
Storm Drains/Streams
Wetlands (National Wetlands Inventory)
Low Permeability Soils (NRCS Type D)

N

400 200 0 400 Feet

DATA SOURCES: ESRI; SANDAG; SANGIS; USGS

Figure 17. Design criteria for MJ-R-D-1

RB-AR 1104

REGIONAL BMP EXAMPLE SUMMARY OUTPUT

Table 12. Structural BMP (regional) pollutant reduction[1,2,3]

	Water Quality (FIB-FC Load) Benefits (10^12 MPN reduction/year)		Water Quality (Nitrate Load) Benefits (lb reduction/year)	Water Quality (TP Load) Benefits (lb reduction/year)
	WY 1993 [Low - High]	*Annual Average [Low - High Years]*	*Annual Average [Low - High Years]*	*Annual Average [Low - High Years]*
SDCo-R-04	8 [7 - 9]	6 [3 - 7]	62 [38 - 78]	22 [16 - 28]
SDCo-R-05	14 [11 - 16]	9 [6 - 12]	143 [87 - 180]	39 [28 - 50]
SDCo-R-06	27 [21 - 30]	18 [11 - 23]	403 [246 - 508]	111 [80 - 141]
O-R-06	55 [43 - 62]	41 [25 - 52]	492 [300 - 620]	134 [97 - 171]
O-R-08	10 [8 - 11]	6 [4 - 8]	65 [39 - 82]	21 [15 - 26]
O-R-10	16 [12 - 18]	11 [7 - 14]	112 [68 - 141]	36 [26 - 46]
O-R-11	25 [19 - 28]	18 [11 - 22]	807 [492 - 1,017]	116 [84 - 147]
MJ-R-01	490 [382 - 549]	329 [204 - 415]	35,000 [21,350 - 44,100]	4,440 [3,197 - 5,639]
MJ-R-02	14 [11 - 15]	10 [6 - 13]	114 [70 - 144]	35 [25 - 45]
MJ-R-04	43 [34 - 48]	30 [19 - 38]	466 [284 - 587]	136 [98 - 172]
Total	**701 [547 - 786]**	**478 [296 - 602]**	**37,663 [22,974 - 47,456]**	**5,091 [3,665 – 6,465]**

[1] Range of WY1993 and annual water quality benefits represent 25th and 75th percentile SBPAT results. Range

RB-AR 1105

DISTRIBUTED BMP EXAMPLES (INCLUDES GREEN STREETS)

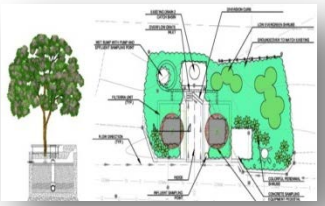


Table 11. Modeled Distributed BMPs[1,2,3]

Jurisdiction	Location/Name	BMPs Planned	Assumed Drainage Area (acres)	Catchment ID
County of San Diego	Bradley Avenue/SR67 Interchange	Curb Inlet Filters	NA[4]	1463
County of San Diego	Woodside Avenue	Curb Inlet Filters	NA	1185
County of San Diego	Flinn Springs Road at Oak Creek Road	Curb Inlet Filters/ Bioretention Swale	NA	1051
City of San Diego	Allied Gardens, 5155 Greenbrier Ave	Green Lot- Filtration	NA	2397
City of San Diego	Park Ridge Blvd, south of Murray Park Dr	Hydrodynamic Separator	NA	2278
City of San Diego	Cabrillo Heights Watershed Protection, 8308 Hurlbut St	Rain Garden	NA	2437
City of Santee	Fanita Parkway, Between Mast and Ganley	Wet Ponds	309	3200, 3201
City of Santee	San Diego River Trail - East project	Bioretention Swale	180	3210, 3211,3801
City of Santee	Mast Park West	3 - Bioretention Projects	100	3202
City of Santee	Woodglen Vista Park Improvement	Bioretention Project	100	3197
City of Santee	Mission Creek Drive & Mission Creek Trail	2 - Bioretention Projects	120	3237
City of Santee	Magnolia Avenue, County Parcel	Bioretention Project	230	3260
City of Santee	Blackhorse Estates - proposed retrofit	Detention Basin with infiltration	40	3263
City of Santee	Ladera (Morning View) Basin	Detention Basin with infiltration	20	3264
City of Santee	Sycamore Creek – Right of Way	Bioretention Swale	37	3212
City of Santee	Shoredale Basin	Detention Basin	15	3206

RB-AR-1106

Geosyntec consultants

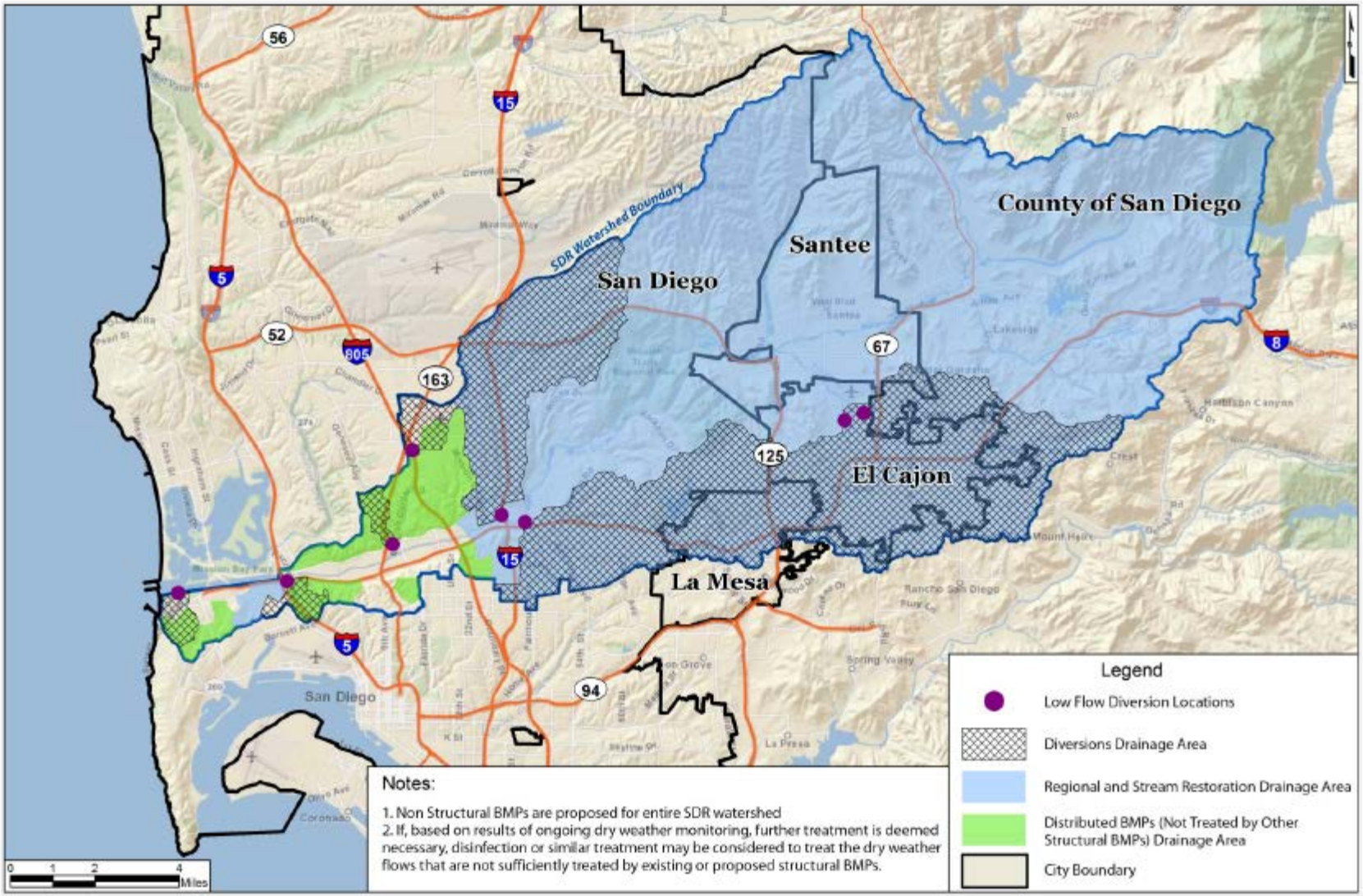
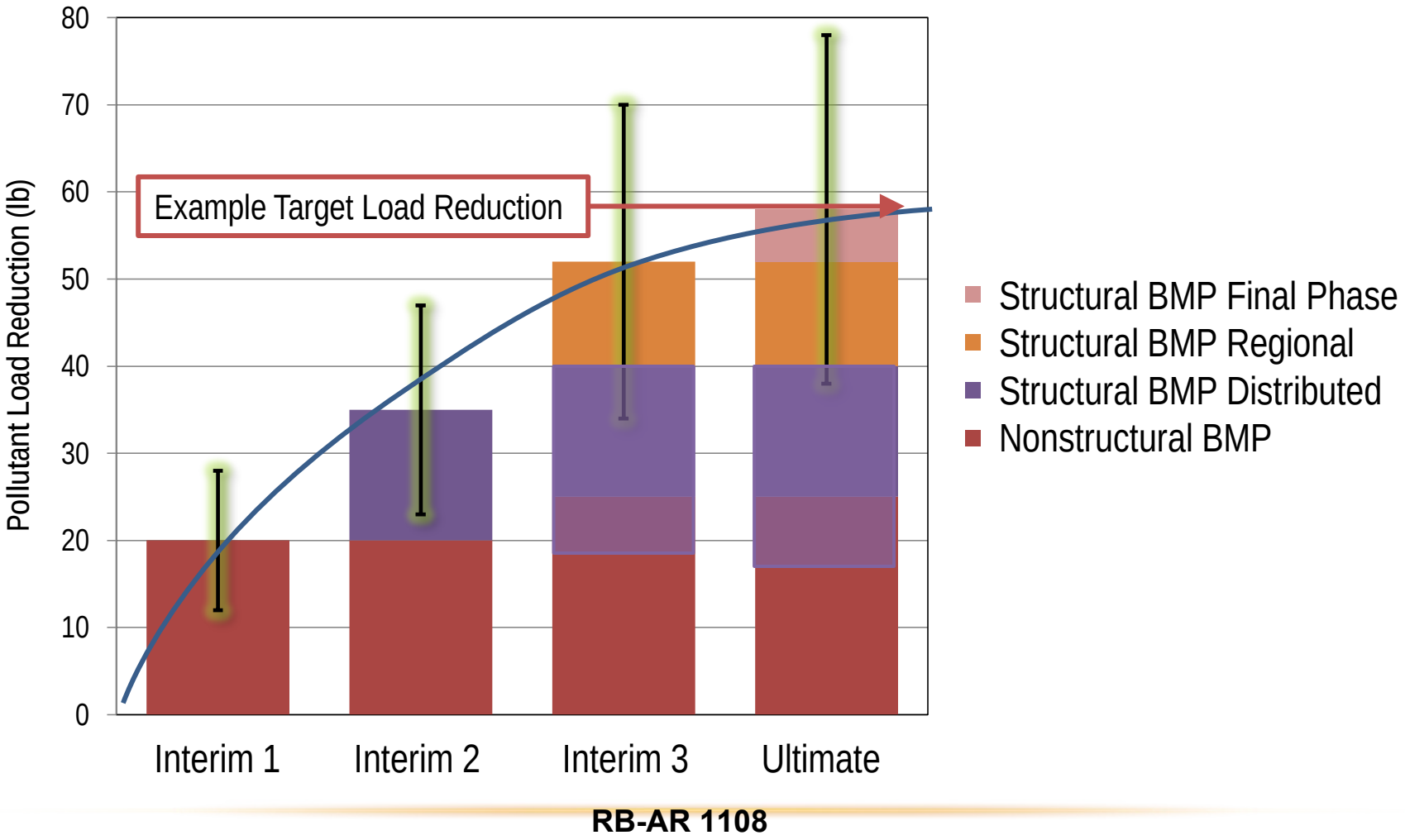


Figure 24. Dry weather [illegible] proposed structural BMPs

SCHEMATIC DEMONSTRATION OF INTERIM COMPLIANCE



RB-AR 1108

COSTS (PRELIMINARY PLANNING OPINIONS-SDR)

Geosyntec consultants

Table ES-3. 20-Year Cost Estimate to Achieve Bacteria TMDL Compliance in 2011 Dollars

Cost Category	Lower Limit ($M)	Upper Limit ($M)
Nonstructural BMPs	$38M	$104M
Infrastructure Improvement	$144M	$423M
Regional Structural BMPs	$59M	$141M
Distributed Structural BMPs	$66M	$219M
Stream Restoration Projects	$42M	$42M
Dry-Weather Diversion/Treatment	$19M	$43M
Private Property BMPs[1]	$216M	$360M
Special Studies	$3M	$6.5M
Monitoring	$3M	$3M
Total Cost Estimates	**$590M**	**$1,340M**

[1] Private property BMPs are an optional strategy and may be considered at the discretion of individual jurisdictions if needed to meet load reduction targets.

RB-AR 1109

COSTS (REGIONAL COST BREAKDOWN)

Table 23. Regional Structural BMP Costs

Location/Name	Preliminary Range of Potential Capital Costs (2011 $)	Preliminary Range of Potential O&M Costs (2011 $)
SDCo-R-D-1	$9,800,000 - $32,600,000	$200,000 - $700,000
SDCo-R-D-2	$1,700,000 - $4,800,000	$100,000 - $300,000
MJ-R-D-1	$9,800,000 - $32,800,000	$430,000 - $900,000
CoSD-R-D-1	$26,700,000 - $45,400,000	$830,000 - $2,800,000
CoSD-R-D-2	$4,900,000 - $7,600,000	$120,000 - $400,000
CoSD-R-D-4	$1,600,000 - $2,400,000	$40,000 - $100,000
MJ-R-D-4	$1,300,000 - $4,300,000	$280,000 - $900,000
CoS-R-D-2	$900,000 - $2,900,000	$100,000 - $300,000
CoS-R-D-3	$300,000 - $1,000,000	$10,000 - $50,000
Totals	$57,000,000 - $134,000,000	$2,000,000 - $7,000,000

Retrofit factor 2.0 to 4.0

WATER QUALITY BENEFITS AND UNCERTAINTIES SAN DIEGO RIVER WATERSHED (ULTIMATE)

BMP CATEGORY	FC Load Reduction (10^{12} MPN/YEAR) 1993 WY Load[1] [Low-High Range]
Non-Structural BMPs	2,000 [710 -3,300]
Regional Structural BMPs	870 [500 -1,000]
Distributed Structural BMPs	1,400 [780 – 1,600]
Stream Restoration Projects	110 [25 – 190]
Subtotal	4,400 [2,000 -6,100]
Load Reduction Adjustment	-500 [-220 to -730]
Load Reduction Effective Fraction	0.28 [0.23 - 0.34]
Load Reduction Sum	1,100 [410 -1,800]
TARGET LOAD REDUCTION	1,750

Highest Variability

RB-AR 1111

UNCERTAINTIES WITH CLRP

- Hydrology (historical unadjusted rainfall statistics available)
- LU EMCs (statistical distributions, continuously augmented)
- BMP Performance (statistical distributions, continuously augmented)
- Non-structural BMPs effectiveness
- Interactions between non-structural and structural BMPs
- Impacts of non-permitted (non responsible parties) in watershed
- Compliance monitoring variability (STV vs. SSM/GM)

LESSONS LEARNED

- Pick modeling methods that can accept new data, and that improves as a result.
- Include responsible parties in each step.
- Have schedule that allows for changes and new data.
- Agree upon decision framework (meet regularly and build on previous meeting).
- Do not depend too heavily on any model, pick an appropriate model for analyses, and understand areas of uncertainty.

NEXT STEPS

- Water Quality Improvement Plans (WQIP) – 2013 MS4 Permit
- Preliminary Structural BMP Designs
- Non-structural BMP Implementation
- Microbial Source Tracking and Human Marker Monitoring
- Reevaluate TMDLs/Models
- ACHIEVE COMPLIANCE!

- Updated BMP Preferences
- Expanded Study Areas
- All Impairments Addressed
- More Active Stakeholder Process
- Consultation Panels
- Reevaluation of Targets (e.g., WY)
- Nonstructural BMP re-quantification
- **Integration with other Models (LSPC)**

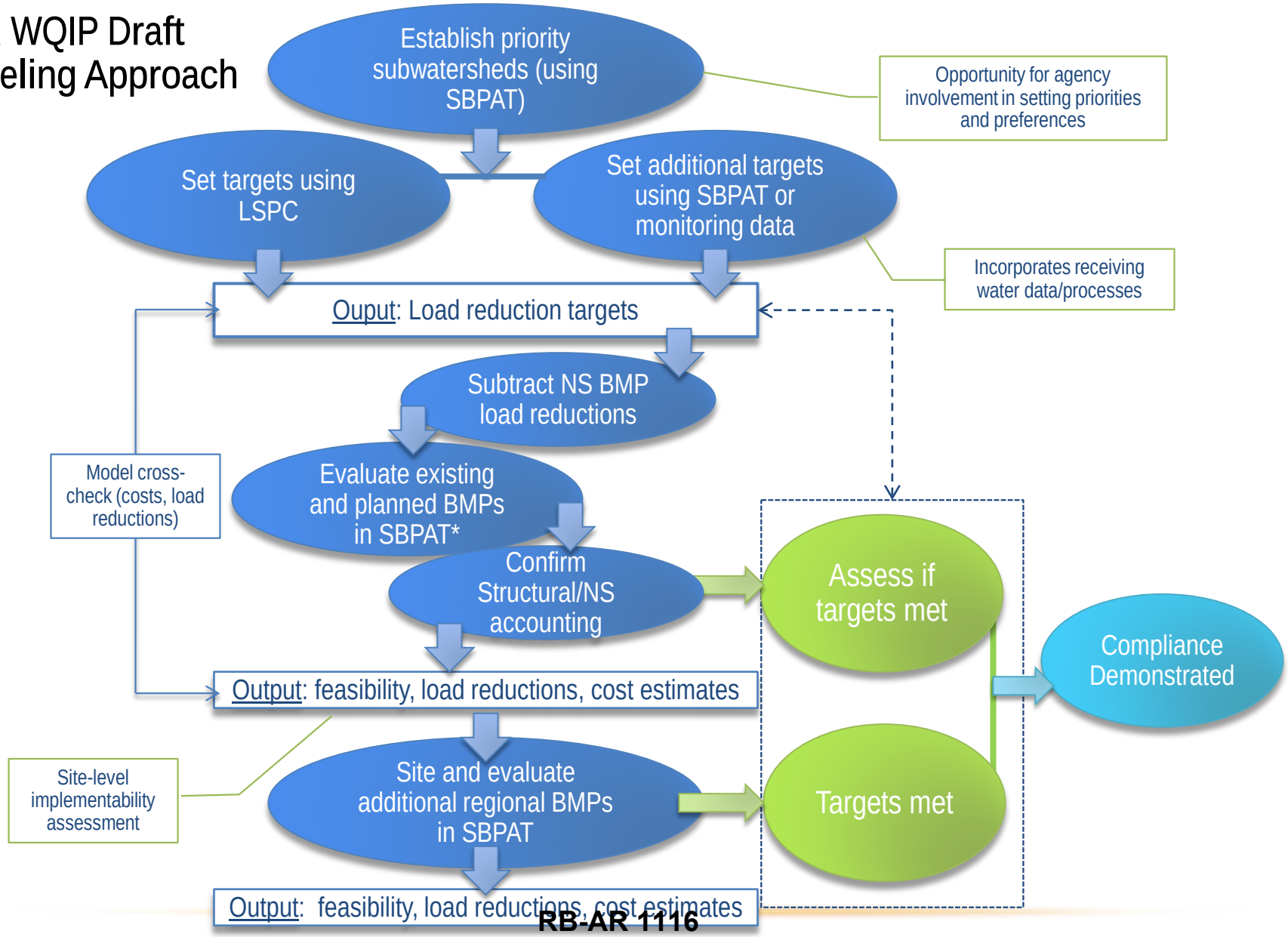
NEXT STEPS (WQIP MODELING)

For San Diego River WQIP Modeling, a paired modeling analysis just initiated:

- LSPC to establish updated target load reductions for MS4 areas in entire watershed (SD Permit includes LSPC modeled load reductions).
- Check/Compare load estimates (SDR)
- SBPAT to
  - Establish/confirm water quality priorities (with monitoring data)
  - Refine/adjust implementation activities for expanded areas and for all 303(d) listed impairments;
  - Quantify load reductions and benefits
- LSPC or SBPAT or other method to reevaluate in-stream and/or large-scale regional BMP performance

Baseline Loads (FC)	LSPC (WY 2003)	SBPAT (WY 2003)
25th Pctl		$1x10^{15}$ MPN
Average	~$2x10^{15}$ MPN (avg)	$2x10^{15}$ MPN (50th pctl) $3x10^{15}$ MPN (avg.)
75th Pctl.		$4x10^{15}$ MPN

SDR WQIP Draft Modeling Approach



RB-AR 1116

THANK YOU!

Ken Susilo, PE, D.WRE, CPSWQ
ksusilo@geosyntec.com
310-946-9009

TAC Commitee

~~October 23, 2013~~
Nov 19, 2013

Group Name	Representative	Sign In	Alternate	Sign In
Alamitos Bay/Los Cerritos Channel Group	Jolene Guerrero County ✓	Jolene Guerrero	Genevieve Osmena, County	
Ballona Creek	Hubertus Cox City of Los Angeles		Lauren Amimoto, Inglewood	
Beach Cities Watershed Management Group	Elaine Jeng Redondo Beach		Kathleen McGowan, GeoSyntec John Dettle, Torrance	John Rudd
Building Industry Association	Holly Schroeder			
City of Lawndale	Nasser Abbaszadeh		Julie Hegvold Ray Tahir	
City of Long Beach	Anthoney Arevalo ✓		Ana De Anda	
City of Walnut	Alicia Jensen ✓		Cody Howing RKA Consulting	
Council for Watershed Health	Mike Antos			
Dominguez Channel Watershed Management Area Group	Vijay Desai, City of Los Angeles		Jolene Guerrero County	
East San Gabriel River Watershed Group	JR Ranells La Verne		Latoya Cyrus, San Dimas	
EPA	Peter Kozelka		Cindy Lin	
Heal the Bay	Kirsten James		Peter Shellenbarger	
LA Waterkeeper	Liz Crosson			
Los Angeles River Upper Reach 2 Sub Watershed	Desi Alvarez Huntington Park		Gina Nila, Commerce	
Los Cerritos Channel Watershed Group	Lisa Rapp Lakewood		Deborah Chankin Bellflower	
Lower Los Angeles River Watershed	Steve Myrter Signal Hill		~~Chris Cash~~ Paramont	
Lower San Gabriel River	Mike O'Grady Cerritos ✓		Adriana Figueroa Norwalk	
Malibu Creek Watershed Group	Joe Bellomo		Giles Coon County	

TAC Commitee

~~October 23, 2013~~
Nov 19, 2013

Marina del Rey	Bruce Hamamoto County		Steve Finton, Culver City	
North Santa Monica Bay Coastal Watersheds	Jennifer Brown City of Malibu		Rob DuBoux Malibu	
NRDC	Noah Garrison			
Peninsula EWMP Agencies	John Hunter, JLHA Consultants		Kathleen McGowan, GeoSyntec	
Regional Water Quality Control Board	Renee Purdy		Ivar Ridgeway	
Rio Hondo/San Gabriel River Water Quality Group	James Carlson Sierra Madre	✓	Rafael Casillas Duarte	
Santa Monica Bay Jurisdictions 2 & 3	Hamid Tadayon City of Los Angeles	H.T	Joshua Carvalho, Santa Monica	
Upper Los Angeles River Watershed Group	Alfredo Magallanes City of Los Angeles	December.	Alvin Cruz, Burbank	
Upper San Gabriel River	Vivian Castro Covina		Jolene Guerrero, County	
Upper Santa Clara River Watershed	Heather Merenda Santa Clarita	✓	Giles Coon County	

City of El Monte
MWH

ED SUHER
Tony Harcock

e_suher@AEI-CASC.COM
tony.harcock@mwhglobal.com

Deb Smith RWQCB

Los Angeles County MS4 Permit
Watershed Management Technical Advisory Committee

Meeting Location	LA County Department of Public Works - Conference Room B 900 South Freemont Avenue Alhambra, CA
Meeting Date	November 19, 2013
Meeting Time	1:00 - 3:00 p.m.
Chairperson	Renee Purdy, LARWQCB (213) 576-6622 Renee.Purdy@waterboards.ca.gov
Notetaker	Mike O'Grady, City of Cerritos (877) 336-1828 mogrady@cerritos.us
Call-in phone #	(877) 336-1828 [passcode: 3087482]

ITEM 1	**INTRODUCTIONS, REVIEW AGENDA, BRIEF ANNOUNCEMENTS**	**Assigned to:**	**Time: 1:00 -1:10 p.m.**
Title		Renee Purdy, Chair	10 min
Purpose	**Standard meeting management item**		
Desired Outcome	1. Approve agenda 2. Approve meeting summary from 10-23-13 TAC meeting		
Contact Person	Renee Purdy	(213) 576-6622, Renee.Purdy@waterboards.ca.gov	
Attachments	TAC Notes 10-23-13.doc		
Notes			
Action Items			

ITEM 2	**REASONABLE ASSURANCE ANALYSIS SUBCOMMITTEE UPDATE**	**Assigned to:**	**Time: 1:10 - 1:40 p.m.**
Title		Bruce Hamamoto	30 min
Purpose	Brief TAC on November 14, 2013 RAA Subcommittee Meeting		
Desired Outcome	Provide update to TAC on RAA subcommittee presentations, discussion and outcomes.		
Background	The third meeting of the RAA/Modeling Subcommittee took place on November 14, 2013. At this meeting, the Regional Board introduced preliminary draft RAA guidelines.		
Contact Person	Bruce Hamamoto	bhamamo@dpw.lacounty.gov	
Attachments			
Notes			
Action Items			

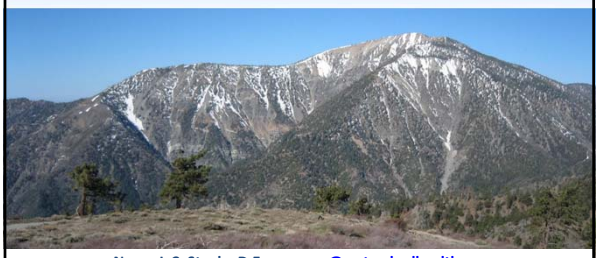
ITEM 3	**HUC-12 EQUIVALENTS**	Assigned to:	**Time: 1:40 - 2:00 p.m.**
Title		TJ Moon, LACDPW	20 min
Purpose	Continue discussion of proposed HUC-12 Equivalents		
Desired Outcome	Agreement on use of HUC-12 Equivalents in monitoring programs and modeling.		
Background	Staff of LA County DPW has delineated alternative HUC-12 drainage areas using more detailed local data on drainage networks. The use of these HUC-12 Equivalents will more accurately		

	portray drainage patterns in the urbanized areas of LA County. The GIS file(s) of these HUC-12 Equivalents are available for download from the Regional Board's website, at http://www.waterboards.ca.gov/losangeles/water_issues/programs/stormwater/municipal/watershed_management/gisfiles_and_maps/index.shtml	
Contact Person	TJ Moon	(626) 458-4380, tmoon@dpw.lacounty.gov
Attachments		
Notes		
Action Items		

ITEM 3	**WATERSHED MONITORING APPROACHES**	Assigned to:	**Time: 2:00 - 2:30 p.m.**
Title		Mike Antos, CWH	30 min
Purpose	Information sharing and case studies about the watershed based monitoring work of the Council for Watershed Health in the Los Angeles River and San Gabriel River Watersheds.		
Desired Outcome	Generally discussion of watershed based monitoring and opportunities for collaboration with the Council for Watershed Health or other organizations conducting watershed monitoring.		
Background			
Contact Person	Mike Antos	(213) 229-9954, mike@watershedhealth.org	
Attachments	MS4_TAC_LARWQCB .pptx		
Notes			
Action Items			

ITEM 5	**MEETING EVALUATION AND WRAP-UP, REVIEW PROGRAM CALENDAR, NEXT MEETING DATES AND AGENDA**	**Assigned to:**	**Time: 2:30 - 2:45 p.m.**
Title		Renee Purdy	15 min
Purpose	To evaluate meeting, acknowledge key forthcoming dates on the Program Calendar, and discuss potential topics for future meetings.		
Desired Outcome	Determine details for the next meeting including agenda items and assignments.		
Contact Person	Renee Purdy	(213) 576-6622, Renee.Purdy@waterboards.ca.gov	
Notes			
Action Items			

Regional Monitoring Programs:
A model for coordinated MS4 monitoring in LA County



Nancy L.C. Steele, D.Env., nancy@watershedhealth.org
Kristy Morris, PhD, kristy@watershedhealth.org
Ph: 213.229.9945

Council for Watershed Health

The region's hub for watershed research and analysis

- Working at the intersection of research and policy
- Driving applied research to improve policy and practice
- Connecting diverse perspectives to address timely issues

A Vision for 2025:

Sustainable Greater Los Angeles

Managing at the watershed scale for economic vitality, social and environmental health

- Clean waters
- Reliable local water supplies
- Restored native habitats
- Ample parks & open spaces
- Integrated flood protection
- Revitalized rivers & communities

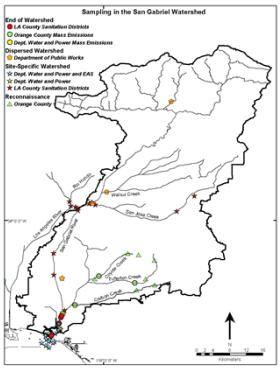
Today's Discussion

- Collaborative Monitoring
- Why has it been successful?
- Applicability for LA County MS4 Permit monitoring

Today's Discussion

- Collaborative Monitoring
- Why has it been successful?
- Applicability for LA County MS4 Permit monitoring

San Gabriel Watershed Example: Pre 2005



A lot of existing monitoring
- 6 agencies
- 3 citizen groups

Programs not coordinated
- Limited data comparability
- Lack of coordination on constituents sampled
- No coordinated QA, IM, etc.

Inefficiencies
- Redundancies between monitoring programs
- Majority of the watershed not monitored

Watershed Monitoring Approach

- Bring together watershed stakeholders
- Compile an inventory of existing effort
- Develop list of monitoring questions
- Assess current ability to answer questions
- Design monitoring program

2005: San Gabriel River Regional Monitoring Program (SGRRMP)
2007: Los Angeles River Watershed Monitoring Program (LARWMP)

Program Partners
SGRRMP & LARWMP

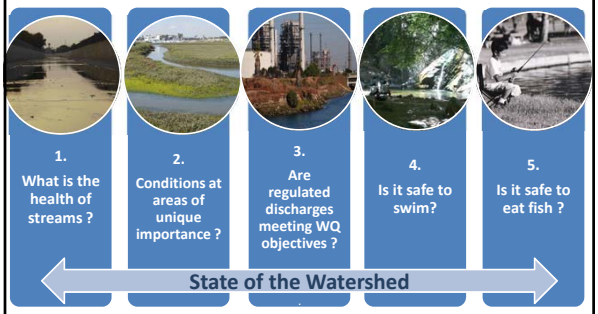
Today's Discussion

- Collaborative Monitoring
- Why has it been successful?
- Applicability for LA County MS4 Permit monitoring

SGR Watershed Stakeholders

Stakeholder Groups	Program Design Phase	Current (Previous 12 months)
AES (generating station)	ACTIVE	
City of Downey	ACTIVE	ACTIVE
Council for Watershed Health	ACTIVE	ACTIVE
Friends of the San Gabriel River	-	-
Los Angeles County Sanitation Districts	ACTIVE	ACTIVE
Los Angeles County Department of Public Works-Flood Control District	ACTIVE	ACTIVE
Los Angeles Department of Water and Power	ACTIVE	-
Los Angeles Regional Water Quality Control Board	ACTIVE	ACTIVE
Orange County Stormwater Program	ACTIVE	ACTIVE
US Army Corps of Engineers	-	-
Rivers and Mountains Conservancy	ACTIVE	ACTIVE
San Gabriel Mountains Regional Conservancy	ACTIVE	ACTIVE
Santa Ana Regional Water Quality Control Board	ACTIVE	-
Southern California Coastal Water Research Project	ACTIVE	ACTIVE
US Forest Service		ACTIVE
US EPA	ACTIVE	ACTIVE

Monitoring Questions



1. What is the health of streams ?
2. Conditions at areas of unique importance ?
3. Are regulated discharges meeting WQ objectives ?
4. Is it safe to swim?
5. Is it safe to eat fish ?

State of the Watershed

Program Integration

Watershed Monitoring Programs

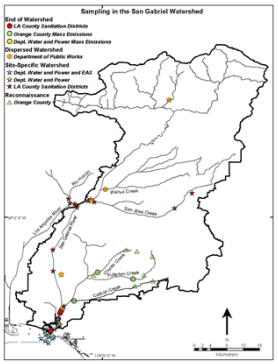
SMC Regional Monitoring Program

SWAMP CA Perennial Streams Assessment

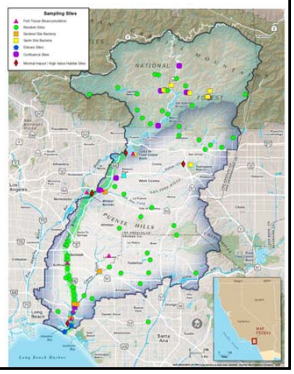
USEPA Western Environmental Monitoring and Assessment Program

Summary of Monitoring Activities

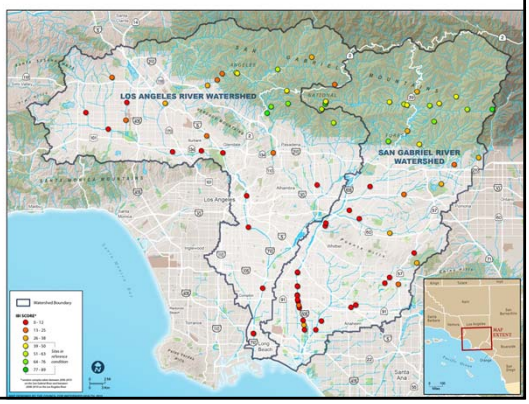
Pre-2005



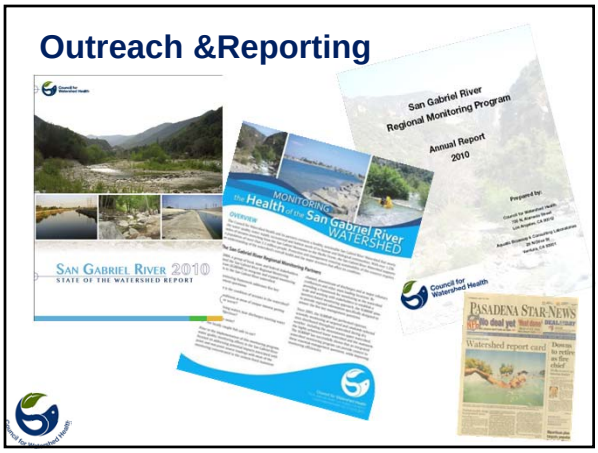
SGRRMP 2005-2010



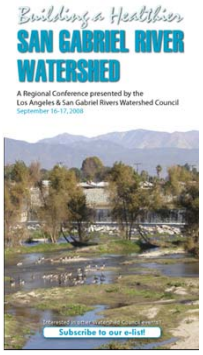
Summary of Monitoring Activities

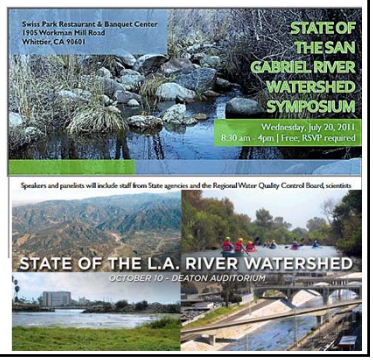


Outreach &Reporting

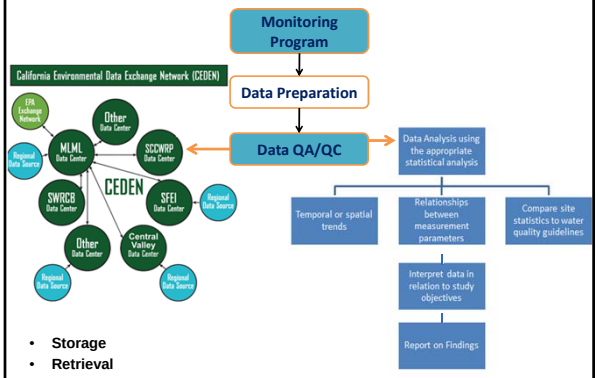


Outreach & Reporting



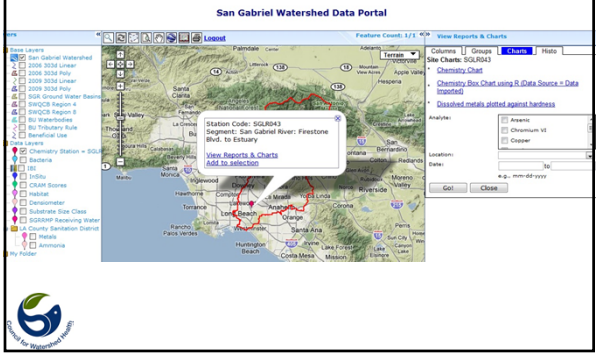


Data Management



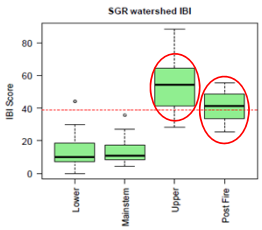
- **Storage**
- **Retrieval**

Program Data Portals



Adaptive and Responsive

2009 Station Fire: LA River Watershed
2009 Morris Fire: San Gabriel River Watershed



Special Studies

- Responsive to emerging concerns, policy and method development
- Program and non-program funded

Examples

Regional Trash Assessments (OC Watersheds, SMC)

Algae IBI development, cyanotoxin surveys (SCCWRP)

Angler Surveys

Bacteria Study

Today's Discussion

- Collaborative Monitoring vs Traditional Monitoring?
- Why has it been successful?
- Applicability for LA County MS4 Permit monitoring

LA County MS4 Permit Monitoring

Clear Objectives:

- Assess Impacts of MS4 discharges on receiving waters using chemical, physical and biological indicators
- Assess compliance with TMDL provisions
- Identify sources of pollutants
- Measure and improve the effectiveness of pollution control measures

LA County MS4 Permit Monitoring

Collaborative Monitoring Benefits:

- Efficient use of monitoring resources
- Satisfy multiple monitoring objectives
- Multiple approaches to meet objectives
- Coordination with approved TMDL Monitoring Plans
- Stakeholder & partner involvement

Role of CWH

- Effective collaboration and stakeholder participation
- Question-based program design
- Standardization across WMAs
- Shared data synthesis and interpretation
- Communication of results
- Strong and consistent program direction

Thank you

Brock Bernstein Consultants

Questions

Nancy L.C. Steele, D.Env., nancy@watershedhealth.org
Kristy Morris, PhD, kristy@watershedhealth.org
Ph: 213.229.9945

Council for Watershed Health

Item 1 – Introductions, Review Agenda, Brief Announcements

- No Phone-In participants were identified
- It was noted that all attachments to the agenda were previously posted to the website
- No changes were made to the agenda
- No changes were made to the minutes from the 10/23/13 meeting
- Action Items
    - None

Item 2 – Reasonable Assurance Analysis Subcommittee Update

- RAA Guidance Document Timeline
    - RAA Guidance Document (General Required Information for Reasonable Assurance Analysis - - -) was distributed to TAC members via email on 11/12/13
    - Comments are to be forwarded to Renee Purdy/Ivar Ridgeway/Bruce Hamamoto
    - Renee indicated the Guidance Document was a starting point for discussion (a "strawman"), and not provides guidelines for permittees so that Regional Board expectations are clear and the review and approval of WMPs/EWMPs is facilitated.
    - RAA Subcommittee will discuss comments at their12/4/13 meeting
    - RAA Subcommittee will meet 12/11/13 to complete discussion on Guidance Document if needed
    - RAA Subcommittee will recommend final RAA Guidance Document at next TAC meeting (12/18/13)

- RAA Guidance Document Comments
    - Regional Board staff indicated that WMMS runs made prior to the issuance of the final Guidance Document will be compliant on most, if not all grounds
    - Permittees expressed concerns that:
        - The 1 acre size is not feasible within the WMP timetable
        - The rainfall calculation in 1 minute intervals is not feasible
    - Bruce Hamamoto indicated that the subcommittee was focused on RAA, not prioritizing
    - Renee Purdy requested comments on the refinement of categories contained in the "strawman"

- Action Items
    - Forward RAA Guidance Document notes to Renee Purdy/Ivar Ridgeway/Bruce Hamamoto prior to 12/4/13 RAA Subcommittee Meeting
    - Forward comments on refinement of categories to Renee Purdy
    - Bruce Hamamoto will send out a master list of meeting dates

Item 3 – HUC-12 Equivalents

- Without objection, the group agreed to use the HUC-12 Equivalents
- It was noted that the WMMS utilizes the HUC-12 Equivalents
- It was noted that the SBPAT can use HUC-12 Equivalents

- Action Items
    - The Regional Board will issue a memo stating that they have reviewed the HUC-12 Equivalents and found them to be acceptable
    - Los Angeles County will provide feedback to national HUC Database
    - Los Angeles County will provide assurance that there is no "gap" in the HUC-12 Equivalents in the event that some watershed groups would continue to use the nationally derived HUC-12 areas, while others would use the HUC-12 equivalents. (To ensure that there will be no watershed area not subject to an RAA.)

Item 4 – Watershed Monitoring Approaches (noted as item 3 on agenda)

- Dr. Kristy Morris from the Council for Watershed Health (CWH) presented an overview of the Council's Los Angeles River and San Gabriel River Watershed Monitoring Program with emphasis on
    - program design
    - consistent regional program development
    - benefits of a coordinated approach
    - Bring in as many stakeholders as possible
    - The current and ongoing program is designed to answer two questions: (1) is the water safe to swim and (2) are the fish safe to eat.

- It was noted that the program included only dry-weather monitoring
- Regional Board staff noted that:
    - specific (TMDL) monitoring has clear parameters in permit screening requirements
    - compliance can be demonstrated in various ways, therefore, the permit does offer some flexibility in monitoring
    - fish tissue monitoring in and of itself is not adequate because it only represents one beneficial use
- Regional Board staff indicated that they have a Monitoring Coordinator who can be of assistance during the development of monitoring programs by the various (E)WMP groups.
-

Item 5 – Meeting Wrap-Up

- Next Meeting:
    - Wednesday, December 18, 2013 (CANCELLED)
    - 12:30 p.m. – 2:30 p.m.
    - Los Angeles County Department of Public Works - Conference Room B

Los Angeles County MS4 Permit
Watershed Management Technical Advisory Committee

Meeting Location	LA County Department of Public Works - Conference Room B 900 South Freemont Avenue Alhambra, CA		
Meeting Date	January 22, 2014		
Meeting Time	12:30 - 1:30 p.m.		
Chairperson	Renee Purdy, LARWQCB (213) 576-6622 Renee.Purdy@waterboards.ca.gov		
Notetaker	To be determined at the meeting		
Call-in phone #	(877) 336-1828 [passcode: 3087482]		
ITEM 1	**INTRODUCTIONS, REVIEW AGENDA, BRIEF ANNOUNCEMENTS**	**Assigned to:**	**Time: 12:30 -12:40 p.m.**
Title		Renee Purdy, Chair	10 min
Purpose	**Standard meeting management item**		
Desired Outcome	1. Approve agenda 2. Approve meeting summary from 11-19-13 TAC meeting		
Contact Person	Renee Purdy	(213) 576-6622, Renee.Purdy@waterboards.ca.gov	
Attachments			
Notes			
Action Items			
ITEM 2	**REASONABLE ASSURANCE ANALYSIS SUBCOMMITTEE**	**Assigned to:**	**Time: 12:40 - 1:10 p.m.**
Title	**UPDATE**	Ivar Ridgeway	30 min
Purpose	Reasonable Assurance Analysis Document Update; Subcommittee Update		
Desired Outcome	To discuss the final RAA document and to update the stakeholders on the most recent RAA meeting.		
Background			
Contact Person	Ivar Ridgeway	(213) 620-2150 Ivar.Ridgeway@waterboards.ca.gov	
Attachments	RevisedRAAModeling Criteria 1-22-14.pdf		
Notes			
Action Items			
ITEM 3	**MEETING EVALUATION AND WRAP-UP, REVIEW PROGRAM CALENDAR, NEXT MEETING DATES AND AGENDA**	**Assigned to:**	**Time:**
Title		Renee Purdy	15 min
Purpose	To evaluate meeting, acknowledge key forthcoming dates on the Program Calendar, and discuss potential topics for future meetings.		
Desired Outcome	Determine details for the next meeting including agenda items and assignments.		
Contact Person	Renee Purdy	(213) 576-6622, Renee.Purdy@waterboards.ca.gov	
Notes			
Action Items			

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 demonstrate that applicable water quality based effluent limitations and receiving water limitations 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 regulatory requirements of 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:

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:

- 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 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 where there is no specific compliance schedule contained in Attachments L-R, the compliance schedule set forth in the E/WMP. 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). For watershed priorities related to achieving WLAs in USEPA established TMDLs, proposed compliance schedules must adhere to the requirements of Part VI.E.3.c.iii-v.

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.

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]
- 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., annual rainfall, flow/runoff volume, pollutant loading, pollutant concentrations over the past 10 years) using calibrated dynamic model results for each subwatershed area. Such baseline loading estimates shall be generated for both (1) critical conditions (consistent with applicable TMDLs) and (2) average conditions for metrics related to quantity and quality (see examples of metrics, above). Critical conditions for baseline estimates shall be based on:
    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; or
        b) Other established 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).

[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.

II. Baseline pollutant loading shall be based on one of the following:

a) 90th percentile of long term pollutant loading/concentration (considering at least the most recent 10 years of available data); or

b) Long term average pollutant loading/concentration (considering at least the most recent 10 years of available data) that also incorporates the coefficient of variation so as to take the variability of pollutant loading into account. Consideration of variability must be sufficient to capture the baseline condition and required pollutant reductions under the critical condition. Where long-term average pollutant loading/concentration is used, critical conditions may be described using the long-term average loading with a coefficient of variation (CV) to take the variability of pollutant loading 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 volumes, concentrations, and/or loads obtained from the long-term average and CV with the selected probability distribution of the pollutant loading. 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 wet year), then CV and VF calculations are not required.

c) 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, they must be used in combination with one of the critical conditions for flow rate/runoff volume identified in Part I, above.

- 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 pollutant loading data 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 pollutant loading 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-Q. If the pollutant is not addressed by a TMDL, but TMDLs for that pollutant exist for other water bodies, permittees should express pollutant loading in terms of averaging period(s) / duration consistent with those other TMDLs.

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 annual 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) consistent with the TMDL and Attachments L-Q. Where a TMDL has not been developed for the water body-pollutant combination, permittees should select an averaging period/duration/critical condition consistent with that used in other TMDLs that have been developed for the pollutant in other water bodies within the region.

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-Q. 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. Initially, 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 that the required loading reduction and timeline specified are expected to be achieved.

- 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 - Q. 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 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-Q. 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 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-Q.

  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-Q 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.

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

Model Type	Available Models
1.4 Integrated BMP Modeling Systems	
* Process based models	EPA SUSTAIN model Los Angeles County WMMS model EPA TMDL Modeling Toolbox
* Empirical based models	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. 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	Most recent

For General Model	Data Source	Data Period
	locally derived data	
• Land Use/Land Cover Layer[5]	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 different soil groups.	SSURGO or locally derived data	Most recent
• 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

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

For General Model	Data Source	Data Period
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.

Table 3.0 Model Calibration Criteria

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.

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[6]	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
• 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

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

• 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[7]	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
3.1.3 Sediment Parameters		

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

• 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 t	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[i] 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.

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 Concen.	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 (1750-12000)-F NA-P	NA	NA	NA	56-300	NA
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	0.07-	0.17-	0.19-0.24	0.15-	0.10-0.13	0.08-	0.08-0.09	0.12-0.14	0.07-	0.13-

Median (95% Conf. Interval) Statistics of BMP Effluent Concen.	Bio-Retention	Bio-Swale	Detention Basin	Filter Strip	Manu-fractured Device	Media Filter	Porous Pavement	Retention Pond	Wetland Basin	Wetland Channel
(mg/L)	0.1	0.20		0.20		0.10			0.09	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,andNO3) (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
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		

Model Output	Output Content	Output Format
	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
	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

[i] Log-transformed arithmetic mean values shown

Los Angeles County MS4 Permit
Watershed Management Technical Advisory Committee

Meeting Location	LA County Department of Public Works - Conference Room A 900 South Freemont Avenue Alhambra, CA		
Meeting Date	May 28, 2014		
Meeting Time	12:30 - 2:30 p.m.		
Chairperson	Ivar Ridgeway, LARWQCB (213) 620-2150 Ivar.Ridgeway@waterboards.ca.gov		
Note taker	To be determined at the meeting		
Call-in phone #	(877) 336-1828 [passcode: 3087482]		
ITEM 1	**INTRODUCTIONS, REVIEW AGENDA, BRIEF ANNOUNCEMENTS**	**Assigned to:**	**Time: 12:30 -12:40 p.m.**
Title		Ivar Ridgeway, Chair	10 min
Purpose	**Standard meeting management item**		
Desired Outcome	1. Approve agenda 2. Approve meeting summary from 1-22-14 TAC meeting		
Contact Person	Ivar Ridgeway	(213) 576-6622, Ivar.Ridgeway@waterboards.ca.gov	
Attachments			
Notes			
Action Items			
ITEM 2	**REASONABLE ASSURANCE ANALYSIS SUBCOMMITTEE UPDATE**	**Assigned to:**	**Time: 12:40 - 1:10 p.m.**
Title		Ivar Ridgeway	30 min
Purpose	Reasonable Assurance Analysis Document Update; Subcommittee Update		
Desired Outcome	To provide an update regarding the final RAA document.		
Contact Person	Ivar Ridgeway	(213) 620-2150 Ivar.Ridgeway@waterboards.ca.gov	
Attachments			
Notes			
Action Items			
ITEM 3	**ANNUAL REPORTING FORM DISCUSSION**	**Assigned to:**	**Time: 1:10 - 2:10 p.m.**
Title		Ivar Ridgeway	1 Hour
Purpose	To initiate a dialog regarding the development of an Annual Reporting Form for the new LA MS4 Permit		
Desired Outcome			
Contact Person	Ivar Ridgeway	(213) 620-2150 Ivar.Ridgeway@waterboards.ca.gov	
Action Items			
ITEM 4	**MEETING EVALUATION AND WRAP-UP, REVIEW PROGRAM CALENDAR, NEXT MEETING DATES AND AGENDA**	**Assigned to:**	**Time:**
Title		Ivar Ridgeway	15 min
Purpose	To evaluate meeting, acknowledge key forthcoming dates on the Program Calendar, and discuss potential topics for future meetings.		
Desired Outcome	Determine need and details for future meetings including agenda items and assignments.		
Contact Person	Ivar Ridgeway	(213) 620-2150, Ivar.Ridgeway@waterboards.ca.gov	
Notes			
Action Items			

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Los Angeles County MS4 Permit
Watershed Management Technical Advisory Committee

Meeting Location	LA County Department of Public Works - Conference Room A 900 South Freemont Avenue Alhambra, CA		
Meeting Date	August 27, 2014		
Meeting Time	2:00 - 4:30 p.m.		
Chairperson	Ivar Ridgeway, LARWQCB (213) 620-2150 Ivar.Ridgeway@waterboards.ca.gov		
Note taker	To be determined at the meeting		
Call-in phone #	(877) 336-1828 [passcode: 3087482]		
ITEM 1	**INTRODUCTIONS, REVIEW AGENDA, BRIEF ANNOUNCEMENTS**	**Assigned to:**	**Time: 2:00 -2:10 p.m.**
Title		Ivar Ridgeway, Chair	10 min
Purpose	**Standard meeting management item**		
Desired Outcome	1. Briefly discuss Regional Board staff review schedule		
Contact Person	Ivar Ridgeway	(213) 576-6622, Ivar.Ridgeway@waterboards.ca.gov	
Attachments			
Notes			
Action Items			
ITEM 2	**DRAFT WMP/CIMP/IMP DISCUSSION**	**Assigned to:**	**Time: 2:10 - 3:40 p.m.**
Title		Ivar Ridgeway	1 hr 30 min
Purpose	To initiate a dialog regarding the recently submitted draft WMPs/IMPs/CIMPs for the LA MS4 Permit		
Desired Outcome	To identify concerns/issues associated with the draft documents.		
Contact Person	Ivar Ridgeway	(213) 620-2150 Ivar.Ridgeway@waterboards.ca.gov	
Attachments			
Notes			
Action Items			
ITEM 3	**ANNUAL REPORTING FORM TEMPLATE**	**Assigned to:**	**Time: 3:40 - 3:50 p.m.**
Title		Ivar Ridgeway	10 min
Purpose	To provide an update on the development of an Annual Report Template		
Desired Outcome			
Contact Person	Ivar Ridgeway	(213) 620-2150 Ivar.Ridgeway@waterboards.ca.gov	
Action Items			
ITEM 4	**MEETING EVALUATION AND WRAP-UP, REVIEW PROGRAM CALENDAR, NEXT MEETING DATES AND AGENDA**	**Assigned to:**	**Time:**
Title		Ivar Ridgeway	15 min
Purpose	To evaluate meeting, acknowledge key forthcoming dates on the Program Calendar, and discuss potential topics for future meetings.		
Desired Outcome	Determine need and details for future meetings including agenda items and assignments.		
Contact Person	Ivar Ridgeway	(213) 620-2150, Ivar.Ridgeway@waterboards.ca.gov	
Notes			
Action Items			

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Los Angeles County MS4 Permit
Watershed Management Technical Advisory Committee

Meeting Location	LA County Department of Public Works - Conference Room C 900 South Freemont Avenue Alhambra, CA		
Meeting Date	September 24, 2014		
Meeting Time	1:00 - 4:00 p.m.		
Chairperson	Renee Purdy, LARWQCB (213) 576-6622 Renee.Purdy@waterboards.ca.gov		
Note taker	To be determined at the meeting		
Call-in phone #	(877) 336-1828 [passcode: 3087482]		
ITEM 1	**INTRODUCTIONS, REVIEW AGENDA, BRIEF ANNOUNCEMENTS**	**Assigned to:**	**Time: 1:00 -1:10 p.m.**
Title		Renee Purdy, Chair	10 min
Purpose	**Standard meeting management item**		
Desired Outcome	1. Briefly discuss Regional Board October 9th workshop		
Contact Person	Ivar Ridgeway	(213) 576-6622, Ivar.Ridgeway@waterboards.ca.gov	
Attachments			
Notes			
Action Items			
ITEM 2	**DRAFT CIMP PRESENTATIONS**	**Assigned to:**	**Time: 1:10 - 2:25 p.m.**
Title		Ivar Ridgeway	1 hr 15 min
Purpose	To present an overview of the development and rationale used in creating the recently submitted draft CIMPs for the LA MS4 Permit. Several representative watershed groups will give presentations on the approaches and elements of their CIMPs.		
Desired Outcome	To discuss concerns/issues associated with the draft CIMPs.		
Contact Person	Ivar Ridgeway	(213) 620-2150 Ivar.Ridgeway@waterboards.ca.gov	
Attachments			
Notes			
Action Items			
ITEM 3	**DRAFT EWMP WORKPLAN PRESENTATIONS**	**Assigned to:**	**Time: 2:25 - 3:40 p.m.**
Title		Ivar Ridgeway	1 hr 15 min
Purpose	To present an overview of the development and rationale used in creating the recently submitted draft EWMPs Workplans for the LA MS4 Permit. Several representative EWMP groups will give presentations on their workplans.		
Desired Outcome			
Contact Person	Ivar Ridgeway	(213) 620-2150 Ivar.Ridgeway@waterboards.ca.gov	
Action Items			
ITEM 4	**MEETING EVALUATION AND WRAP-UP, REVIEW PROGRAM CALENDAR, NEXT MEETING DATES AND AGENDA**	**Assigned to:**	**Time: 3:40 p.m.-4:00**
Title		Renee Purdy	20 min
Purpose	To evaluate meeting, briefly discuss October 9th Board workshop, and discuss potential topics for future meetings.		
Desired Outcome	Determine need and details for future meetings including agenda items and assignments.		
Contact Person	Ivar Ridgeway	(213) 620-2150, Ivar.Ridgeway@waterboards.ca.gov	

Notes	
Action Items	

Artesia
Bellflower
Cerritos
Diamond Bar
Downey
Hawaiian Gardens
La Mirada
Lakewood
Long Beach
Norwalk
Pico Rivera
Santa Fe Springs
Whittier
Los Angeles County Flood Control District

Lower San Gabriel River Watershed Committee

A briefing regarding the Coordinated Integrated Monitoring Program to the Technical Advisory Committee

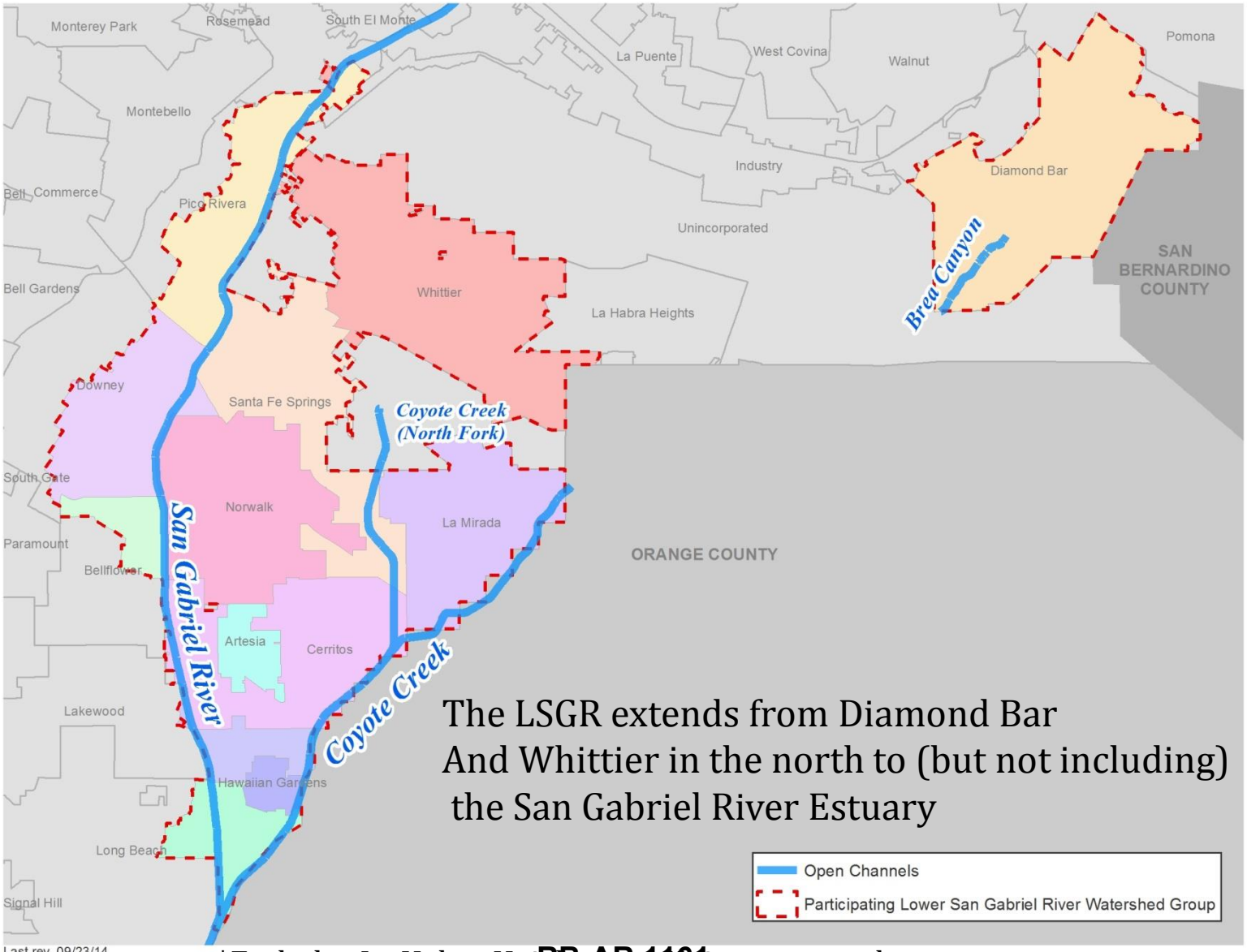
September 24, 2014

RB-AR 1159

The LSGR includes

- Artesia
- Bellflower
- Cerritos
- Diamond Bar
- Downey
- Hawaiian Gardens
- La Mirada
- Lakewood
- Long Beach
- Norwalk
- Pico Rivera
- Santa Fe Springs
- Whittier
- Los Angeles County Flood Control District

The LSGR CIMP includes



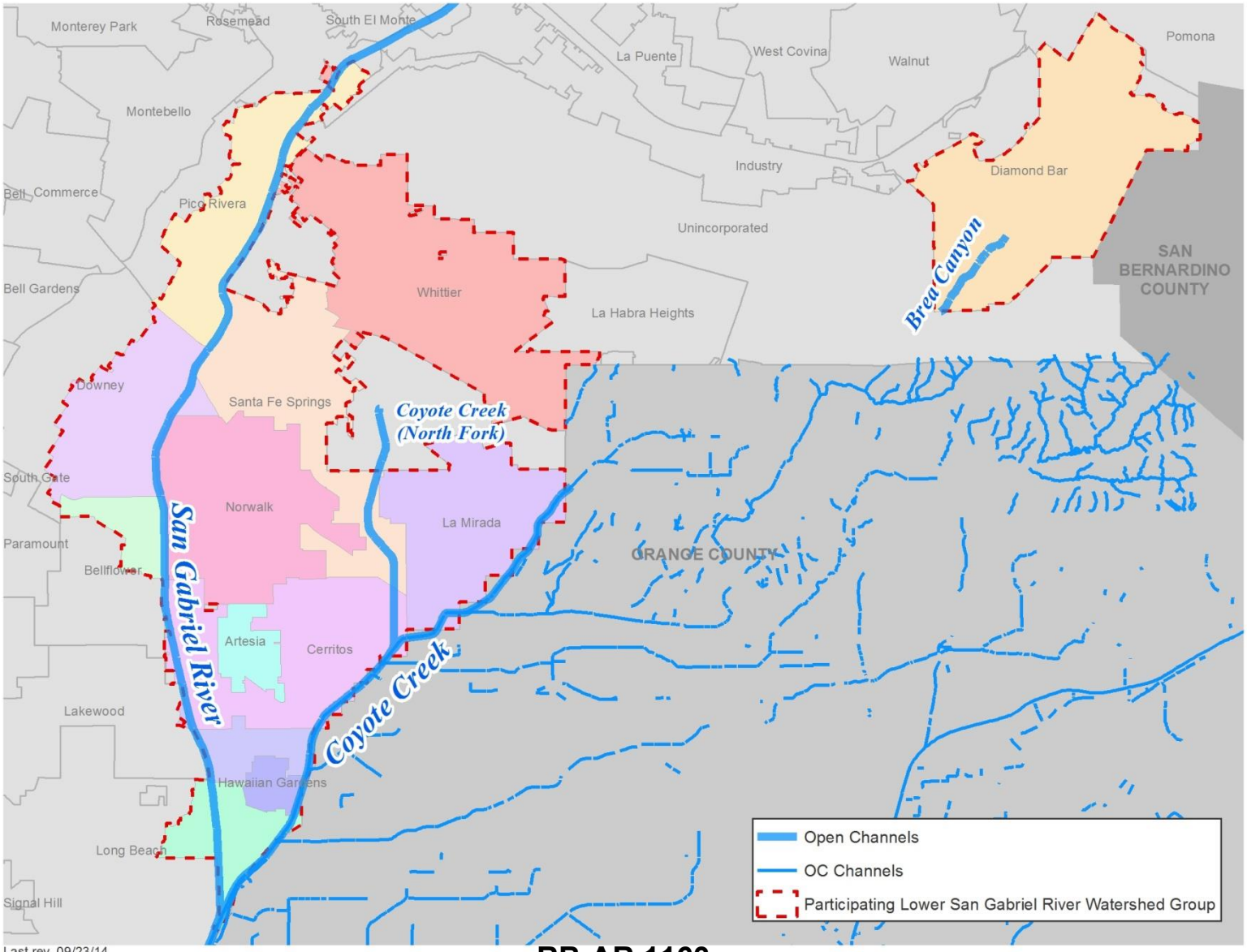
*Excludes La Habra Heights and Unincorporated areas

Coyote Creek

- More that 50% of the drainage comes from Orange County.

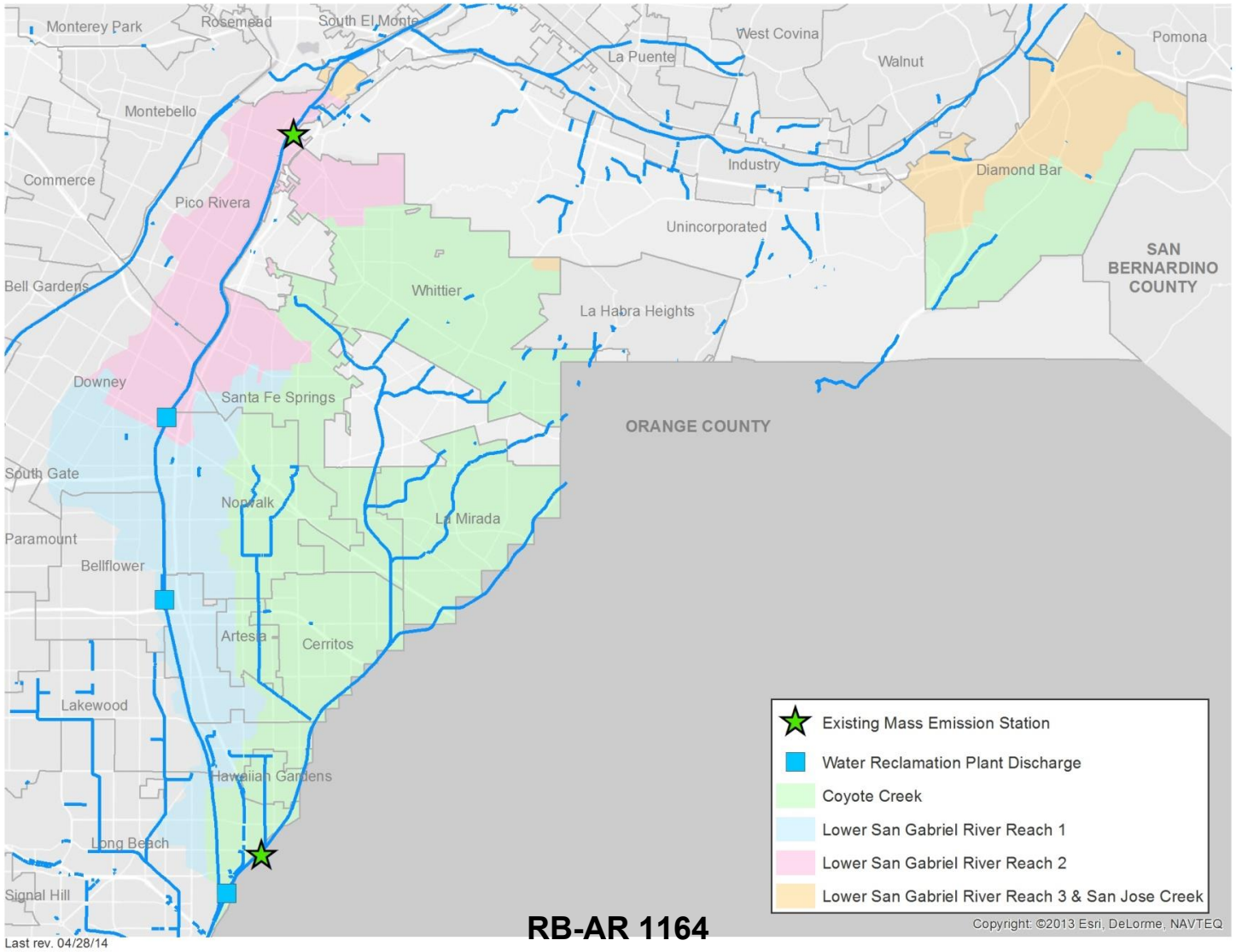
- An initial attempt to coordinate was made, but thus far, the different MS4 Permits and making the combining of efforts complex

OC's Coyote Creek contribution



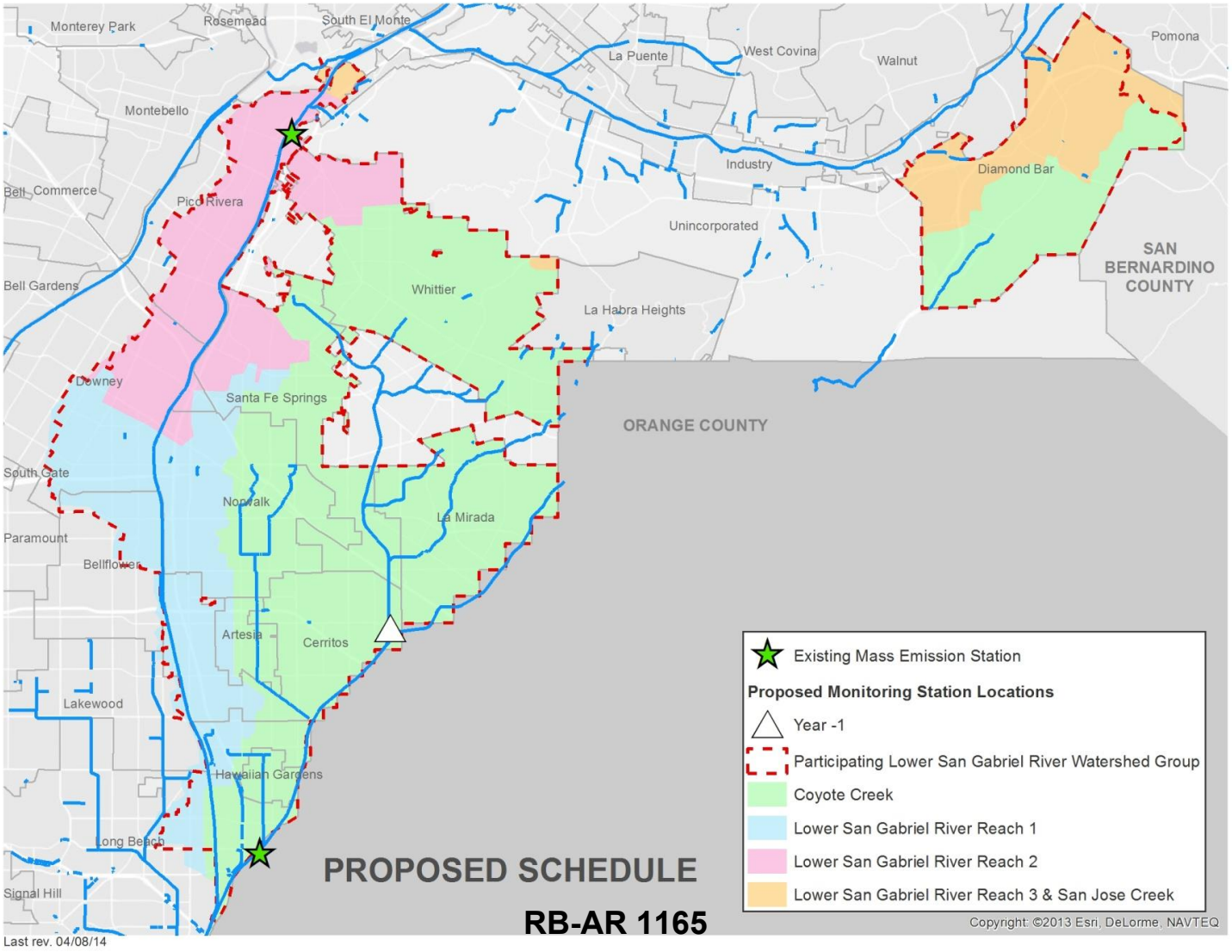
RB-AR 1163

Water Reclamation Plants and Existing MS4 Monitoring Stations



RB-AR 1164

To begin a process to resolve this, an Early Action Monitoring Station was installed in 2013 (prior to the CIMP approval)



Early Action Monitoring Station

RB-AR 1166

Early Action Monitoring

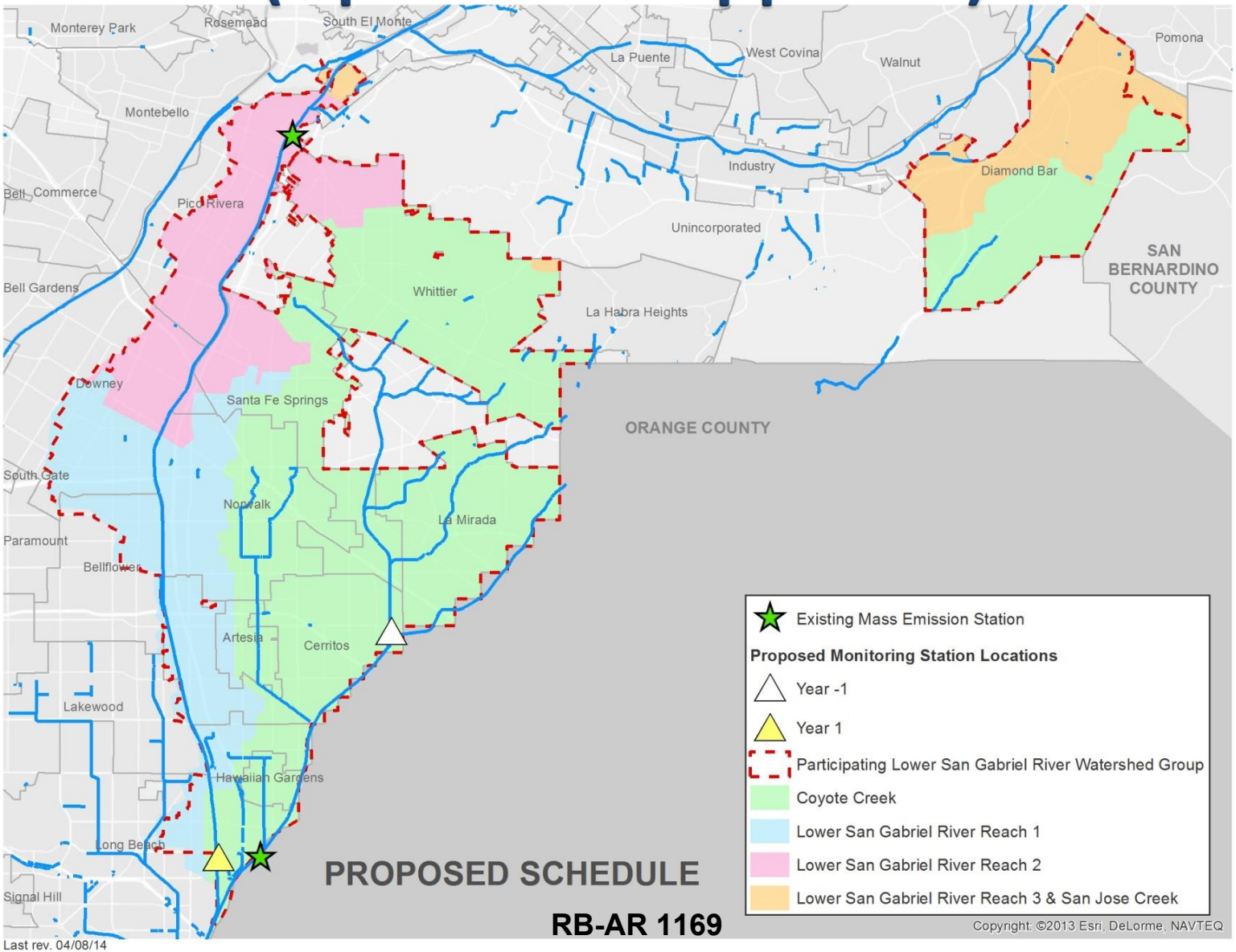
- North Coyote Creek was selected due to the large drainage area and existing, but unused, monitoring infrastructure.
- Due to the severe drought, the 2013-14 sample collection proved to be very challenging.
- Basically we detected mud.

LSGR has embarked on a three-part monitoring Implementation schedule

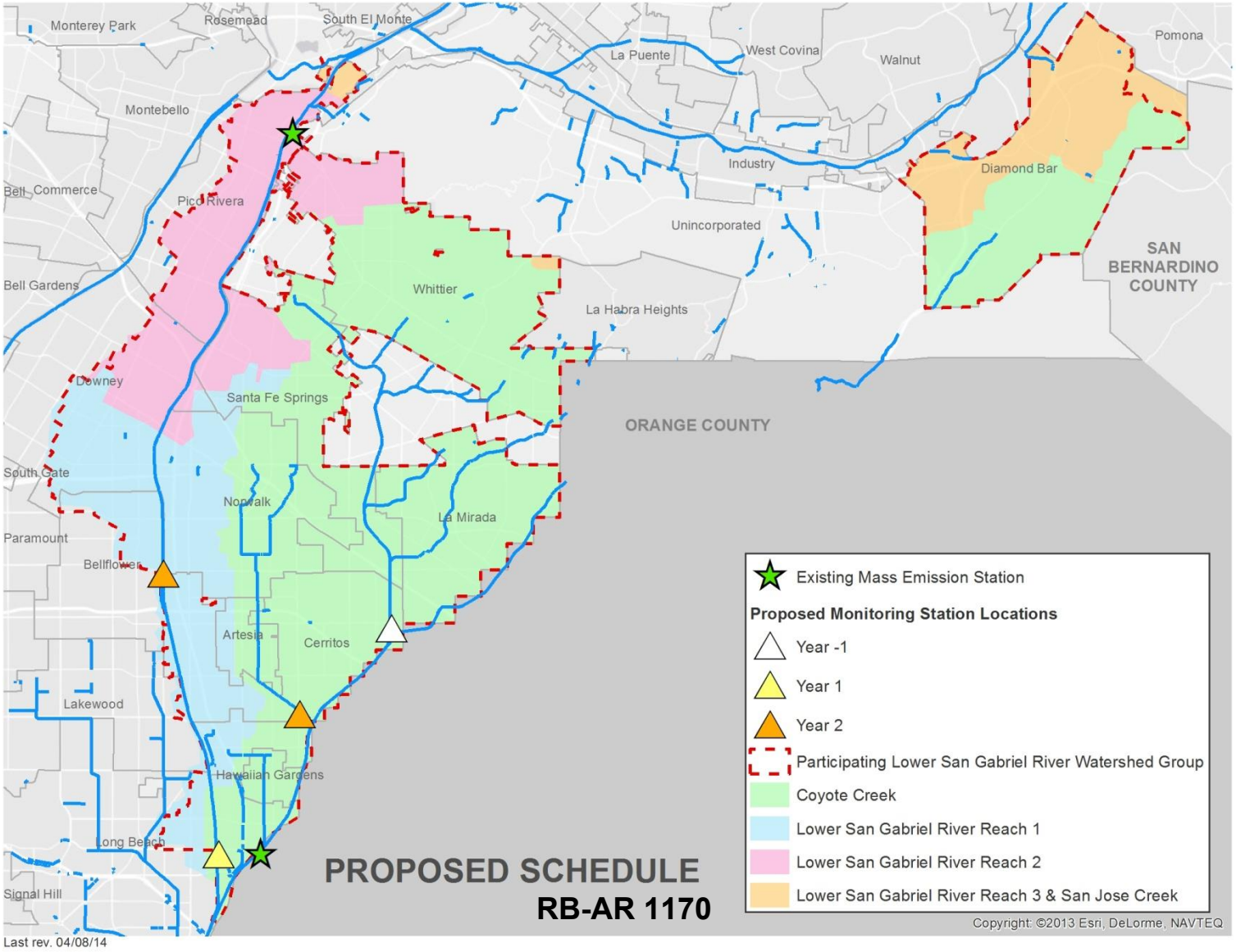
- The Early-Action monitoring station at Coyote Creek was phase 1

- For 2013-14, Metals were the primary concern

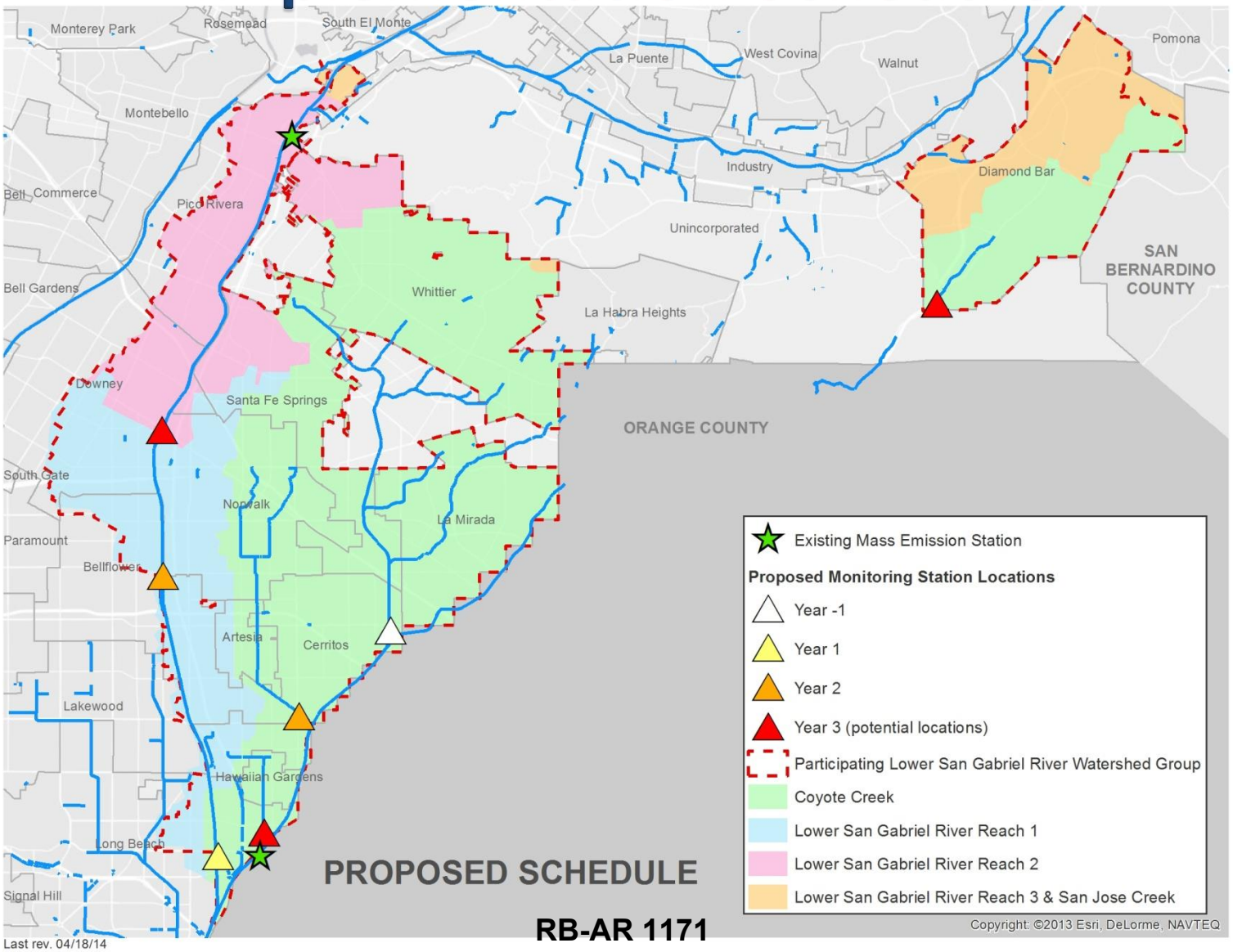
Step 1
(Upon CIMP approval)



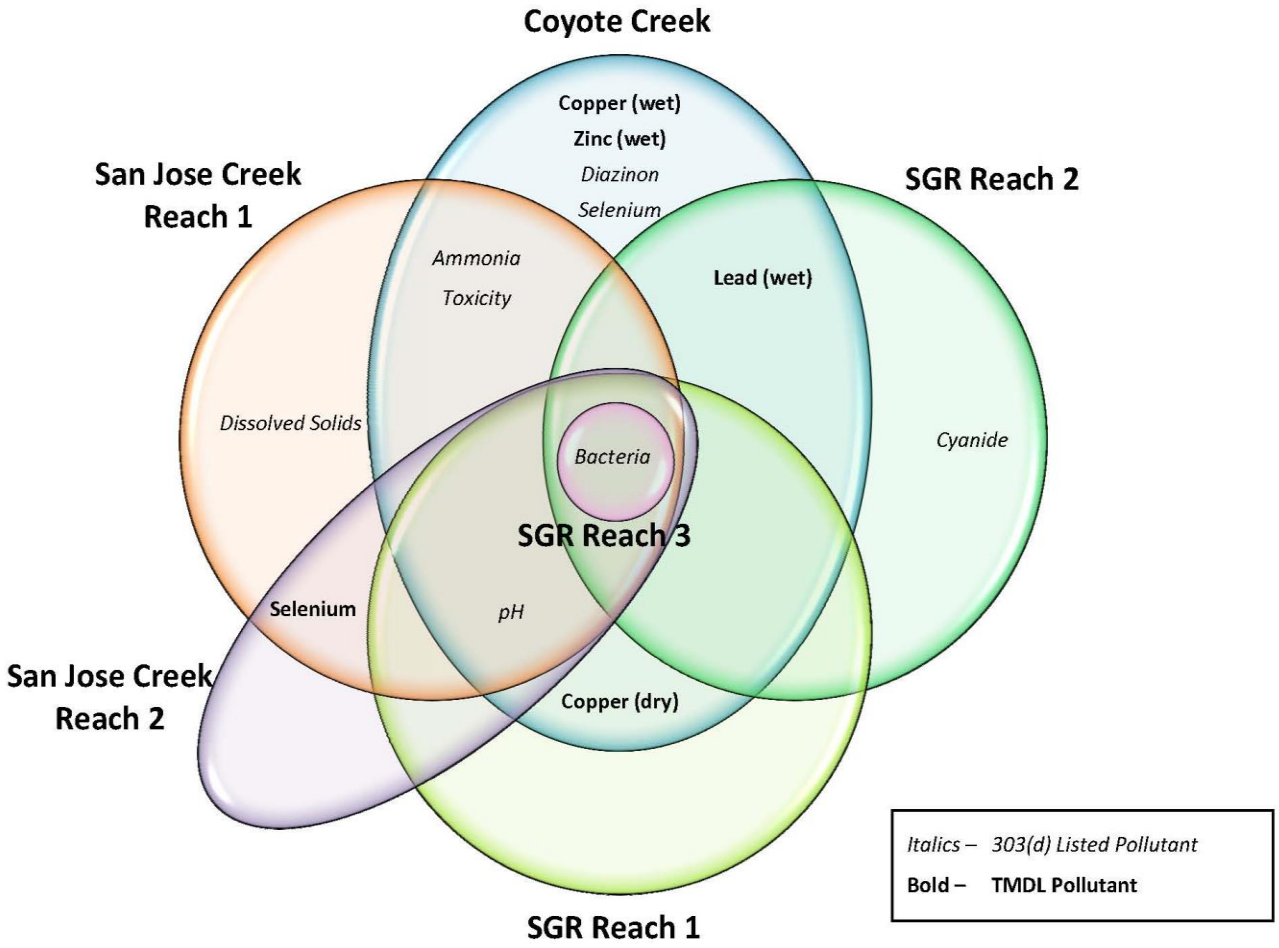
Step 2
Implementation Schedule



Step 3
Implementation Schedule



Greatly expanded Testing for Pollutants which include:



RB-AR 1172

Ongoing Efforts

RB-AR 1173

Thank You

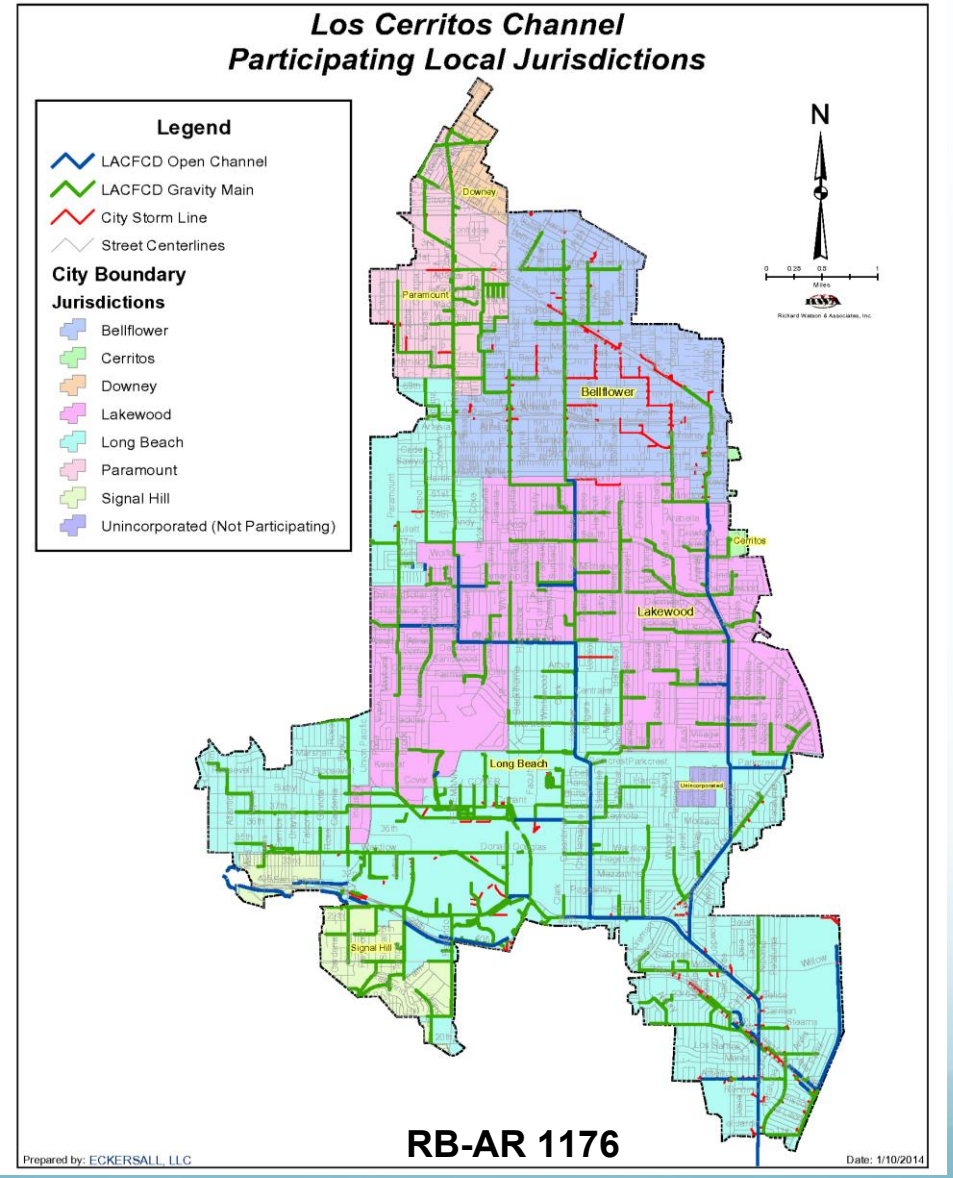
Overview of the Los Cerritos Channel Comprehensive Integrated Monitoring Program

Presented by Richard Watson

Presented to the Los Angeles County MS4 Permit Watershed Management Technical Advisory Committee

24 September 2014

Participating Local Jurisdictions



LCC CIMP Provides a Customized Wet-Weather Approach

- Approach is based, in part, on specific characteristics of watershed
  - EPA identified 10 sub-basins in Metals TMDLs
  - Watershed is self-contained and does not receive water from any other Watershed Groups
  - Los Cerritos Channel has three major tributary channels
  - One of the major tributary channels has two significant secondary tributary channels
- Approach partially based on the dry-weather monitoring design for a Prop 84 project – the Los Cerritos Channel Watershed Segmentation and Low Impact Development Project.

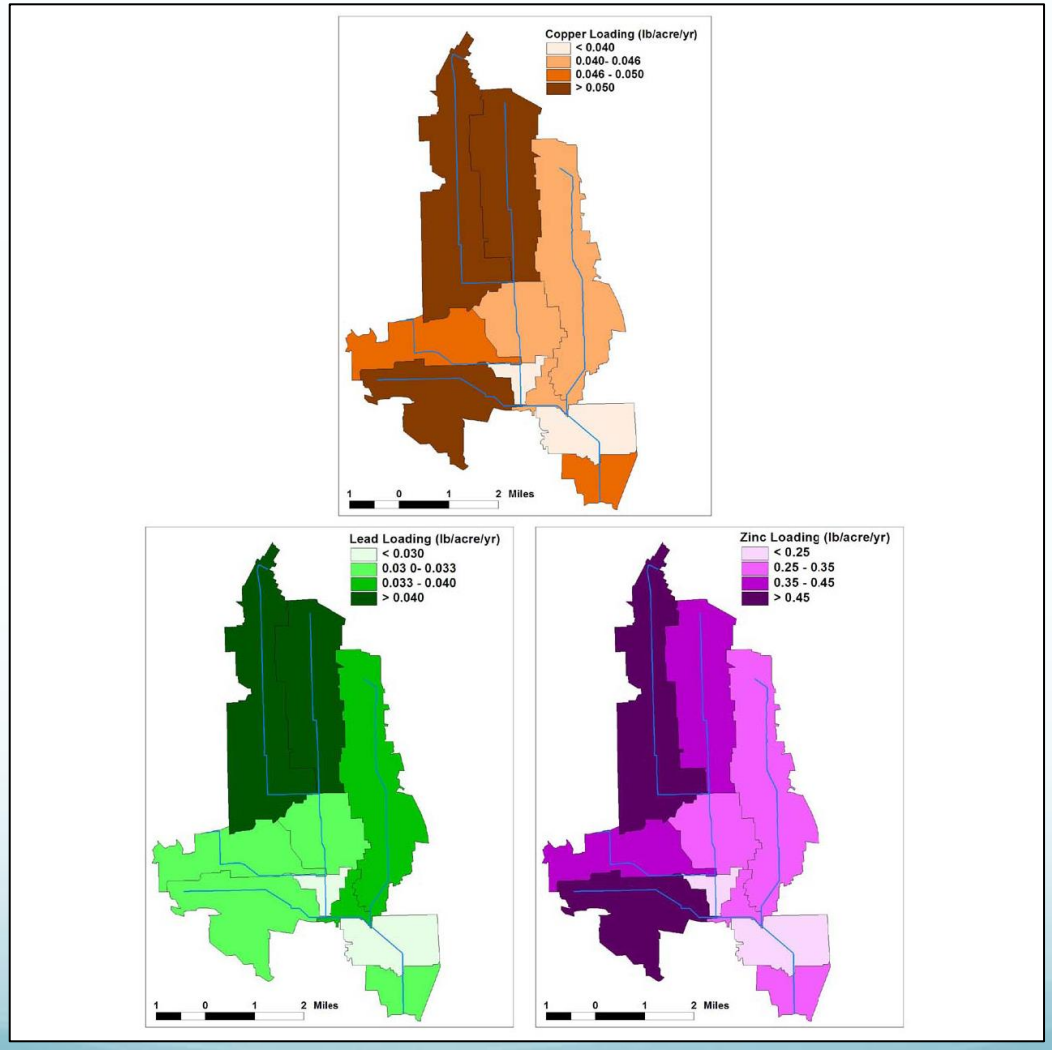
Basic Approach

- The basic approach is one of watershed segmentation and forensic monitoring.
- Receiving water quality monitoring will continue at the historic LCC site at Stearns Street, which also serves as the TMDL compliance monitoring point.
- The LCC CIMP is further structured pursuant to two customized approaches to match watershed characteristics.
- Four primarily watershed segmentation and source tracking monitoring sites have been identified to monitor discharges from the three sub-basins estimated in the EPA-established Metals TMDLs to have the highest concentrations of copper, lead, and zinc based on modeling by Tetra Tech.

Basic Approach (Continued)

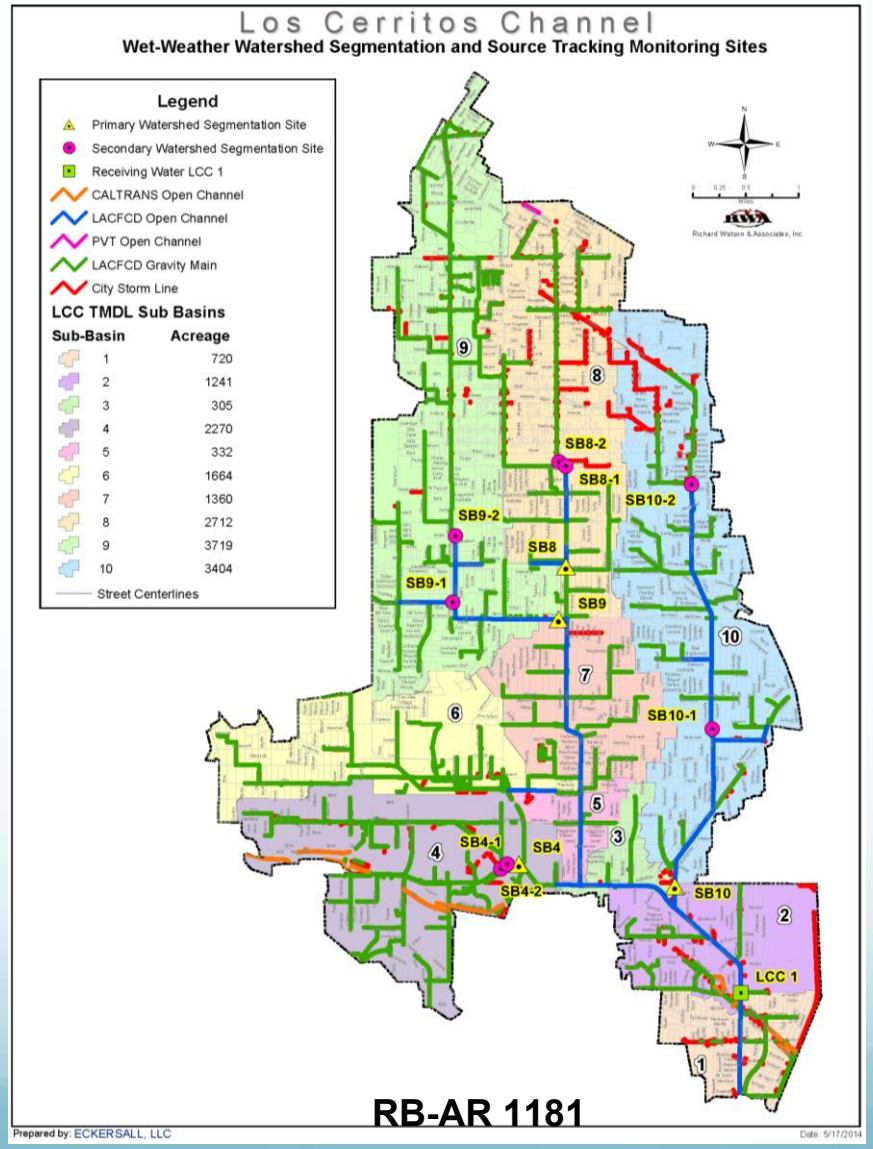
- A fourth sub-basin will also be monitored since it is the second largest sub-basin in the watershed and could be impacted by atmospheric deposition.
- Eight potential secondary watershed segmentation sites have also been identified – two in each of the primary watershed segments.
- The secondary monitoring sites will be monitored, as necessary, with portable monitoring installations to further sub-divide problematic sub-basins.
- Further forensic monitoring will be employed upstream of the secondary segmentation sites, as required, to locate sources of pollutants so that they may be addressed.

Estimated Concentrations of Metals from Each Sub-basin of the Los Cerritos Channel



RB-AR 1180

Map of Wet-Weather Watershed Segmentation and Source Tracking Sites



RB-AR 1181

Rationale for the Wet-Weather Approach

- Continued emphasis on the Stearns Street monitoring site is based on the permit requirement to continue monitoring at mass emissions sites and on the designation of that site as the compliance point for the LCC Metals TMDLs.
- We selected the watershed segmentation and forensic monitoring approach, rather than the stormwater outfall approach described in Attachment E of the permit. We think this approach is a better way to identify sources of pollutants and improve the effectiveness of pollutant controls than the approach of monitoring one outfall per jurisdiction per sub-watershed, at least for this self-contained watershed.

Non-Stormwater Outfall Monitoring Program

- Three initial surveys will be conducted.
- The first survey has been completed.
- It focused on verification of outfalls as identified in available City and County GIS research, providing baseline photographic records, assessing flow, field water quality measurements, and secondary observations.
- The first survey was consistent with the reduction in dry-weather runoff since 2009 – few significant discharges.
- The second survey is underway.

Non-Stormwater Outfall Monitoring Program (Continued)

- The first survey included 133 major outfalls and 119 minor outfalls.
- Industrial land uses are found in tributary areas for 29 major outfalls and 7 minor outfalls.
- Only 3 major outfalls had evidence of high flows (greater than 20 gpm)
- 2 major outfalls had moderate flows (5-20 gpm) and 4 had low flows (1-5 gpm)
- Information from the three initial surveys will be used to determine which outfalls have significant discharges and to classify the outfalls for further investigation.

Waterbody-Pollutant Categories for the Los Cerritos Channel

Category	Constituents
1	Copper, lead, zinc, DDT, chlordane, PCBs, PAHs
2	Ammonia, bis(2) ethylhexyl-phthalate, E. coli, pH
3	MBAS, enterococcus

Summary of Constituents to be Monitored

	Mass Emission Site		Primary Watershed Segmentation Sites
Class of Measurements	**Wet**	**Dry**	**Wet**
Flow	3	2	3
Field Measurements (dissolved oxygen, pH, temperature, specific conductivity)	3	2	3
MRP Table E-2 Constituents (Other than those specifically listed below)	1	1	
Aquatic Toxicity	2	1	
General and Conventional Pollutants (all except total phenols, turbidity, BODs, MTBE, & perchlorate, chloride, and fluoride)	3	2	3
Microbiological Constituents (*E. coli,* Total & fecal coliform, enterococcus)	3	2	3
Nutrients – none required			
Organochlorine Pesticides & PCBs – Chlordane	3	2	
Metals - Cu, Pb, & Zn	3	2	3
Organophosphate Pesticides – none reqd.			
Semivolatile Organic Compounds – Bis(2)ethylhexylphthalate	3	2	

RB-AR 1186

Schedule for Implementation of Watershed Monitoring Activities

Task	Dry 2014	Dry 2015	Wet 2015-16	Dry 2016	Wet 2016-17	Dry 2017	Wet 2017-18	Dry 2018
Receiving Water/TMDL								
LCC1 Stearns St.	Note 6							
Chemistry[1]		2	3	2	3	2	3	2
Aquatic Toxicity		1	2	1	2	1	2	1
Primary Watershed Segments								
SB10			3		3		3	
SB4			3		3		3	
SB8							3	
SB9					3		3	
Secondary Watershed Segments[2]								
SBX-1					3		3	
SBX-2					3		3	
Non-Stormwater Outfall								
Inventory & Screen[3]	3							
Source ID[4]		Ongoing		Ongoing		Ongoing		Ongoing
Monitoring[5]				2		2		2

Questions?

Richard Watson

Richard Watson & Associates, Inc. (RWA)

rwatson@rwaplanning.com

949.855.6272