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

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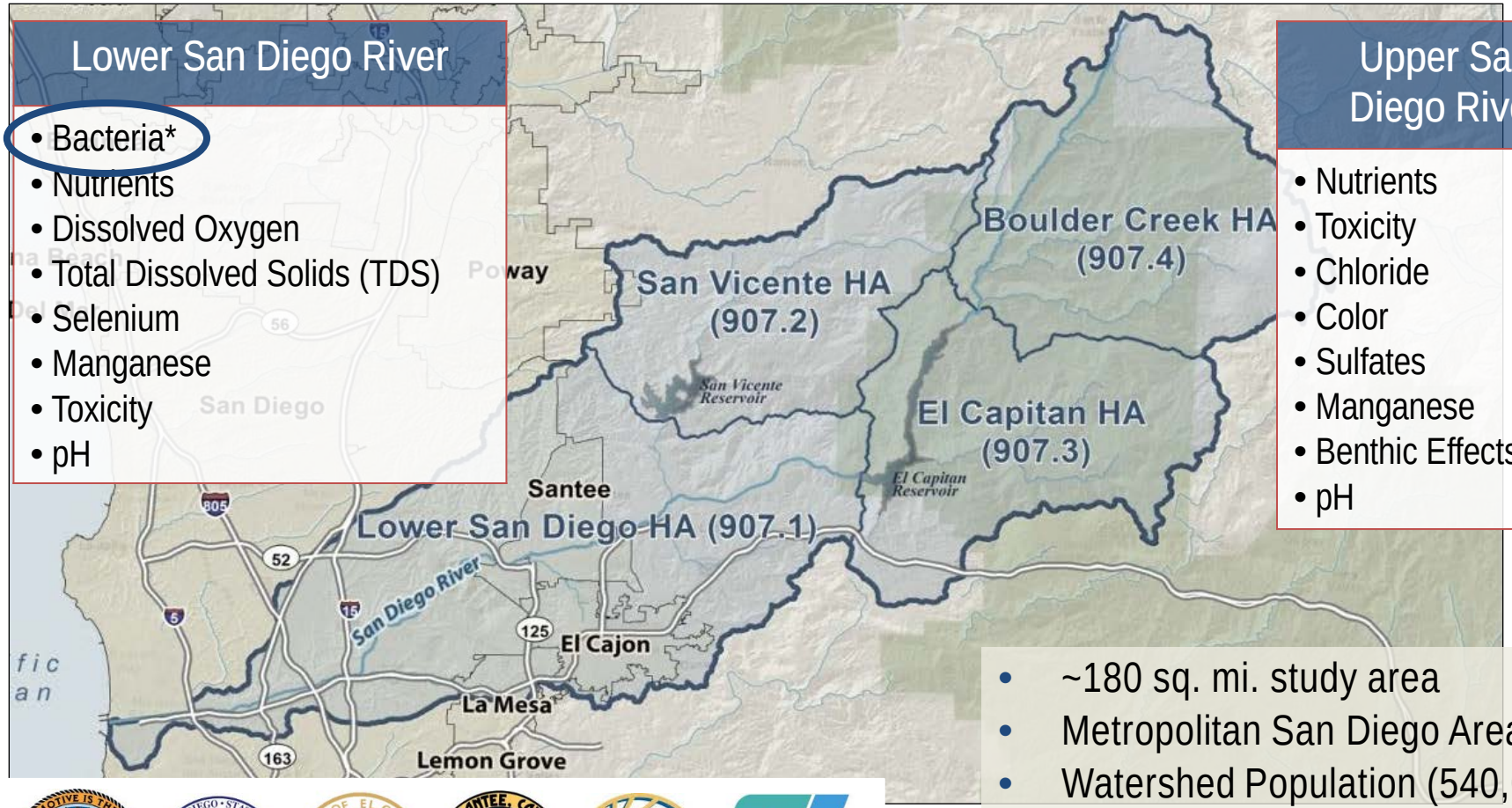
October 17, 2013
Los Angeles County Department of Public Works, Alhambra, CA

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

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%)**

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

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)

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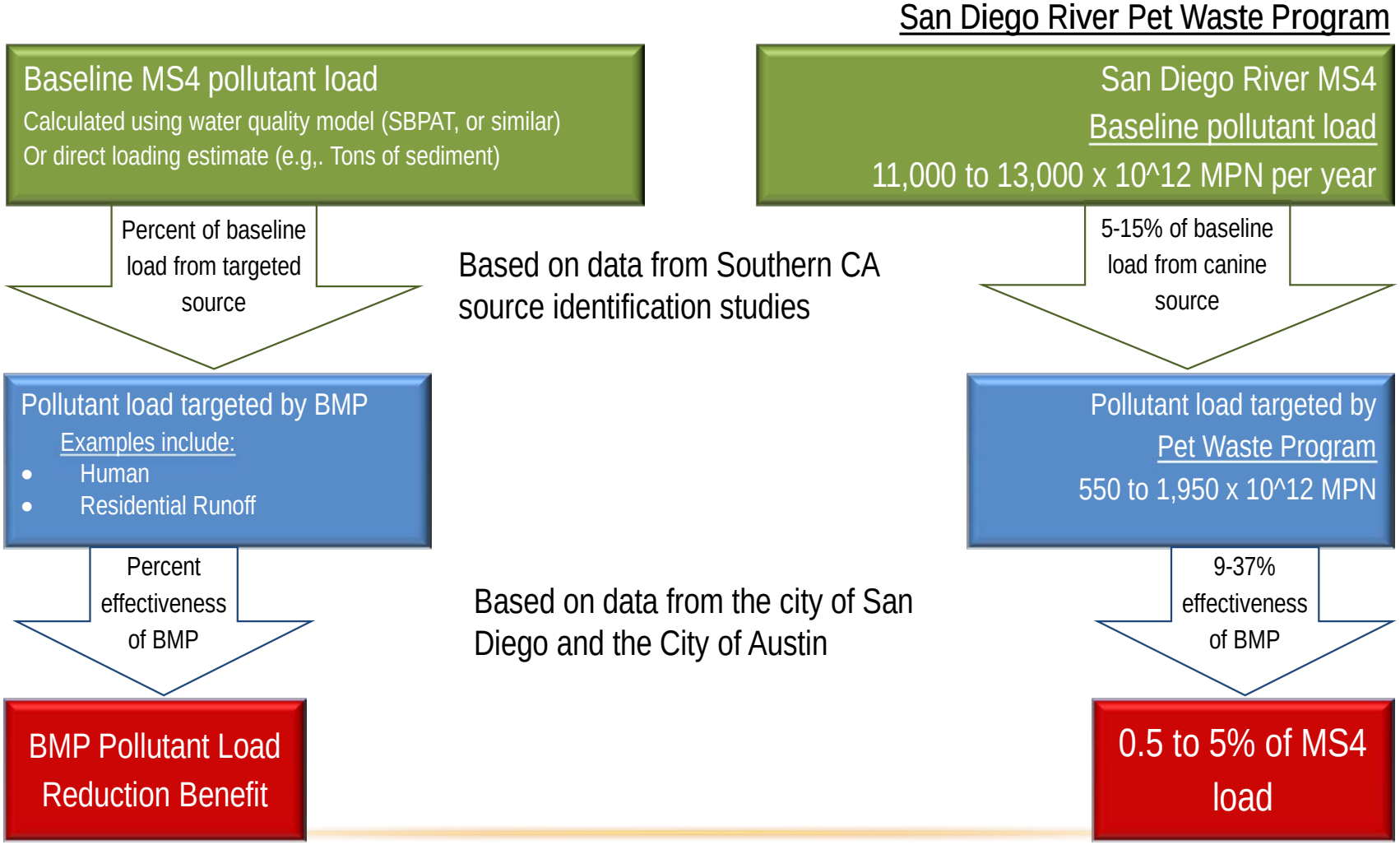
PRIORITY POTENTIAL BMP STRATEGIES (NONSTRUCTURAL)

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

NONSTRUCTURAL BMP QUANTIFICATION (PET WASTE EXAMPLE)



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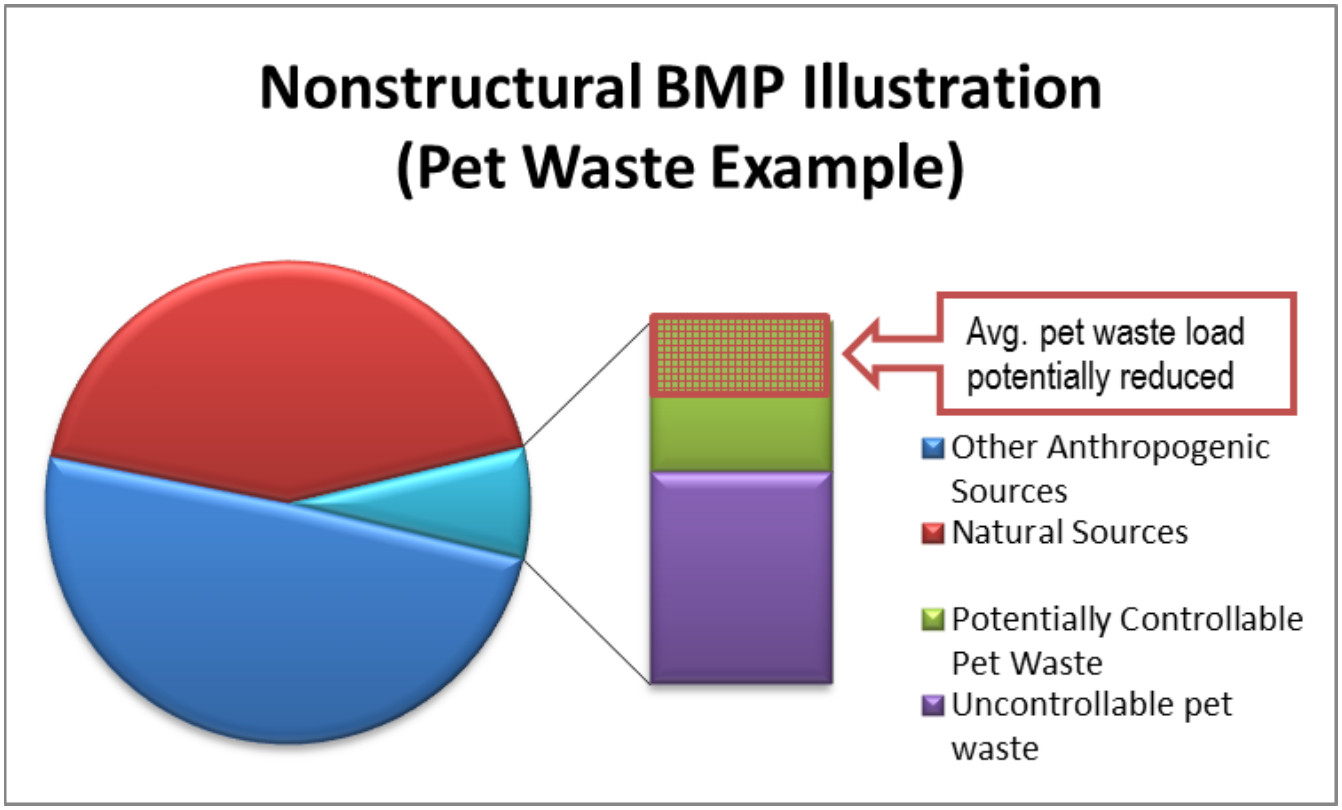


POTENTIAL BMP STRATEGIES (STRUCTURAL)

	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

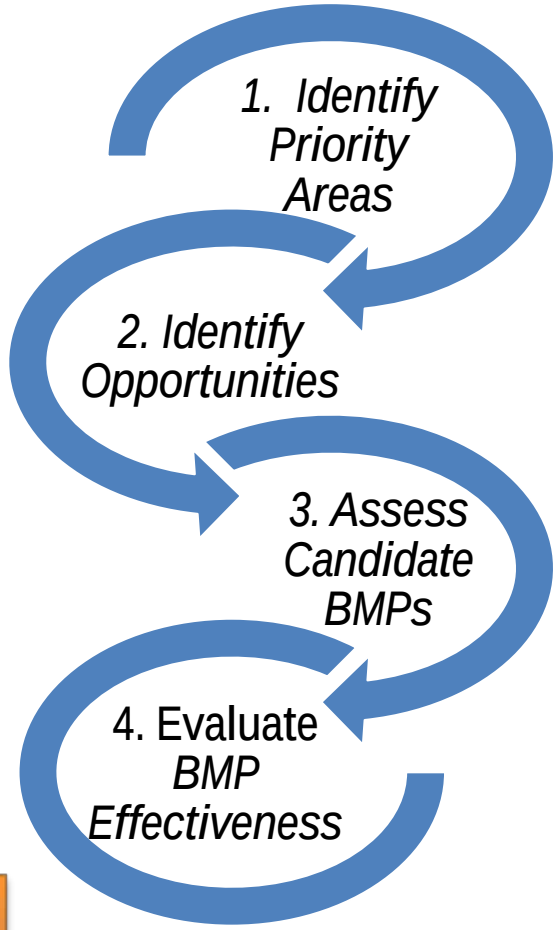
BASIS FOR SELECTING MODELING TOOLS

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



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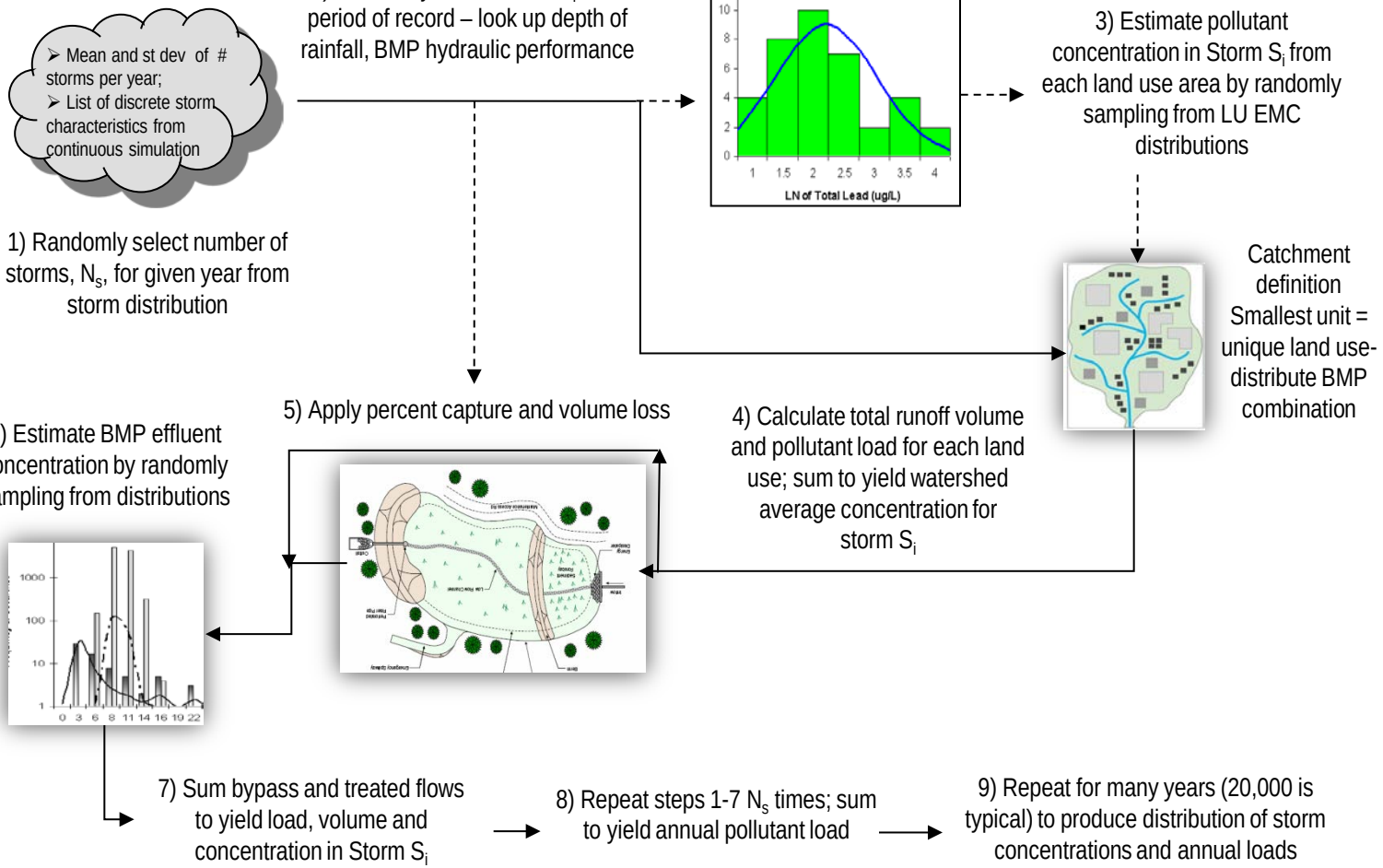
Original funding by agencies, SWRCB and RWQCB

SBPAT MONTE CARLO PROCESS



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

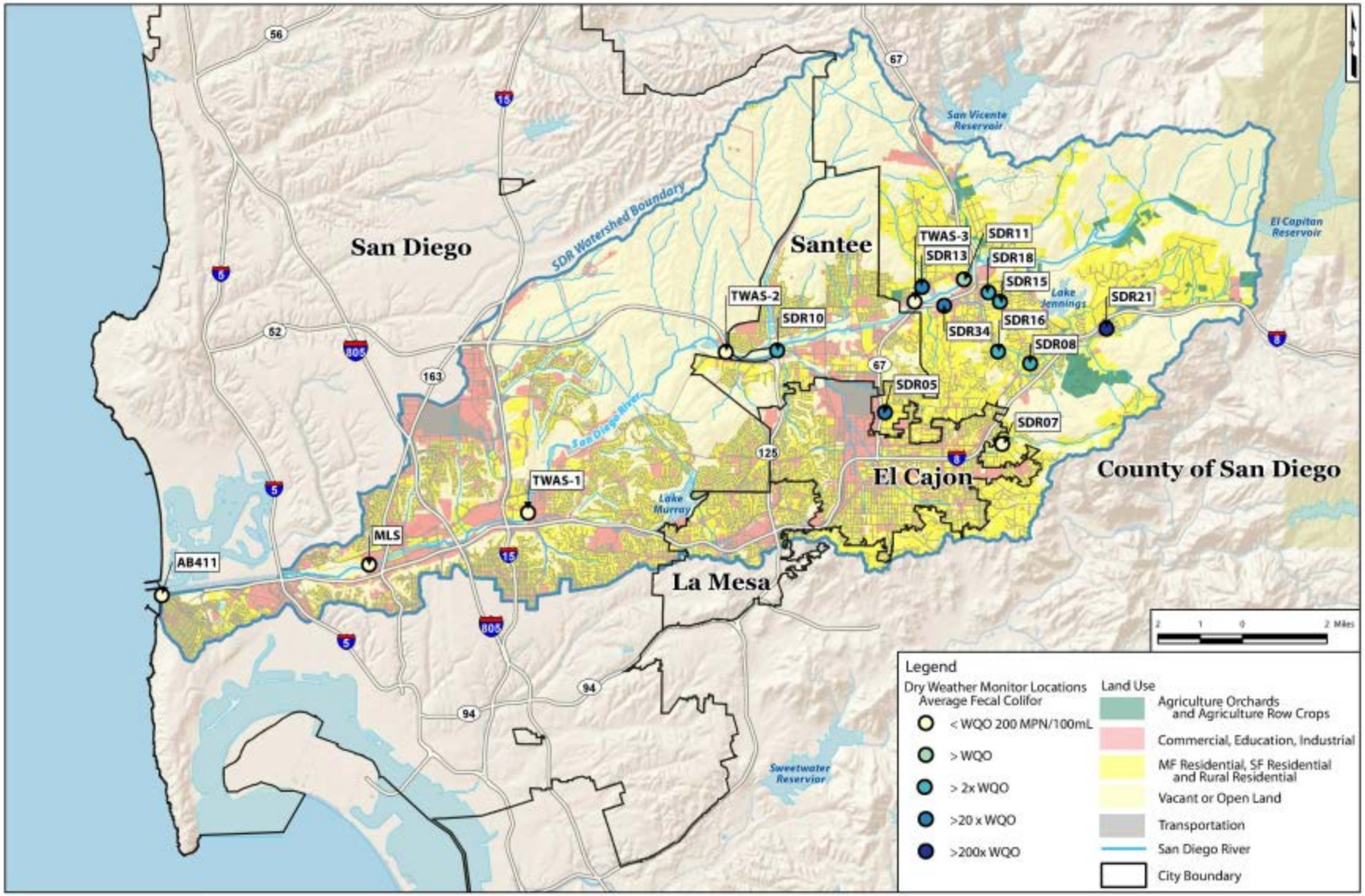
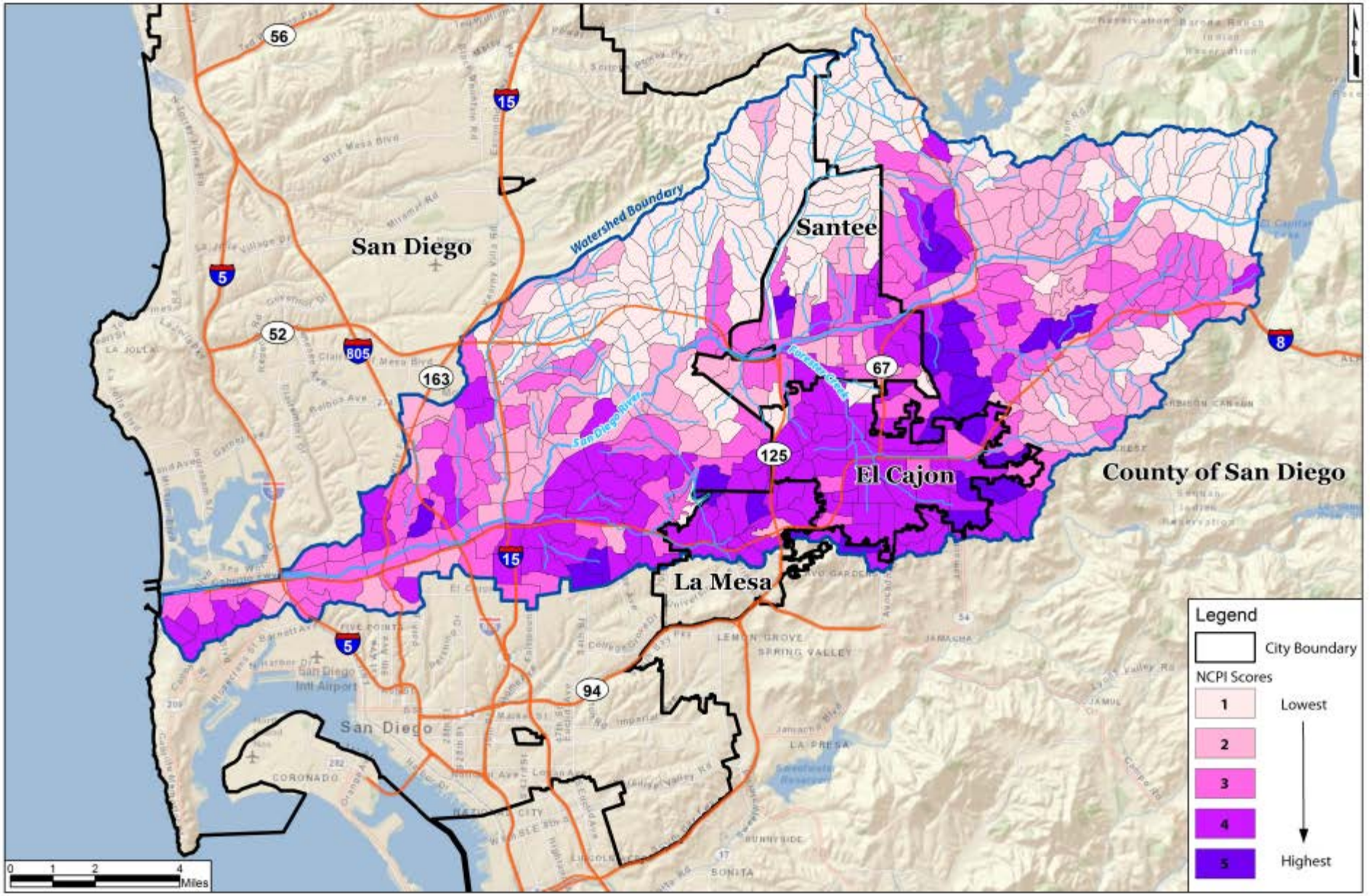


Figure 7. Average fecal coliform results during dry weather in SDR Watershed.



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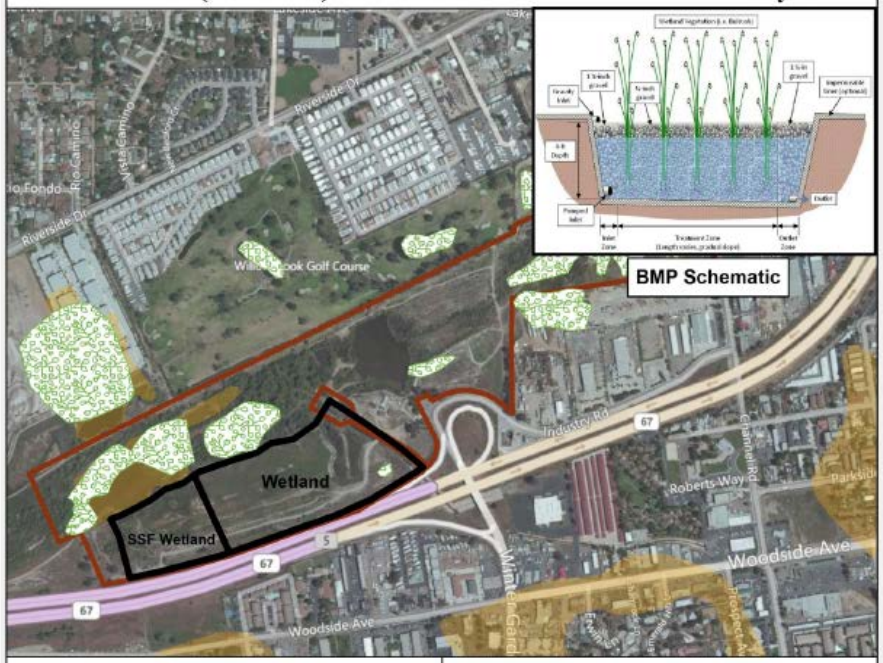
San Diego River Watershed
Comprehensive Load Reduction Plan
Regional BMP Identification and Constraints

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

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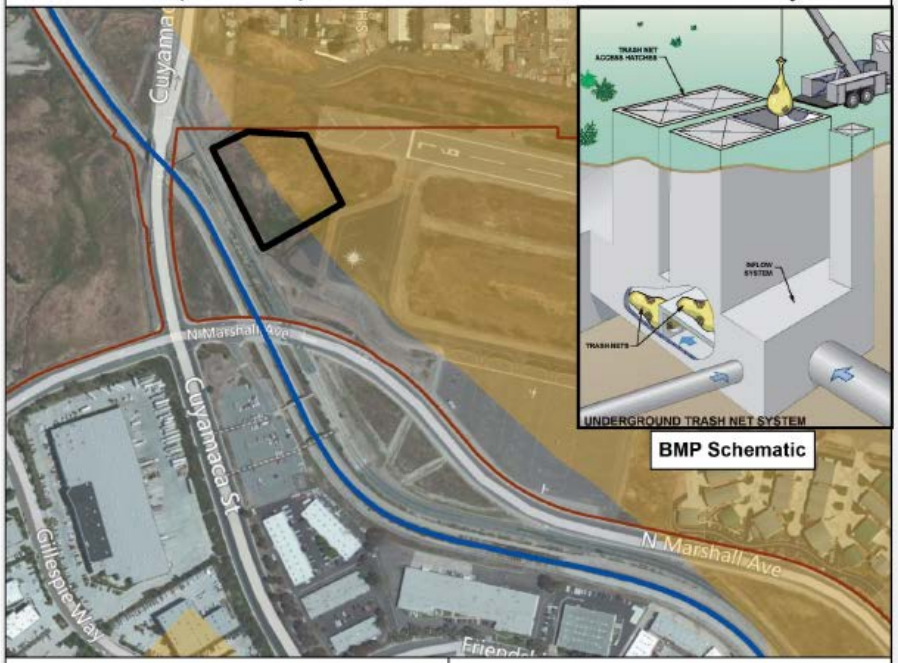
San Diego River Watershed
Comprehensive Load Reduction Plan
Regional BMP Identification and Constraints

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

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

DISTRIBUTED BMP EXAMPLES (INCLUDES GREEN STREETS)

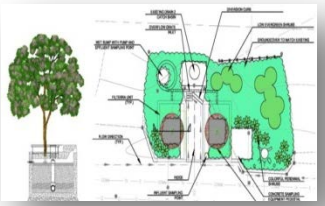


Table 11. Modeled Distributed BMPs[1,2,3]

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

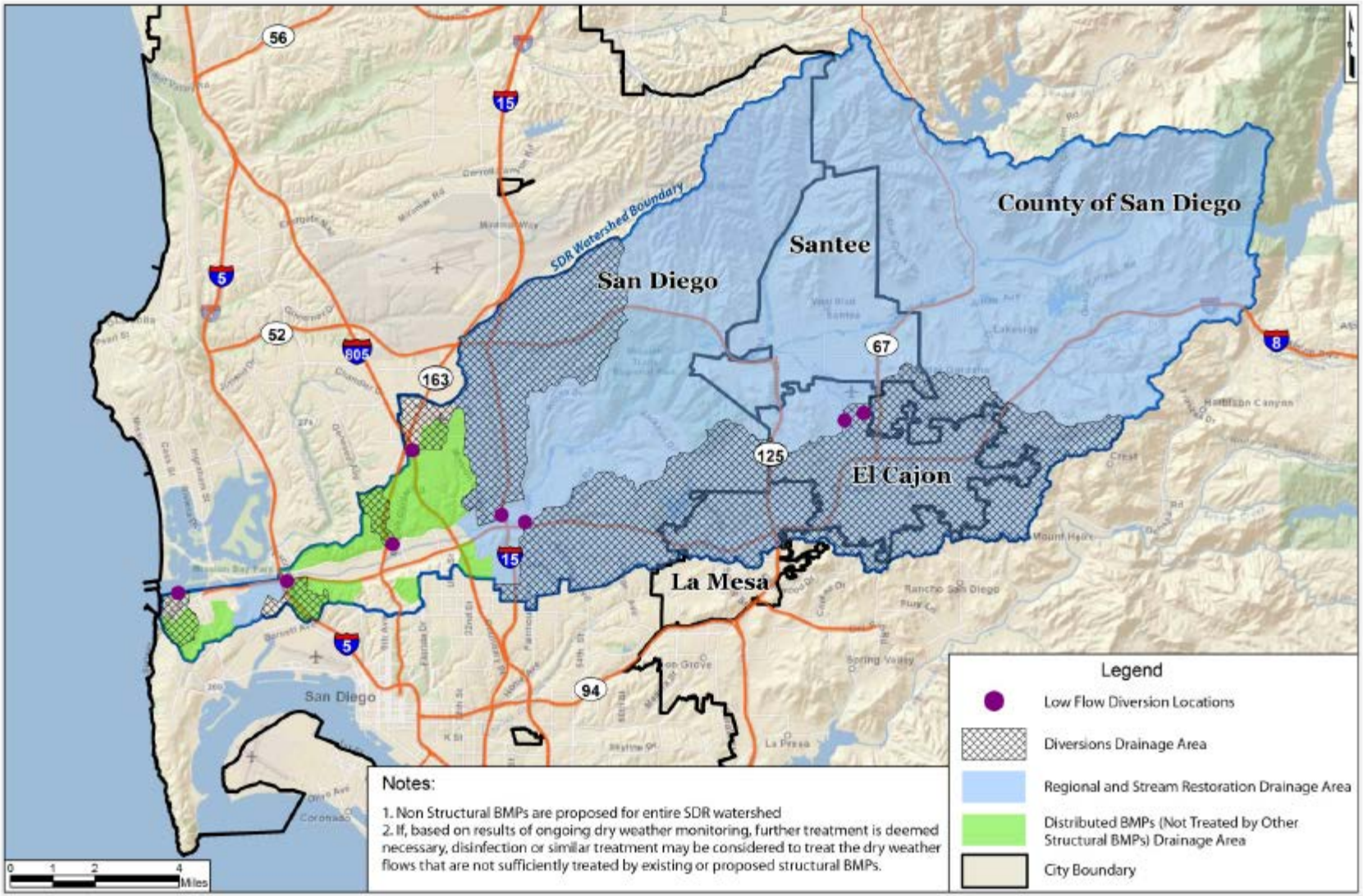
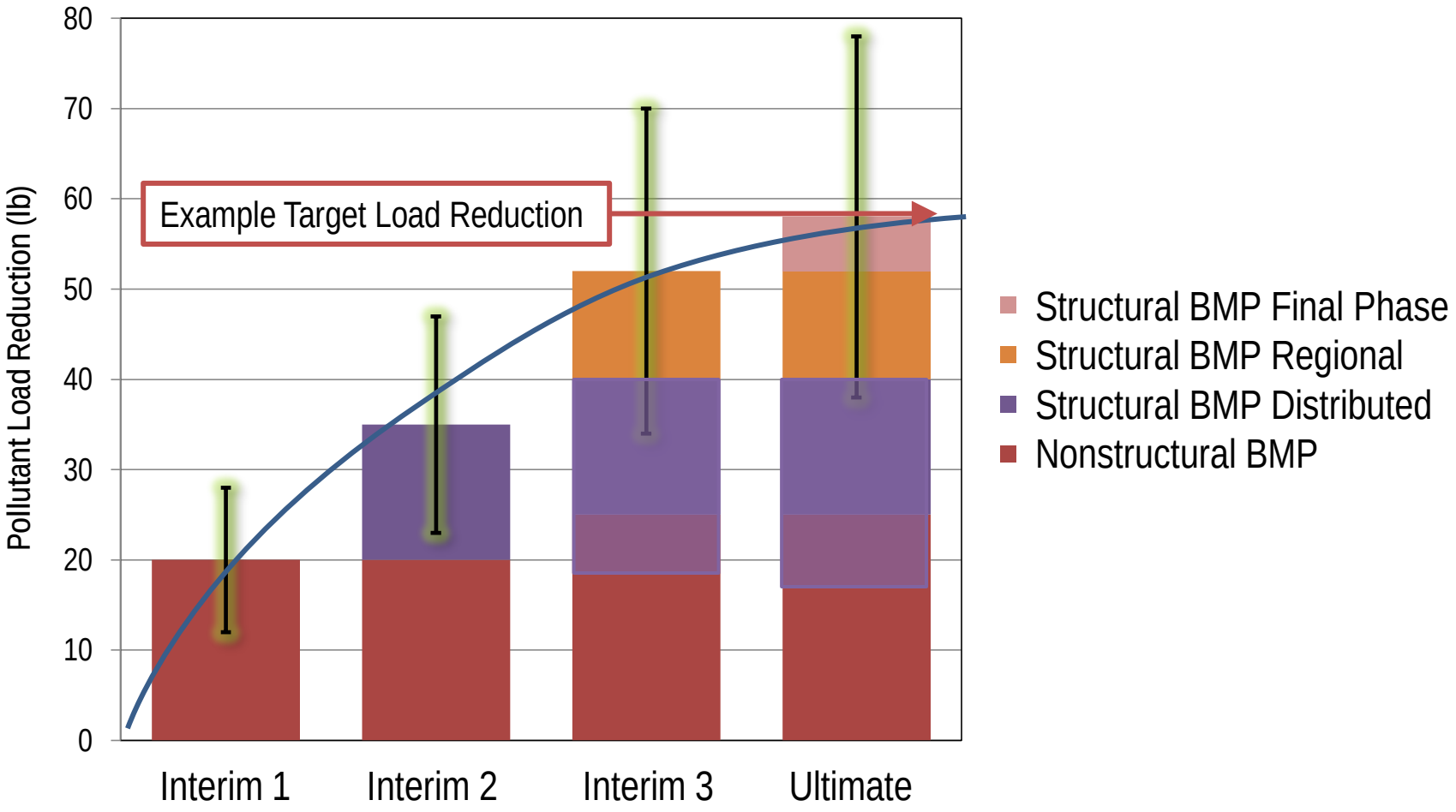


Figure 24. Dry weather flow area treated by proposed structural BMPs

SCHEMATIC DEMONSTRATION OF INTERIM COMPLIANCE



COSTS (PRELIMINARY PLANNING OPINIONS-SDR)

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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.

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

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)**

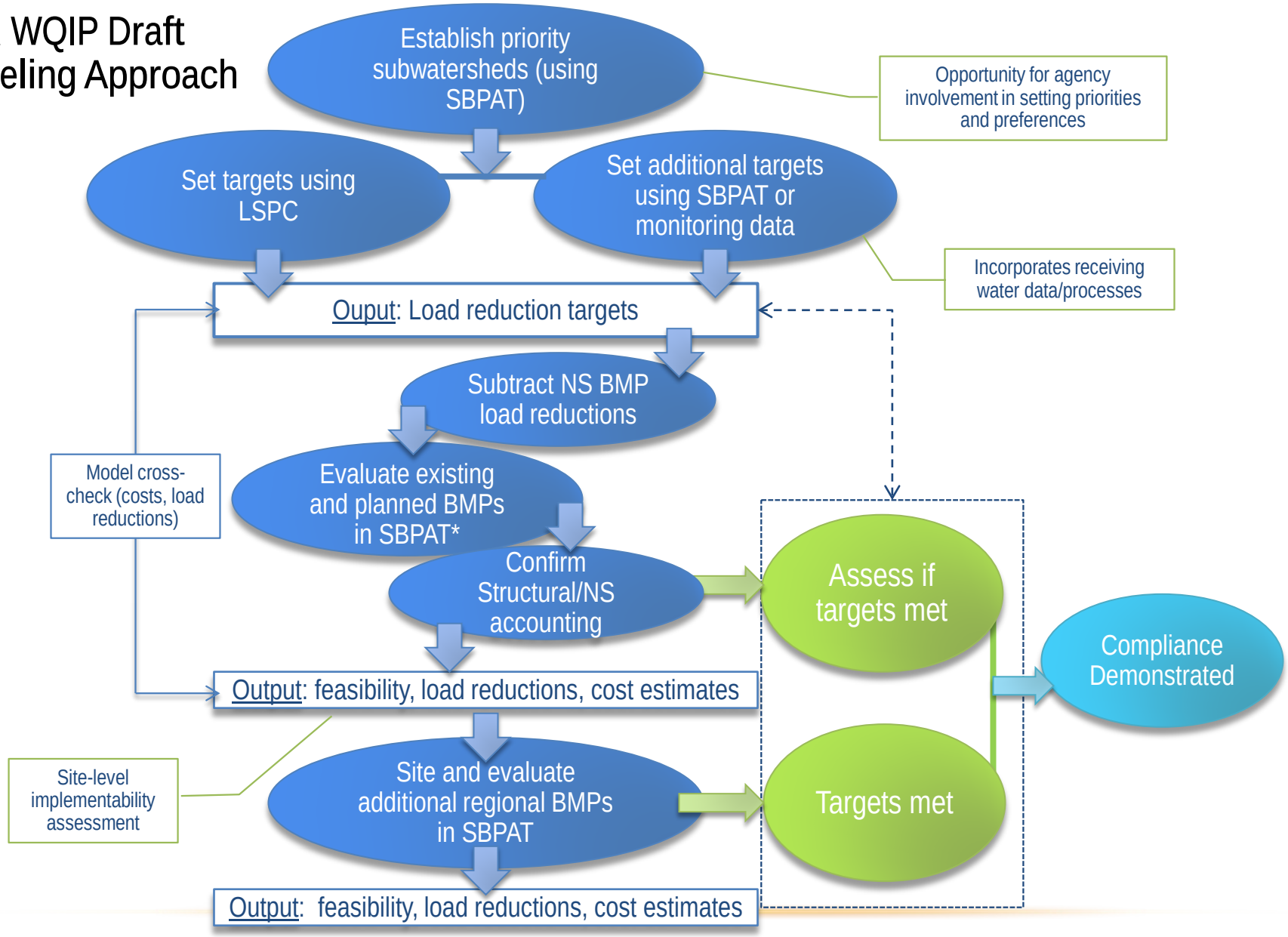
NEXT STEPS (WQIP MODELING)

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



THANK YOU!

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