Prepared for

Ventura Countywide Stormwater Quality Management Program

Ventura Countywide Municipal Stormwater Resource Plan

Ventura County, CA

Prepared by

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engineers | scientists | innovators

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Executive Summary

In response to the shift in stormwater management approaches in California, which now focus on watershed-based solutions that provide multiple benefits, the Water Quality, Supply, and Infrastructure Improvement Act (Proposition 1) was approved to provide a source of funding to agencies for implementation of these multi-benefit stormwater management projects. Prior to Proposition 1, the Water Code was amended, by the Stormwater Resource Planning Act (Senate Bill 985), to require that projects seeking grant funding from Bond acts approved after January 1, 2014 be included in a Stormwater Resource Plan (SWRP) in in order to be eligible for funding. This Ventura Countywide Municipal Stormwater Resource Plan (MSWRP) was developed for the Ventura Countywide Stormwater Quality Management Program[1] to fulfill the SWRP requirements outlined in the water code in order to receive eligibility for future funding of multi-benefit stormwater and dry weather projects. This MSWRP also identifies projects for the program that are expected to contribute towards meeting Municipal Separate Storm Sewer System (MS4) Permit and Total Maximum Daily Load (TMDL) requirements, in addition to augmenting local water supplies.

Table ES-1 shows the requirements and recommendations listed in the SWRP Guidelines, the corresponding Water Code Section(s) if applicable, and the section(s) within the MSWRP that address each requirement.

Table ES-1. Water Code Requirements

Guideline Elements/ Water Code Section(s)	Requirement/ Recommendation	MSWRP Section Reference
Watershed Identification	Identify watershed and subwatershed(s) based on USGS Hydrologic Unit designations	2.1
10565(c) 10562(b)(1) 10565(c)	Describe applicability of watersheds chosen, describe internal boundaries, identify water quality priorities (applicable TMDLs and 303(d) listed waterbodies), describe potable water suppliers and supply, provide map of natural or open space, identify existing natural processes being disrupted.	2.1 - 2.3

[1] Ventura County Municipal Separate Storm Sewer Systems (MS4) Permittees, which include the City of Camarillo, Ventura, Fillmore, Moorpark, Ojai, Oxnard, Port Hueneme, Santa Paula, Simi Valley, Thousand Oaks, County of Ventura, and Ventura County Watershed Protection District.

Guideline Elements/ Water Code Section(s)	Requirement/ Recommendation	MSWRP Section Reference
Water Quality Compliance 10562(d)(7) 10562(b)(5) 10562(b)(6)	Identify activities that contribute to the pollution of stormwater, dry weather runoff, or impairing beneficial uses and identify how the Plan is consistent with applicable TMDL Implementation Plans, National Pollutant Discharge Elimination System (NPDES) permits, and waste discharge permits.	2.2 - 2.3
Organization, Coordination, Collaboration 10565(a) 10562(b)(4)	Consult local agencies and nongovernmental organizations (NGOs) and provide community participation during Plan development. Describe existing Integrated Regional Water Management (IRWM) group and coordinate with additional agencies including nonprofits, water utilities, and other stakeholders. Identify decisions and coordination required for plan implementation.	3 and 5
	Describe existing planning documents and ordinances and how the Plan will be implemented within these established requirements and guidelines.	2.3 and 3
Quantitative Methods	Include an integrated metrics-based analysis demonstrating water quality, capture and use, water supply and flood management, environmental and community benefits.	4.5 - 4.6 (and Appendix C/D)
	Describe data collection and management.	4.3 - 4.5 (and Appendix C)
Identification and Prioritization of Projects 10562(d)(1) 10562(d)(2) 10562(d)(3) 10562(d)(4) 10562(d)(5) 10562(b)(8) 10562(b)(2)	Identify opportunities to augment local water supply, provide pollutant source control, reestablish natural water drainage, enhance habitat and open space, and use publicly owned lands.	4.4 – 4.5
	Use appropriate quantitative methods based on multiple benefits to prioritize projects (minimum of two multiple benefits per project)	4.6 (and Appendix D)
Implementation Strategy and Schedule 10562(d)(8)	Identify projects and programs, decision support tools and data necessary to ensure effective implementation of Plan.	5
	Identify funding strategy, schedule for implementation, and how implementation will be tracked.	

Guideline Elements/ Water Code Section(s)	Requirement/ Recommendation	MSWRP Section Reference
10562(d)(8) 10562(b)7	Submit the Plan to the applicable IRWM group for incorporation into the IRWM plan	5
Education, Outreach, Public Participation 10562(b)4	Provide mechanisms and milestones to promote community participation and public education during major technical/policy issues and project design and implementation discussions. Identify expected community audience, strategies to engage disadvantaged and climate vulnerable communities, and environmental injustice within the watershed. Include necessary public engagement schedule.	5

The MSWRP includes a summary of potential multi-benefit stormwater and dry weather projects that have been identified throughout the Ventura County and are in various planning level stages. This summary includes projects identified from other planning efforts (e.g., TMDL implementation plans, management plans, and capital improvement plans,) as well as new project opportunities specifically identified and conceptually planned during the MSWRP development. The MSWRP describes the process applied for identifying and conceptually planning these newly identified project opportunities, including screening of County-wide public parcels for best management practice (BMP) implementation feasibility and selecting the most effective BMP type and associated design parameters based on the Ventura County Technical Guidance Manual for Stormwater Quality Control Measures (Geosyntec Consultants and LWA, 2011). These conceptual projects were then modeled to determine their expected average annual water supply volume and pollutant load reduction benefits.

Based on modeling results and other information, these projects (MSWRP modeled projects), in addition to projects previously identified from other sources (identified projects), were prioritized based on their ability to provide multiple benefits and likelihood of successful implementation. Identified projects from other sources were grouped into two groups, with group 1 representing projects with concept designs and/or a preliminary benefit quantification (identified group 1) and group 2 containing projects that have not been developed into concept-level designs and modeled (identified group 2). The process of identifying all projects, quantifying their benefits, and prioritizing each project is illustrated in Figure ES-1.

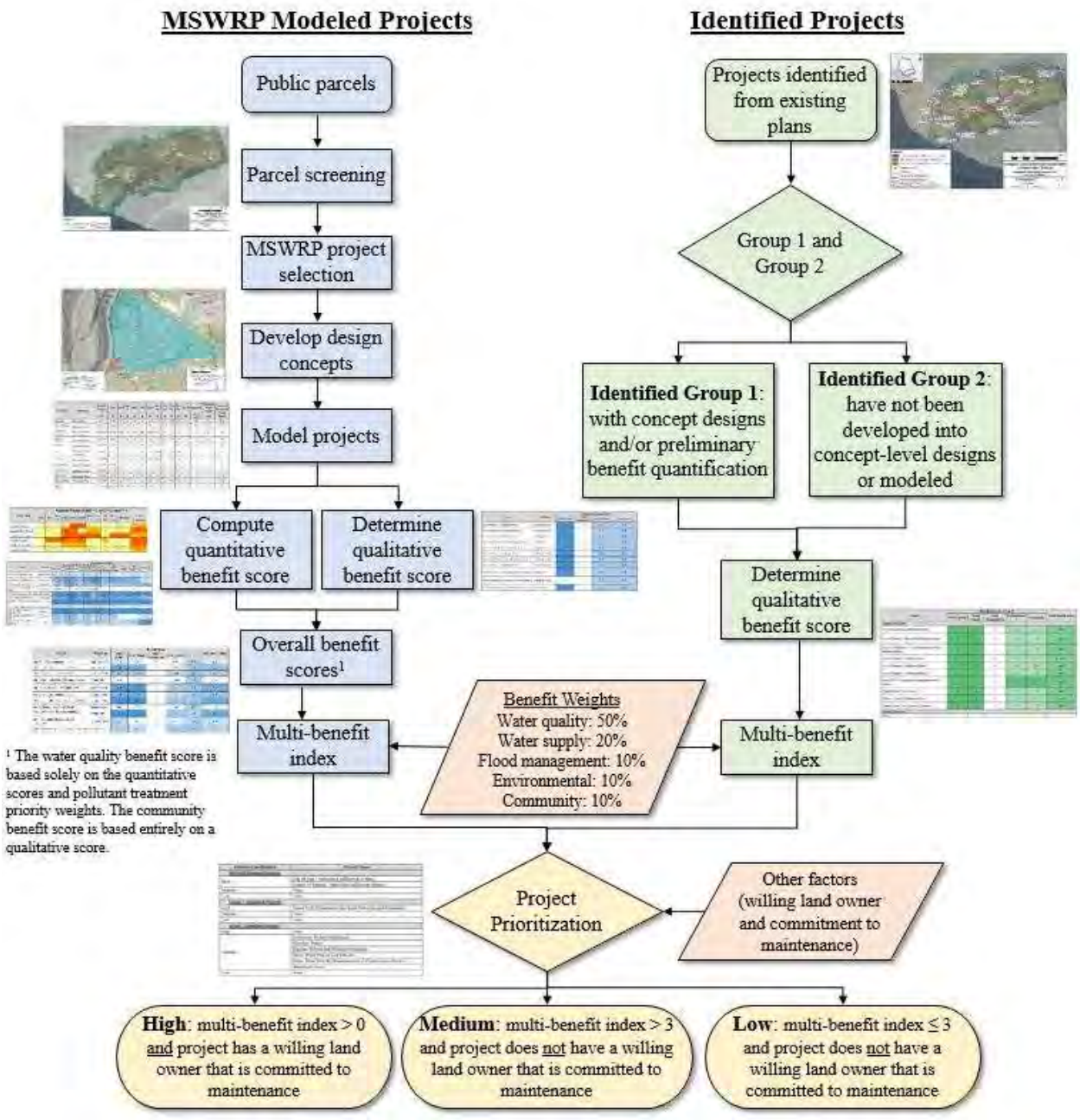


Figure ES-1. Project Development and Prioritization Process

All projects presented in this MSWRP are summarized in Table ES-2 through

Table ES-6.

Table ES-2. Project Prioritization Santa Clara River Watershed

Project ID	Project Name	Proposed By	Project Description	Priority Classification
MSWRP Modeled Projects				
M-SCR01	City of Fillmore – Infiltration Basin	City of Fillmore	Infiltration Basin (Drainage area = 53 acres, footprint = 32,000 sq. ft., drawdown time = 48 hrs, infiltration rate = 0.5 in/hr, depth = 2 ft)	High
M-SCR02	City of Santa Paula - Infiltration Basin	City of Santa Paula	Infiltration Basin (Drainage area = 440 acres, footprint = 33,000 sq. ft., drawdown time = 48 hrs, infiltration rate = 1.0 in/hr, depth = 4 ft)	
M-SCR03	County of Ventura – Piru Stormwater Capture for Groundwater Recharge	County of Ventura	Infiltration Basin (Drainage area = 123 acres, Footprint = 25 acres, drawdown time = 48 hrs, infiltration rate = 0.5 in/hr, depth = 4-6 ft)	
Group 1 Identified Projects				
SCR01	City of Santa Paula - Infiltration Basin	City of Santa Paula	Infiltration Basin (Drainage area = 433 acres, footprint = 170,000 sq. ft., drawdown time = 48 hrs, infiltration rate = 0.5 in/hr, depth = 2 ft)	High
SCR02	City of Ventura - Subsurface Infiltration Basin	City of Ventura	Subsurface infiltration basin (Drainage area = 660 acres, footprint = 90,000 sq. ft., infiltration rate = 0.5 in/hr, depth = 8 ft)	
SCR03	County of Ventura - County Maintenance Yard Infiltration Basin	County of Ventura	Infiltration Basin (Drainage area = 261 acres, footprint = 150,000 sq. ft., drawdown time = 48 hrs, infiltration rate = 1 in/hr, depth = 4 ft)	
SCR04	City of Oxnard - Infiltration Basin	City of Oxnard	Infiltration Basin (Drainage area = 66 acres, footprint = 85,000 sq. ft., infiltration rate = 0.5 in/hr, depth = 2 ft)	
SCR05	City of Fillmore - Infiltration Basin 1	City of Fillmore	Infiltration Basin (Drainage area = 494 acres, footprint = 160,000 sq.ft., drawdown time = 48 hrs, infiltration rate = 1 in/hr, depth = 4 ft)	

Project ID	Project Name	Proposed By	Project Description	Priority Classification
SCR06	City of Fillmore - Infiltration Basin 2	City of Fillmore	Infiltration Basin (Drainage area = 466 acres, footprint = 200,000 sq.ft., drawdown time = 48 hrs, infiltration rate = 1 in/hr, depth = 4 ft)	High
SCR07	Sierra Club - A stormwater management pilot project	Sierra Club	Multi-purpose project: groundwater recharge of select flows from the river in abandoned gravel pits; SCR parkway floodplain preservation; biological resource enhancement; and education/recreation/open space project	
SCR08	United Water - Ferro Basin	United Water District	Infiltration basin for stormwater capture and groundwater recharge	
SCR09	Caltrans - Saticoy Infiltration basin	County of Ventura	Infiltration basin	

Table ES-3. Project Prioritization Calleguas Creek Watershed

Project ID	Project Name	Proposed By	Project Description	Priority Classification
MSWRP Modeled Projects				
M-CC01	City of Camarillo – Infiltration Basin	City of Camarillo	Infiltration basin (Drainage area = 217 acres, footprint = 44,000 sq. ft., drawdown time = 48 hours, infiltration rate = 0.53 in/hr, depth = 2.1 ft)	High
M-CC02	City of Moorpark – Infiltration Basin	City of Moorpark	Infiltration Basin (Drainage area = 760 acres, Footprint = 83,000 sq. ft., drawdown time = 48 hrs, infiltration rate = 0.5 in/hr, depth = 2 ft)	
M-CC03	City of Simi Valley – Subsurface Storage Tank (rainwater harvesting)	City of Simi Valley	Subsurface Storage Tank (Drainage area = 1,860 acres, Footprint = 150,000 sq. ft., depth = 13 ft)	

Project ID	Project Name	Proposed By	Project Description	Priority Classification
Group 1 Identified Projects				
CC01	Calleguas Creek IP Project TO-1	City of Thousand Oaks	Capture and Reuse	High
CC02	Calleguas Creek IP Project TO-2	City of Thousand Oaks	Capture and Reuse	
CC03	Calleguas Creek IP Project UC-1	County of Ventura, City of Camarillo	Infiltration Basin	
CC04	Calleguas Creek IP Project UC-2	County of Ventura, City of Thousand Oaks	Infiltration Basin	
CC05	Calleguas Creek IP Project CM-1	City of Camarillo	Infiltration Basin	
CC06	Calleguas Creek IP Project CM-2	City of Camarillo	Capture and Reuse	
CC07	Calleguas Creek IP Project SV-1	City of Simi Valley	Capture and Reuse	
CC08	Calleguas Creek IP Project SV-2	City of Simi Valley	Infiltration Basin	
CC09	Calleguas Creek IP Project MP-1	City of Moorpark	Infiltration Basin	
CC10	Calleguas Creek IP Project MP-2	City of Moorpark	Infiltration Basin	
CC11	Calleguas Creek IP Project MP-3	City of Moorpark	Infiltration Basin	

Project ID	Project Name	Proposed By	Project Description	Priority Classification
CC16	Tierra Rejada Rd Improvements	City of Moorpark	Proposed landscape improvement along Tierra Rejada Rd, possibly installing several bioswales for stormwater infiltration	High
CC17	Old Town drainage	City of Camarillo	Permeable gutters to promote infiltration	
CC18	Cerro Vista Detention Basin	City of Camarillo	Retrofit the detention basin as an infiltration basin	
Group 2 Identified Projects				
CC12	Arroyo Simi Grade Stabilization	VCWPD	Invert stabilization to eliminate scour and degradation within the project reach. A preliminary study and design will be completed to properly site required stabilizers	High
CC13	Calleguas Creek Low Flow Channel	VCWPD	Cut low flow channel through Calleguas Creek	
CC14	Conejo Mountain Creek Detention Basins 2-5 at Dos Vientos	VCWPD	Rehabilitate existing debris and detention basins to meet original construction drawings per litigation settlement	
CC19	Watershed Management Strategy Study Projects	City of Thousand Oaks	Alternatives intended to convey the 100-year flood using various strategies including: channel conveyance, bridge replacement, culvert enlargement, storage (detention basin), or local drainage improvements	Medium
CC15	Gabbert Channel Restoration	VCWPD	Restoration of a 50-yr old concrete channel with a new concrete channel or natural channel with bank stabilization and detention	Low

Table ES-4. Project Prioritization Ventura River Watershed

Project ID	Project Name	Proposed By	Project Description	Priority Classification
MSWRP Modeled Projects				
M-VR01	City of Ojai – Subsurface Infiltration System	City of Ojai	Subsurface Infiltration System (Drainage area = 8.7 acres, Footprint = 3,400 sq. ft., infiltration rate = 0.5 in/hr, depth = 7.9 ft)	High
M-VR02	County of Ventura – Subsurface Infiltration System	County of Ventura	Subsurface Infiltration System (Drainage area = 871 acres, Footprint = 380,000 sq. ft., infiltration rate = 0.5 in/hr, depth = 7.9 ft)	
Group 1 Identified Projects				
VR01	Foster Park Infrastructure and Bank Protection and Restoration	N/A	Build groins, revegetate banks and prevent bank erosion to prevent critical infrastructure loss and to support the development of steelhead habitat	High
VR08	Ojai Unified School District Stormwater LID Project	Sierra Watershed Progressive, Ojai Unified School District	Retrofit impervious surfaces with alternatives (e.g. permeable pavement, bioswales, rainwater capture) that capture, treat, and infiltrate urban stormwater runoff	
VR09	The Thacher Creek Equestrian Instream Flow and Water Quality Project	Sierra Watershed Progressive, Thacher School	Rainwater capture and retrofit impervious surfaces with LID alternatives (e.g. bioswales and infiltration basins) that capture, treat, and infiltrate urban stormwater runoff in conjunction with enhancing baseflow in Thacher and San Antonio Creeks to support high quality habitat for the endangered California Steelhead Trout	

Project ID	Project Name	Proposed By	Project Description	Priority Classification
Group 2 Identified Projects				
VR10	Ventura Water San Jon/Prince Barranca Urban Stormwater/Flood Control Retrofit Pilot Project	N/A	Retrofit parking and recreation areas, construct detention basins, and upgrade storm drains in order to enhance infiltration, water conservation, stormwater reuse, and urban flood protection	High
VR02	Stormwater Retrofit Demonstrations (LID and Green Streets)	N/A	Retrofit impervious surfaces with alternatives (e.g. LID and green streets) that capture, treat, and infiltrate urban stormwater runoff	Medium
VR04	Riparian Habitat and Wetland Restoration	N/A	Restore riparian habitats and wetlands to promote native vegetation growth to benefit fish and wildlife, promote attenuation of flood flows, capture of sediments, treatment of runoff, infiltration and to deter algae growth	
VR06	Infiltration System Installations	N/A	Install or retrofit, at new and existing homes, buildings, landscapes and farms, systems for capturing and infiltrating stormwater	
VR03	Stormwater Parking Lot Retrofits	N/A	Retrofits parking lots and their landscapes to improve stormwater capture and infiltration	Low
VR05	Watershed Corps	N/A	Fund, through a job programs, the installation of multiple small-scale projects to retrofit urban and agriculture lands to enhance water conservation/capture/quality and flood management	
VR07	Overflow Ponds	N/A	Create overflow areas and ponds along storm channels to slow down flow and allow for infiltration	

Table ES-5. Project Prioritization Malibu Creek Watershed

Project ID	Project Name	Proposed By	Project Description	Priority Classification
MSWRP Modeled Project				
M-MC01	City of Thousand Oaks – Subsurface Storage Tank (rainwater harvesting)	City of Thousand Oaks	Subsurface Storage Tank (Drainage area = 1,030 acres, Footprint = 68,000 sq. ft., depth = 9 ft)	High
Group 2 Identified Projects				
MC01	Distributed BMPs	County of Ventura	Various distributed BMP opportunities targeted to single-family residential and commercial land uses, includes distributed infiltration gardens, green streets, and outfall infiltration	Medium
MC02	Low flow diversion to sewer	County of Ventura	Diversion of dry weather flows to the sewer system for treatment (based on locations identified in the dry weather MS4 special study)	Low

Table ES-6. Project Prioritization Coastal Watersheds

Project ID	Project Name	Proposed By	Project Description	Priority Classification
MSWRP Modeled Projects				
M-OC01	City of Oxnard – Infiltration Basin	City of Oxnard	Infiltration Basin (Drainage area = 72 acres, Footprint = 100,000 sq. ft., depth = 2 ft)	High
M-OC02	City of Port Hueneme – Infiltration Basin	City of Port Hueneme	Infiltration Basin (Drainage area = 197 acres, Footprint = 143,000 sq. ft., drawdown time = 48 hrs, infiltration rate = 0.5 in/hr, depth = 2 ft)	
M-VC01	City of Ventura – Infiltration Trench	City of Ventura	Infiltration Trench (Drainage area = 488 acres, Footprint = 12,000 sq. ft., drawdown time = 48 hrs, infiltration rate = 0.5 in/hr, gravel layer depth = 5.6 ft, sand layer depth = 0.5 ft)	
Group 1 Identified Projects				
CHB01	Development Retrofit Area	City of Oxnard	Bioretention/Subsurface flow wetland or equivalent (Drainage area = 28.1 acres)	High
CHB02	Harbor Park Redevelopment	City of Oxnard	Bioretention/Subsurface flow wetland or equivalent (Drainage area = 23.6 acres)	

1 Introduction

1.1 Purpose

In recent years, stormwater management approaches in California have shifted from providing limited treatment and off-site conveyance to promoting watershed-based solutions that manage stormwater and dry weather runoff onsite and seek to implement treatment through projects that replicate natural hydrology and watershed processes, as well as provide multiple benefits (e.g., water supply, water quality, flood control, community, and environmental benefits). To provide a funding source for planning and implementation of these stormwater projects, the Water Quality, Supply, and Infrastructure Improvement Act (Proposition 1) was approved on November 4, 2014 to provide $200 million for matching grants to public agencies (among other stakeholders) to implement multi-benefit stormwater management projects in California. Prior to the passage of Proposition 1, Senate Bill 985, the Stormwater Resource Planning Act, was adopted to amend the Water Code to require the development of a Stormwater Resource Plan (SWRP) in order to receive grants for stormwater and dry weather capture projects from a bond act approved after January 1, 2014.

The Ventura County Municipal Separate Storm Sewer Systems (MS4) permit[2] Permittees[3] have developed this document to serve as the Ventura Countywide Municipal Stormwater Resource Plan (MSWRP). This MSWRP includes all required SWRP components per the Water Code and will be submitted to the Integrated Regional Water Management (IRWM) group, and therefore satisfies the Proposition 1 Stormwater Grants Program funding eligibility requirements. In addition, this MSWRP identifies projects that will help the Permittees in complying with the upcoming revision to the Ventura Countywide MS4 Permit and its Watershed Management Program and Total Maximum Daily Loads (TMDL) requirements. Ventura County, to a large degree, relies on local water supplies, including groundwater. To the extent that this MSWRP identifies projects that recharge groundwater and/or capture and reuse of stormwater to supplement water supply, this will also benefit local water supply agencies.

[2] Order R4-2010-0108, National Pollutant Discharge Elimination System (NPDES) Permit No. CAS004002: Waste Discharge Requirements for Storm Water (Wet Weather) and Non-Storm Water (Dry Weather) Discharges from the Municipal Separate Storm Sewer Systems within the Ventura County Watershed Protection District, County of Ventura, and the Incorporated Cities Therein (California Regional Water Quality Control Board Los Angeles Region (LARWQCB), 2010)

[3] City of Camarillo, Ventura, Fillmore, Moorpark, Ojai, Oxnard, Port Hueneme, Santa Paula, Simi Valley, Thousand Oaks, County of Ventura, and Ventura County Watershed Protection District

1.2 Organization

This MSWRP contains four main sections outlined below. References to relevant Water Code requirements are included throughout to illustrate compliance.

- Section 2 - Background Information: identifies the MSWRP boundary, watersheds within the MSWRP region, and water quality issues within the major watersheds, including pollutants identified on the 303(d) list of impaired water bodies or with relevant TMDLs. This section also includes discussion of the MSWRP in relation to TMDL Implementation Plans (IPs) and the MS4 Permit.
- Section 3 - Organization, Coordination, and Collaboration: describes the community engagement process that occurred during plan development, including identification of audiences, an overview of the existing integrated regional water management group, and the mechanisms used to engage the public in plan development.
- Section 4 - Identification and Prioritization of MSWRP Projects: includes a list of previously identified projects, the process of site selection and development of MSWRP projects, conceptual designs for each MSWRP project, the methodology and results for quantification of water supply and water quality benefits of proposed projects, and prioritization of both MSWRP and previously identified projects.
- Section 5 - Implementation Strategy and Schedule: outlines programs to assist in implementation of strategies identified in this MSWRP, including community outreach during project development. This section also discusses how current monitoring required by the Ventura County MS4 Permit will be utilized as part of the adaptive management process, in addition to a general schedule of SWRP milestones.

2 Background Information

2.1 Watershed Identification and MSWRP Boundary

The Watersheds Coalition of Ventura County (WCVC), which was formed in 2006 after the Ventura County Integrated Regional Water Management Planning Group and the Calleguas Creek Steering Committee merged, serves as the Regional Water Management Group for entities in Ventura County. The WCVC IRWM region encompasses the majority of Ventura County, with the exception of upper portion of the Malibu Creek watershed located within Ventura County (as it is included in the Greater Los Angeles County IRWM region – North Santa Monica Bay subregion). The MSWRP boundary includes the WCVC IRWM region as well as the upper portion of the Malibu Creek watershed, where the City of Thousand Oaks, County of Ventura, and VCWPD own and/or operate MS4s. Therefore, the MSWRP region is defined by the Ventura County boundary.

Watersheds within the MSWRP boundary include the Ventura River watershed, Santa Clara River watershed, Calleguas Creek watershed, Cuyama River watershed, miscellaneous Ventura Coastal subwatersheds (Santa Monica Bay, Oxnard, North Ventura, and Rincon Creek), and that portion of Malibu Creek watershed within Ventura County. A map of the MSWRP boundary, Ventura County IRWM Region, and the associated watersheds is shown in Figure 1. The following includes a brief description of the watersheds within the MSWRP boundary:

- **The Calleguas Creek watershed** drains approximately 343 square miles in southern Ventura County, flowing from the Santa Susana Pass in the east to Mugu Lagoon in the southwest. The major hydrologic features include Conejo Creek, Arroyo Santa Rosa, Arroyo Simi, Arroyo Las Posas, Calleguas Creek, Revolon Slough, and Mugu Lagoon. The main surface water system drains from the mountains in the northeast part of the watershed toward the southwest where it flows through the Oxnard Plain before emptying into the Pacific Ocean through Mugu Lagoon. The east-west flowing watershed is approximately thirty miles long and fourteen miles wide. The Santa Susana Mountains, South Mountain, and Oak Ridge form the northern boundary of the watershed. The southern boundary is formed by the Simi Hills and Santa Monica Mountains. Municipalities in the Calleguas Creek watershed include Simi Valley, Moorpark, Thousand Oaks, Camarillo, Oxnard, VCWPD, and areas of Unincorporated Ventura County.

  Land uses include agriculture, high and low density residential, commercial, industrial, open space, and a Naval Air Base located around Mugu Lagoon. Approximately 25 percent of the land is urban or urban landscape (cemeteries, golf courses, and other urban lawn areas) and about 25 percent is used for agriculture. Agricultural areas are predominately located in the middle and lower portions of the watershed with the major urban areas located in the upper watershed. Land uses dedicated to human activity account for

approximately 51 percent of the watershed. Approximately one half of the watershed is undeveloped open space.

- **The Santa Clara River watershed** encompasses approximately 1,630 square miles; approximately 40 percent of the watershed is located within Los Angeles County. The Santa Clara River is the largest river in Southern California that remains in a mostly natural state. The headwater of the river starts at Pacifico Mountain in the San Gabriel Mountains and flows west (passing through Tie Canyon, Aliso Canyon, Soledad Canyon, the Santa Clarita Valley, the Santa Clara River Valley, and the Oxnard Plain), discharging into the Pacific Ocean close to the Ventura Harbor. The major tributaries are Castaic, San Francisquito, Sespe, Piru, and Santa Paula Creeks.

  The Santa Clara River watershed is the largest watershed in Ventura County and also has the lowest proportion of developed areas. Approximately 90 percent of the watershed is characterized by various mountain ranges, with a significant portion located within the Angeles National Forest and Los Padres National Forest. The remaining 10 percent of the watershed is characterized by fairly flat terrains of the Oxnard Plain, Santa Clarita Valley, Castaic Valley, and the Santa Clara River Valley. Urban areas within the watershed in Ventura County include portions of the Cities of Ventura and Oxnard and the cities of Santa Paula, Fillmore, and Ventura County Unincorporated areas of Piru and Saticoy.

- **The Ventura River watershed** has a drainage area of approximately 228 square miles in western Ventura County. The river runs north-south for 33 miles and its major tributaries include Matilija Creek, San Antonio Creek, and Canada Larga. Its headwaters are in the 6,000 foot peaks of the coastal Transverse Range; the river eventually drains to a small coastal estuary. Residents within the Ventura River watershed rely completely upon its water supplies as no water is currently imported into the watershed for use. The watershed is largely comprised of undeveloped open space, with 57 percent of the total watershed's area in protected status, and much of the northern half of the watershed is within the Los Padres National Forest. Urban areas in the watershed include parts of the Cities of Ventura, Ojai and the communities of Meiners Oaks, Mira Monte, Oak View, Live Oak Acres, Casitas Springs, and Matilija Canyon. Agriculture is the dominant land use in the developed areas of the watershed.

- **The Malibu Creek watershed** encompasses approximately 110 square miles; however, only 39 percent (approximately 43 square miles) of the watershed is located within Ventura County. Although the entire watershed is included in the Greater Los Angeles IRWM Region, the portion of the watershed within Ventura County is included in the MSWRP boundary. Major tributaries include Potrero Valley Creek, Triunfo Creek, Lindero Creek, Medea Creek, Las Virgenes Creek, Cold Creek, and Malibu Creek, which drain the Santa Monica Mountains. Malibu Creek flows to the Santa Monica Bay through Malibu Lagoon. The major urban areas of the watershed within Ventura County include a portion of the

City of Thousand Oaks and Ventura County Unincorporated areas of Sherwood and Oak Park.

- **The Cuyama River watershed** includes approximately 282 square miles, the majority of which (85 percent) is located within Ventura County. The Cuyama River begins in the San Emigdio Mountains within the Los Padres National Forest and flows northwest into Santa Barbara County. The drainage area within Ventura County is characterized by mountainous open space.
- **The coastal watersheds** within Ventura County include the Rincon Coastal, Ventura Coastal, Oxnard Coastal, and Santa Monica Coastal watersheds.
    - The Rincon Coastal watershed encompasses approximately 37 square miles and 90 percent of the watershed is located within Ventura County. The major waterbody within the watershed is Rincon Creek, which drains into the Pacific Ocean at Rincon Beach Park. Numerous other waterbodies drain the coastal areas of northwestern Ventura County and discharge into the Pacific Ocean.
    - The Ventura Coastal watershed includes approximately 23 square miles. The upper portion of the watershed is characterized by mountainous open space and the City of Ventura encompasses the majority of the lower portion of the watershed.
    - The Oxnard Coastal watershed covers approximately 33 square miles. The City of Port Hueneme is located within the Oxnard Coastal watershed along with the majority of the City of Oxnard. The watershed is characterized by predominately urban land uses, followed by agricultural land.
    - The Santa Monica Coastal watershed includes approximately 46 square miles and 85 percent of the watershed is located within Ventura County. Major tributaries include Big Sycamore Canyon, Little Sycamore Canyon, and Arroyo Sequit (Los Angeles County). The majority of the watershed is characterized by mountainous open space.


N
Cuyama River
Santa Clara River
Ventura River
Rincon Coastal
Calleguas Creek
Ventura Coastal
Oxnard Coastal
Malibu Creek
Santa Monica Coastal
0 7 14 Miles
Legend
MSWRP Region and Ventura County boundary
IRWMP Region boundary
City and unincorporated urban boundary
Watershed
Ventura Countywide MSWRP Region Watersheds and Subwatersheds
Countywide Municipal Stormwater Resource Plan
Ventura County, CA
Geosyntec consultants
Santa Barbara
July 2016
Figure 1

2.2 Water Quality Priorities

The MS4 Permit requires establishment of a monitoring program to assess compliance with TMDL targets and Water Quality Objectives (WQOs) that have been adopted by the Regional Water Quality Control Board and approved by the United States Environmental Protection Agency (USEPA). TMDLs are numerical calculations of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, including an allocation of that amount to the pollutant's sources. TMDL targets and WQO standards are established to protect all related beneficial uses. Table 1 lists the pollutant categories for which there are approved TMDLs for each MSWRP watershed.

Table 1. TMDL Listed Pollutants by Watershed and Pollutant Category

Pollutant Category[1]	Watershed[2]					
	Calleguas Creek	Santa Clara River	Ventura River	Malibu Creek	Oxnard Coastal	Santa Monica Coastal
Bacteria		X		X	X	X[3]
Metals	X					
Nutrients	X	X	X	X		
Salts	X	X				
Toxicity	X					
Toxics	X				X	
Trash	X		X	X		X[4]

[1]Additional information concerning TMDL and 303(d) pollutant waterbody combinations is included in Appendix A.

[2]There are no approved TMDLs for the Cuyama, Rincon Coastal, and Ventura Coastal watersheds.

[3]The County is a responsible party under the Santa Monica Bay Beaches Bacteria TMDL for compliance monitoring sites at beaches at the mouth of Malibu Creek, however these responsibilities are being addressed through the County's activities under the Malibu Creek Bacteria TMDL.

[4]Ventura County is also included in the Santa Monica Bay marine debris TMDL although they have obtained an exemption.

Water quality concerns within the MSWRP boundary vary by watershed. Water quality concerns noted in the WCVC IRWM Plan (IRWMP) (WCVC, 2014) for each major watershed include:

- **Calleguas Creek:** In the Calleguas Creek watershed, urban development and agriculture have contributed to degrading water resources, flooding, and sedimentation issues. The Calleguas Creek Watershed Management Plan (CCWMP) (Calleguas Creek Watershed WMP Steering Committee, 2004), completed in 2004, identified applicable TMDLs (for metals, salts, toxicity, bacteria, trash, sediment, and pesticides) and groundwater water quality (salts, iron, and manganese) as the main water quality concerns.

- **Santa Clara River:** In the Santa Clara River watershed, seawater intrusion, agricultural runoff, agricultural and urban erosion, waste water treatment plant pollution (nitrogen and chloride), impacts from remaining septic systems (nitrates and salts), and compliance with permits and basin plan objectives have been identified as the main water quality concerns.
- **Ventura River:** In the Ventura River watershed, water quality is considered good, although urban runoff, the Ojai Valley Wastewater Treatment Plant, septic systems in the Ojai Valley, construction, agriculture, grazing, air deposition, and recreation contribute as nonpoint sources of pollution. The Ventura River watershed has the highest annual rainfall and intensities of all watersheds in Ventura County, which, combined with steep slopes, results in high contributions of sediment to water bodies. Agencies and water districts in the Ventura River watershed identified pollution prevention, stormwater/urban runoff quality and management, and septic system pollution as the main water quality concerns within the watershed.
- **Malibu Creek:** The Malibu Creek watershed in Ventura County is predominately undeveloped. Residential and commercial development (through urban runoff, septics, and the effects of private lakes), along with agricultural and equestrian/grazing land uses, has resulted in degradation of water quality. Development-related water quality degradation, as well as the established bacteria, nutrient, trash, and benthic TMDLs, have been identified as the main water quality concerns within the Malibu Creek watershed.

2.3 Water Quality Compliance

Several TMDL Implementation Plans (IPs) have been developed that identify projects with the potential to comply with the waste load allocations (WLAs) outlined in these TMDLs. By identifying stormwater and dry weather management projects, this MSWRP will assist with TMDL implementation and MS4 Permit compliance.

2.3.1 Ventura County TMDLs and TMDL IPs

A brief overview for each of the existing TMDL IPs in Ventura County is provided below:

- Draft Indicator Bacteria Total Maximum Daily Load Implementation Plan for the Lower Santa Clara River Watershed (County of Ventura, 2015b): This TMDL IP addresses the TMDL requirements for indicator bacteria in the Santa Clara River Estuary and Reach 3 adopted by the Los Angeles Regional Water Quality Control Board (LARWQCB) (Resolution No. R10-006) in March 2012. The participating agencies include the County of Ventura and the cities of Ventura, Santa Paula, Fillmore, and Oxnard. The Bacteria TMDL was intended to protect human health for recreation activities by reducing bacteria

discharged to the Santa Clara River. The TMDL IP outlines the activities proposed to achieve dry and wet weather MS4 WLAs for bacteria.

- Total Maximum Daily Load for Algae, Eutrophic Conditions, and Nutrients in the Ventura River and its Tributaries Draft Implementation Plan (County of Ventura, 2015c): This TMDL IP was developed to address the TMDL for Algae, Eutrophic Conditions, and Nutrients in the Ventura River, which was adopted by the LARWQB (Resolution No. R12-011). The participating agencies include the County of Ventura, Ventura County Watershed Protection District (VCWPD), Caltrans, and the cities of Ojai and Ventura. Dry and wet weather WLAs were set for total nitrogen, total phosphorus, and nitrate+nitrite as nitrogen. The TMDL IP contains separate strategies for dry weather and wet weather WLAs, although available monitoring data suggested that wet weather WLAs have already been met. The TMDL IP identifies an adaptive management approach that prioritizes implementation of dry weather best management practices (BMPs), in order to meet dry weather WLAs.
- Calleguas Creek Watershed Implementation Plan (Phase I) (County of Ventura, 2015a): This document outlines the first phase of IP development. The stakeholders implementing TMDLs in the Calleguas Creek Watershed have worked collaboratively to implement effective TMDLs since 2009. During the beginning of the TMDL implementation program, stakeholders focused on collecting information to guide implementation and evaluate assumptions made during TMDL development while implementing baseline requirements in applicable permits and/or waivers. The majority of the special studies identified in applicable TMDLs have been completed and almost six years of TMDL monitoring data are available for analysis. It has been determined that some constituents will not meet the TMDL targets and allocations without implementing further actions. Additionally, while the majority of the 303(d) listings in the watershed have been addressed by TMDLs, there are remaining listings that will need to be addressed. Therefore, the stakeholders initiated development of an IP to identify the additional actions necessary to meet the remaining TMDL requirements and 303(d) listings.
- Draft Malibu Creek Bacteria and Nutrient Total Maximum Daily Load Implementation Plan Addendum for Unincorporated Ventura (County of Ventura, 2011): This TMDL IP outlines an approach to comply with the Malibu Creek Watershed Bacteria TMDL (Resolution No. 2004-019R adopted by the LARWQCB) and Nutrient TMDL (developed by the USEPA) for the portion of the watershed within Ventura County. The plan was developed for the County of Ventura and VCWPD and includes both structural and nonstructural BMPs prioritized based on of the relative bacteria and nutrient loadings for areas in the Upper Lindero and Upper Medea subwatersheds.
- Harbor Beaches of Ventura County (Kiddie Beach and Hobie Beach) Wet Weather Bacteria TMDL IP for Unincorporated Ventura County (VCWPD, 2010): This TMDL IP

outlines the County of Ventura's approach for complying with the Harbor Beaches Bacteria TMDL, which was adopted by the LARWQCB (Resolution No. R2007-017). Both institutional and structural BMPs were identified to aid in compliance with wet weather bacteria WLAs.

- Harbor Beaches of Ventura County (Kiddie Beach and Hobie Beach) Bacteria TMDL Workplan for Dry Weather Implementation Measures (City of Oxnard, 2012): This workplan was developed in response to the Harbor Beaches Bacteria TMDL. The plan includes implementation measures for the City of Oxnard in order to address the allowable number of dry weather exceedances. Implementation strategies are categorized to address point and non-point sources that are potentially impacting the beach water quality.
- Harbor Beaches Dry Weather Bacteria TMDL Implementation Plan for Unincorporated Ventura County (VCWPD, 2009): This TMDL IP was developed for the Harbor Beaches of Ventura County to outline an approach to meet dry weather bacteria TMDL requirements. The implementation strategy includes watershed management/planning administration and selection of corrective actions, which include source controls, pilot studies, special studies, and structural controls.

The existing TMDL IPs address many of the requirements included in the Water Code and the SWRP Guidelines. Many IPs include TMDL pollutant quantification and BMP prioritization based on cost effectiveness, feasibility, MS4 Permittee preferences, and other considerations. Several IPs may have included outreach to stakeholders and watershed groups. However, some of the TMDL IPs do not address the following criteria and are therefore not considered functionally equivalent SWRP plans:

- Community participation was provided in plan development and implementation (Water Code 10562(b)(4)
- Plan uses quantitative methods for prioritization of projects, using a metrics-based evaluation and analysis of multiple benefits (Water Code 10562(b)(2))

If the TMDL IPs are updated to address community participation and comment on the proposed projects, as well as to incorporate a quantitative prioritization of projects, they could be considered a functionally equivalent SWRP. Many of the projects identified in the TMDL IPs have also been included in this MSWRP to provide funding eligibility for these projects.

2.3.2 Ventura County MS4 Permit

The MS4 Permit includes provisions to implement the TMDLs and other provisions to protect receiving waters throughout Ventura County. This MSWRP will assist in meeting applicable waste discharge requirements included in the MS4 Permit. A summary of these requirements organized

by section of the MS4 Permit and how the MSWRP will contribute towards meeting them is provided below:

- Section F – Implementation: proposed MSWRP projects will improve water quality of stormwater discharges to receiving waters and aid in compliance with established water quality standards. Specific items in Section F that the MSWRP addresses include:
    - Item F.2: ensure that discharges from the MS4 comply with water quality standards, which includes protection of the beneficial uses;
    - Item F.3: implementation of measures are "reasonably expected to reduce the discharge of pollutants conveyed in stormwater discharges into receiving waters, and to meet the TMDL WLAs for discharges from MS4s that have been adopted by the Regional Water Board;" and
    - Item F.5: Permittees should implement measures to reduce pollutants which contribute to water quality impairments, even if TMDLs have not been developed, in order to avoid the need for a WLA or TMDL in the future.
- Part 2 - Receiving Water Limitations: MSWRP projects will contribute to reducing or eliminating MS4 discharges that can cause a water quality violation or condition of nuisance by implementing measures that will reduce pollutants in stormwater discharges.
- Part 3 - Stormwater Quality Management Program Implementation: projects identified in this MSWRP are considered programs and control measures that will reduce the discharge of pollutants in stormwater and aid in compliance with TMDL WLAs.
- Part 4 - Special Provisions: this MSWRP will contribute to the timely, comprehensive, cost-effective stormwater pollution control program aimed at reducing the discharge of pollutants in stormwater. The MSWRP also contributes to enhancement of the Public Information and Participation Program PIPP by engaging the community in project development.
- Part 5 - Total Maximum Daily Load Provisions: the proposed MSWRP projects will aid MS4 Permittees in achieving compliance with WLAs and other TMDL requirements.

3 Organization, Coordination, and Collaboration

The California Water Code Section 10562(b)(4) requires that "a stormwater resource plan shall provide for community participation in plan development and implementation" and Section 10565(a) requires that local agencies and nongovernmental organizations be consulted in the SWRP development. This section of the MSWRP describes the community engagement process that occurred during plan development including identification of audiences, a description of the existing integrated regional water management group, and the mechanisms and processes used to engage the public in plan development. Community involvement has been an integral part of the development of the MSWRP and was used to support the process of evaluating and prioritizing the projects under consideration and development of other plan elements.

Surrounded by abundant open space, the citizens of Ventura County have long valued protection of their local, natural environment. Ventura County has a long history of collaboration amongst the entities, organizations, agencies and communities active in protecting its precious open space, including the quality of its local waters. These waters provide beneficial uses including recreational opportunities, natural habitat for plants and animals, and a critical water supply for local industries as well as drinking water for many communities.

3.1 Integrated Regional Water Management Group Overview

Local groups diverse in membership but with a common interest in water quality protection and preservation are many in number and have been meeting and working together in Ventura County since the 1970's. In early 2002, a group of 27 local water related agencies came together to pursue the integrated management of water resources in the region, and in 2006 this group became the WCVC. Coalesced under WCVC were the existing planning groups for the County's three major watersheds, the Calleguas Creek, Ventura River and Santa Clara River watersheds. Each watershed group would continue to operate under its existing governance structure, but the watersheds would coordinate through the WCVC as a whole. The stakeholders active in these groups represent the diverse range of interests in water supply and protection in the County and are listed below in Table 2. The WCVC wrote an IRWMP in 2006 (updated in 2014) which outlines the breadth of collaboration amongst the diverse partnerships and communities represented in the WCVC. The IRWMP was written in order to integrate the planning and implementation efforts related to regional improvements in the reliability of water supply, water recycling and conservation, access and recreation, flood control and habitat and environmental resource protection. This SWRP will be integrated into the IRWMP upon its completion.

3.2 Identification of Audiences

The members of the WCVC represent a huge cross section of the citizens of the County and thus were identified as suitable audiences for input about the MSWRP development. Table 2 lists the stakeholders of the WCVC.

Table 2. WCVC Stakeholders

Stakeholder Type	Stakeholder
City	City of Camarillo
	City of Fillmore
	City of Moorpark
	City of Ojai
	City of Oxnard
	City of Santa Paula
	City of Port Hueneme
	City of Simi Valley
	City of Thousand Oaks
	City of Ventura (San Buenaventura)
Wholesale Water Agency	Calleguas Municipal Water District
	Casitas Municipal Water District
	United Water Conservation District
Major Retailer Water Agency	Camrosa Water District
	Meiners Oaks County Water District
	Ventura River County Water District
	Pleasant Valley Mutual Water Company
	Ventura County Waterworks District #1 - Moorpark
	Ventura County Waterworks District #8 – Simi Valley
	Golden State Water Company
	Fillmore Irrigation Company
	Channel Islands Beach Community Services District
County Agency	Ventura County Public Works Agency
	Ventura County Executive Office
	Ventura County Resource Management Agency
	Ventura County Watershed Protection District
	Ventura County Board of Supervisors
	Ventura County Agricultural Commissioner
NGOs/Environmental Stewardship Organizations	Friends of the Santa Clara River
	Matilija Coalition
	Ventura County Resource Conservation District

Stakeholder Type	Stakeholder
	California Wildlife Conservation Board
	California Native Plant Society
	Ojai Valley Land Conservancy
	Ventura Hillsides Conservancy
	The Nature Conservancy
	Wetlands Recovery Project
	Trust for Public Land
	Surfrider Foundation
	Ventura Coastkeeper
	Santa Barbara Channelkeeper
	Santa Monica Mountains Conservancy
	Sierra Club – Ventura Chapter
State, Federal, and Regional Agencies and Universities	Regional Water Quality Control Board – Los Angeles Region
	California Coastal Commission
	California Coastal Conservancy
	U.C. Cooperative Extension – Farm Advisor
	University of California – Santa Barbara
	California State University – Channel Islands
	California Department of Fish and Wildlife
	California Department of Water Resources
	Southern California Assoc. of Governments
	California Department of Parks and Recreation
	U.S. Forest Service –Los Padres National Forest
	Natural Resources Conservation Service
	U.S. Army Corps of Engineers
	U.S. Environmental Protection Agency
	U.S. Bureau of Reclamation
	U.S. Fish and Wildlife Service
	Naval Base Ventura County
Wastewater Agencies	Ojai Valley Sanitary District
	Camarillo Sanitary District
	Saticoy Sanitary District
	Ventura Regional Sanitation District
Groundwater Basin Management Authorities	Fox Canyon Groundwater Management Agency
	Ojai Basin Groundwater Management Agency –
	Santa Paula Basin Pumpers Association
	City of Fillmore/United Water Conservation District

Stakeholder Type	Stakeholder
Community Organizations and Recreational Interests	Association of Water Agencies of Ventura County
	Santa Monica Mountains Recreation and Conservation Authority
	Rancho Simi Recreation and Park District
	Pleasant Valley Park and Recreation District
	Conejo Recreation and Parks District
	League of Women Voters
Flood Management Agencies	Ventura County Watershed Protection District
Native American Tribes	Individual members of various bands of the Chumash Tribe and Wishtoyo Foundation
Agricultural and Business Groups	Farm Bureau of Ventura County
	Building Industry Association
	Ventura County Economic Development Association
	Coalition of Labor Agriculture and Business
	Limoneira Ranch

3.3 Process for Engaging Stakeholders in MSWRP Development

As discussed above, the IRWM has provided a forum for stakeholder involved in water quality and water resource issues throughout Ventura County for almost 15 years. The IRWM process includes regular open stakeholder meetings in most of the major watersheds, newsletters and email mailing lists, and county-wide meetings on topics of interest. Given the link between the MSWRP and the IRWM and the established communication pathways to local agencies, NGOs and the community, the existing IRWM meetings and communication structures were utilized as one of the primary outreach mechanisms during MSWRP development.

The Watersheds Coalition of Ventura County (WCVC), formed in 2006 as the Regional Water Management Group for the IRWM, is comprised of most entities in Ventura County that have authority or responsibility over water management. It is a large, inclusive group, where decisions are made by consensus. The WCVC has five committees that are engaged in local planning efforts, implementation of current projects, and development of future project and plans. Each WCVC committee is unique, attracting a mix of stakeholders, and meets two to 12 times per year depending on need. Outreach to new participants is achieved through public events, the website, and contacting local organization to get their members involved. More information about the IRWMP including its stakeholder involvement processes can be found in Section 4.0 of the 2014 IRWMP (WCVC, 2014).

In addition to the IRWMP process, meetings, and outreach in coordination of the MS4 Permit implementation provide opportunities for local agency input in plan development. Additionally, broader education and outreach efforts take place within a larger regional stormwater education outreach program associated with the County's MS4 Permit. Every year the County and local Permittees undertake significant efforts to increase the public's knowledge and awareness about local water supply and quality and ultimately to change their behavior in order to reduce stormwater pollution. These efforts have fostered a local environment in which water resources and water quality threats are on the radar of its citizens. Many residents are interested in and receptive to more information about the efforts by the County and local jurisdiction to further enhance and protect local water resources. These efforts include:

- Public reporting hotlines and web resources for each local jurisdiction;
- Public outreach made over 11 million impressions in the last reporting year using;
- Media outreach via TV, radio, print;
- Adult and youth targeted outreach;
- Web outreach and educational resources presented www.vcstormwater.org;
- Social media campaigns and accounts on Facebook and Twitter;
- Specialized jurisdictional outreach events and campaigns;
- Working with local citizen watershed groups;
- Storm drain stenciling and signage;
- Distribution of outreach materials;
    - Retail store outreach (auto parts, hardware, pet stores);
- Business outreach;
    - BMP fact sheets distribution; and
    - Business water quality technical assistance.

For a full description of the public information and public participation programs employed by the County and the local Permittees, please see Chapter 3 of the County stormwater program's latest Annual Report (Ventura Countywide Stormwater Quality Management Program, 2015). This section of the 2014-2015 Annual Report covers control measures, public reporting, public outreach implementation, business outreach, and effectiveness assessment.

Communication channels and established relationships present within the framework of these two larger programs are widely known by everyone involved in the field of water quality and supply management in the County. Therefore, rather than undertake the creation of a less widely known

or effective mechanism for communicating with these communities about the MSWRP, the County determined that leveraging the existing structures would ensure that awareness about the MSWRP and opportunities for engagement and input would be maximized.

3.4 Local Agency, Nongovernmental Organization and Community Participation in Plan Development

Beginning in early 2016, the Permittees on behalf of the County began an effort to reach out to the existing watershed forums, committees and council described above. Email invitations describing the MSWRP and purpose of the outreach were sent to the extensive email lists of these groups. As stated, these groups have been in existence for many years and the addresses on their email listservs number in the thousands. In addition, the meeting announcements and invitations included additional content about the MSWRP, including web links to content on the State Board's website and draft copies of the PowerPoint presentation about the MSWRP. Furthermore, the meeting announcements, agendas and the presentation were posted on the County's website and on those of the various councils and committees.

These meetings were conducted to obtain initial input on MSWRP elements and obtain input regarding planned and potential projects to be included in the MSWRP. The presentation that was given at each of the council and committee meetings was designed to provide attendees with an overview of the County's stormwater management program, the current trends in receiving water quality, and to introduce the MSWRP and its elements. Much of the presentation focuses on the MSWRP and its intent to support new methods of managing stormwater with a focus on stormwater as a resource that is best managed collaboratively at the watershed scale. In addition, particular focus is paid to the types of local projects required under the MSWRP that would improve water quality and have the potential to be partially State grant funded.

The summarized contents of the presentation are as follows:

- Introduction to the County's stormwater management program
- Recent program efforts and lessons learned
- Overview of improving trends demonstrated by receiving water quality data
- Overview of the next upcoming NDPES MS4 Permit
- Introduction to SB 985 and Stormwater Resource Planning and the paradigm of recognizing stormwater as a resource
- Overview of requirements for projects eligible for grant funds and examples of potential projects
- Introduction of County's desire to develop a SWRP and implement multi-benefit projects

- Introduction of criteria to prioritize potential locations for future projects and to develop project concepts for those locations
- Introduce example project locations and types including possible infiltration basin locations that would provide multiple benefits to surrounding communities
- Gather feedback from presentation attendees
- Develop opportunities to involve disadvantaged and climate vulnerable communities as project develops

The presentation outlined above was given in person by County staff at the following meetings on the noted dates:

- 1/7/16: Ventura River Watershed Council
- 1/19/16: Ventura County Association of Water Agencies Water Issues Committee
- 1/21/16: Ventura Countywide Stormwater Quality Management Committee
- 1/28/16: Watershed Coalition of Ventura County
- 2/8/16: Ventura Countywide Stormwater Planning and Land Development Subcommittee
- 3/31/16: Santa Clara River Watershed Committee

Upcoming forums for the presentation include:

- Calleguas TMDL MOA Parties
- Calleguas MWD Purveyors Meeting
- Ventura County Board of Supervisors
- Ventura River Watershed Council
- Santa Clara River Watershed Committee – update
- Ventura Countywide Stormwater Quality Management Committee
- Watershed Coalition of Ventura County

During these presentations, County staff provided the information described above and also answered any questions by audience members or participants about either the MSWRP or the broader County stormwater program, clarified misunderstandings, and gathered feedback on proposed projects. The feedback received ranged from general ideas about project types and locations to specific comments about the efforts including project location information that altered sites in consideration.

4 Identification and Prioritization of MSWRP Projects

4.1 Introduction

Various opportunities for stormwater and dry weather capture have been identified in Ventura County that meet one or more of the criteria established for project selection included in the Water Code and the SWRP Guidelines (State Water Resources Control Board (SWRCB) and California Environmental Protection Agency, 2015). These criteria include projects that:

- Augment local water supply (Water Code 10562(d)(1));
- Provide source control for both pollution and dry weather runoff, onsite and local infiltration, and use of stormwater and dry weather runoff (Water Code 10562(d)(2));
- Reestablish natural water drainage treatment/infiltration systems or mimic natural system functions to the maximum extent feasible (Water Code 10562(d)(3));
- Develop, restore, or enhance habitat and open space through runoff management including wetlands, riverside habitats, parkways, and parks (Water Code 10562(d)(4)); and
- Use existing publicly owned lands (Water Code 10562(d)(5) and 10562(b)(8)).

Existing opportunities that have been previously identified in recent TMDL and other stormwater management planning efforts are summarized in Section 4.2, while the developmental process and conceptual designs for proposed projects identified as part of this MSWRP are outlined in Section 4.3.

4.2 Previously Identified Projects

To provide a comprehensive and integrated stormwater management plan, this MSWRP identifies projects throughout the MSWRP planning area that have been identified in TMDL planning documents, ongoing watershed planning efforts, or capital improvement plans. The following sources were referenced to identify projects for inclusion in this MSWRP:

- Indicator Bacteria TMDL Implementation Plan for the Lower Santa Clara River Watershed
- Harbor Beaches of Ventura County (Kiddie Beach and Hobie Beach) Wet-Weather Bacteria TMDL Implementation Plan for Unincorporated Ventura County
- Malibu Creek Watershed Bacteria and Nutrient TMDL Implementation Plan for Unincorporated Ventura County
- Integrated Watershed Protection Plan (still in development)
- Calleguas Creek TMDL Implementation Plan (still in development)

- Ventura River Watershed Management Plan
- VCWPD Capital Improvement Plan
- Upper Calleguas Creek Watershed Management Strategy Study
- Communication with MS4 Permittees

Projects from these sources were identified for inclusion in this MSWRP if they are expected to provide multiple benefits as outlined in the SWRP guidelines. Table 3 through Table 7 summarize, by watershed, the available information describing the identified projects and Figure 2 through Figure 6 illustrate the spatial distribution of projects where specific locations were provided[4]. The metrics-based and integrated evaluation and analysis developed to prioritize all projects by watershed as required by Water Code 10562(b)(2) is provided in Section 4.6. For reference and documentation purposes, Table B-1 (Appendix B) was also prepared to summarize previously identified municipal stormwater quality management projects that have already received grant funding.

[4] Some project locations only include parcels identified for BMP implementation, while others include projects that have been conceptually designed.

Table 3. Calleguas Creek Watershed Previously Identified Projects

Project ID	Project Name	Proposed By	Public/Private Parcel	Specific Location/Address	Project Description	Multiple Benefits (X = Expected)					Source	Notes
						Water Quality	Water Supply	Flood Management	Environmental	Community		
CC01	Calleguas Creek IP Project TO-1	City of Thousand Oaks	Public	Wildflower Playfield (34.219056 N, -118.896700 W)	Capture and Reuse	X	X	X	X	X	Calleguas Creek Implementation Plan	
CC02	Calleguas Creek IP Project TO-2	City of Thousand Oaks	Public	Thousand Oaks Community Park (34.214277 N, -118.871760 W)	Capture and Reuse	X	X	X	X	X	Calleguas Creek Implementation Plan	
CC03	Calleguas Creek IP Project UC-1	County of Ventura, City of Camarillo	Private	Conejo at Hway. 101 (34.206835 N, -118.994148 W)	Infiltration Basin	X	X	X	X	X	Calleguas Creek Implementation Plan	
CC04	Calleguas Creek IP Project UC-2	County of Ventura, City of Thousand Oaks	Public	Santa Rosa Valley Park (34.229414 N, -118.932070 W)	Infiltration Basin	X	X	X	X	X	Calleguas Creek Implementation Plan	
CC05	Calleguas Creek IP Project CM-1	City of Camarillo	Public/Private	Confluence Camarillo Hills Drain and Revolon Slough (34.210132 N, -119.111497 W)	Infiltration Basin	X	X	X	X	X	Calleguas Creek Implementation Plan	
CC06	Calleguas Creek IP Project CM-2	City of Camarillo	Public	Calle Quetzal (next to the Camarillo Sanitary Plant) (34.196437 N, -119.003148 W)	Capture and Reuse	X	X	X	X	X	Calleguas Creek Implementation Plan	
CC07	Calleguas Creek IP Project SV-1	City of Simi Valley	Public	Simi Hills Neighborhood Park (34.299381 N, -118.692804 W)	Capture and Reuse	X	X	X	X	X	Calleguas Creek Implementation Plan	
CC08	Calleguas Creek IP Project SV-2	City of Simi Valley	Public	Rocky Pointe Natural Park (34.263567 N, -118.662876 W)	Infiltration Basin	X	X	X	X	X	Calleguas Creek Implementation Plan	
CC09	Calleguas Creek IP Project MP-1	City of Moorpark	Public	County Trail Park (34.264201 N, -118.907591 W)	Infiltration Basin	X	X	X	X	X	Calleguas Creek Implementation Plan	
CC10	Calleguas Creek IP Project MP-2	City of Moorpark	Public	Mountain Meadows City Park (34.269281 N, -118.890618 W)	Infiltration Basin	X	X	X	X	X	Calleguas Creek Implementation Plan	
CC11	Calleguas Creek IP Project MP-3	City of Moorpark	Public	Peach Hill Park (34.267970 N, -118.877441 W)	Infiltration Basin	X	X	X	X	X	Calleguas Creek Implementation Plan	
CC12	Arroyo Simi Grade Stabilization	VCWPD	N/A	Hitch Blvd to Los Angeles Ave (34.276610 N, -118.891880 W)	Invert stabilization to eliminate scour and degradation within the project reach. A preliminary study and design will be completed to properly site required stabilizers.	X		X		X	Capital Improvement Plan Map	Potential water quality and flood management benefits by reducing sediment loading from instream erosional sources.
CC13	Calleguas Creek Low Flow Channel	VCWPD	N/A	34.134000 N, -119.073000 W	Cut low flow channel through Calleguas Creek.	X			X	X	Capital Improvement Plan Map	This project needs to provide channel restoration (i.e., creating a soft bottom low flow channel, replacing the existing lined condition) to be eligible for Proposition 1 funding.

Project ID	Project Name	Proposed By	Public/Private Parcel	Specific Location/Address	Project Description	Multiple Benefits (X = Expected)					Source	Notes
						Water Quality	Water Supply	Flood Management	Environmental	Community		
CC14	Conejo Mountain Creek Detention Basins 2-5 at Dos Vientos	VCWPD	N/A	34.171860 N, -118.987430 W	Rehabilitate existing debris and detention basins to meet original construction drawings per litigation settlement.	X	X	X		X	Capital Improvement Plan Map	The exact details of this project are unknown; however, the rehabilitation may include water quality, water supply, and/or flood management benefits.
CC15	Gabbert Channel Restoration	VCWPD	N/A	34.281353 N, -118.910908 W	Restoration of a 50-yr old concrete channel with a new concrete channel or natural channel with bank stabilization and detention.	X	X	X		X	Capital Improvement Plan Map	If natural channel selected, this project is potentially eligible for Proposition 1 funding as it could provide water quality and supply benefits.
CC16	Tierra Rejada Rd Improvements	City of Moorpark	Public	Along Tierra Rejada Road within the City of Morrpark	Proposed landscape improvement along Tierra Rejada Rd, possibly installing several bioswales for stormwater infiltration	X			X	X	Correspondence with City of Moorpark Permittee	
CC17	Old Town drainage	City of Camarillo	Public	Dizdar Park (Chapel Drive and Holly Drive) (34.215741 N, -119.037387 W) and Elm Drive and Mission Walk (34.215396 N, -119.041354 W)	Permeable gutters to promote infiltration	X	X				2009 City of Camarillo Plan of Drainage - Volume 2 - Prioritized Project Study	
CC18	Cerro Vista Detention Basin	City of Camarillo	Private	Cerro Vista Way at Calle Higuera (34.236689 N, -119.058742 W)	Retrofit the detention basin as an infiltration basin	X	X		X	X	Correspondence with City of Camarillo Permittee	
CC19	Watershed Management Strategy Study Projects	City of Thousand Oaks	N/A	Various locations	Alternatives intended to convey the 100-year flood using various strategies including: channel conveyance, bridge replacement, culvert enlargement, storage (detention basin), or local drainage improvements.	X	X	X	X	X	Upper Calleguas Creek Watershed Management Strategy Study (July 2013)	Study proposes a variety of project types with multiple alternatives per site location

Table 4. Coastal Watersheds Previously Identified Projects

Project ID	Project Name	Proposed By	Public/Private Parcel	Specific Location/Address	Project Description	Multiple Benefits (X = Expected)					Source	Notes
						Water Quality	Water Supply	Flood Management	Environmental	Community		
CHB01	Development Retrofit Area	City of Oxnard	Public	Channel Island Harbor	Bioretention/Subsurface flow wetland or equivalent (Drainage area = 28.1 acres)	14.5 x 10^12 MPN Fecal Coliform reduction (average annual)			X	X	Channel Island Harbor TMDL Implementation Plan	
CHB02	Harbor Park Redevelopment	City of Oxnard	Public	Channel Island Harbor	Bioretention/Subsurface flow wetland or equivalent (Drainage area = 23.6 acres)	7 x 10^12 MPN Fecal Coliform reduction (average annual)			X	X	Channel Island Harbor TMDL Implementation Plan	

Table 5. Malibu Creek Watershed Previously Identified Projects

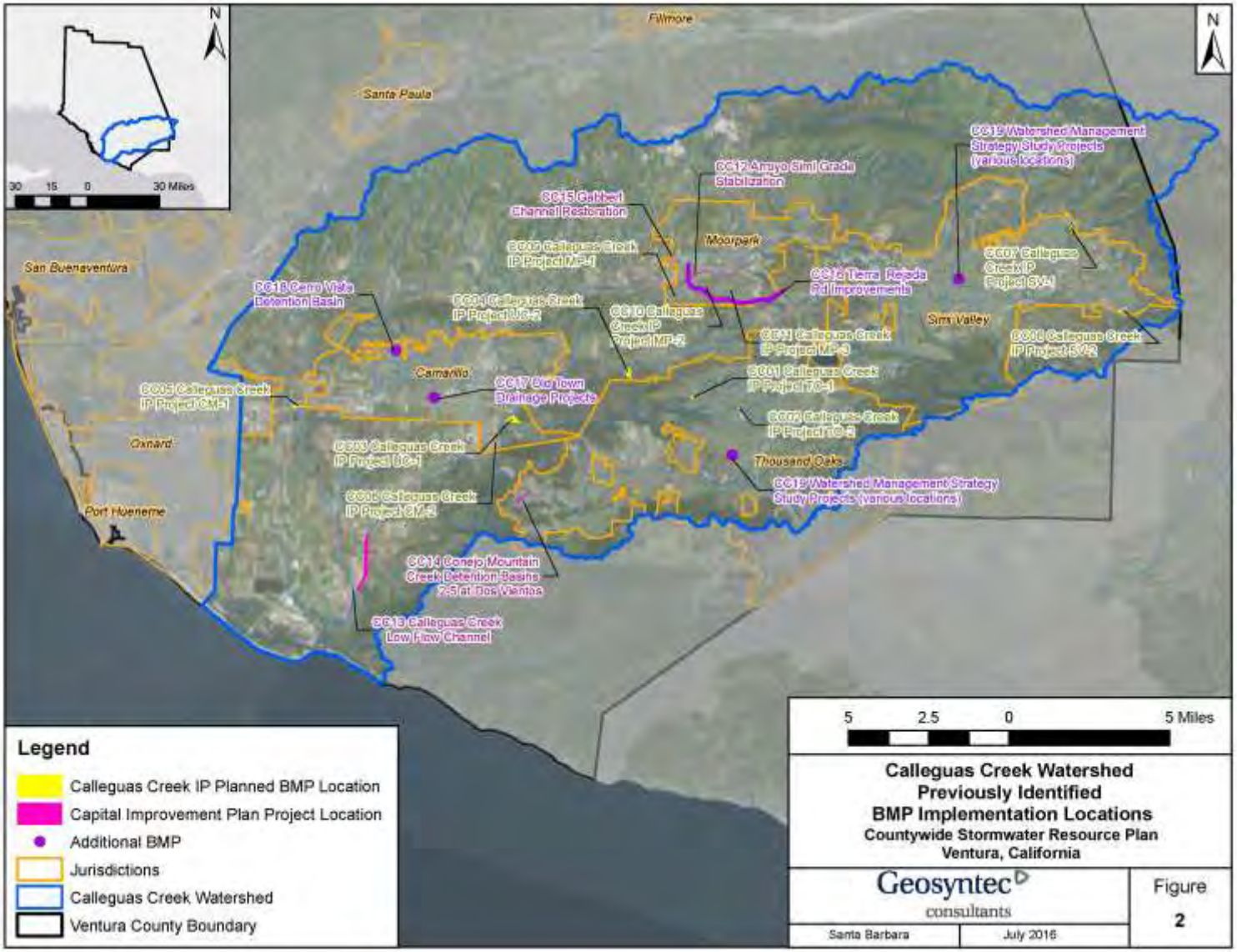
Project ID	Project Name	Proposed By	Public/Private Parcel	Specific Location/Address	Project Description	Multiple Benefits (X = Expected)					Source	Notes
						Water Quality	Water Supply	Flood Management	Environmental	Community		
MC01	Distributed BMPs	County of Ventura	Public/Private	Various (Upper Lindero and Medea subwatersheds)	Various distributed BMP opportunities targeted to single-family residential and commercial land uses, includes distributed infiltration gardens, green streets, and outfall infiltration	X	X		X	X	Bacteria and Nutrient TMDL IP Addendum for Unincorporated Ventura County and VCWPD	
MC02	Low flow diversion to sewer	County of Ventura	Public/Private	Various (Upper Lindero and Medea subwatersheds)	Diversion of dry weather flows to the sewer system for treatment (based on locations identified in the dry weather MS4 special study)	X			X		Bacteria and Nutrient TMDL IP Addendum for Unincorporated Ventura County and VCWPD	

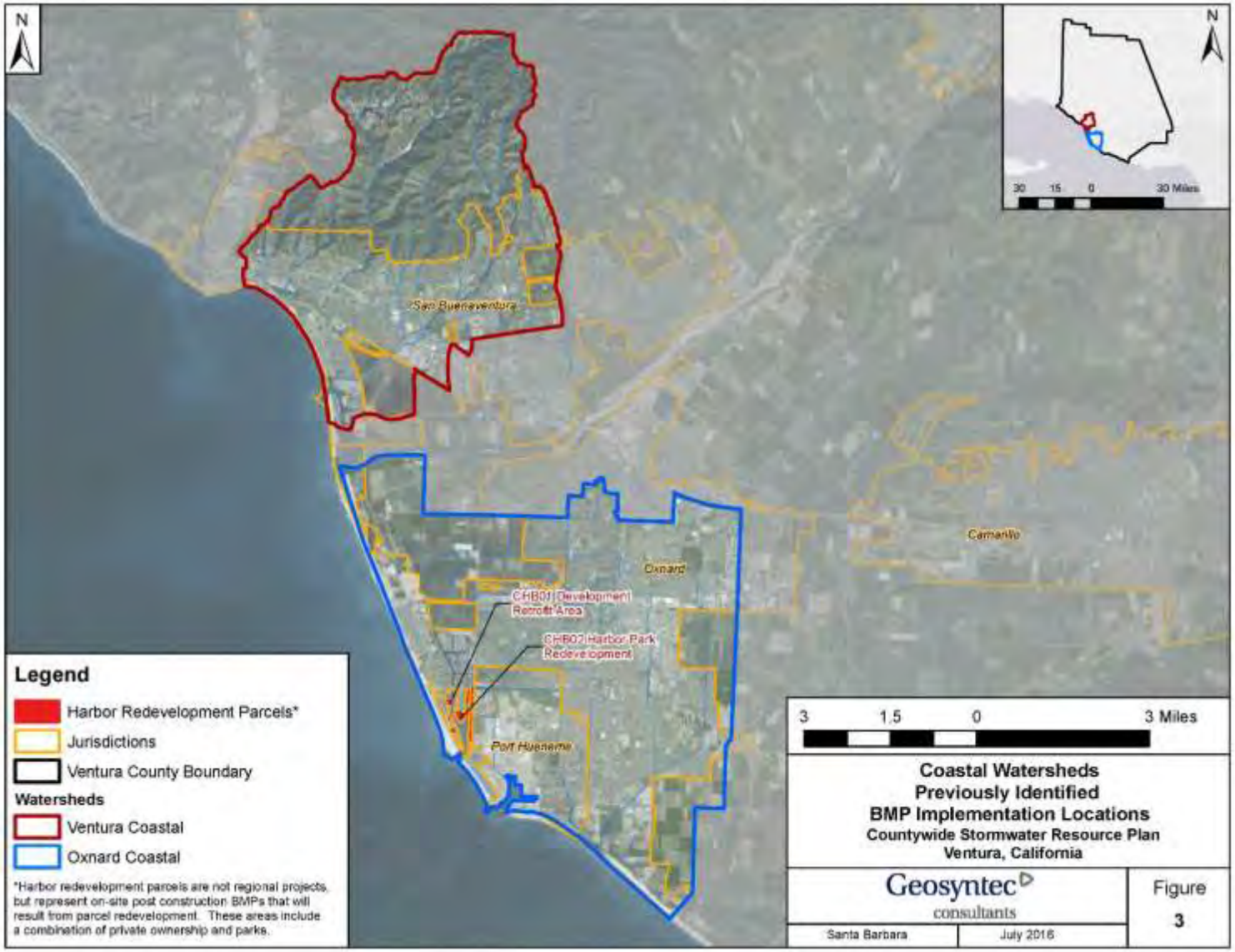
Table 6. Santa Clara River Watershed Previously Identified Projects

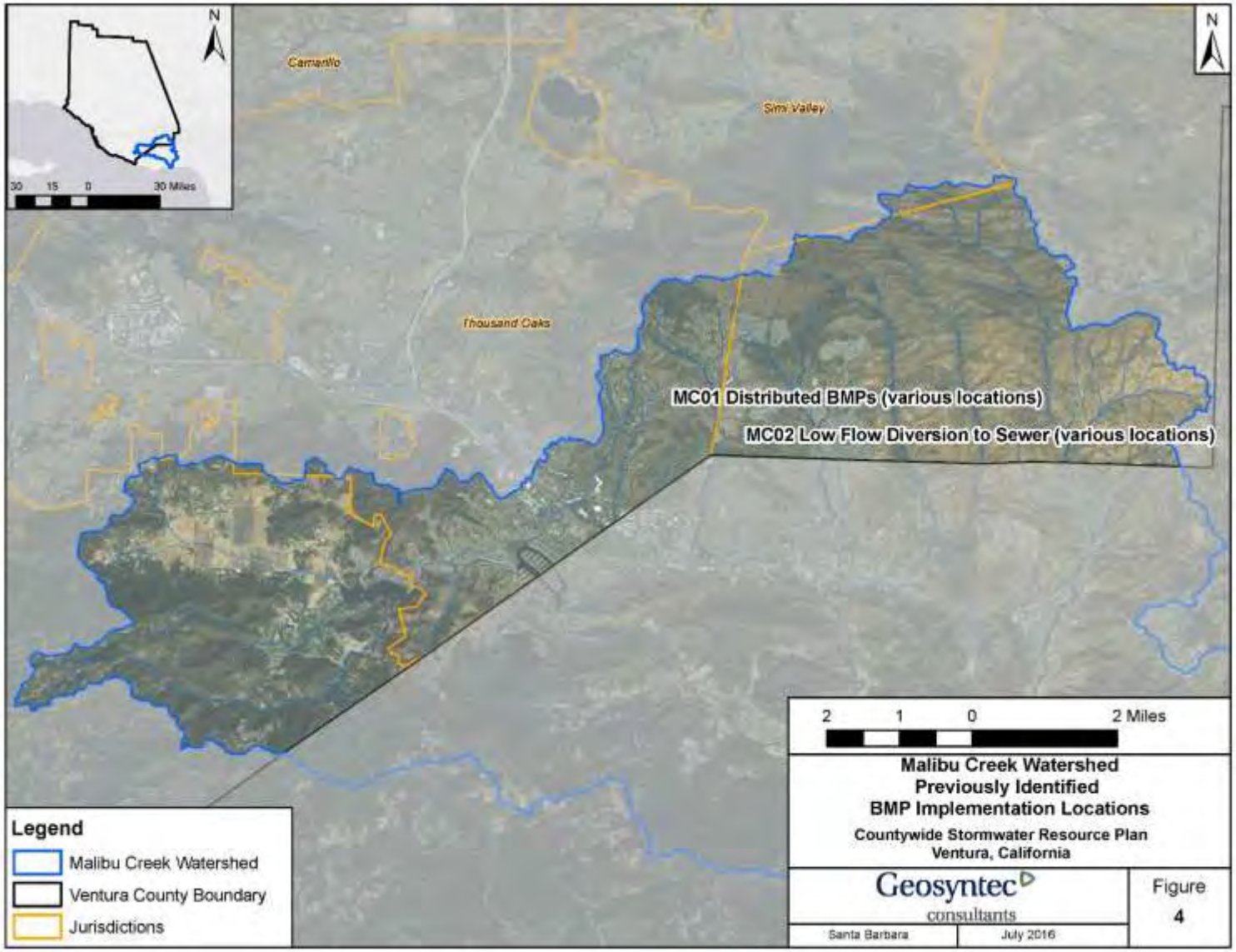
Project ID	Project Name	Proposed By	Public/Private Parcel	Specific Location/Address	Project Description	Multiple Benefits (X = Expected)					Source	Notes
						Water Quality	Water Supply	Flood Management	Environmental	Community		
SCR01	City of Santa Paula Infiltration Basin	City of Santa Paula	Private	Adjacent to Santa Paula airport	Infiltration Basin (Drainage area = 433 acres, Footprint = 170,000 sq. ft., drawdown time = 48 hrs, infiltration rate = 0.5 in/hr, depth = 2 ft)	29 x 10^12 MPN Fecal Coliform (90th percentile water year)	X		X	X	Lower Santa Clara River TMDL Implementation Plan	
SCR02	City of Ventura - Subsurface Infiltration Basin	City of Ventura	Public	Chumash Park along South Petit Avenue	Subsurface infiltration basin (Drainage area = 660 acres, footprint = 90,000 sq. ft., infiltration rate = 0.5 in/hr, depth = 8 ft)	63 x 10^12 MPN Fecal Coliform (90th percentile water year)[2]	X		X	X	Lower Santa Clara River TMDL Implementation Plan	
SCR03	County of Ventura - County Maintenance Yard Infiltration Basin	County of Ventura	Public	County Maintenance Yard adjacent to Northbank Drive	Infiltration Basin (Drainage area = 261 acres, footprint = 150,000 sq. ft., drawdown time = 48 hrs, infiltration rate = 1 in/hr, depth = 4 ft)		X		X	X	Lower Santa Clara River TMDL Implementation Plan	
SCR04	City of Oxnard - Infiltration Basin	City of Oxnard	Public	South Bank Park	Infiltration Basin (Drainage area = 66 acres, footprint = 85,000 sq. ft., infiltration rate = 0.5 in/hr, depth = 2 ft)	7.7 x 10^12 MPN Fecal Coliform (90th percentile water year)	X		X	X	Lower Santa Clara River TMDL Implementation Plan	
SCR05	City of Fillmore - Infiltration Basin 1	City of Fillmore	Public	Planned Heritage Valley Park and Community Park (southern end of Mountain View street adjacent to the soil cement levee on the north bank of the Santa Clara River)	Infiltration Basin (Drainage area = 494 acres, footprint = 160,000 sq.ft., drawdown time = 48 hrs, infiltration rate = 1 in/hr, depth = 4 ft)	67 x 10^12 MPN Fecal Coliform (90th percentile water year)	X		X	X	Lower Santa Clara River TMDL Implementation Plan	
SCR06	City of Fillmore - Infiltration Basin 2	City of Fillmore	Public	Previous percolation ponds #3, #4, and #5 of the City wastewater treatment plant located on the north bank of the Santa Clara River	Infiltration Basin (Drainage area = 466 acres, footprint = 200,000 sq.ft., drawdown time = 48 hrs, infiltration rate = 1 in/hr, depth = 4 ft)		X		X	X	Lower Santa Clara River TMDL Implementation Plan	
SCR07	Sierra Club - A stormwater management pilot project	Sierra Club	Private	Along Santa Clara River levee system (SCR-1), adjacent to the RiverPark development	Multi-purpose project: groundwater recharge of select flows from the river in abandoned gravel pits; SCR parkway floodplain preservation; biological resource enhancement; and education/recreation/open space project	X	X		X	X	Correspondence with Sierra Club	
SCR08	United Water - Ferro Basin	United Water District	Private	Adjacent to Central Ave. drain (34.264484 N, -119.152249 W)	Infiltration basin for stormwater capture and groundwater recharge	X	X		X	X	Correspondence with United Water	Potential stormwater project for the stormwater master plan.
SCR09	Caltrans - Saticoy Infiltration basin	County of Ventura	Public	Adjacent to Los Angeles Avenue (34.279547 N, -119.142534 W)	Infiltration basin	X	X			X	Correspondence with County of Ventura	

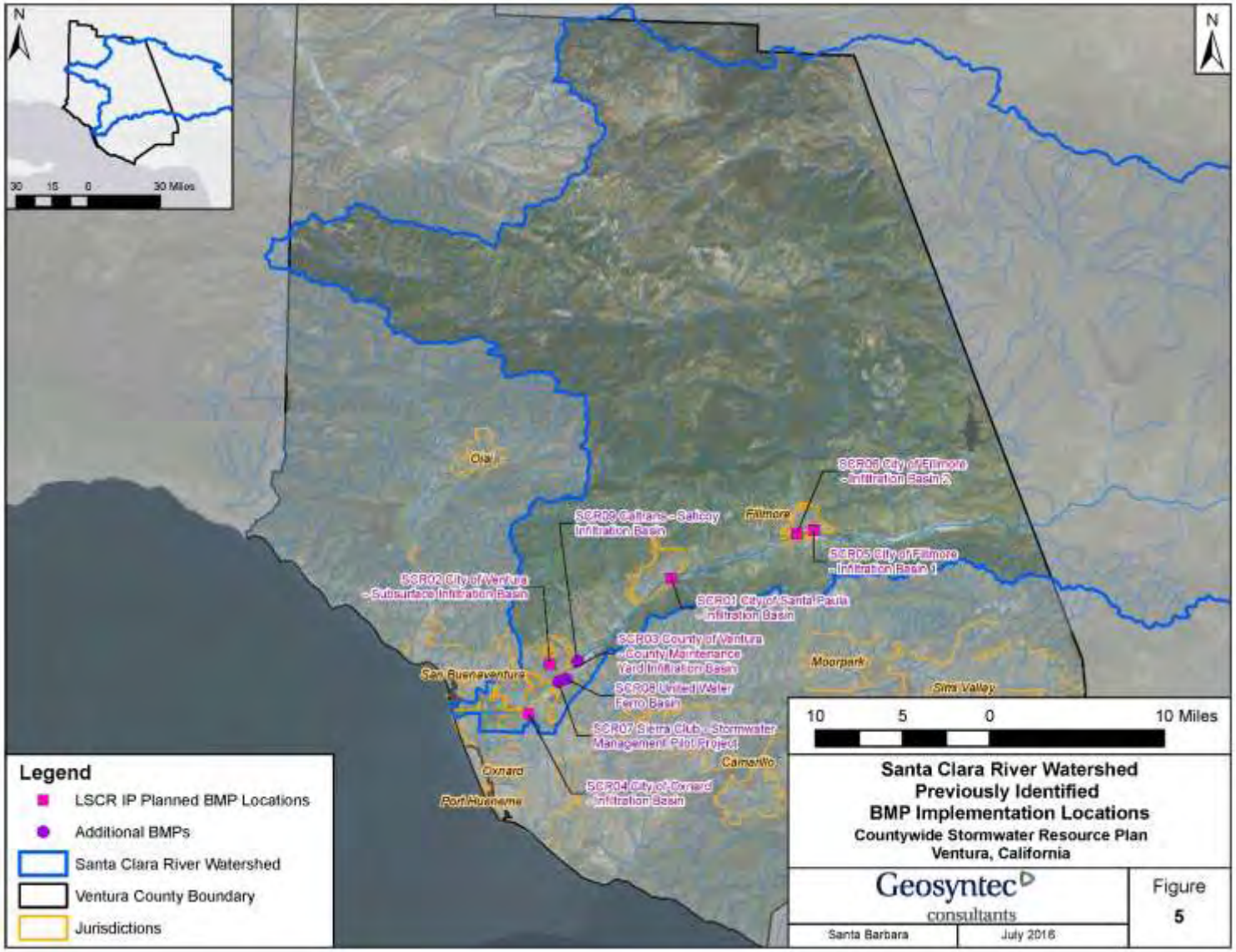
Table 7. Ventura River Watershed Previously Identified Projects

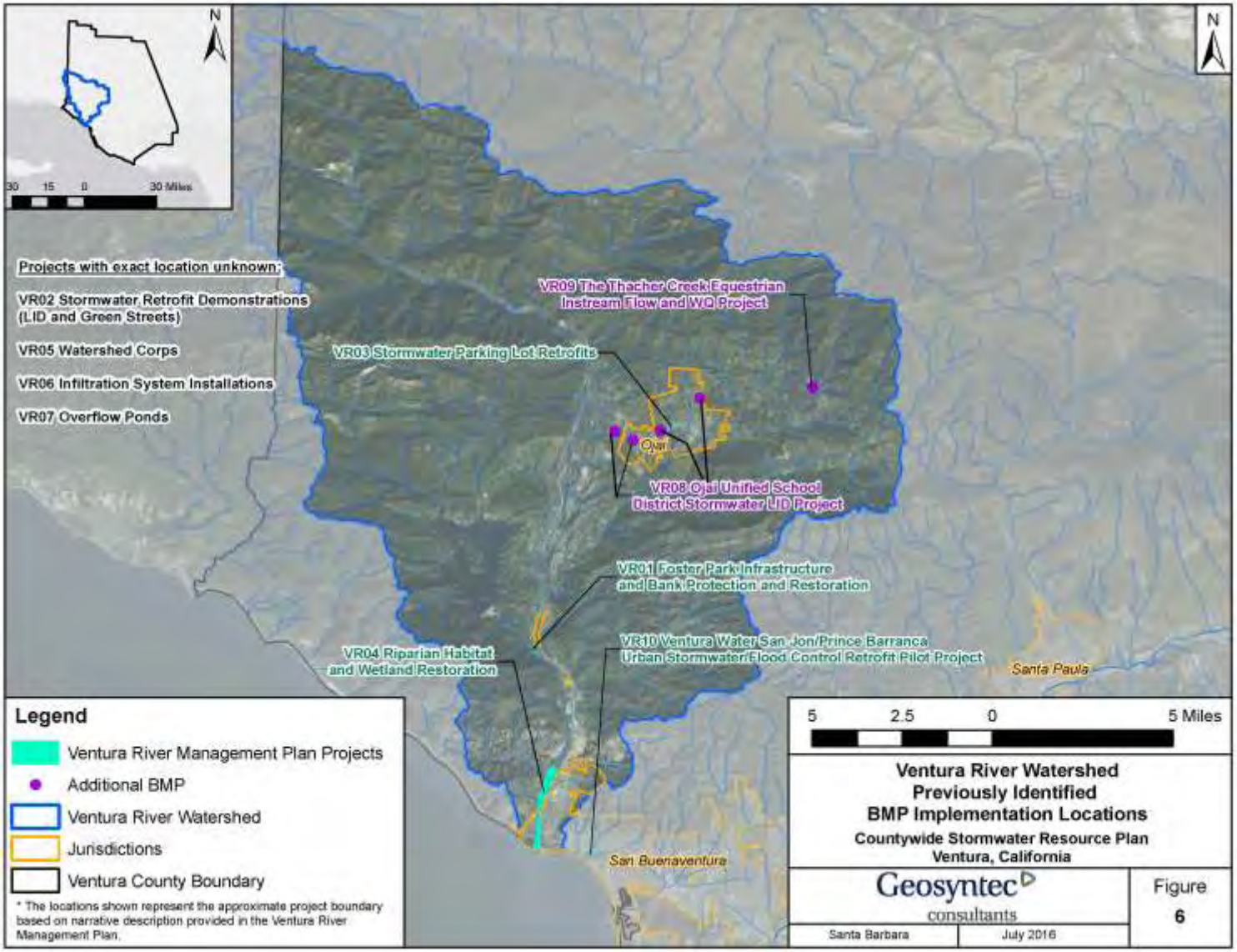
Project ID	Project Name	Proposed By	Public/Private Parcel	Specific Location/Address	Project Description	Multiple Benefits (X = Expected; N/A = information not available)					Source	Notes
						Water Quality	Water Supply	Flood Management	Environmental	Community		
VR01	Foster Park Infrastructure and Bank Protection and Restoration	N/A	N/A	Coyote Creek reach within Foster Park (34.355158,-119.3176794)	Build groins, revegetate banks and prevent bank erosion to prevent critical infrastructure loss and to support the development of steelhead habitat			X	X	X	Ventura River Watershed Management Plan	Tier 1L: Project ID # 41
VR02	Stormwater Retrofit Demonstrations (LID and Green Streets)	N/A	Public and Private	N/A	Retrofit impervious surfaces with alternatives (e.g. LID and green streets) that capture, treat, and infiltrate urban stormwater runoff.	X	X				Ventura River Watershed Management Plan	Tier 1L: Project ID # 63
VR03	Stormwater Parking Lot Retrofits	N/A	N/A	Parking Lots in Ojai	Retrofits parking lots and their landscapes to improve stormwater capture and infiltration	X	X				Ventura River Watershed Management Plan	Tier 1L: Project ID #77
VR04	Riparian Habitat and Wetland Restoration	N/A	Public and private	Wetland and riparian area along Ventura River	Restore riparian habitats and wetlands to promote native vegetation growth to benefit fish and wildlife, promote attenuation of flood flows, capture of sediments, treatment of runoff, infiltration and to deter algae growth	X	X	X	X	X	Ventura River Watershed Management Plan	Tier 1L: Project ID #143
VR05	Watershed Corps	N/A	N/A	N/A	Fund, through a job programs, the installation of multiple small-scale projects to retrofit urban and agriculture lands to enhance water conservation/capture/quality and flood management	X	X	X		X	Ventura River Watershed Management Plan	Tier 1S: Project ID # 152
VR06	Infiltration System Installations	N/A	Private	N/A	Install or retrofit, at new and existing homes, buildings, landscapes and farms, systems for capturing and infiltrating stormwater	X	X				Ventura River Watershed Management Plan	Tier2: Project ID #45
VR07	Overflow Ponds	N/A	N/A	N/A	Create overflow areas and ponds along storm channels to slow down flow and allow for infiltration		X	X			Ventura River Watershed Management Plan	Tier 2: Project ID # 83
VR08	Ojai Unified School District Stormwater LID Project	Sierra Watershed Progressive, Ojai Unified School District	Public	Topa Topa Elementary School, Meiners Oaks Elementary School, Matilija Jr. High School, Nordoff High School	Retrofit impervious surfaces with alternatives (e.g. permeable pavement, bioswales, rainwater capture) that capture, treat, and infiltrate urban stormwater runoff.	X	X		X	X	Sierra Watershed Progressive Proposed Project Catalog	Project Summary included in Attachment F
VR09	The Thacher Creek Equestrian Instream Flow and Water Quality Project	Sierra Watershed Progressive, Thacher School	Private	The Thacher School	Rainwater capture and retrofit impervious surfaces with LID alternatives (e.g. bioswales and infiltration basins) that capture, treat, and infiltrate urban stormwater runoff in conjunction with enhancing baseflow in Thacher and San Antonio Creeks to support high quality habitat for the endangered California Steelhead Trout.	X	X		X	X	The Thacher School Water Management Plan	Project Summary included in Attachment F
VR10	Ventura Water San Jon/Prince Barranca Urban Stormwater/Flood Control Retrofit Pilot Project	N/A	N/A	Parking and recreations areas along San Jon (34.2756782,-119.2844291) and Prince Barranca (34.3194324,-119.264613)	Retrofit parking and recreation areas, construct detention basins, and upgrade storm drains in order to enhance infiltration, water conservation, stormwater reuse, and urban flood protection	X	X	X			Ventura River Watershed Management Plan	Tier 1L: Project ID # 72


N
30 15 0 30 Miles
Fillmore
Santa Paula
San Buenaventura
Moorpark
Simi Valley
Camarillo
Oxnard
Port Hueneme
Thousand Oaks
CC19 Watershed Management Strategy Study Projects (various locations)
CC12 Arroyo Simi Grade Stabilization
CC15 Gabbard Channel Restoration
CC16 Cerro Vista Detention Basin
CC18 Tierra Rejada Rd Improvements
CC10 Calleguas Creek IP Project MP-2
CC17 Big Town Drainage Projects
CC14 Conejo Mountain Creek Detention Basins 2-5 at Box Canyon
CC13 Calleguas Creek Low Flow Channel
5 2.5 0 5 Miles
Legend
Calleguas Creek IP Planned BMP Location
Capital Improvement Plan Project Location
Additional BMP
Jurisdictions
Calleguas Creek Watershed
Ventura County Boundary
Calleguas Creek Watershed
Previously Identified
BMP Implementation Locations
Countywide Stormwater Resource Plan
Ventura, California
Geosyntec consultants
Santa Barbara
July 2016
Figure
2


N
San Buenaventura
Oxnard
Camarillo
Port Hueneme
CHB01 Development Retrofit Area
CHB02 Harbor Park Redevelopment
Legend
Harbor Redevelopment Parcels*
Jurisdictions
Ventura County Boundary
Watersheds
Ventura Coastal
Oxnard Coastal
*Harbor redevelopment parcels are not regional projects, but represent on-site post construction BMPs that will result from parcel redevelopment. These areas include a combination of private ownership and parks.
30 15 0 30 Miles
3 1.5 0 3 Miles
Coastal Watersheds
Previously Identified
BMP Implementation Locations
Countywide Stormwater Resource Plan
Ventura, California
Geosyntec consultants
Santa Barbara
July 2016
Figure
3


N
Camarillo
Simi Valley
Thousand Oaks
MC01 Distributed BMPs (various locations)
MC02 Low Flow Diversion to Sewer (various locations)
30 15 0 30 Miles
2 1 0 2 Miles
Legend
Malibu Creek Watershed
Ventura County Boundary
Jurisdictions
Malibu Creek Watershed
Previously Identified
BMP Implementation Locations
Countywide Stormwater Resource Plan
Ventura, California
Geosyntec consultants
Santa Barbara
July 2016
Figure
4


N
30 15 0 30 Miles
N
Oxnard
Fillmore
Moorpark
Simi Valley
San Buenaventura
Camarillo
Port Hueneme
SCR08 City of Fillmore - Infiltration Basin 2
SCR09 Caltrans - Saticoy Infiltration Basin
SCR05 City of Fillmore - Infiltration Basin 1
SCR02 City of Ventura - Subsurface Infiltration Basin
SCR01 City of Santa Paula - Infiltration Basin
SCR03 County of Ventura - County Maintenance Yard Infiltration Basin
SCR06 United Water Ferro Basin
SCR07 Sierra Club - Stormwater Management Pilot Project
SCR04 City of Oxnard - Infiltration Basin
Legend
LSCR IP Planned BMP Locations
Additional BMPs
Santa Clara River Watershed
Ventura County Boundary
Jurisdictions
10 5 0 10 Miles
Santa Clara River Watershed
Previously Identified
BMP Implementation Locations
Countywide Stormwater Resource Plan
Ventura, California
Geosyntec consultants
Santa Barbara
July 2016
Figure
5


N
30 15 0 30 Miles
Projects with exact location unknown:
VR02 Stormwater Retrofit Demonstrations (LID and Green Streets)
VR05 Watershed Corps
VR06 Infiltration System Installations
VR07 Overflow Ponds
VR09 The Thacher Creek Equestrian Instream Flow and WQ Project
VR03 Stormwater Parking Lot Retrofits
Ojai
VR08 Ojai Unified School District Stormwater LID Project
VR01 Foster Park Infrastructure and Bank Protection and Restoration
VR10 Ventura Water San Jon/Prince Barranca Urban Stormwater/Flood Control Retrofit Pilot Project
VR04 Riparian Habitat and Wetland Restoration
Santa Paula
San Buenaventura
Legend
Ventura River Management Plan Projects
Additional BMP
Ventura River Watershed
Jurisdictions
Ventura County Boundary
* The locations shown represent the approximate project boundary based on narrative description provided in the Ventura River Management Plan.
5 2.5 0 5 Miles
Ventura River Watershed
Previously Identified
BMP Implementation Locations
Countywide Stormwater Resource Plan
Ventura, California
Geosyntec consultants
Santa Barbara
July 2016
Figure
6

4.3 New MSWRP Modeled Project Development

Each Permittee identified one new project under this MSWRP, selecting from the potential opportunity parcels that were screened and provided to each MS4 Permittee. This resulted in 12 new projects under the MSWRP. Guidelines from the Ventura County Technical Guidance Manual (TGM) (Geosyntec Consultants and Larry Walker Associates, 2011) were utilized to both prioritize potential project locations and develop conceptual designs for regional stormwater and dry weather capture BMPs that would serve to reduce stormwater and dry weather runoff pollution of downstream receiving waters and provide potential water supply benefits. A procedure for parcel prioritization was first executed to eliminate parcels that were unsuitable for BMP implementation and identify publically owned parcels with optimal conditions for BMP implementation (described in Section 4.3.1 below). The potential list of project locations was then screened by each MS4 Permittee to account for unforeseen obstacles (e.g., existing planned use of parcels, land ownership commitments, etc.). Once the MS4 Permittees selected their preferred parcel for BMP implementation, the most effective BMP type was selected based on watershed priorities, site conditions, and guidance from the TGM. Each BMP selected was conceptually designed and modeled to determine potential water supply and/or water quality benefits as described in the following sections.

4.3.1 Project Selection

A Geographic Information Systems (GIS)-based screening process was executed on parcels within Ventura County to determine potential parcels for BMP implementation. The general intent of the GIS screening was to identify large, undeveloped publically-owned parcels located adjacent to storm drains and downgradient of large urban areas, with a preference for sites with Ventura County soil numbers four through seven (i.e., infiltrative soil types). Infiltrative soil types were preferred because priority was given to infiltration-based BMPs for the water quality and potential water supply benefits. For areas without infiltrative soils, where infiltration-based BMPs would not be appropriate, capture and reuse projects were also considered as potential BMP opportunities[5]. Parcels were first screened such that only publically-owned parcels within a city or County Unincorporated area were considered, using site use codes that represented publically-

[5] For some project opportunities where shallow soil infiltration may be poor, but deep soil infiltration may be better, dry wells may also be considered as an additional method for infiltration. Subsurface infiltration rates were not available, therefore dry wells were not considered during MSWRP project development. If future testing shows that subsurface infiltration rates are far greater than surface soil infiltration rates, dry wells may be incorporated into an infiltration basin to access this lower infiltrative layer. EPA Region 9 has a program in place for the registration of all injection wells which may apply to stormwater dry wells; however a permitting process for dry wells does not exist but is in development by EPA Region 9, therefore permitting considerations must be incorporated into dry well planning efforts.

owned properties (VCWPD, 2011b). The parcel prioritization process used for infiltration-based BMPs and capture and reuse BMPs are outlined in the following sections.

Parcel Prioritization for Infiltration-based BMPs

The following constraints were used in the parcel prioritization process for identification of potential infiltration-based BMPs:

- Soils: eliminated areas within soil types 1 and 2 (using Ventura County soil groups 1-7)
- Water wells: eliminated areas within 100 feet of a water well
- Slope: eliminated parcels if the centroid of the parcel was in an area with greater than five percent slopes
- Landslide potential: eliminated areas classified as an "actual potential landslide" area
- Expansive soils: eliminated areas classified with "high" expansive soils
- Coastal environmentally sensitive areas: eliminated all coastal environmentally sensitive areas
- Liquid waste sites: eliminated parcels with on-site septic systems
- Lakes: eliminated areas within 300 feet of a lake
- Storm Drains or channels: eliminated parcels that were not located within 100 feet of a storm drain pipe or channel

In order to further screen the remaining parcels that met the aforementioned criteria, parcels with less than half an acre of area available for BMP implementation (area left within a given parcel after all constraints were applied) were also eliminated. The remaining parcels were then investigated further, using aerial imagery and parcel information, to determine if BMP implementation was feasible based on land surface features. Potential development and feasibility issues were noted, along with verification of ownership, location within the MS4 system, the presence of agricultural and open space areas within the tributary area, and any other issues that could affect implementation and effectiveness of a potential BMP. Parcels that were considered infeasible for regional infiltration BMP implementation based on this investigation were eliminated. Future site-specific field testing may result in additional sites identified for infiltration opportunities.

Parcel Prioritization for Capture/Reuse BMPs

To identify potential locations suitable for a capture and reuse project, parcels that could potentially benefit from the use of recycled stormwater were first identified. These parcels

included the following site use code descriptions (potential use of recycled water is noted in parenthesis):

- Community and junior colleges (irrigation)
- State University (irrigation)
- Golf course (irrigation)
- Camps, resorts, private parks (irrigation and other non-potable uses such as toilet flushing)
- Parks, including play fields – developed (irrigation and other non-potable uses such as toilet flushing)
- Cemetery (irrigation)

All public parcels located within a 500-foot radius of a potential water reuse parcel (determined by the site use descriptions listed above) were identified and considered for BMP implementation. The following constraints were then applied as part of the parcel prioritization process for identification of potential locations for capture and reuse projects:

- Water wells: eliminated areas within 100 feet of a water well
- Slope: eliminated parcels if the centroid of the parcel was in an area with greater than five percent slopes
- Landslide potential: eliminated areas classified as an "actual potential landslide" area
- Expansive soils: eliminated areas classified with "high" expansive soils
- Coastal environmentally sensitive areas: eliminated all coastal environmentally sensitive areas
- Liquid waste sites: eliminated parcels with on-site septic systems
- Lakes: eliminated areas within 300 feet of a lake
- Storm Drains or channels: eliminated parcels that were not located within 100 feet of a storm drain pipe or channel

Similar to the process for identifying potential infiltration BMP locations, parcels with less than half an acre of area remaining (after all constraints were applied) were eliminated. Remaining parcels were further investigated to eliminate infeasible parcels based on verification of ownership, location within the MS4 system, possible development or feasibility issues, and the presence of agricultural areas within the tributary area. It should be noted that if a storm drain has ever been classified as a blue line channel, the project will be subject to different permitting requirements that may result in additional costs.

4.3.2 MSWRP Modeled Project Development

Each MS4 Permittee then reviewed their jurisdictional area's list of potential BMP locations to screen this list of opportunities based on internal knowledge of potential obstacles. The MS4 Permittees also identified areas screened out during the prioritization process that may in fact be feasible based on nearby infiltration testing or other knowledge of the parcel's attributes. For projects proposed on privately owned land, agencies will coordinate with the landowners to secure agreements to allow for BMP construction. Based on MS4 Permittee knowledge, one final parcel was selected for each MS4 Permittee and BMP design concepts were developed. Project concepts included:

- Delineation of upstream drainage areas;
- Identification of BMP type based on parcel area, soil conditions, and MS4 Permittee priorities; and
- Determining conceptual BMP design parameters.

For projects where the drainage area was not provided by the MS4 Permittee, the drainage area to the proposed BMP location was delineated using waterbody and storm drain spatial files and a digital elevation model (DEM). The most effective BMP type was then determined based on project goals and site-specific conditions, with priority given to infiltration-based BMPs for the water quality and potential water supply benefits. Several BMP types were identified for MSWRP projects, including: infiltration basin, infiltration trench, proprietary infiltration (subsurface infiltration system), and rainwater harvesting (subsurface storage tank).

Each BMP was sized to maximize the usable area of the parcel in order to capture and infiltrate, treat, or reuse the largest amount of stormwater and dry weather runoff (based on visual assessment of site specific constraints and existing infrastructure, or information provided by the agencies). The stormwater quality design volume (SQDV) was also determined for each project using the Urban Runoff Quality Management (URQM) approach, as outlined in the TGM. This method estimates the maximized stormwater quality captured volume based on translating rainfall to runoff using regression equations and approximately corresponds to the 85th percentile runoff event. The drainage area size and average imperviousness of the drainage area (identified from land use GIS layers and explained in more detail in Appendix C.1) were used as project-specific inputs for the SQDV calculation. A 48-hour drawdown time (consistent with TGM requirements) and mean storm precipitation depth of 0.65 inches (WEF and ASCE, 1998) was assumed for all projects. All MSWRP modeled projects did not achieve 100 percent capture of the 85th percentile runoff volume (SQDV) due to parcel area constraints; however, the percent of SQDV provided by each BMP is shown to represent the expected percent capture of the 85th percentile 24-hour storm event.

Based on guidance from the Ventura County TGM, the BMPs were then conceptually designed. General BMP design parameter assumptions for each BMP type are as follows. General concept figures for each project type, including a typical plan and profile view, are shown in Figure 7 through Figure 10.

Infiltration Basins (INF-1)

- Pretreatment: assumed to occupy 25 percent of the available area
- Drawdown time: 48 hours (limited for vector control purposes)
- Infiltration rate: Based on the site-specific hydrologic soil group (1.0 in/hr for Ventura County soil numbers six and seven and 0.5 in/hr for soil numbers four and five)
- Area: Determined by space available for the BMP
- Depth: Governed by the drawdown time and infiltration rate
- Side slope: 3:1
- Freeboard Depth: 1 ft

Infiltration Trenches (INF-2)

- Pretreatment: assumed to occupy 25 percent of the available area
- Drawdown time: 48 hours (limited for vector control purposes)
- Infiltration rate: based on the site-specific hydrologic soil group (1.0 in/hr for Ventura County soil numbers six and seven and 0.5 in/hr for soil numbers four and five)
- Area: determined by space available for the BMP
- Gravel Layer Depth: 3 – 5 ft (governed by the drawdown time and infiltration rate)
- Porosity of Gravel Layer: 0.32
- Sand Layer Depth (bottom layer): 0.5 ft
- Porosity of Sand Layer: 0.40
- Freeboard Depth: 1 ft

Proprietary Infiltration (Subsurface Infiltration Systems) (INF-6)

- Pretreatment: assumed to occupy 25 percent of the available area
- Porosity: 0.94 (to account for subsurface structures) (based on information provided in Invisible Structures, Inc., 2016)

- Infiltration rate: based on the site-specific hydrologic soil group (1.0 in/hr for Ventura County soil numbers six and seven and 0.5 in/hr for soil numbers four and five)
- Area: determined by space available for the BMP
- Maximum depth: 7.9 ft (based on information provided in Invisible Structures, Inc., 2016)

Rainwater Harvesting (Subsurface Storage Tanks) (RWH-1)

- Pretreatment: assumed to occupy 25 percent of the available area
- Area: determined by space available for the BMP
- Depth: 3 - 13 ft (based on information provided in Contech Engineered Solutions, 2016)
- Freeboard: 1 ft

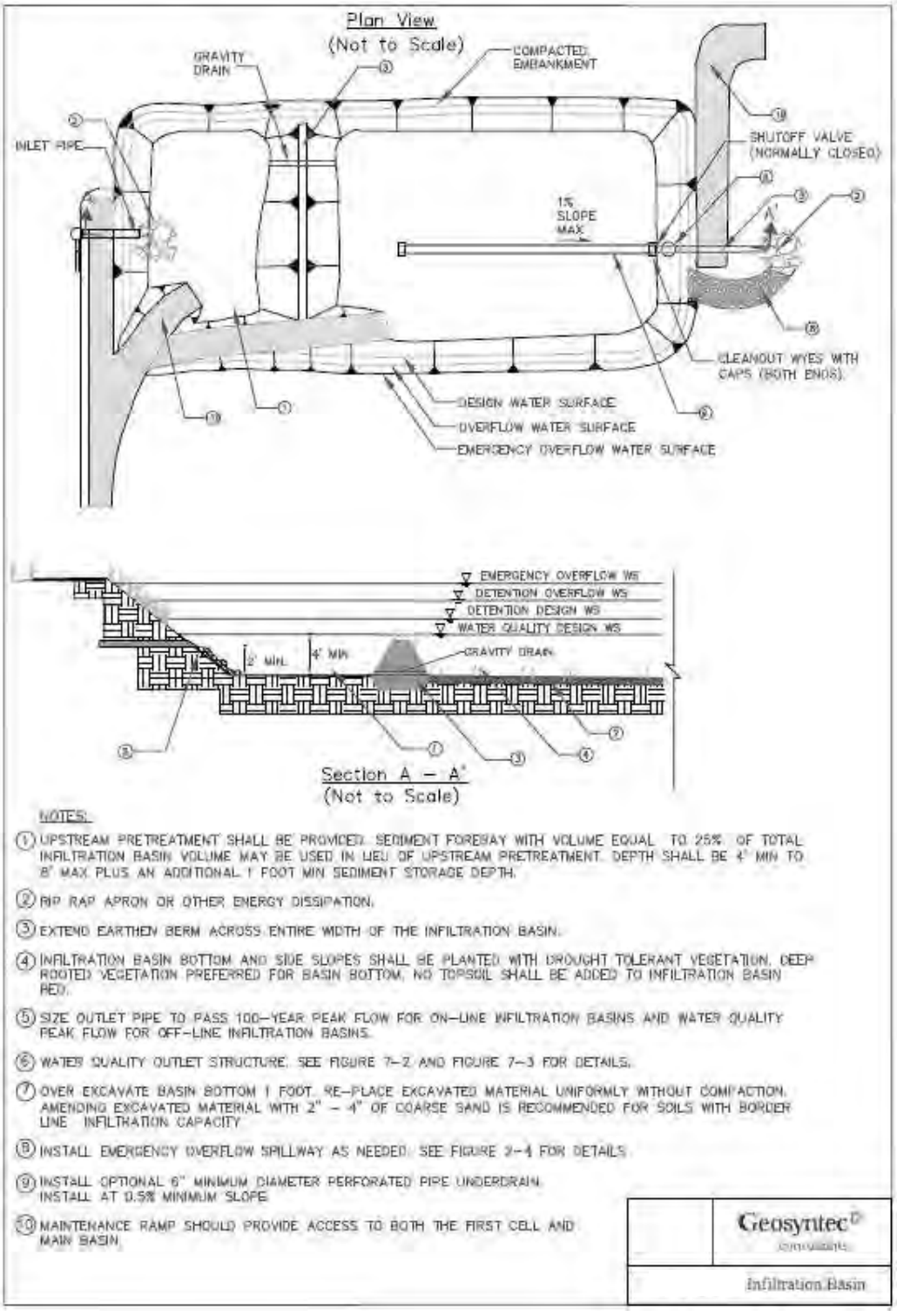


Figure 7. Infiltration Basin (INF-1) Concept

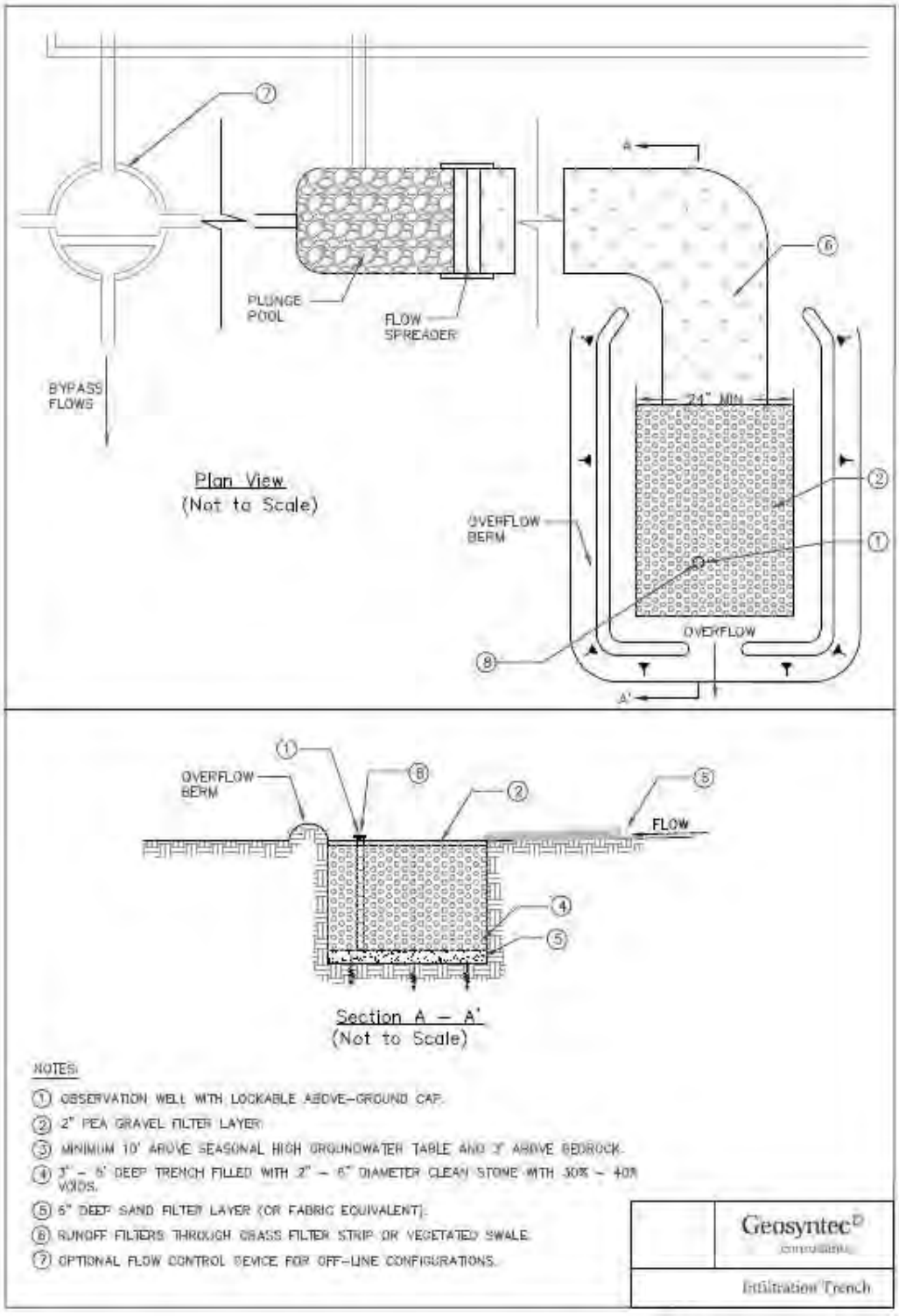


Figure 8. Infiltration Trench (INF-2) Concept

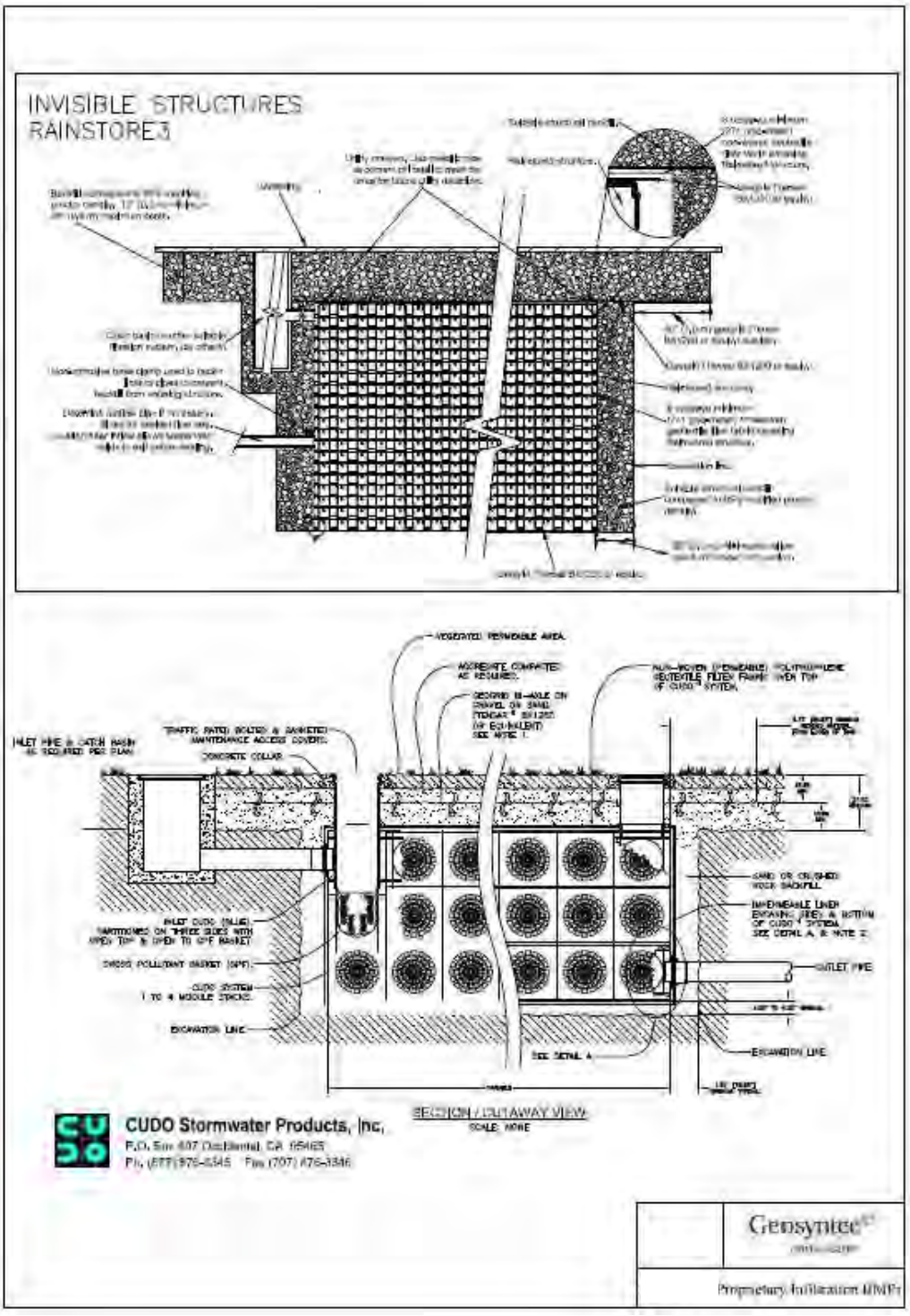


Figure 9. Subsurface Infiltration System (INF-6) Concept

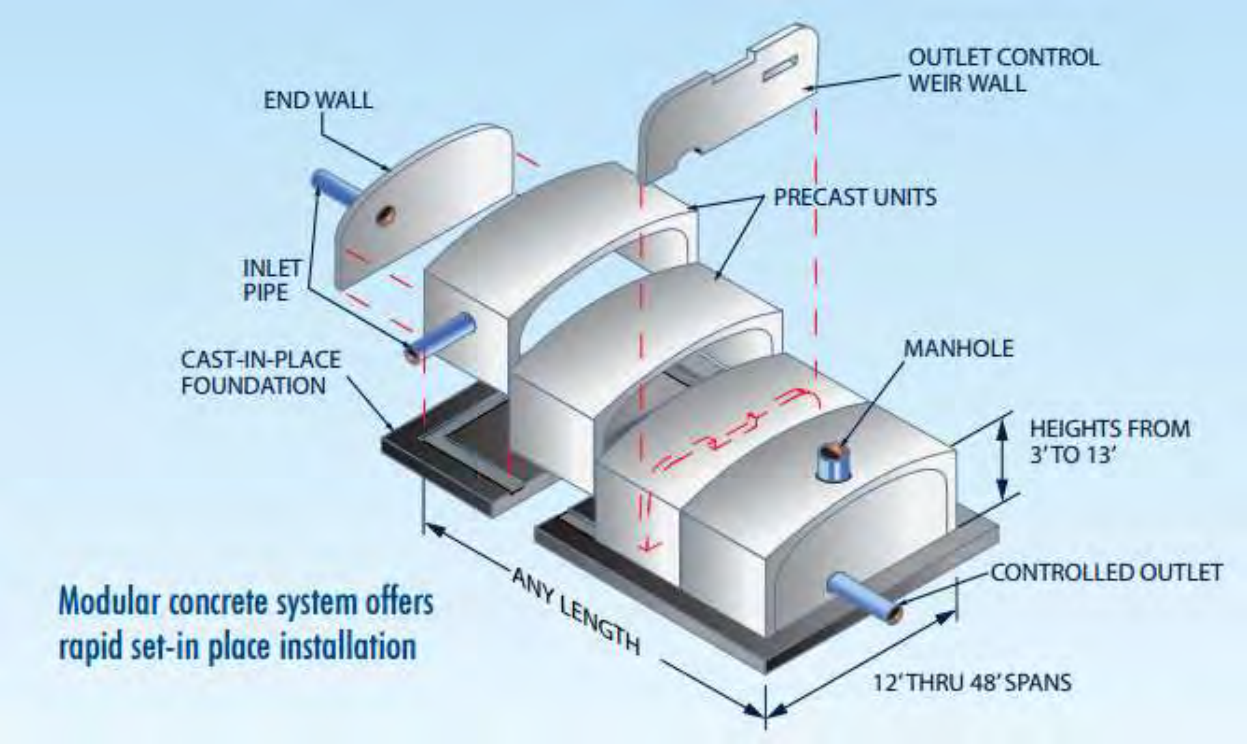


Figure 10. Subsurface Storage Tank (RWH-1) Concept (Contech Engineered Solutions, 2016)

4.4 MSWRP Modeled Projects

Information and conceptual design attributes of all proposed BMPs are summarized in the following subsections. Figures illustrating each project concept are shown in Figure 11 through Figure 22.

Annual O&M for infiltration facilities includes cleaning and removal of debris after major storm events, mowing and maintenance of upland vegetated areas, and sediment cleanout. Additional O&M is also recommended every three to five years, which includes removal of accumulated sediment from forebays/sediment storage areas and scarifying surfaces with light equipment. Annual O&M for subsurface storage tanks (rainwater harvesting) includes maintenance for an UltraViolet (UV) system, which includes lamp replacement, energy, and cleaning.

City of Camarillo (M-CC01) – Infiltration Basin (INF-1)

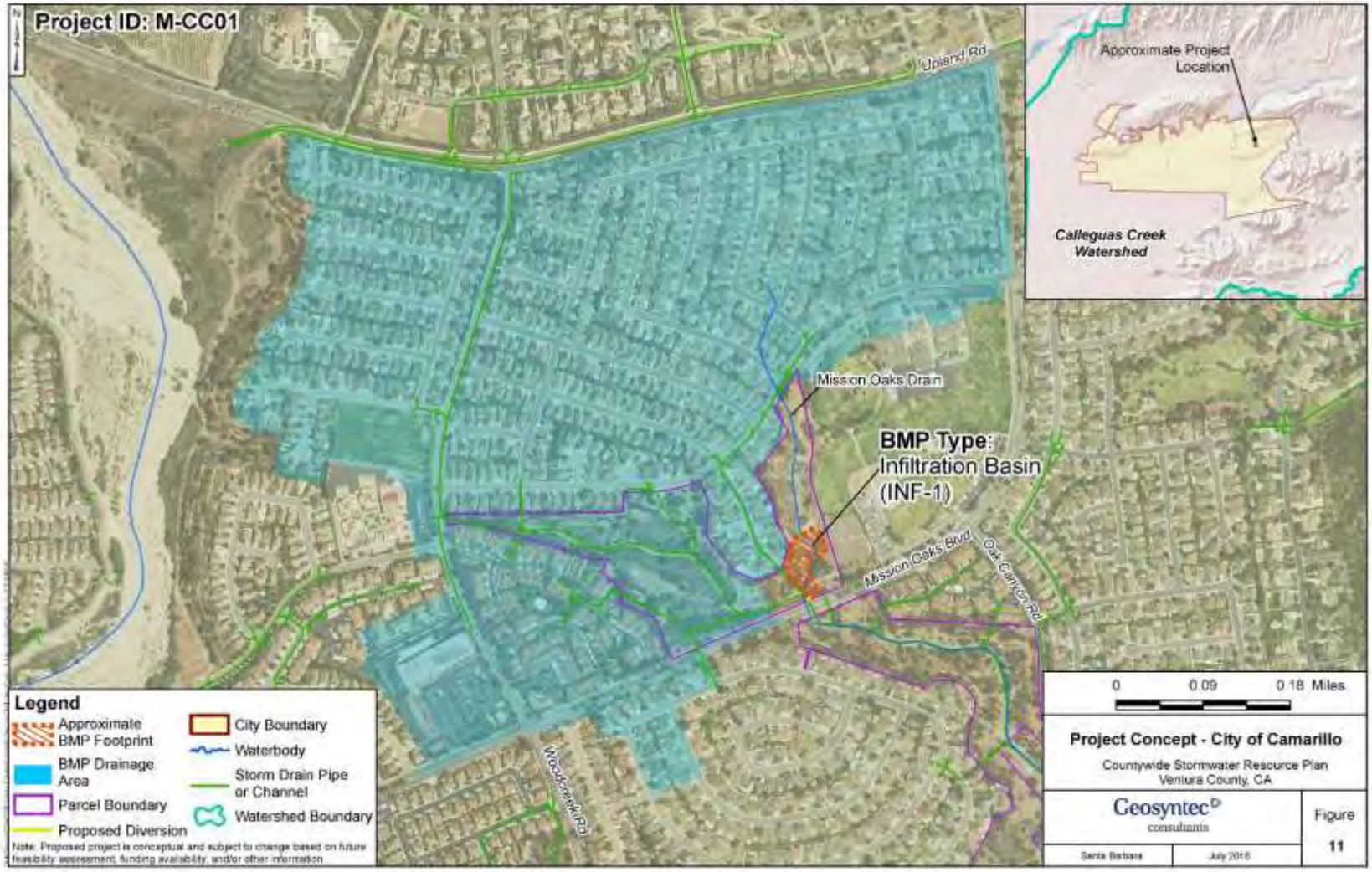
The Mission Oaks drain area was identified as a potential location for an infiltration basin BMP. The parcel is owned by the City of Camarillo and will treat flow from the Mission Oaks Drain, which is downstream of a residential area. The proposed project will also capture flow from a 42-inch storm drain, which is owned by the City of Camarillo and also drains a predominately residential area.

Site-specific soil testing was performed to determine if underlying soils had adequate infiltration capacity at this site. Falling-head borehole infiltration tests were performed, per the Ventura County TGM, at two locations (at 23-25 feet below ground surface and 19-21 feet below ground surface). The average field measured percolation rate was determined to be 1.38 inches per hour. A factor of safety of 2.6 was determined based on procedures outlined in the Ventura County TGM[6], resulting in an infiltration rate of 0.53 inches per hour. Since these deep percolation tests are more representative of subsurface infiltration rates at depths beneath the proposed infiltration basin, dry wells may be considered in the future if surface infiltration is found to be too restrictive.

The major water wholesale agency that supplies water to the City of Camarillo is the Calleguas Municipal Water District. The BMP was sized for the maximum footprint available that was south of the most downstream check dam, also avoiding large trees and dense vegetation. This project includes the following design parameters and assumptions:

- Approximate Pretreatment Footprint Area: 11,000 sq ft
- Approximate BMP Footprint Area: 33,000 sq ft
- Drainage Area: 217 acres
- Imperviousness of Drainage Area: 47%
- Infiltration Rate: 0.53 in /hr
- Depth: 2.1 ft
- Freeboard Depth: 1 ft
- Storage Volume: 68,000 cu ft
- Expected percentage of the 85th percentile 24-hour storm event captured: 21%
- Watershed: Calleguas Creek
- Land Uses Treated: Single-Family Residential (73%), Multi-Family Residential (8.9%), Education (7.0%), Open Space (6.1%), and Commercial (4.8%)

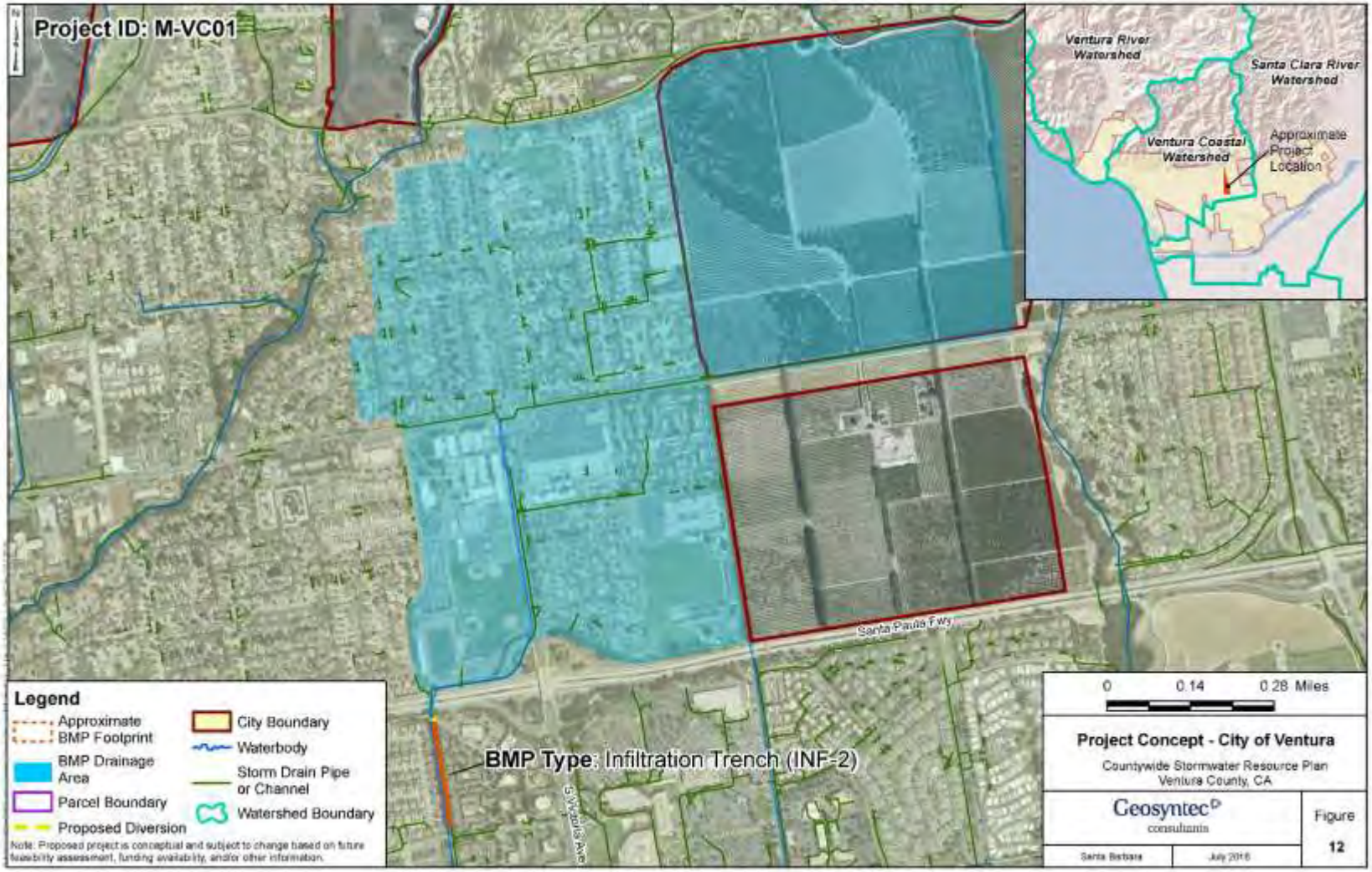
[6] The factor of safety determination outlined in the Ventura County TGM was based on small-scale testing and is intended to be applied to short-term infiltration rates. This procedure may not be applicable to deep infiltration rates resulting from falling head tests.


Project ID: M-CC01
Upland Rd
Approximate Project Location
Calleguas Creek Watershed
Mission Oaks Drain
BMP Type:
Infiltration Basin
(INF-1)
Mission Oaks Blvd
Oak Canyon Rd
Woodcreek Rd
Legend
Approximate BMP Footprint
BMP Drainage Area
Parcel Boundary
Proposed Diversion
City Boundary
Waterbody
Storm Drain Pipe or Channel
Watershed Boundary
Note: Proposed project is conceptual and subject to change based on future feasibility assessment, funding availability, and/or other information
0
0.09
0.18 Miles
Project Concept - City of Camarillo
Countywide Stormwater Resource Plan
Ventura County, CA
Geosyntec consultants
Santa Barbara
July 2016
Figure
11

City of Ventura (M-VC01) – Infiltration Trench (INF-2)

An opportunity to implement an infiltration trench was identified at a parcel, owned by the City of Ventura, located directly south of the CA-126 and just east of Tierney Avenue. Because of the narrow parcel footprint and bike path running through the parcel, an infiltration trench was determined to be the most feasible BMP opportunity. Infiltration trenches are proposed on both sides of the bike path, starting just south of the CA-126 and running south towards Thille Street. The major water wholesale agency that supplies water to the City of Ventura is the Casitas Municipal Water District. The infiltration trenches were sized based on the maximum footprint available, without disturbing the existing bake path or compromising safety for bicyclists. The proposed footprint has infiltrative soils (Ventura County soil numbers 4 and 5) and is located in close proximity to a 96-inch storm drain (owner unknown) downstream of a predominately residential and educational area. The project includes the following design parameters and assumptions:

- Approximate Pretreatment Footprint Area: 3,100 sq ft
- Approximate BMP Footprint Area: 9,200 sq ft
- Drainage Area: 488 acres
- Imperviousness of Drainage Area: 39%
- Infiltration Rate: 0.5 in /hr
- Gravel Layer Depth: 5.6 ft
- Sand Layer Depth (bottom layer): 0.5 ft
- Freeboard Depth: 1 ft
- Storage Volume: 18,000 cu ft
- Expected percentage of the 85th percentile 24-hour storm event captured: 3.0%
- Watershed: Ventura Coastal
- Land Uses Treated: Agriculture (38%), Single-Family Residential (34%), Education (18%), Multi-Family Residential (5.1%), Commercial (2.9%), Open Space (1.2%), and others (1.0%)

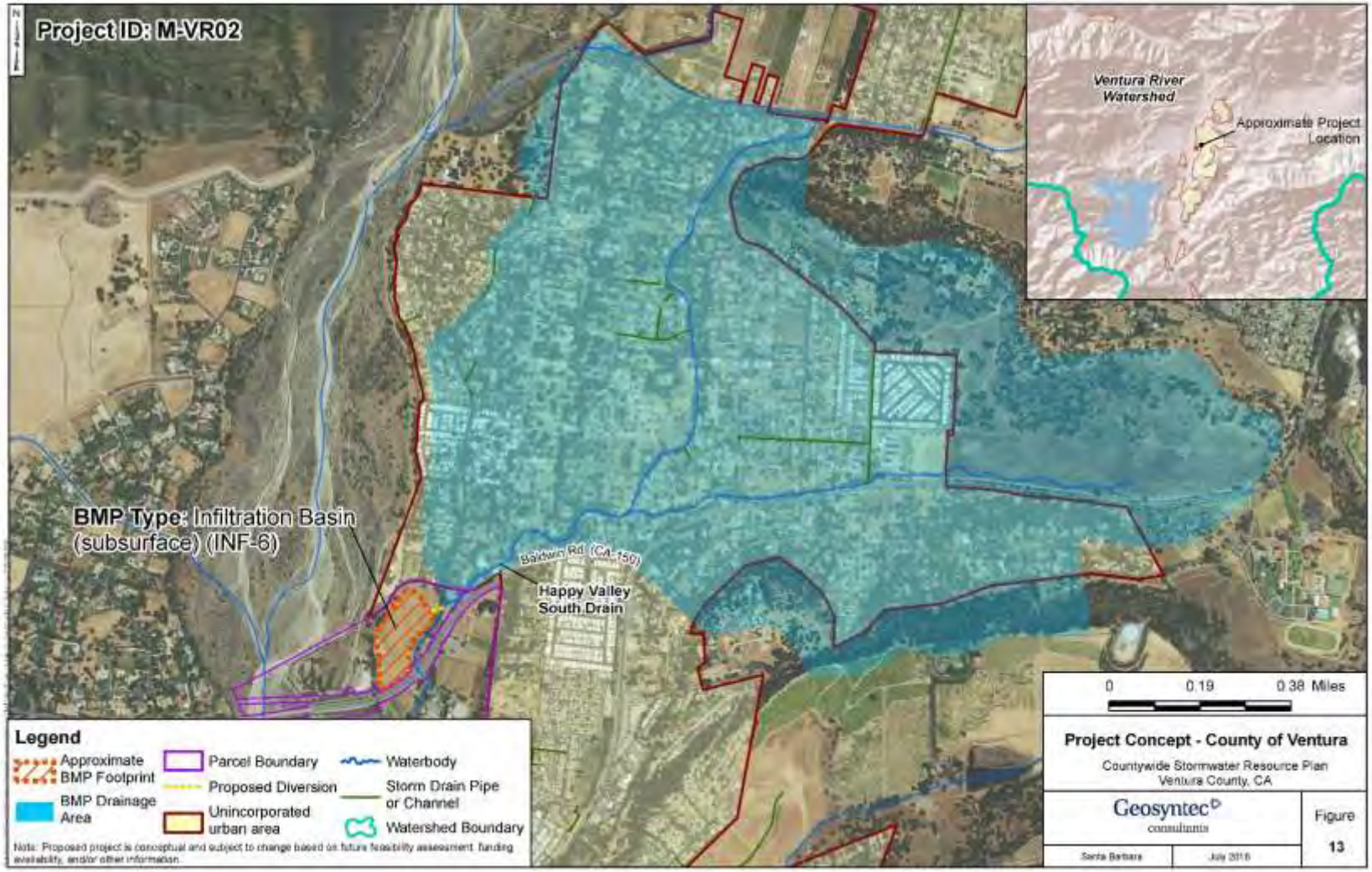

Project ID: M-VC01
Ventura River Watershed
Santa Clara River Watershed
Ventura Coastal Watershed
Approximate Project Location
Santa Paula Fwy
BMP Type: Infiltration Trench (INF-2)
Legend
Approximate BMP Footprint
BMP Drainage Area
Parcel Boundary
Proposed Diversion
City Boundary
Waterbody
Storm Drain Pipe or Channel
Watershed Boundary
Note: Proposed project is conceptual and subject to change based on future feasibility assessment, funding availability, and/or other information.
0 0.14 0.28 Miles
Project Concept - City of Ventura
Countywide Stormwater Resource Plan
Ventura County, CA
Geosyntec consultants
Santa Barbara
July 2016
Figure 12

County of Ventura (M-VR02) – Proprietary Infiltration (Subsurface Infiltration System) (INF-6)

The "Mira Monte" site, located adjacent to Baldwin Road (CA-150), was identified as a potential location for proprietary infiltration (a subsurface infiltration system). This parcel, owned by the County of Ventura, is in close proximity to the Happy Valley Drain South, which is a tributary to the Ventura River and is downstream of a predominately residential area. Currently available information show that the underlying soils on the parcel are Ventura County soil number 3. Therefore, site-specific testing will be needed to ensure adequate surface infiltration can be achieved at this site or whether subsurface soil infiltration testing should be carried out to determine drywell feasibility. The major water wholesale agency that supplies water to Ventura County is the Casitas Municipal Water District.

The northeastern portion of the parcel, north of Baldwin Road, will be used for implementation of the subsurface infiltration basin. The basin was sized based on the maximum footprint available in this portion of the site, which excludes the northeastern-most portion to maintain a 100 ft radius from a water well. The resulting storage capacity was adequate to treat the 85th percentile volume from the drainage area. Implementation of a subsurface infiltration system will allow for development and other site uses on top of the BMP. This project includes the following design parameters and assumptions:

- Approximate Pretreatment Footprint Area: 95,000 sq ft
- Approximate BMP Footprint Area: 284,000 sq ft
- Drainage Area: 871 acres
- Imperviousness of Drainage Area: 25%
- Infiltration Rate: 0.5 in/hr
- Porosity: 0.94
- Depth: 7.9 ft
- Storage Volume (accounting for porosity): 2,110,000 cu ft
- Expected percentage of the 85th percentile 24-hour storm event captured: >100%
- Watershed: Ventura River
- Land Uses Treated: Single-Family Residential (61%), Open Space (27%), Multi-Family Residential (4.9%), Agriculture (4.5%), Education (2.7%), and Commercial (0.14%)


Project ID: M-VR02
BMP Type: Infiltration Basin (subsurface) (INF-6)
Baldwin Rd. (CA-150)
Happy Valley South Drain
Ventura River Watershed
Approximate Project Location
Legend
Approximate BMP Footprint
BMP Drainage Area
Parcel Boundary
Proposed Diversion
Unincorporated urban area
Waterbody
Storm Drain Pipe or Channel
Watershed Boundary
Note: Proposed project is conceptual and subject to change based on future feasibility assessment, funding availability, and/or other information.
0
0.19
0.38 Miles
Project Concept - County of Ventura
Countywide Stormwater Resource Plan
Ventura County, CA
Geosyntec consultants
Santa Barbara
July 2016
Figure
13

County of Ventura (M-SCR03) – Piru Stormwater Capture for Groundwater Recharge

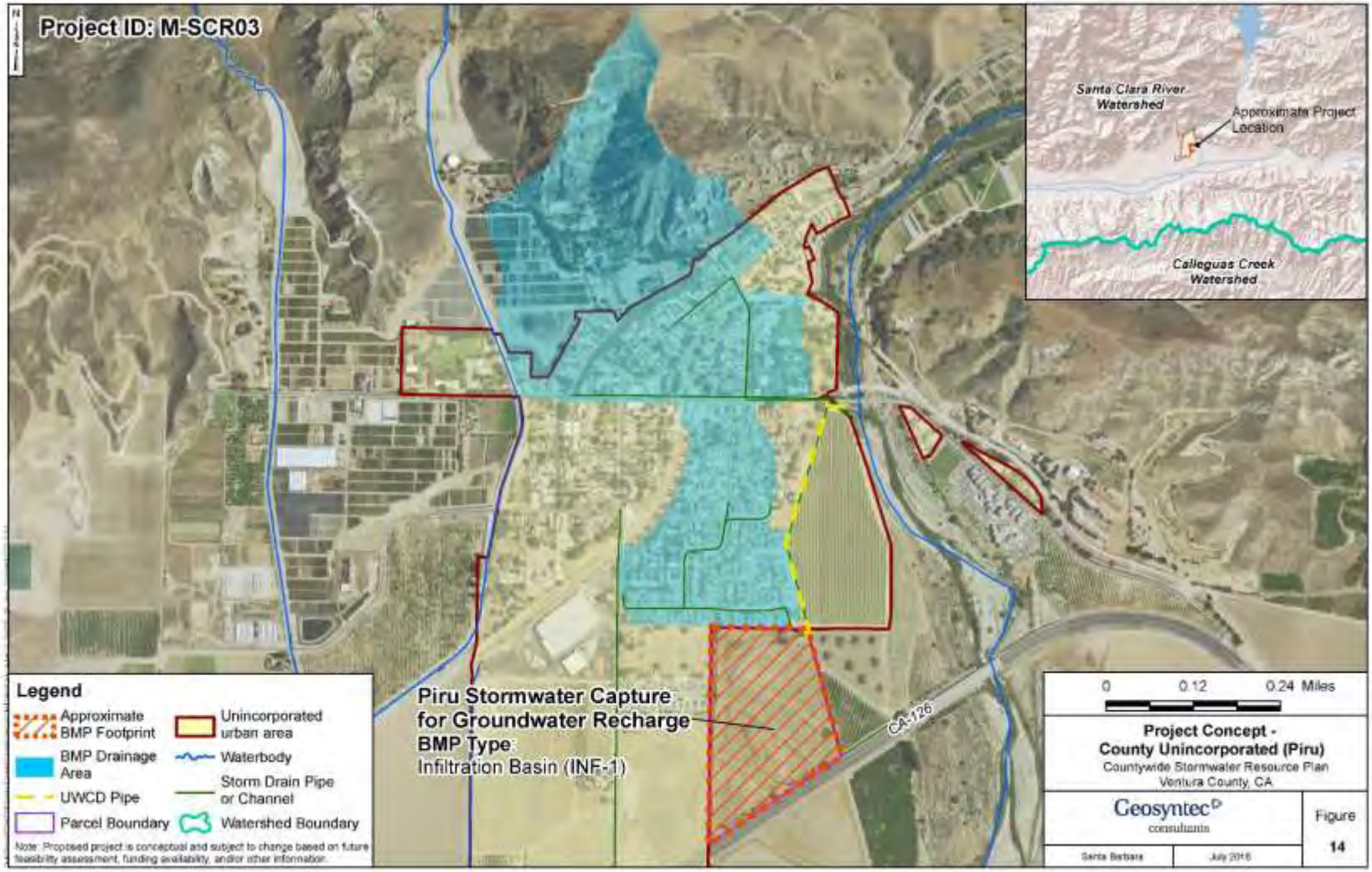
An opportunity at a parcel immediately north of the CA-126 in the County Unincorporated area of Piru was identified to capture stormwater runoff from the community of Piru and convey it to the existing Piru Spreading Grounds for groundwater recharge (The Piru Stormwater Capture for Groundwater Recharge Project). The spreading grounds are owned by the United Water Conservation District (UWCD) and have not been in operation since September 2008, due to inability to meet fish passage requirements. This project would provide groundwater recharge to the Piru basin, which provides supply for the Piru Mutual Water Company (agricultural users) and Warring Water Service (primarily domestic users).

The proposed project is downstream of a residential area, which represents approximately 45 percent of the Piru residential area, and a portion of open space outside of Piru. The project will connect existing County of Ventura storm drains (24-inch, 30-inch, and 42-inch) to UWCD's existing 48-inch pipeline, which was previously used to transport water from Piru Creek to the spreading grounds before it was abandoned in 2008.

The Piru area is known to County of Ventura staff as an area with highly permeable soils, as documented by the Unites States Geological Survey (USGS). However, site-specific testing may be needed to confirm whether adequate infiltration can still be achieved at this site.

The proposed infiltration-based project will occupy the entire parcel, which is owned by UWCD and was previously utilized as spreading grounds. The spreading grounds' estimated storage capacity far exceeds the runoff volume anticipated from the project's drainage area. The project includes the following design parameters and assumptions:

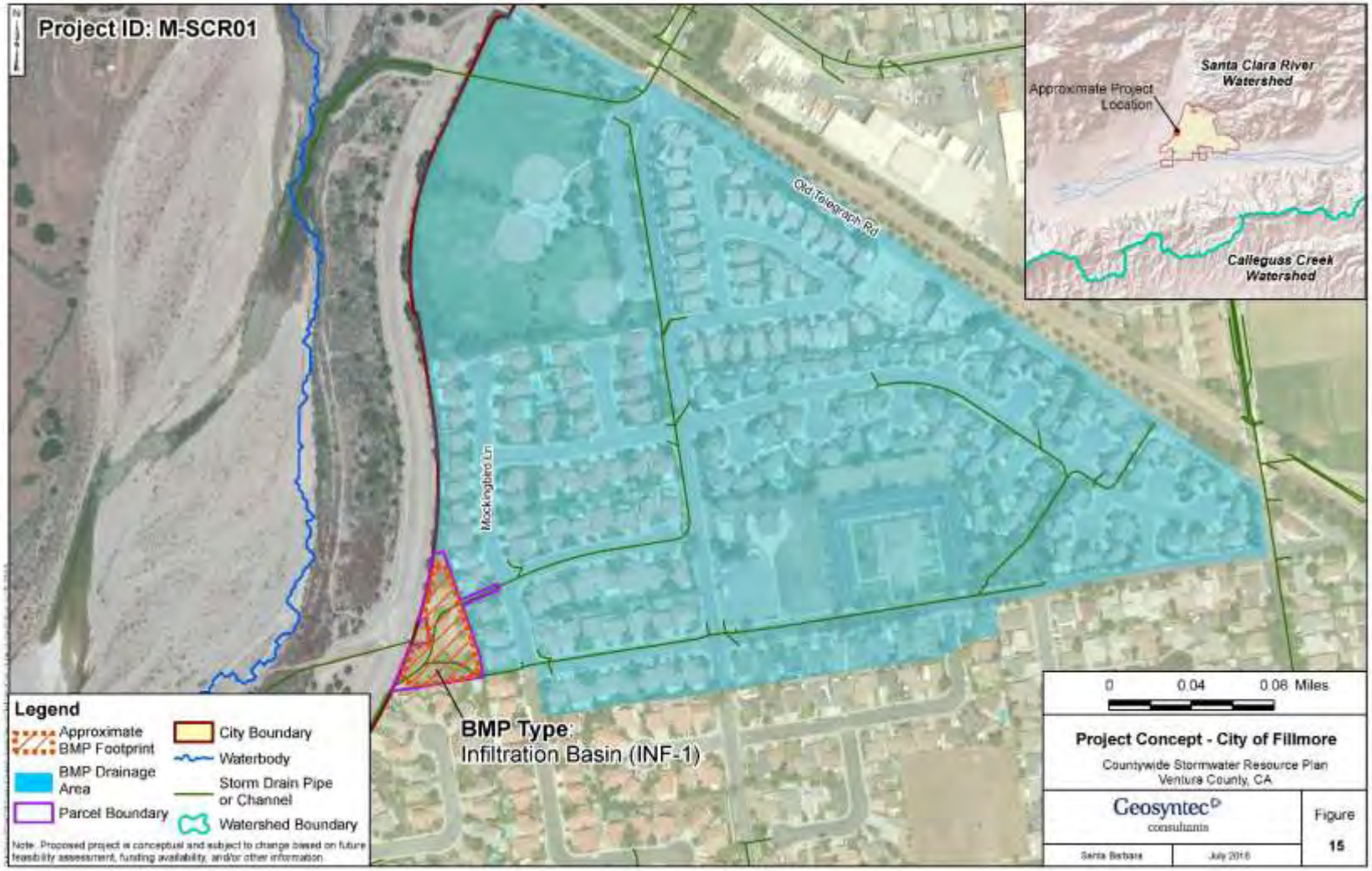
- Approximate BMP Footprint Area: 25 acres
- Drainage Area: 123 acres
- Imperviousness of Drainage Area: 28%
- Infiltration Rate: 0.5 in /hr
- Depth: 4-6 ft (varies)
- Estimated Storage Volume: 2,500,000 cu ft
- Expected percentage of the 85th percentile 24-hour storm event captured: >100%
- Watershed: Santa Clara River
- Land Uses Treated: Single-Family Residential (50%), Open Space (37%), Education (4.9%), Multi-Family Residential (3.3%), Commercial (1.9%), Agriculture (1.5%) and others (0.8%)


Project ID: M-SCR03
Santa Clara River Watershed
Approximate Project Location
Calleguas Creek Watershed
Legend
Approximate BMP Footprint
BMP Drainage Area
UWCD Pipe
Parcel Boundary
Unincorporated urban area
Waterbody
Storm Drain Pipe or Channel
Watershed Boundary
Note: Proposed project is conceptual and subject to change based on future feasibility assessment, funding availability, and/or other information.
Piru Stormwater Capture for Groundwater Recharge
BMP Type
Infiltration Basin (INF-1)
CA-126
0
0.12
0.24 Miles
Project Concept - County Unincorporated (Piru)
Countywide Stormwater Resource Plan
Ventura County, CA
Geosyntec consultants
Santa Barbara
July 2016
Figure
14

City of Fillmore (M-SCR01) – Infiltration Basin (INF-1)

An opportunity to implement an infiltration basin was identified at an undeveloped parcel off Mockingbird Lane, which is owned by the City of Fillmore. The parcel has infiltrative soils (Ventura County soil number 5), and a 48-inch storm drain (owned by the City of Fillmore) runs through the parcel that drains a residential neighborhood, church campus, and developed park. The major water wholesale agency that supplies water to the City of Fillmore is the United Water Conservation District. The proposed infiltration basin was sized based on the maximum footprint available, and the project includes the following design parameters and assumptions:

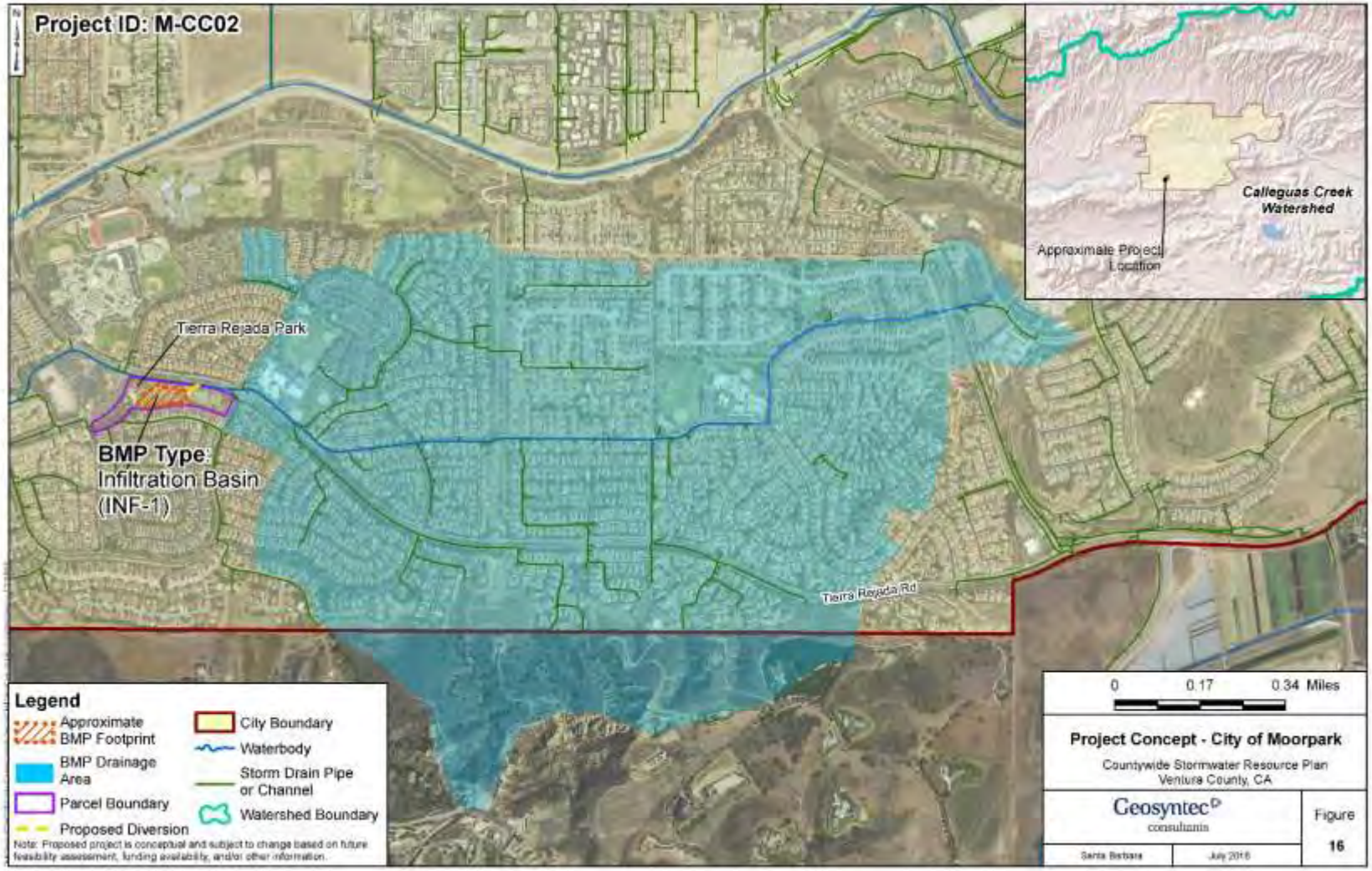
- Approximate Pretreatment Footprint Area: 8,100 square feet (sq ft)
- Approximate BMP Footprint Area: 24,000 sq ft
- Drainage Area: 53 acres
- Imperviousness of Drainage Area: 42%
- Infiltration Rate: 0.5 inches per hour (in /hr)
- Depth: 2 feet (ft)
- Freeboard Depth: 1 ft
- Storage Volume: 47,000 cubic feet (cu ft)
- Expected percentage of the 85th percentile 24-hour storm event captured: 65%
- Watershed: Santa Clara River
- Land Uses Treated: Single-Family Residential (67%), Education (30%), Commercial (2.1%), Industrial (1.0%), and others (0.10%)


Project ID: M-SCR01
Approximate Project Location
Santa Clara River Watershed
Calleguas Creek Watershed
Old Telegraph Rd
Mockingbird Ln
BMP Type:
Infiltration Basin (INF-1)
Legend
Approximate BMP Footprint
BMP Drainage Area
Parcel Boundary
City Boundary
Waterbody
Storm Drain Pipe or Channel
Watershed Boundary
Note: Proposed project is conceptual and subject to change based on future feasibility assessment, funding availability, and/or other information.
0
0.04
0.08 Miles
Project Concept - City of Fillmore
Countywide Stormwater Resource Plan
Ventura County, CA
Geosyntec consultants
Santa Barbara
July 2016
Figure
15

City of Moorpark (M-CC02) – Infiltration Basin (INF-1)

An opportunity to implement an infiltration basin was identified at Tierra Rejada Park, which is owned by the City of Moorpark. The park has infiltrative soils (Ventura County soil number 5) and is located in close proximity to a 90-inch storm drain, owned by the City of Moorpark, which drains a large, predominately residential area upstream. The major water wholesale agency that supplies water to the City of Moorpark, through the Ventura County Waterworks District #1, is the Calleguas Municipal Water District. The proposed infiltration basin will only occupy undeveloped portions of the park, avoiding tennis courts, basketball courts, parking lots, and other paved areas. The project includes the following design parameters and assumptions:

- Approximate Pretreatment Footprint Area: 21,000 sq ft
- Approximate BMP Footprint Area: 62,000 sq ft
- Drainage Area: 760 acres
- Imperviousness of Drainage Area: 35%
- Infiltration Rate: 0.5 in /hr
- Depth: 2 ft
- Freeboard Depth: 1 ft
- Storage Volume: 122,000 cu ft
- Expected percentage of the 85th percentile 24-hour storm event captured: 14%
- Watershed: Calleguas Creek
- Land Uses Treated: Single-Family Residential (72%), Open Space (17%), Education (8.5%), and Agriculture (2.8%)

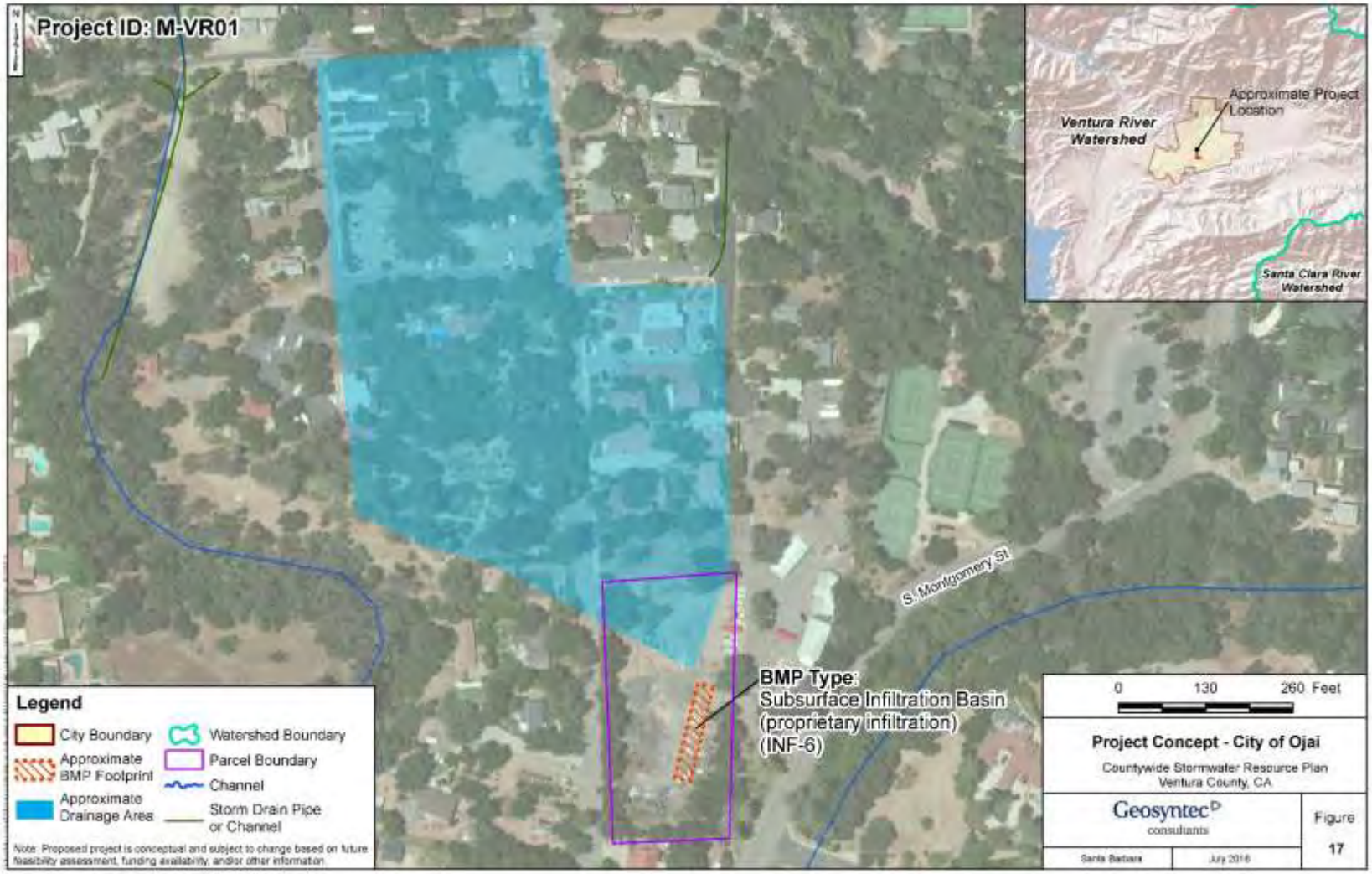

Project ID: M-CC02
Calleguas Creek Watershed
Approximate Project Location
Tierra Rejada Park
BMP Type:
Infiltration Basin
(INF-1)
Tierra Rejada Rd
Legend
Approximate BMP Footprint
BMP Drainage Area
Parcel Boundary
Proposed Diversion
City Boundary
Waterbody
Storm Drain Pipe or Channel
Watershed Boundary
Note: Proposed project is conceptual and subject to change based on future feasibility assessment, funding availability, and/or other information.
0
0.17
0.34 Miles
Project Concept - City of Moorpark
Countywide Stormwater Resource Plan
Ventura County, CA
Geosyntec consultants
Santa Barbara
July 2016
Figure
16

City of Ojai (M-VR01) - Proprietary Infiltration (Subsurface Infiltration System) (INF-6)

A parcel located immediately north of the intersection of South Montgomery Street and South Ventura Street was identified as a potential location for proprietary infiltration (a subsurface infiltration system). Currently available information shows that the majority of the parcel has underlying soils characterized by Ventura County soil number 2 and the remaining portion of the parcel is Ventura County soil number 3. Therefore, site-specific testing will be needed to ensure adequate surface infiltration can be achieved at this site or whether subsurface soil infiltration testing should be carried out to determine drywell feasibility. This parcel, owned by the City of Ojai, currently serves as a storage yard. The drainage area to this proposed BMP is fairly small and is characterized by predominately residential land uses. The major water wholesale agency that supplies water to the City of Ojai is the Casitas Municipal Water District.

In order to maintain the current site use of the parcel as a storage yard, the proposed BMP will only occupy the southeastern portion of the parcel. The proposed BMP is subsurface, which will allow the current site use to be maintained above the BMP, but minimizing the BMP footprint will reduce concern for loadings from heavy trucks over the BMP footprint. The resulting storage capacity was adequate to treat the 85th percentile volume from the drainage area. This project includes the following design parameters and assumptions:

- Approximate Pretreatment Footprint Area: 860 sq ft
- Approximate BMP Footprint Area: 2,600 sq ft
- Drainage Area: 8.7 acres
- Imperviousness of Drainage Area: 43%
- Infiltration Rate: 0.5 in/hr
- Porosity: 0.94
- Depth: 7.9 ft
- Storage Volume (accounting for porosity): 19,000 cu ft
- Expected percentage of the 85th percentile 24-hour storm event captured: >100%
- Watershed: Ventura River
- Land Uses Treated: Single-Family Residential (45%), Commercial (33%), Agriculture (12%), Open Space (9.6%), and Industrial (0.6%)

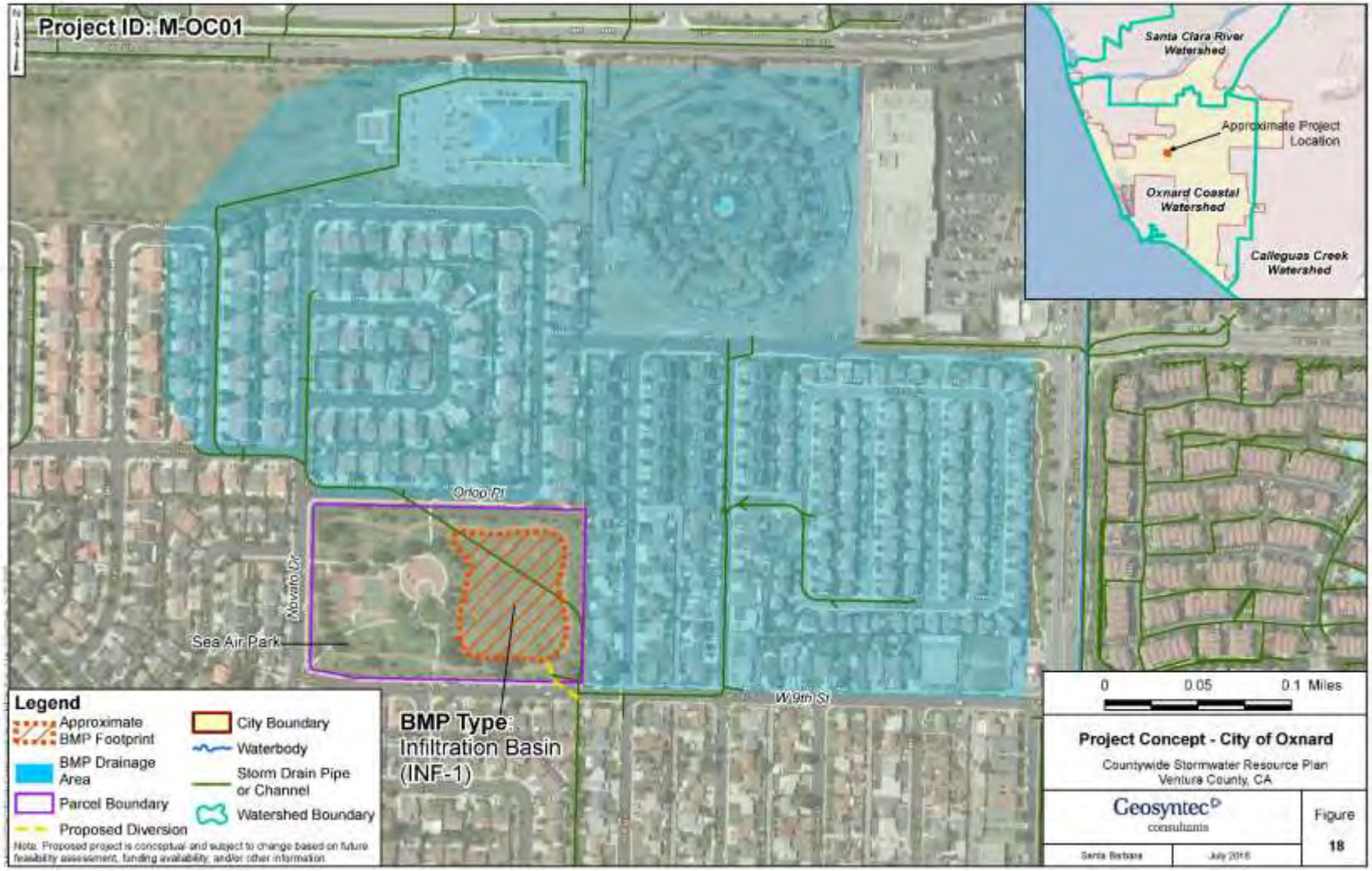

Project ID: M-VR01
Approximate Project Location
Ventura River Watershed
Santa Clara River Watershed
S. Montgomery St
BMP Type:
Subsurface Infiltration Basin
(proprietary infiltration)
(INF-6)
Legend
City Boundary
Watershed Boundary
Approximate BMP Footprint
Parcel Boundary
Channel
Approximate Drainage Area
Storm Drain Pipe or Channel
Note: Proposed project is conceptual and subject to change based on future feasibility assessment, funding availability, and/or other information.
0
130
260 Feet
Project Concept - City of Ojai
Countywide Stormwater Resource Plan
Ventura County, CA
Geosyntec consultants
Santa Barbara
July 2016
Figure
17

City of Oxnard (M-OC01) – Infiltration Basin (INF-1)

An opportunity to implement an infiltration basin was identified at Sea Air Park, which is owned by the City of Oxnard. Currently available information show that the underlying soils on the parcel are Ventura County soil number 3. Therefore, site-specific testing will be needed to ensure adequate surface infiltration can be achieved at this site or whether subsurface soil infiltration testing should be carried out to determine drywell feasibility. A 36-inch storm drain, owned by the City of Oxnard, runs through the parcel downstream of a predominately residential area. A 60-inch storm drain, also owned by the City of Oxnard, is located adjacent to the parcel and flow from the upstream residential area will also be captured by the parcel. The major water wholesale agency that supplies water to the City of Oxnard is the Calleguas Municipal Water District.

The proposed infiltration basin will only occupy the eastern portion of the park, which is undeveloped. The infiltration basin was sized based on the maximum footprint available, without disrupting developed portions of the park, and the resulting storage capacity was adequate to treat the 85th percentile volume from the drainage area. The project includes the following design parameters and assumptions:

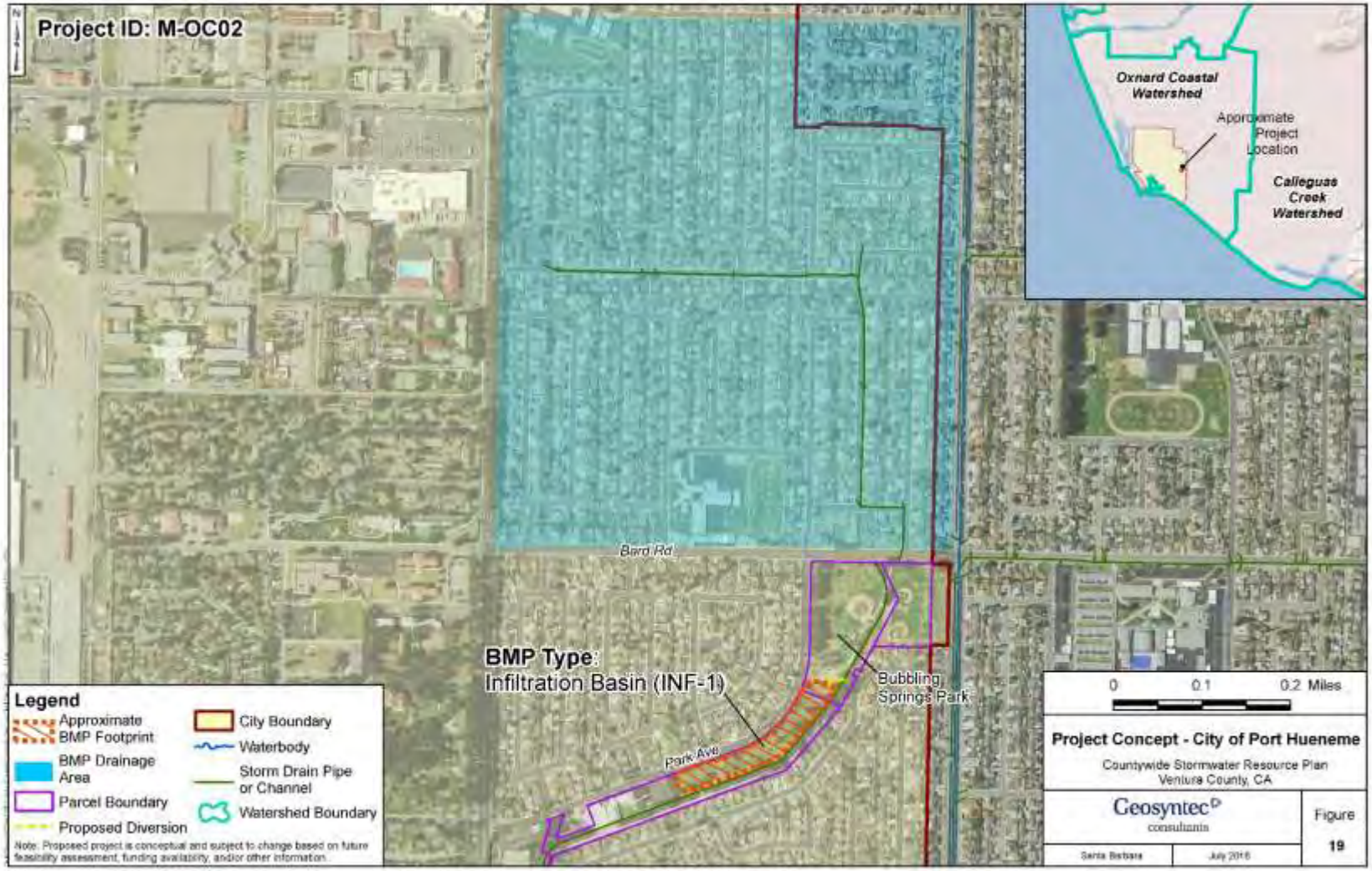
- Approximate Pretreatment Footprint Area: 25,000 sq ft
- Approximate BMP Footprint Area: 75,000 sq ft
- Drainage Area: 72 acres
- Imperviousness of Drainage Area: 54%
- Infiltration Rate: 0.5 in /hr
- Depth: 2 ft
- Freeboard Depth: 1 ft
- Storage Volume: 147,000 cu ft
- Expected percentage of the 85th percentile 24-hour storm event captured: >100%
- Watershed: Oxnard Coastal
- Land Uses Treated: Single-Family Residential (58%), Multi-Family Residential (27%), Commercial (9.6%), and Education (5.5%)


Project ID: M-OC01
Santa Clara River Watershed
Approximate Project Location
Oxnard Coastal Watershed
Calleguas Creek Watershed
Orion Pl
Novato Dr
Sea Air Park
W 9th St
BMP Type:
Infiltration Basin
(INF-1)
Legend
Approximate BMP Footprint
BMP Drainage Area
Parcel Boundary
Proposed Diversion
City Boundary
Waterbody
Storm Drain Pipe or Channel
Watershed Boundary
Note: Proposed project is conceptual and subject to change based on future feasibility assessment, funding availability, and/or other information.
0
0.05
0.1 Miles
Project Concept - City of Oxnard
Countywide Stormwater Resource Plan
Ventura County, CA
Geosyntec consultants
Santa Barbara
July 2016
Figure
18

City of Port Hueneme (M-OC02) – Infiltration Basin (INF-1)

Bubbling Springs Park, owned by the City of Port Hueneme, was identified for implementation of an infiltration basin. Currently available information show that the underlying soils on the parcel are Ventura County soil number 3. Therefore, site-specific testing will be needed to ensure adequate surface infiltration can be achieved at this site or whether subsurface soil infiltration testing should be carried out to determine drywell feasibility. A storm drain, owned by the City of Oxnard, runs through the park downstream of a predominately residential area. The major water wholesale agency that supplies water to the City of Port Hueneme is the United Water Conservation District. The proposed infiltration basin will only occupy the undeveloped portion of the park, to avoid disturbing baseball fields and paved areas, and the resulting storage capacity was adequate to treat the 85th percentile volume from the drainage area. The infiltration basin was sized based on the maximum footprint available, without disrupting developed portions of the park. The project includes the following design parameters and assumptions:

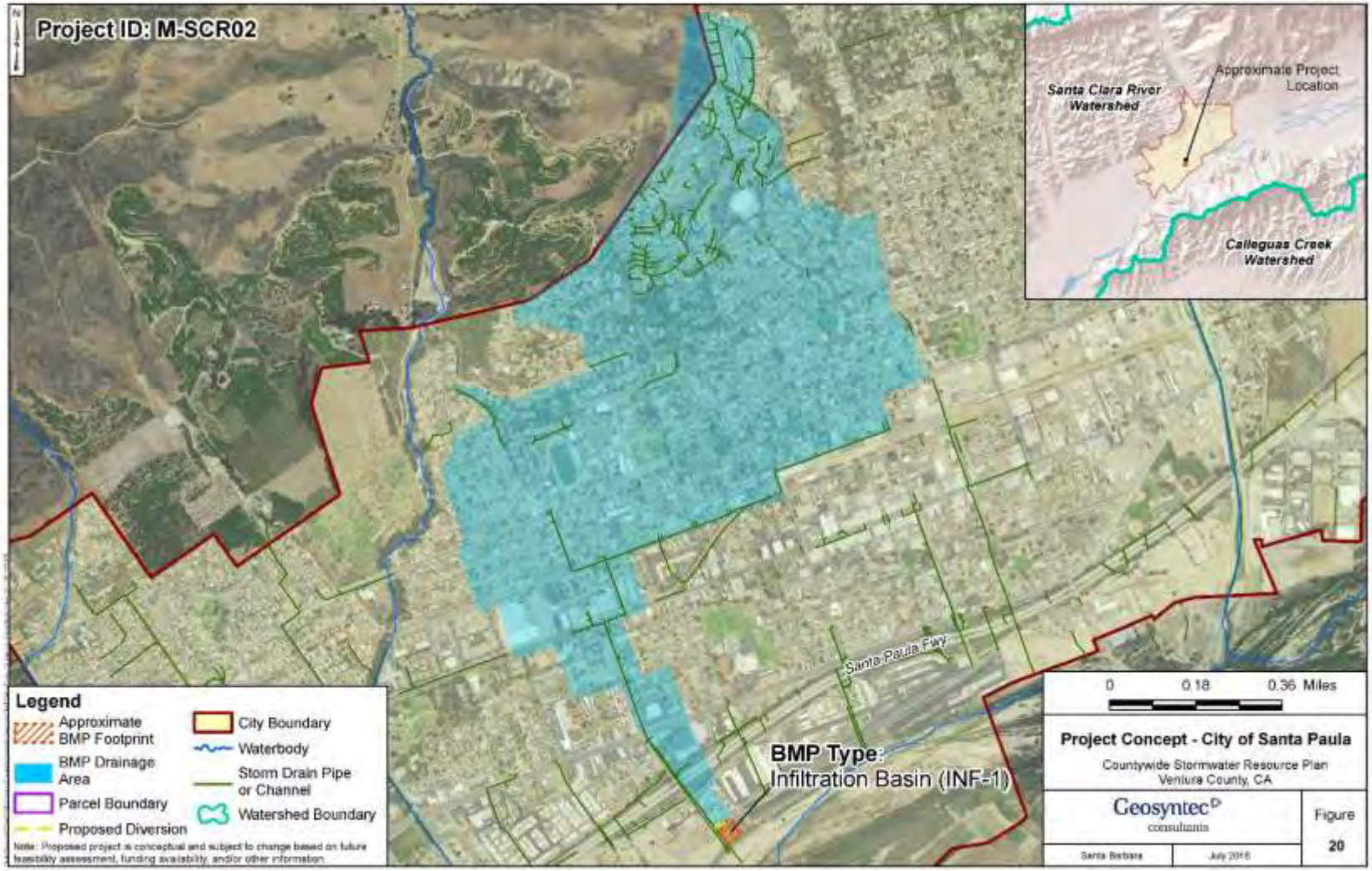
- Approximate Pretreatment Footprint Area: 36,000 sq ft
- Approximate BMP Footprint Area: 107,000 sq ft
- Drainage Area: 197 acres
- Imperviousness of Drainage Area: 45%
- Infiltration Rate: 0.5 in /hr
- Depth: 2 ft
- Freeboard Depth: 1 ft
- Storage Volume: 211,000 cu ft
- Expected percentage of the 85th percentile 24-hour storm event captured: >100%
- Watershed: Oxnard Coastal
- Land Uses Treated: Single-Family Residential (92%) and Education (8.4%)


Project ID: M-OC02
Oxnard Coastal Watershed
Approximate Project Location
Calleguas Creek Watershed
Bard Rd
BMP Type:
Infiltration Basin (INF-1)
Bubbling Springs Park
Park Ave
Legend
Approximate BMP Footprint
BMP Drainage Area
Parcel Boundary
Proposed Diversion
City Boundary
Waterbody
Storm Drain Pipe or Channel
Watershed Boundary
Note: Proposed project is conceptual and subject to change based on future feasibility assessment, funding availability, and/or other information.
0
0.1
0.2 Miles
Project Concept - City of Port Hueneme
Countywide Stormwater Resource Plan
Ventura County, CA
Geosyntec consultants
Santa Barbara
July 2016
Figure
19

City of Santa Paula (M-SCR02) – Infiltration Basin (INF-1)

A small parcel located off South Olive Street and adjacent to the Santa Paula Airport (also in close proximity to the Santa Clara River) was identified as an opportunity for an infiltration basin. The parcel has very infiltrative underlying soils (Ventura County soil number 7). There is a 58-inch storm drain, owned by the City of Santa Paula, and 36-inch storm drain, owned by Caltrans, adjacent to the parcel that drains a large urban area. The major water wholesale agency that supplies water to the City of Santa Paula is the United Water Conservation District. The proposed infiltration basin was sized based on the maximum footprint available, and the project includes the following design parameters and assumptions:

- Approximate Pretreatment Footprint Area: 8,400 sq ft
- Approximate BMP Footprint Area: 25,000 sq ft
- Drainage Area: 440 acres
- Imperviousness of Drainage Area: 47%
- Infiltration Rate: 1.0 in /hr
- Depth: 4 ft
- Freeboard Depth: 1 ft
- Storage Volume: 98,000 cu ft
- Expected percentage of the 85th percentile 24-hour storm event captured: 15%
- Watershed: Santa Clara River
- Land Uses Treated: Single-Family Residential (68%), Education (7.6%), Multi-Family Residential (5.8%), Open Space (6.0%), Industrial (4.6%), Commercial (4.3%), Agriculture (2.7%), and Transportation (0.7%)

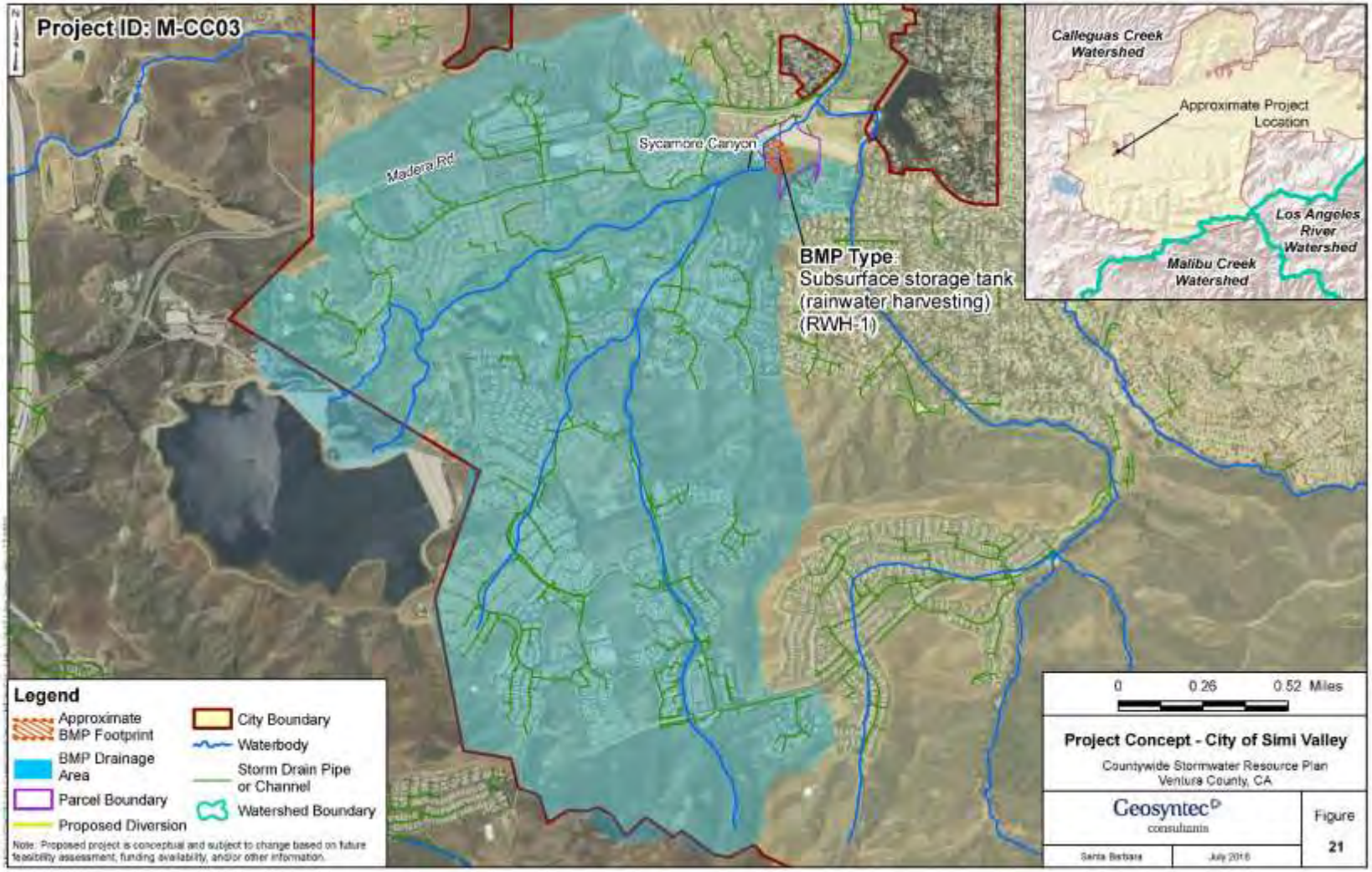

Project ID: M-SCR02
Santa Clara River Watershed
Approximate Project Location
Calleguas Creek Watershed
Santa Paula Fwy
BMP Type:
Infiltration Basin (INF-1)
Legend
Approximate BMP Footprint
BMP Drainage Area
Parcel Boundary
Proposed Diversion
City Boundary
Waterbody
Storm Drain Pipe or Channel
Watershed Boundary
Note: Proposed project is conceptual and subject to change based on future feasibility assessment, funding availability, and/or other information.
0
0.18
0.36 Miles
Project Concept - City of Santa Paula
Countywide Stormwater Resource Plan
Ventura County, CA
Geosyntec consultants
Santa Barbara
July 2016
Figure
20

City of Simi Valley (M-CC03) – Rainwater Harvesting (Subsurface Storage Tank) (RWH-1)

An opportunity to implement a rainwater harvesting system (a capture-use subsurface storage tank) was identified at a parcel south of Madera Road, immediately southwest of Sinaloa Lake. The parcel is owned by the Ventura County Flood Control District, and the major water wholesale agency that supplies water to the City of Simi Valley is the Calleguas Municipal Water District. There are several sites located in close proximity to the parcel that could potentially utilize recycled water for irrigation purposes. These sites include a small golf course located northeast of the parcel (Sinaloa Golf Course) and a park with five baseball fields located immediately east of the parcel. A subsurface storage tank is proposed to provide irrigation for the golf course and park.

The project will capture flow from Sycamore Canyon, downstream of a large residential and open space area. The tank was sized to meet the estimated irrigation demand of. 80 acre-ft per year, which was estimated based on the water use per irrigated turf grass acre on an average 18-hole gold facility in the Southwest (Lyman, 2012). This BMP was modeled and it was determined that based on historical rainfall, the available storage volume is sufficient to meet 97 percent of the irrigation needs of the golf course and park. This project includes the following design parameters and assumptions:

- Approximate Pretreatment Footprint Area: 38,000 sq ft
- Approximate BMP Footprint Area: 110,000 sq ft
- Drainage Area: 1,860 acres
- Imperviousness of Drainage Area: 21%
- Depth: 13 ft
- Freeboard: 1 ft
- Storage Volume: 1,500,000 cu ft
- Expected percentage of the 85th percentile 24-hour storm event captured: 98%
- Watershed: Calleguas Creek
- Land Uses Treated: Open Space (57%), Single-Family Residential (25%), Multi-Family Residential (7.9%), Agriculture (4.4%), Education (3.3%), Commercial (1.1%), and others (1.8%).

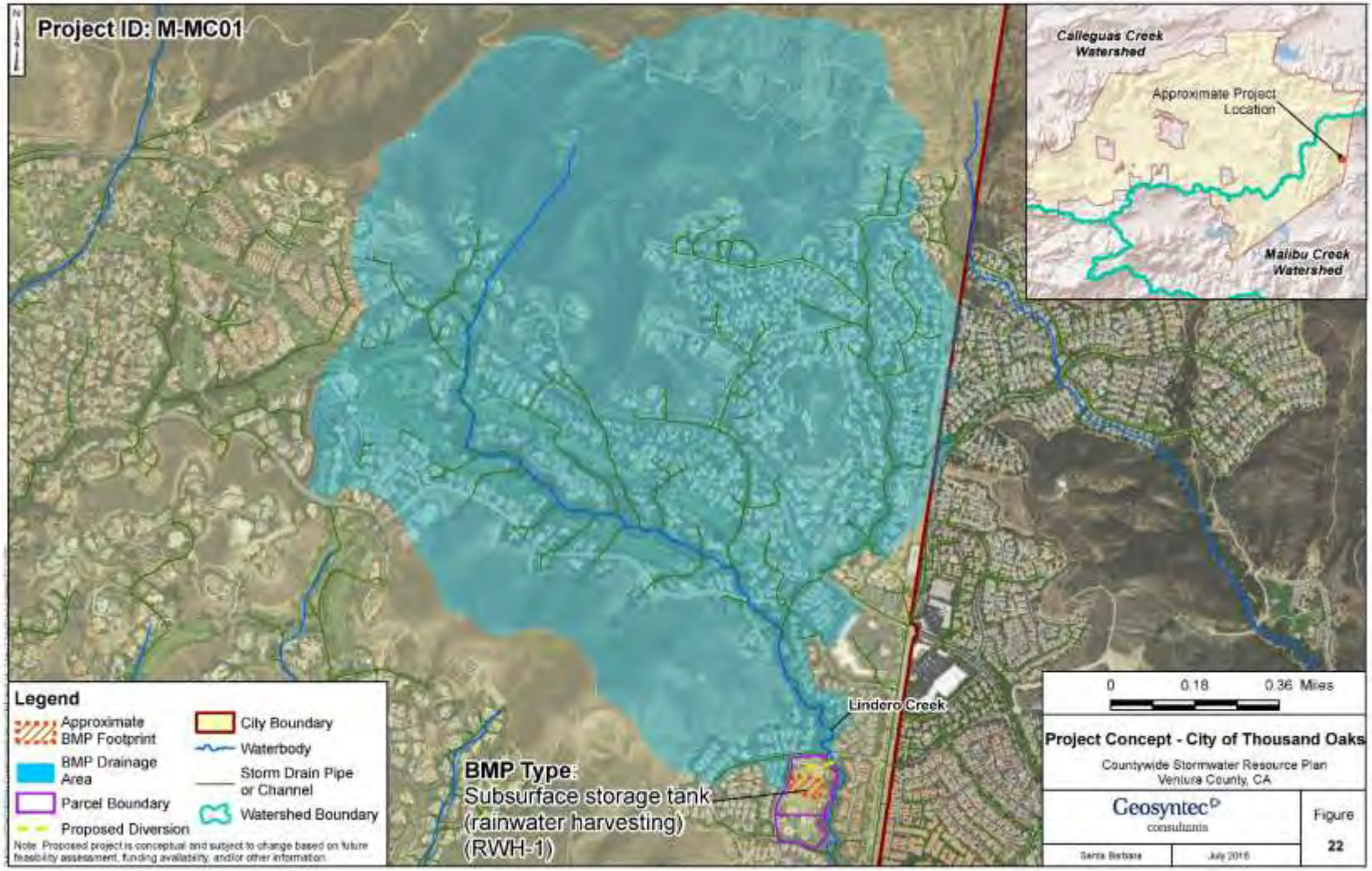

Project ID: M-CC03
Madera Rd
Sycamore Canyon
BMP Type:
Subsurface storage tank
(rainwater harvesting)
(RWH-1)
Calleguas Creek Watershed
Approximate Project Location
Los Angeles River Watershed
Malibu Creek Watershed
Legend
Approximate BMP Footprint
BMP Drainage Area
Parcel Boundary
Proposed Diversion
City Boundary
Waterbody
Storm Drain Pipe or Channel
Watershed Boundary
Note: Proposed project is conceptual and subject to change based on future feasibility assessment, funding availability, and/or other information.
0 0.26 0.52 Miles
Project Concept - City of Simi Valley
Countywide Stormwater Resource Plan
Ventura County, CA
Geosyntec consultants
Santa Barbara
July 2016
Figure
21

City of Thousand Oaks (M-MC01) – Rainwater Harvesting (Subsurface Storage Tank) (RWH-1)

An opportunity to implement a rainwater harvesting system (a capture-use subsurface storage tank) was identified at North Ranch Playfield Park, a large park owned by the Conejo Recreation and Park District. The major water wholesale agency that supplies water to the City of Thousand Oaks is the Calleguas Municipal Water District. The park is irrigated; therefore, a subsurface storage tank is proposed to provide the irrigation demand of approximately 10,500 HCF (hundred cubic feet) per year. Implementation of a subsurface storage system will also allow for continued use of the footprint as a developed park on top of the storage tank.

The project will divert flow from Lindero Creek, downstream of a large residential and open space area. The tank was sized to meet the annual irrigation demand and will not disturb developed portions of the park, such as baseball fields, sidewalks, tennis/basketball courts, and other paved areas. This BMP was modeled and it was determined that based on historical rainfall, the storage volume is sufficient to meet the irrigation needs of the park. This project includes the following design parameters and assumptions:

- Approximate Pretreatment Footprint Area: 17,000 sq ft
- Approximate BMP Footprint Area: 51,000 sq ft
- Drainage Area: 1,030 acres
- Imperviousness of Drainage Area: 14%
- Depth: 9 ft
- Freeboard: 1 ft
- Storage Volume: 460,000 cu ft
- Expected percentage of the 85th percentile 24-hour storm event captured: 71%
- Watershed: Malibu Creek
- Land Uses Treated: Open Space (61%), Single-Family Residential (35%), Multi-Family Residential (2.5%), and others (1.3%)


Project ID: M-MC01
Calleguas Creek Watershed
Approximate Project Location
Malibu Creek Watershed
Legend
Approximate BMP Footprint
BMP Drainage Area
Parcel Boundary
Proposed Diversion
City Boundary
Waterbody
Storm Drain Pipe or Channel
Watershed Boundary
Note: Proposed project is conceptual and subject to change based on future feasibility assessment, funding availability, and/or other information.
BMP Type:
Subsurface storage tank (rainwater harvesting) (RWH-1)
Lindero Creek
0
0.18
0.36 Miles
Project Concept - City of Thousand Oaks
Countywide Stormwater Resource Plan
Ventura County, CA
Geosyntec consultants
Santa Barbara
July 2016
Figure
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4.5 MSWRP Project Modeling

Water supply and water quality benefits were quantified by estimating average annual stormwater runoff volumes[7] and associated pollutant loads that would be captured by proposed MSWRP projects. In general, where appropriate, these methods align with the LARWQCB's 2012 MS4 Reasonable Assurance Analysis (RAA) guidelines for the Enhanced Watershed Management Plans (EWMPs) (i.e., acceptable modeling software, BMP modeling approach, hydrologic input parameter values, and land use event mean concentrations). The steps to perform this quantification included:

1. Determining drainage areas for each proposed BMP;
2. Synthesizing spatial data in GIS to determine necessary hydrologic modeling inputs for each BMP drainage area, including imperviousness (determined by land use), soil parameters, average width of drainage area, and slope;
3. Using USEPA's Stormwater Management Model (SWMM) and local precipitation data to determine the estimated average annual runoff volume generated from each drainage area based on a continuous simulation of 15 historical years;
4. Using SWMM and proposed BMP geometry[8] to determine the anticipated annual runoff volume that will bypass the BMP (i.e., volume untreated) and the volume that will be captured by each BMP for treatment, infiltration, or storage (for future use);
5. Combining land use-specific runoff volumes with land use event mean concentrations (EMCs) to calculate average annual pollutant loads; and
6. Using the expected runoff volume infiltrated/treated/stored for each BMP (from SWMM) with baseline pollutant loads and BMP effluent concentrations to calculate average annual pollutant load reductions.

Results for both the baseline runoff volume and pollutant loads and anticipated reduction in volume and loads resulting from implementation of the MSWRP modeled projects are presented in the following sections. Details and relevant assumptions of the procedure used to model MSWRP projects are outlined in detail in Appendix C.

[7] Dry weather water quality benefits may also be expected but are not estimated here.

[8] Involves modeling the hydraulics of each BMP, including filling, overflow, and draining of the BMPs during and in between rain events.

4.5.1 "Modelable" Pollutants

Twelve pollutants to be modeled were identified based on Ventura County TMDL priorities and pollutants considered "modelable." The term "modelable" is defined here to mean that there are current and sufficient land use EMC data available to support modeling analysis. This is the case for the following pollutant categories: (1) indicator bacteria (fecal coliform), (2) nutrients, (3) metals, and (4) total suspended solids. The specific modelable pollutants are listed below in Table 8. A complete list of pollutants with an applicable TMDL or identified on the 303(d) list of impaired waterbodies, including the "modelable" status for each pollutant, is shown in Table A- in Appendix A**.**

Table 8. Modelable Pollutants

Category	Pollutant	Abbreviation
Indicator Bacteria	Fecal Coliform	Fecal Col.
Nutrients	Total Phosphorus	Tot P
	Ammonia	NH3
	Nitrate	NO3
	Total Kjeldahl Nitrogen	TKN
	Dissolved Phosphorus	Diss P
Metals	Total Copper	Diss Cu
	Total Lead	Tot Pb
	Total Zinc	Tot Zn
	Dissolved Copper	Diss Cu
	Dissolved Zinc	Diss Zn
Sediment	Total Suspended Solids (TSS)	TSS

4.5.2 Baseline Runoff Volume and Pollutant Loads

To derive land use-based runoff volumes, the total runoff volume from each MSWRP modeled project drainage area (determined from SWMM modeling) was multiplied by the percentage of impervious area attributed to each land use.

To model the pre-BMP scenario (i.e., existing or "baseline" conditions), these volumes were multiplied by the land use EMCs, resulting in a land use-based loads, that were then summed by drainage area. This scenario estimates the total load generated from the drainage area prior to BMP treatment, which is a critical input to estimating the load reduction as a result of the proposed BMPs. These baseline runoff volume and pollutant loads for the MSWRP modeled project's drainage areas are shown in Table 9.

Table 9. Average Annual Baseline Runoff Volume and Pollutant Loads for each BMP project, by Location

Location (Project ID)	Annual Baseline Loads from each BMP Drainage Area												
	Volume	TSS	Tot P	Diss P	NH3	NO3	TKN	Diss Cu	Tot Cu	Tot Pb	Diss Zn	Tot Zn	Fecal Col.
	cu ft	lb	lb	lb	lb	lb	lb	lb	lb	lb	lb	lb	10^12 MPN
City of Camarillo (M-CC01)	4,300,000	28,000	98	79	150	230	730	2.6	5.1	2.6	14	27	17
City of Ventura (M-VC01)	10,000,000	76,000	250	190	330	910	1,500	6.9	13	4.9	41	73	36
County of Ventura (M-VR02)	19,000,000	170,000	570	400	640	2,600	3,400	12	25	12	50	110	81
County of Ventura (Piru) (M-SCR03)	2,300,000	19,000	63	46	79	230	410	1.4	3.0	1.5	6.7	14	9.2
City of Fillmore (M-SCR01)	1,300,000	9,400	30	24	40	59	210	0.84	1.6	0.76	4.4	8.2	5.2
City of Moorpark (M-CC02)	12,000,000	99,000	310	250	370	800	2,200	7.5	15	8.0	26	61	53
City of Ojai (M-VR01)	290,000	1,600	7.4	5.4	18	14	59	0.21	0.51	0.2	2.2	3.5	0.70
City of Oxnard (M-OC01)	1,600,000	8,500	34	28	62	100	260	0.93	1.9	0.90	6.9	12	5.8
City of Port Hueneme (M-OC02)	3,700,000	28,000	88	71	110	170	630	2.3	4.3	2.3	8.0	18	16
City of Santa Paula (M-SCR02)	11,000,000	83,000	270	210	390	620	1,900	7.6	15	7.6	63	100	45
City of Simi Valley (M-CC03)	19,000,000	120,000	400	320	610	1,400	2,900	11	21	10	81	140	71
City of Thousand Oaks (M-MC01)	22,000,000	200,000	420	330	540	1,300	3,100	9.4	22	12	55	100	67

4.5.3 Anticipated Water Supply Volume and Pollutant Load Reductions

Anticipated pollutant load reductions achieved by the MSWRP modeled projects are determined by calculating the difference between the baseline runoff volume and pollutant loads and the predicted effluent volume and pollutant loads. The anticipated average annual runoff volume and pollutant load reductions, including the potential water supply volume, from all projects are shown in Table 10. The potential groundwater recharge volume, representing potential water supply benefits, was estimated by multiplying the infiltrated volume by an adjustment factor based on a modeling analysis of groundwater recharge performed by Munévar and Mariño (1999). This study showed that on average, approximately 65 percent of infiltrated water reaches the water table and is therefore available for water supply (in the Central California region). Therefore, the potential water supply volume provided by infiltration BMPs was calculated to be 65 percent of the modeled infiltration volume. The number of households that could utilize their entire yearly water supply from the potential increase in water supply volume (household equivalents supplied) is also shown, based on average annual household water use (Aquacraft, 2011) and the estimated groundwater recharge volumes.

Table 10. Average Annual Runoff Volume and Pollutant Load Reductions and Water Supply Volume (or groundwater recharge)

Location (Project ID)	BMP Type	Runoff Volume	TSS	Tot P	Diss P	NH3	NO3	TKN	Diss Cu	Tot Cu	Tot Pb	Diss Zn	Tot Zn	Fecal Col.	Potential Water Supply	Household Equivalents Supplied (per year)[1]
		cu ft	lb	lb	lb	lb	lb	lb	lb	lb	lb	lb	lb	10^12 MPN	ac-ft	
City of Camarillo (M-CC01)	Infiltration Basin	980,000	6,300	22	18	34	53	170	0.59	1.2	0.59	3.2	6.1	3.8	14	36
City of Ventura)M-VC01)	Infiltration Trench	270,000	2,000	6.6	5.0	8.7	24	40	0.18	0.36	0.13	1.1	1.9	0.95	4.0	10
County of Ventura (M-VR02)	Infiltration Basin (subsurface)	11,000,000	93,000	310	220	350	1,400	1,800	6.4	14	6.6	27	61	44	160	390
County of Ventura (Piru) (M-SCR03)	Infiltration Basin	2,300,000	19,000	63	46	79	230	410	1.4	3.0	1.5	6.7	14	9.2	34	120
City of Fillmore (M-SCR01)	Infiltration Basin	570,000	4,200	13	11	18	26	94	0.37	0.71	0.34	1.9	3.6	2.3	8.4	21
City of Moorpark (M-CC02)	Infiltration Basin	2,100,000	17,000	54	42	64	140	370	1.3	2.6	1.4	4.4	10	9.0	31	77
City of Ojai (M-VR01)	Infiltration Basin (subsurface)	130,000	740	3.4	2.5	8.2	6.6	27	0.095	0.23	0.10	0.99	1.6	0.32	2.0	4.8
City of Oxnard (M-OC01)	Infiltration Basin	1,200,000	6,200	25	20	45	76	190	0.68	1.4	0.65	5.0	8.8	4.2	18	44

Location (Project ID)	BMP Type	Runoff Volume	TSS	Tot P	Diss P	NH3	NO3	TKN	Diss Cu	Tot Cu	Tot Pb	Diss Zn	Tot Zn	Fecal Col.	Potential Water Supply	Household Equivalents Supplied (per year)[1]
		cu ft	lb	lb	lb	lb	lb	lb	lb	lb	lb	lb	lb	10^12 MPN	ac-ft	
City of Port Hueneme (M-OC02)	Infiltration Basin	2,200,000	16,000	52	42	64	100	370	1.3	2.5	1.4	4.7	11	9.2	32	79
City of Santa Paula (M-SCR02)	Infiltration Basin	1,600,000	12,000	37	30	55	86	270	1.1	2.1	1.0	8.8	14	6.3	24	59
City of Simi Valley (M-CC03)	Subsurface Tank (rainwater harvesting)	3,500,000	22,000	73	57	110	240	530	1.9	3.8	1.9	15	25	13	52	130[2]
City of Thousand Oaks (M-MC01)	Subsurface Tank (rainwater harvesting)	1,100,000	9,700	20	16	26	62	150	0.46	1.1	0.57	2.7	4.9	3.3	16	39[2]
Total		27,000,000	210,000	680	510	860	2,400	4,400	16	33	16	81	160	110	400	1,010

[1] Based on average annual household water use of 362 gallons/household/day (Aquacraft, 2011) and estimated groundwater recharge volumes.
[2] Non-potable irrigation supply resulting from rainwater harvesting BMPs, potentially offsetting potable water demand.

4.6 Multiple Benefits

As required by California Water Code Section 10562(e) and the SWRP Guidelines, the MSWRP must use "measureable factors to identify, quantify and prioritize potential stormwater and dry weather runoff capture projects." Projects were prioritized based on their potential to be implemented and maintained (i.e., with a committed landowner and operation and maintenance capabilities) and their potential to achieve multiple benefits in the five benefit categories identified by the SWRP Guidelines listed in Table 11. The purpose of the prioritization is not to rank the project with respect to each other, but to simply identify those projects that will achieve multiple benefits and are likely to be constructed and maintained, which would therefore qualify them for funding. Benefit categories include water quality, water supply, flood management, environmental, and community benefits. Projects that achieve multiple benefits support a watershed-based approach to treating stormwater and dry weather runoff as a resource rather than an environmental nuisance or flood hazard. The SWRP guidelines identify main benefits in each benefit category and additional benefits to inform project selection and design. Projects implemented in accordance with the SWRP are required to address at least two main benefits and as many additional benefits as feasible for each project.

Table 11. Stormwater Management Benefits (Table 4 in the SWRP Guidelines)

Benefit Category	Main Benefit	Additional Benefit
Water Quality	• Increased infiltration and/or treatment of runoff	• Nonpoint source pollution control • Reestablished natural water drainage and treatment
Water Supply	• Water supply reliability • Conjunctive use	• Water conservation
Flood Management	• Decreased flood risk by reducing runoff rate and/or volume	• Reduced sanitary sewer overflows
Environmental	• Environmental and habitat protection • Increased urban green space	• Reduced energy use, greenhouse gas emissions, or provides a carbon sink • Reestablishment of natural hydrograph • Water temperature improvements
Community	• Employment opportunities provided • Public education	• Enhance and/or create recreational and public use areas

The approach for assessing multiple benefits consists of two parts: quantification of multiple benefits to determine a multi-benefit index for each identified project and prioritization of all identified projects based on the multi-benefit index and other factors. The approach for each part is described in more detail in the following sections.

4.6.1 Multi-Benefit Index Quantification

The approach for quantifying a multi-benefit index for the MSWRP utilizes a combination of quantitative results from conceptual designs and stormwater treatment modeling and qualitative assessments of multiple benefits. The MSWRP includes project concepts developed under this MSWRP (MSWRP modeled projects) for 12 projects within the County and planned projects identified from other sources. Identified projects from other sources were grouped into two groups with group 1 representing projects with concept designs and/or a preliminary benefit quantification (identified group 1) and group 2 containing projects that have not been developed into concept-level designs and modeled (identified group 2).

Multiple benefit indices for MSWRP modeled projects and projects identified from other sources were determined in two separate lists in the MSWRP. For MSWRP modeled projects, available design and modeling results were used to determine quantitative metrics for the benefit categories outlined in the SWRP, and these were combined with qualitative assessments of each project's benefits to determine a multi-benefit index. For the projects identified from other sources, a modified multiple benefit approach based on the process for MSWRP modeled projects was used. The multi-benefit index for these projects was based solely on qualitative assessments of each project's ability to achieve multi-benefits, as the detail needed to quantify all benefits have not yet been developed. The detailed methodology and results for the multi-benefit index quantification is included in Appendix D.

4.6.2 Project Prioritization

After multi-benefit indices were determined for both MSWRP projects and other identified projects, projects were prioritized (Water Code 10562(b)(2)) based on their multi-benefit indices and other factors related to feasibility of implementation and commitment to maintenance as shown below:

- **High**: multi-benefit index greater than zero and the project has a willing land owner that is also committed to performing necessary maintenance
- **Medium**: multi-benefit index greater than three, but the project does not have (or it is undetermined) a willing land owner also committed to maintenance
- **Low**: multi-benefit index less than or equal to three and the project does not have (or it is undetermined) a willing land owner also committed to maintenance

This approach for multiple benefit quantification and prioritization of identified projects was developed to fulfill requirements in the Water Code and SWRP Guidelines, and the methodology will serve as a useful tool for evaluating multiple benefits of projects. However, this methodology was not intended to serve as a basis for ranking projects or to imply that certain projects are more

likely to be successful than others, but was rather intended to identify projects that will provide multiple benefits and are likely to succeed once implemented.

MSWRP projects, Group 1 identified projects, and Group 2 identified projects were prioritized separately, and the prioritization process was executed for each watershed as required by the SWRP guidelines as shown in Table 12 through Table 16.

Table 12. Project Prioritization – Santa Clara River Watershed

Project ID	Project Name	Priority Classification
MSWRP Modeled Projects		
M-SCR01	City of Fillmore - Infiltration Basin	High
M-SCR02	City of Santa Paula - Infiltration Basin	
M-SCR03	County of Ventura (Piru) Stormwater Capture for Groundwater Recharge	
-	*None*	Medium
-	*None*	Low
Group 1 Identified Projects		
SCR01	City of Santa Paula Infiltration Basin	High
SCR02	City of Ventura - Subsurface Infiltration Basin	
SCR03	County of Ventura - County Maintenance Yard Infiltration Basin	
SCR04	City of Oxnard - Infiltration Basin	
SCR05	City of Fillmore - Infiltration Basin 1	
SCR06	City of Fillmore - Infiltration Basin 2	
SCR07	Sierra Club - A stormwater management pilot project	
SCR08	United Water - Ferro Basin	
SCR09	Caltrans - Saticoy Infiltration basin	
-	*None*	Medium
-	*None*	Low
Group 2 Identified Projects		
-	*None*	High
-	*None*	Medium
-	*None*	Low

Table 13. Project Prioritization – Calleguas Creek Watershed

Project ID	Project Name	Priority Classification
MSWRP Modeled Projects		
M-CC01	City of Camarillo - Infiltration Basin	High
M-CC02	City of Moorpark - Infiltration Basin	
M-CC03	City of Simi Valley - Subsurface Storage Tank (rainwater harvesting)	
-	*None*	Medium
-	*None*	Low
Group 1 Identified Projects		
CC01	Calleguas Creek IP Project TO-1 (capture and reuse)	High
CC02	Calleguas Creek IP Project TO-2 (capture and reuse)	
CC03	Calleguas Creek IP Project UC-1 (infiltration)	
CC04	Calleguas Creek IP Project UC-2 (infiltration)	
CC05	Calleguas Creek IP Project CM-1 (infiltration)	
CC06	Calleguas Creek IP Project CM-2 (capture and reuse)	
CC07	Calleguas Creek IP Project SV-1 (capture and reuse)	
CC08	Calleguas Creek IP Project SV-2 (infiltration)	
CC09	Calleguas Creek IP Project MP-1 (infiltration)	
CC10	Calleguas Creek IP Project MP-2 (infiltration)	
CC11	Calleguas Creek IP Project MP-3 (infiltration)	
CC16	Tierra Rejada Rd Improvements	
CC17	Old Town drainage	
CC18	Cerro Vista Detention Basin	
-	*None*	Medium
-	*None*	Low
Group 2 Identified Projects		
CC12	Arroyo Simi Grade Stabilization	High
CC13	Calleguas Creek Low Flow Channel	
CC14	Conejo Mountain Creek Detention Basins 2-5 at Dos Vientos	
CC19	Watershed Management Strategy Study Projects	Medium
CC15	Gabbert Channel Restoration	Low

Table 14. Project Prioritization – Ventura River Watershed

Project ID	Project Name	Priority Classification
MSWRP Modeled Projects		
M-VR01	City of Ojai - Subsurface Infiltration System	High
M-VR02	County of Ventura - Subsurface Infiltration System	
-	*None*	Medium
-	*None*	Low
Group 1 Identified Projects		
VR01	Foster Park Infrastructure and Bank Protection and Restoration	High
VR08	Ojai Unified School District Stormwater LID Project	
VR09	The Thacher Creek Equestrian Instream Flow and Water Quality Project	
-	*None*	Medium
-	*None*	Low
Group 2 Identified Projects		
VR10	Ventura Water San Jon/Prince Barranca Urban Stormwater/Flood Control Retrofit Pilot Project	High
VR02	Stormwater Retrofit Demonstrations (LID and Green Streets)	Medium
VR04	Riparian Habitat and Wetland Restoration	
VR06	Infiltration System Installations	
VR03	Stormwater Parking Lot Retrofits	Low
VR05	Watershed Corps	
VR07	Overflow Ponds	

Table 15. Project Prioritization – Malibu Creek Watershed

Project ID	Project Name	Priority Classification
MSWRP Modeled Projects		
M-MC01	City of Thousand Oaks - Subsurface Storage Tank (rainwater harvesting)	High
-	*None*	Medium
-	*None*	Low
Group 1 Identified Projects		
-	*None*	High
-	*None*	Medium
-	*None*	Low
Group 2 Identified Projects		
-	*None*	High
MC01	Distributed BMPs	Medium

Project ID	Project Name	Priority Classification
MC02	Low flow diversion to sewer	Low

Table 16. Project Prioritization – Coastal Watersheds

Project ID	Project Name	Priority Classification
MSWRP Modeled Projects		
M-OC01	City of Oxnard - Infiltration Basin	High
M-OC02	City of Port Hueneme - Infiltration Basin	
M-VC01	City of Ventura - Infiltration Trench	
-	*None*	Medium
-	*None*	Low
Group 1 Identified Projects		
CHB01	Development Retrofit Area	High
CHB02	Harbor Park Redevelopment	
-	*None*	Medium
-	*None*	Low
Group 2 Identified Projects		
-	*None*	High
-	*None*	Medium
-	*None*	Low

5 Implementation Strategy and Schedule

The following programs have been identified to assist in effective implementation of strategies identified in this MSWRP, in accordance with Water Code 10562 (d)(8):

- **Regular meetings to discuss SWRP project developments:** The MS4 Permittees regularly meet to discuss water quality concerns and other regulatory matters within each respective watershed throughout Ventura County. After submission of the SWRP to the IRWM group, these regular meetings will include a SWRP meeting agenda item to encourage implementation of SWRP projects and to collaborate and share any lessons learned.
- **SWRP E-mail groups and newsletters:** A SWRP e-mail group will be established including members of the VCWPD, MS4 Permittees, and other community participants. A quarterly newsletter will be sent out to remind all parties of upcoming deliverables (e.g., implementation funding deadlines) and to encourage collaboration among all groups.

In addition, decision support tools, including data necessary to use these tools, will be utilized throughout the MSWRP implementation process. Table 17 shows the implementation schedule for activities and milestones relating to the Prop 1 Stormwater Grant Program (SWGP) and a proposed schedule for activities specific to the MSWRP. Future revisions to the MSWRP, including new projects, may be added to Appendix E as part of the adaptive management strategy.

Table 17. Implementation Schedule

Milestone	Date
State SWGP Activities	
Prop 1 SWGP final planning grant funding list (Round 1)	May 2016
Prop 1 SWGP implementation grant solicitation period closes (Round 1)	July 8, 2016
Prop 1 SWGP final implementation grant funding list (Round 1)	October 2016
Prop 1 SWGP implementation grant solicitation application period (Round 2)	2018
Ventura County Stormwater Program Activities	
Distribute final MSWRP draft to subcommittee and Management Committee	July 11, 2016
Planning and Land Development Recommendations for Approval of MSWRP	July 18, 2016
Management Committee Approval of MSWRP	July 21, 2016
Submit MSWRP to WCVC for incorporation into IRWMP	July 28, 2016
Pursuit of other funding options	TBD based on funding availability and implementation constraints
Incorporation of projects into Watershed Management Plans (WMP)	
Planning for projects	
Permitting for projects	
Design of projects	
Construction of projects	

Milestone	Date
Incorporate projects into the MSWRP from WMPs, future TMDL IPs, and other efforts	Ongoing

5.1 Community Outreach

Community outreach will be incorporated during project development, in order to allow community members to be involved in projects that affect them and also spread awareness and education on issues related to stormwater management. In addition to ongoing outreach by watershed programs at watershed council meetings, each Permittee will carry out project design and construction phases in accordance with local regulations and public process requirements. The community has the opportunity to engage and contribute to the project through the project life, including during planning, permitting, design, and construction phases. While each Permittee will have slightly different milestones within the project life, as an example, the County of Ventura has the following steps that solicit public involvement and encourage community engagement and collaboration throughout the project life:

- Engagement with and presentations to interested stakeholder groups, interested watershed councils or committees, appropriate unincorporated community's Municipal Advisory Council (MAC), and other community groups;
- Public outreach related to County's contracting processes for project design, construction, and grant applications/acceptance (if applicable);
- Public outreach as required by the California Environmental Quality Act (CEQA);
- Outreach within project construction area and its vicinity prior to initiation of project construction activities;
- Post-construction outreach including ribbon cutting ceremonies, project presentations and demonstrations at schools, for community groups and for other interested groups and organizations.

5.2 Monitoring

Monitoring is currently required by the MS4 Permit in accordance with Attachment F of the Ventura County MS4 Permit. The monitoring program is intended to assess the impacts of MS4 discharge on receiving waters, the overall health of receiving water quality, compliance with TMDLs and water quality objectives, and the quality of stormwater discharges, in addition to identifying the source of pollutants and measuring the effectiveness of implemented measures. The monitoring program includes core monitoring of mass emissions, major outfalls, dry weather

analytical monitoring, and aquatic toxicity monitoring. Special studies also required by the MS4 Permit include a pyrethroid insecticides study, a hydromodification control study, low impact development, Southern California Bight Project, Bioassessment, volunteer monitoring programs, TMDL monitoring, and beach water quality monitoring. Monitoring is also required to comply with the standard monitoring provisions outline in the MS4 Permit.

Monitoring in accordance with the current MS4 Permit will continue to be performed and will be used to measure effectiveness of measures identified in this MSWRP. An adaptive management approach will also be used to revise monitoring strategies to meet current needs as they change over time and make updates to MSWRP projects or recommendations for future projects to be included and implemented.

5.3 Data Management

In accordance with recommendations in the SWRP Guidelines (section VI.C.3), the Permittees will maintain procedures for monitoring data collection and management. The monitoring procedures (e.g., planning for how data may be accessed by stakeholders and the public, how existing water quality monitoring will be assessed and maintained, the frequency at which data will be updated, and how data gaps will be identified) will be specific to each project. However, the current data management plan is to follow procedures currently included in the existing MS4 Stormwater Monitoring Program. Consistent with this approach, each Permittee will also incorporate new projects into their electronic tracking system, as applicable, to ensure that BMPs are properly maintained.

6 References

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Appendix A - TMDL and 303(d) Pollutants

A.1 Pollutant Priorities

Table A-1 shows the pollutant categories that are identified on the State's 303(d) list of impaired water bodies or have an applicable TMDL for watersheds with MSWRP modeled projects.

Table A-1. TMDL and 303(d) Pollutants for MSWRP Modeled Projects by Watershed

Pollutant Category	Calleguas Creek	Santa Clara River	Ventura River	Malibu Creek	Oxnard Coastal	Ventura Coastal	Comments
Metals	TMDL	303(d)	303(d)	303(d)			Modeled as Cu, Pb, Zn
Nutrients	TMDL	TMDL	TMDL	TMDL	303(d)		Modeled as P, NH3, NO3, TKN
Pathogens	303(d)	TMDL	303(d)	TMDL	TMDL	303(d)	Modeled as fecal coliform
Hydromodification			303(d)	303(d)			Insufficient data to model
Miscellaneous	303(d)	303(d)		303(d)			
Nuisance	303(d)	303(d)		303(d)			
Other Inorganics	303(d)	303(d)		303(d)			
Other Organics	TMDL			303(d)	TMDL	303(d)	
Pesticides	TMDL	303(d)		303(d)	TMDL	303(d)	
Salinity	TMDL	TMDL	303(d)	303(d)			
Sediment	303(d)			TMDL			
Toxicity	TMDL	303(d)		303(d)	303(d)		
Trash	TMDL		TMDL	TMDL			

Appendix B - Identified Projects with Grant Funding

B.1 Identified Projects with Grant Funding

Table B-1 shows previously identified projects that have already received grant funding.

Table B-1. Identified Projects with Grant Funding

Project Name	Potential Contributing Parties	Watershed	Public/ Private Parcel	Specific Location/Address	Project Description	Multiple Benefits	Funding Source	Notes
Oak Park Green Streets Urban Retrofit	County of Ventura	Malibu Creek	Public	Median parkways along Kanan Rd between Smoke Tree Avenue and Conifer Street;	Parkway biofilters (Western drainage area = 4 acres, Eastern drainage area = 16 acres; sized to maximize surface area and capture 70% of average annual runoff)	Average annual load reduction = 1.7E12 MPN E. Coli, 6.0 pounds Phosphorus, 54 pounds Nitrate, 92 pounds total nitrogen)	Proposition 84	
				Ten modular wetland systems distributed within community	Sized to capture 30% of average annual runoff.	Average annual load reduction = 2.4E12 MPN E. Coli, 10 pounds Phosphorus, 88 pounds Nitrate, 154 pounds total nitrogen)		
County Government Center Parking Lot Green Streets Urban Retrofit	County of Ventura	Ventura Coastal	Public	Ventura County Government Center, 800 Victoria Ave, Ventura CA	LID green street would receive, store, treat and infiltrate 100% of the first flush stormwater and non-stormwater runoff from an existing 39 acres of impervious surface using pervious gutters, infiltration basins, drywells and permeable pavement		Proposition 84	

Project Name	Potential Contributing Parties	Watershed	Public/ Private Parcel	Specific Location/Address	Project Description	Multiple Benefits	Funding Source	Notes
Urban LID Retrofit at Meiners Oaks	County of Ventura	Ventura River	Ojai Valley Land Conservancy	Between Besant Road and El Plano Drive east of South Lomita Avenue	Bioswale to capture, treat, and reduce pollutant loads		Proposition 84	

Appendix C - MSWRP Project Modeling

C.1 Geographic Information System Spatial Datasets

The Geographic Information System (GIS)-based spatial datasets shown in Table C-1 were acquired for Ventura County. The GIS-based spatial files were used to characterize each MSWRP modeled project's drainage area land uses and imperviousness, hydrologic soil group(s), land slope, and other properties described below required as inputs for the SWMM hydrologic modeling. The necessary datasets were analyzed for a series of parameters within drainage areas, utilizing GIS tools, for integration into the SWMM model, as described in the following sections.

Table C-1. GIS Datasets Used for SWMM Modeling Input

Dataset Description	Dataset Format
Drainage Area Boundaries	Vector (poly)
Land Use	Vector (poly)
Soils	Vector (poly)
Digital Elevation Model	Raster
Streams[1]	Vector (line)
Storm Drains[1]	Vector (line)

[1] Not required for model calculations, but were used to aid in delineating project drainage areas and were used to improve visual output in GIS

C.1.1 Drainage Area Delineation, Land Use, and Percent Imperviousness

The first step of the modeling process involved determining the appropriate drainage areas for all proposed projects. Some drainage areas were provided by the MS4 Permittees, while others were delineated using waterbody and storm drain spatial files and a DEM. The size of the resultant drainage areas are shown in Table C-2.

Table C-2. Project Drainage Areas

Location (Project ID)	Drainage Area (acre)
City of Camarillo (M-CC01)	220
City of Ventura (M-VC01)	490
County of Ventura (M-VR02)	870
County of Ventura (Piru) (M-SCR03)	123
City of Fillmore (M-SCR01)	53
City of Moorpark (M-CC02)	760
City of Ojai (M-VR01)	8.7
City of Oxnard (M-OC01)	72
City of Port Hueneme (M-OC02)	200
City of Santa Paula (M-SCR02)	440
City of Thousand Oaks (M-MC01)	1,000

Location (Project ID)	Drainage Area (acre)
City of Simi Valley (M-CC03)	1,900

To calculate the average imperviousness of the drainage area to each MSWRP modeled project, a Southern California Association of Governments (SCAG) land use spatial file, which contained categories with unique land use classifications, was referenced. Percent imperviousness values were assigned to each land use descriptor, as shown in Table C-7, based on available literature, including the Los Angeles County Hydrology Manual land use imperviousness values used as defaults in the Structural BMP Prioritization and Analysis Tool (SBPAT) (Geosyntec, 2012) and values determined for jurisdictional areas within the Santa Clara River watershed and used in the Draft Santa Clara River Indicator Bacteria TMDL Implementation Plan (County of Ventura, 2015b). After a value for imperviousness was assigned to each unique land use classification, an area-weighted imperviousness was determined for each MSWRP modeled project's drainage area. The final SWMM inputs for each project, determined by these GIS analyses, are shown in Table C-4.

C.1.2 Drainage Area Soil Properties

The soil dataset, provided by the County of Ventura, characterizes the entire County by the Ventura County soil numbers one through seven. The Ventura County soil numbers were then translated into hydrologic soil groups A through D, as shown in Table C-3. Hydrologic soil group A is defined by a high saturated hydraulic conductivity (i.e., high infiltration potential) and therefore has low runoff potential. Alternatively, hydrologic soil group D has high runoff potential and low saturated hydraulic conductivity.

Values for Green-ampt soil parameters, including saturated hydraulic conductivity (Ksat), soil suction head, and maximum initial moisture deficit were assigned to the soil dataset based on hydrologic soil groups, using values from the SBPAT Manual (Geosyntec, 2012). However, for areas within the Santa Clara River watershed, adjusted values from the Draft Lower Santa Clara River Bacteria IP (County of Ventura, 2015b) were instead used as watershed-specific hydraulic conductivities[9]. The default soil parameters based on hydrologic soil group are shown in Table C-3. Similar to imperviousness, an area-weighted value for each of these parameters was determined for each BMP drainage area for input into the hydrologic model. The final SWMM inputs for each project, determined by these GIS analyses, are shown in Table C-4.

[9] Stream flow data was analyzed to calculate the base flow using the USGS 1113500 Santa Paula Creek near Santa Paula gage, and predicted runoff volumes from SBPAT were compared to measured base flow to determine an appropriate K_{sat} adjustment factor (0.25).

Table C-3. Soil Parameters Required by SWMM

Watershed	Hydrologic Soil Group	Ventura County Soil #	Ksat (in/hr)	Soil Suction Head (in)	Initial Moisture Deficit (in)
Santa Clara River	A	7	0.25	2.9	0.32
Santa Clara River	A	6	0.25	2.9	0.32
Santa Clara River	B	5	0.125	5.04	0.36
Santa Clara River	B	4	0.125	5.04	0.36
Santa Clara River	C	3	0.0375	8.6	0.24
Santa Clara River	C	2	0.0375	8.6	0.24
Santa Clara River	D	1	0.0125	10.47	0.29
All others	A	7	0.375	2.9	0.32
All others	A	6	0.375	2.9	0.32
All others	B	5	0.225	5.04	0.36
All others	B	4	0.225	5.04	0.36
All others	C	3	0.1	8.6	0.24
All others	C	2	0.1	8.6	0.24
All others	D	1	0.025	10.47	0.29

C.1.3 Land Slope and Other Required Parameters

A DEM was acquired in raster format and converted to a slope raster. The zonal statistics tool in GIS was used to determine the average percent slope in each MSWRP modeled project's drainage area.

Average flow width for each drainage area was determined by dividing the total drainage area by an estimate of the length of the longest flow path. The DEM was used to create a flow direction raster in GIS, which was then used to develop a flow accumulation raster to visually show areas where accumulated flow occurs. Flow length lines were manually created, with guidance from the flow accumulation raster, for each drainage area. The resultant flow lengths were used with the drainage areas to estimate a width for each project drainage area.

The drainage area for the Thousand Oaks project was divided into "hillside" and "urban" portions due to the large drainage areas consisting of distinct developed "urban" areas and open space "hillside" areas, to more accurately determine the SWMM modeling inputs. SWMM is able to more accurately predict runoff volumes from the divided drainage areas, instead of using average conditions over the entire drainage area. The final SWMM inputs for each project, determined by these GIS analyses, are shown in Table C-4.

Table C-4. SWMM Input Data by Project

Location (Project ID)	Watershed	Drainage Area (acre)	Flow Length (ft)	Width (ft)	Average Slope (%)	Area-weighted Soil Suction Head (in)	Area-weighted Ksat (in/hr)	Area-weighted Initial Moisture Deficit (in)	Area-weighted Imperviousness (%)
City of Camarillo (M-CC01)	Calleguas Creek	217	4,900	1,900	5.6	10.2	0.036	0.29	47
City of Ventura (M-VC01)	Ventura Coastal	488	9,800	2,200	3.9	6.0	0.19	0.33	39
County of Ventura (M-VR02)	Ventura River	871	9,900	3,800	8.4	8.6	0.10	0.24	25
County of Ventura (Piru) (M-SCR03)	Santa Clara River	123	6,100	880	7.0	6.5	0.096	0.34	28
City of Fillmore (M-SCR01)	Santa Clara River	53	2,000	1,200	0.82	5.0	0.13	0.36	42
City of Moorpark (M-CC02)	Calleguas Creek	760	11,000	3,100	10	9.4	0.066	0.29	35
City of Ojai (M-VR01)	Ventura River	8.7	1,400	270	3.1	8.6	0.10	0.24	43
City of Oxnard (M-OC01)	Oxnard Coastal	72	3,700	850	0.59	8.6	0.10	0.24	54
City of Port Hueneme (M-OC02)	Oxnard Coastal	197	6,200	1,400	0.21	8.6	0.10	0.24	45
City of Santa Paula (M-SCR02)	Santa Clara River	441	12,000	1,600	8.9	5.2	0.12	0.35	47
City of Thousand Oaks Rural (M-MC01)	Malibu Creek	446	2,800	7,000	32	9.8	0.053	0.272	1.5
City of Thousand Oaks Urban (M-MC01)	Malibu Creek	582	8,800	2,900	13	8.7	0.096	0.264	24
City of Simi Valley (M-CC03)	Calleguas Creek	1,858	13,000	6,200	18	8.2	0.11	0.28	21

C.2 SWMM Modeling

SWMM models were developed to model the runoff volume from each MSWRP modeled project's drainage area and to estimate the percent of runoff captured and the volume reduced due to the presence of the proposed BMP. Each SWMM model was developed with the drainage area inputs (previously described), publicly available climate and precipitation data, and BMP geometry determined by guidance from the Ventura County TGM (described previously in section 4.4). The following sections describe the SWMM model development and how the model was used to estimate average annual runoff contributed by each MSWRP modeled project's drainage area and how much of the runoff is expected to be captured by the project's BMP. The methodology to determine the pollutant loading associated with these runoff volumes is also described below.

C.2.1 Precipitation and Evaporation

Rain gages were selected as well as monthly evaporation rates to predict the resulting runoff from each MSWRP modeled project's drainage area. Rain gages were located using the VCWPD Hydrologic Data Server. Six stations were selected to represent the geographic distribution and elevation range of MSWRP modeled project locations throughout Ventura County, as shown in Table C-5. Stations were selected based on the continuous number of years of published data and their proximity to proposed MSWRP modeled projects. All selected stations contain at least 15 years of continuous historical data and extend, on a water year basis, from October 1, 2000 through September 20, 2015. Hourly rainfall data from the gages were downloaded and used as the precipitation input for the SWMM model.

Table C-5. VCWPD Rain Gage Stations

Station ID	Station Name	Station Elevation (ft)	Relevant MS4 Permittee MSWRP Modeled Project(s)
121C	Lake Sherwood County Fire Station	960	City of Thousand Oaks
140	Oak View County Fire Station	520	County of Ventura, City of Ojai
168	Oxnard Airport	34	Cites of Oxnard and Port Hueneme
171	Fillmore Fish Hatchery	465	Cities of Fillmore, Santa Paula, City of Ventura
194	Camarillo-Adohr	110	City of Camarillo
246	Simi Sanitation Plant	660	Cities of Simi Valley and Moorpark

Monthly evaporation rates were estimated using data from CIMIS (Table C-6) and used to predict evaporation rates from each drainage area based on the MSWRP modeled project's location.

Table C-6. Average Monthly Evaporation Rates by CIMIS Zone

CIMIS Zone	Average Evaporation Rates (inches/day)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3[a]	0.06	0.08	0.12	0.16	0.17	0.19	0.18	0.17	0.14	0.11	0.08	0.06
4[b]	0.06	0.08	0.11	0.15	0.17	0.19	0.19	0.18	0.15	0.11	0.08	0.06
9[c]	0.07	0.10	0.13	0.17	0.19	0.22	0.24	0.22	0.19	0.13	0.09	0.06
10[d]	0.03	0.06	0.10	0.15	0.19	0.24	0.26	0.23	0.17	0.10	0.05	0.03

[a]This zone includes Cities of Oxnard and Port Hueneme
[b]This zone includes City of Ventura
[c]This zone includes Cities of Camarillo, Fillmore, Moorpark, Santa Paula, Simi Valley, and Thousand Oaks
[d]This zone includes County of Ventura and City of Ojai

The remaining necessary input parameters (e.g., depression storage, Manning's n roughness coefficient, subarea Routing) were set as the SWMM default values.

C.2.2 BMP Design Inputs

The MSWRP modeled project-specific BMP input data for SWMM were determined using design parameters and specific BMP attributes detailed in Section 4.3.2. The following BMP parameters were included in the model for each MSWRP modeled project:

- BMP footprint
- BMP depth
- Side slope
- Infiltration rate (when applicable)
- Outlet structure weir height (set at maximum design volume to model bypass)

Based on the information provided above, each MSWRP modeled project was modeled in SWMM to estimate the percent of runoff volume captured and the volume reduced as a result of the proposed BMP. Runoff from each drainage area was modeled using the soil, imperviousness, and drainage area attributes provided in Table C-4. In SWMM, runoff is collected in a channel and conveyed, through a diversion, to the BMP inlet. As the basin begins to fill, runoff is either infiltrated and evaporated (e.g. infiltration basin, infiltration trench, subsurface infiltration system), treated (e.g. bioretention with underdrain), or reused for irrigation (e.g. subsurface storage tank for capture-reuse). If the BMP volume is exceeded, there is a spillway at the inlet that allows runoff to overtop each BMP. Evaporation rates were determined using CIMIS data and are provided in Table C-6. Infiltration rates were determined using the existing subsurface soil

characteristics and are provided in Table C-6. Irrigation demand for the capture and reuse subsurface storage tank was provided by the MS4 permittee and modeled using the BMP storage volume and by assuming that the pump was turned on for a total of three hours per day for seven days per week. SWMM results include total inflow volume to the BMP, and total volume evaporated, infiltrated, treated, or reused, based on BMP type over the 15-year simulation period.

C.3 Pollutant Modeling

SWMM-derived land use specific average annual runoff volumes were combined with land use EMCs to calculate average annual pollutant loads. SWMM results also provided the expected runoff volume infiltrated/treated/stored as a result of each BMP, which was coupled with baseline pollutant loads and expected BMP effluent concentrations to calculate average annual pollutant load reductions resulting from implementation of the proposed MSWRP modeled projects. This pollutant load estimation process is described in the following sections.

C.3.2 Land Use Event Mean Concentrations (EMCs)

An EMC is the mean concentration of a pollutant found in stormwater runoff and is typically based on compositing flow weighted samples over a runoff event. EMCs are available for nine general land use groups. For purposes of modeling the more numerous Ventura County land use classifications were grouped into the following nine general EMC land use categories:

- Single-Family Residential
- Multi-Family Residential
- Transportation
- Vacant (Open Space)
- Commercial
- Industrial
- Agriculture
- Education
- Water

Table C-7 shows how the detailed land use classifications in the SCAG land use spatial file were consolidated.

Table C-7. Land Use EMC Groups and Imperviousness

Land Use (from SCAG Land Use File)	EMC Land Use Group	Imperviousness (%)
Abandoned Orchards and Vineyards	Open Space	2
Air Field	Transportation	91
Airports	Transportation	91
Base (Built-up Area)	Commercial	65
Beach Parks	Education	10
Beaches (Vacant)	Open Space	2
Bus Terminals and Yards	Transportation	91
Cemeteries	Education	10
Chemical Processing	Industrial	91
Colleges and Universities	Education	47
Commercial Recreation	Commercial	90
Commercial Storage	Commercial	90
Communication Facilities	Industrial	82
Correctional Facilities	Commercial	70
Dairy, Intensive Livestock, and Associated Facilities	Agriculture	2
Developed Local Parks and Recreation	Education	10
Developed Regional Parks and Recreation	Education	2
Duplexes, Triplexes and 2-or 3-Unit Condominiums and Townhouses	Multi-Family Residential	55
Electrical Power Facilities	Industrial	47
Elementary Schools	Education	82
Fire Stations	Commercial	91
Freeways and Major Roads	Transportation	91
Golf Courses	Open Space	3
Government Offices	Commercial	91
Harbor Facilities	Transportation	91
High-Density Single Family Residential	Single-Family Residential	42
High-Rise Apartments and Condominiums	Multi-Family Residential	90
High-Rise Major Office Use	Commercial	90
Horse Ranches	Agriculture	42
Hotels and Motels	Multi-Family Residential	96
Improved Flood Waterways and Structures	Water	100
Irrigated Cropland and Improved Pasture Land	Agriculture	2
Junior or Intermediate High Schools	Education	82
Liquid Waste Disposal Facilities	Industrial	96
Low- and Medium-Rise Major Office Use	Commercial	91

Land Use (from SCAG Land Use File)	EMC Land Use Group	Imperviousness (%)
Low-Density Single Family Residential	Single-Family Residential	21
Low-Rise Apartments, Condominiums, and Townhouses	Multi-Family Residential	86
Maintenance Yards	Industrial	91
Major Medical Health Care Facilities	Commercial	74
Manufacturing	Industrial	91
Manufacturing, Assembly, and Industrial Services	Industrial	91
Marina Water Facilities	Commercial	100
Medium-Rise Apartments and Condominiums	Multi-Family Residential	86
Mineral Extraction - Oil and Gas	Industrial	10
Mineral Extraction - Other Than Oil and Gas	Industrial	10
Mixed Commercial and Industrial	Industrial	91
Mixed Multi-Family Residential	Multi-Family Residential	74
Mixed Residential	Multi-Family Residential	59
Mixed Transportation	Transportation	90
Mixed Urban	Commercial	89
Modern Strip Development	Commercial	96
Motion Picture and Television Studio Lots	Commercial	91
Natural Gas and Petroleum Facilities	Industrial	91
Navigation Aids	Commercial	91
Non-Attended Public Parking Facilities	Commercial	91
Non-Irrigated Cropland and Improved Pasture Land	Agriculture	2
Nurseries	Agriculture	15
Older Strip Development	Commercial	97
Open Storage	Industrial	66
Orchards and Vineyards	Agriculture	2
Other Agriculture	Agriculture	42
Other Open Space and Recreation	Education	10
Other Public Facilities	Commercial	91
Other Special Use Facilities	Commercial	86
Packing Houses and Grain Elevators	Industrial	96
Park-and-Ride Lots	Transportation	91
Petroleum Refining and Processing	Industrial	91
Police and Sheriff Stations	Commercial	91
Poultry Operations	Agriculture	2
Pre-Schools/Day Care Centers	Education	68
Railroads	Transportation	15
Regional Shopping Center	Commercial	95

Land Use (from SCAG Land Use File)	EMC Land Use Group	Imperviousness (%)
Religious Facilities	Education	82
Research and Development	Industrial	91
Retail Centers (Non-Strip With Contiguous Interconnected Off-Street	Commercial	96
Rural Residential, High-Density	Single-Family Residential	20
Rural Residential, Low-Density	Single-Family Residential	10
Senior High Schools	Education	82
Solid Waste Disposal Facilities	Industrial	2
Special Care Facilities	Commercial	74
Specimen Gardens and Arboreta	Agriculture	2
Trade Schools and Professional Training Facilities	Education	82
Trailer Parks and Mobile Home Courts, High-Density	Multi-Family Residential	91
Truck Terminals	Transportation	91
Under Construction	Commercial	91
Undeveloped Local Parks and Recreation	Open Space	2
Undeveloped Regional Parks and Recreation	Open Space	2
Vacant Area	Open Space	1
Vacant Undifferentiated	Open Space	1
Vacant With Limited Improvements	Open Space	42
Water Storage Facilities	Industrial	91
Water Transfer Facilities	Open Space	96
Water Within a Military Installation	Water	100
Water, Undifferentiated	Water	100
Wholesaling and Warehousing	Industrial	91
Wildlife Preserves and Sanctuaries	Open Space	1

The average land use EMCs used in this analysis were taken from Los Angeles region SBPAT values, which include data from Los Angeles County, Ventura County, and SCCWRP Los Angeles region land use data. These data have been used in multiple Los Angeles Region TMDL IPs, Watershed Management Plans (WMPs), and EWMPs. Select EMC values specified for fecal coliform were modified for Ventura County and used in the Draft Lower Santa Clara River Bacteria TMDL IP (County of Ventura, 2015b). The SBPAT User's Guide (Geosyntec, 2012) contains additional detail on the datasets from which the default values were derived. The EMC values used for calculations, including their data sources, are summarized in Table C-8. These values are lognormal distributional statistics that are shown here in arithmetic space for ease of review (i.e., they are converted from log space values). The number of samples used to develop the EMC dataset from each data source are shown in Table C-9.

Table C-8. EMCs for Pollutant Modeling – Arithmetic Estimates of the Lognormal Means

Land Use	Pollutants											
	TSS mg/L	Tot P mg/L	Diss P mg/L	NH3 mg/L	NO3 mg/L	TKN mg/L	Diss Cu ug/L	Tot Cu ug/L	Tot Pb ug/L	Diss Zn ug/L	Tot Zn ug/L	Fecal Col.[a] #/100mL
Single-Family Residential	124.2	0.40	0.32	0.49	0.78	2.96	9.4	18.7	11.3	27.5	71.9	15,600
Commercial	67.0	0.40	0.29	1.21	0.55	3.44	12.3	31.4	12.4	153.4	237.1	5,510
Industrial	219.2	0.39	0.26	0.60	0.87	2.87	15.2	34.5	16.4	422.1	537.4	18,700
Education (Municipal)	99.6	0.30	0.26	0.40	0.61	1.71	12.2	19.9	3.6	75.4	117.6	11,800[b]
Transportation	77.8	0.68	0.56	0.37	0.74	1.84	32.4	52.2	9.2	222.0	292.9	1,680
Multi-Family Residential	39.9	0.23	0.20	0.50	1.51	1.80	7.4	12.1	4.5	77.5	125.1	11,800[c]
Agriculture (row crop)	999.2	3.34	1.41	1.65	34.40	7.32	22.5	100.1	30.2	40.1	274.8	24,800
Vacant / Open Space	216.6	0.12	0.09	0.11	1.17	0.96	0.6	10.6	3.0	28.1	26.3	484

Based on 1996-2000 data for Los Angeles County land use sites (LACDPW, 2000).

Based on Ventura County MS4 EMCs (VCFCD, 2003).

Based on 2000-2005 Southern California Coastal Water Research Project (SCCWRP) Los Angeles region land use data (SCCWRP,

Based on Ventura County MS4 monitoring data (County of Ventura, 2015b).

Based on samples collected from the Arroyo Sequit reference watershed in western Los Angeles County, or 11 samples collected between December 2004 and April 2006. Data were used by the Los Angeles Regional Board for multiple bacteria TMDLs and are taken from (SCCWRP, 2005) and (SCCWRP 2007a).

[a] Where original data were for *E. coli*, values were divided by 0.85 to adjust to fecal coliform.

[b] Multi-Family Residential EMC used since educational land use site not available in the SCCWRP fecal coliform dataset.

[c] The fecal coliform EMC for the multi-family residential land use is based on SCCWRP dataset for "high-density residential."

Table C-9. Number of Data Points for Land Use EMC Data

Land Use	Pollutants											
	TSS	Tot P	Diss P	NH3	NO3	TKN	Diss Cu	Tot Cu	Tot Pb	Diss Zn	Tot Zn	Fecal Col.[a]
Single-Family Residential	41	42	42	44	43	46	48	48	48	48	48	34
Commercial	31	32	33	33	33	36	40	40	40	40	40	14
Industrial	53	55	56	57	56	57	61	61	61	61	61	35
Education (Municipal)	51	49	49	52	51	51	54	54	54	54	54	N/A[b]
Transportation	75	71	71	74	75	75	77	77	77	77	77	2
Multi-Family Residential	45	38	38	46	46	50	54	54	54	54	54	7
Agriculture (row crop)	20	18	18	21	19	17	18	21	21	21	21	23
Vacant / Open Space	48	46	44	48	50	50	52	52	57	52	52	11

Based on 1996-2000 data for Los Angeles County land use sites (LACDPW, 2000)

Based on Ventura County MS4 EMCs (VCFCD, 2003)

Based on 2000-2005 SCCWRP Los Angeles region land use data (SCCWRP, 2007b)

Based on Ventura County MS4 monitoring data (County of Ventura, 2015b).

Based on samples collected from the Arroyo Sequit reference watershed in western Los Angeles County, or 11 samples collected between December 2004 and April 2006. Data were used by the Los Angeles Regional Board for multiple bacteria TMDLs and are taken from (SCCWRP, 2005) and (SCCWRP 2007a).

[a] Where original data were for *E. coli*, values were divided by 0.85 to adjust to fecal coliform.

[b] Multi-Family Residential EMC used since educational land use site not available in the SCCWRP fecal coliform dataset.

C.3.3 BMP Water Supply Volume and Pollutant Reductions

The SWMM model was used to calculate the average annual percent volume capture for each of the proposed MSWRP modeled project BMPs. For infiltration-based BMPs, this represents the percentage of annual runoff from the drainage area that will be captured and infiltrated by the BMP. It is then assumed that all of the captured runoff volume and pollutant load is reduced due to infiltration or evapotranspiration.

For the subsurface storage tank, the annual percent capture modeled by SWMM represents the percentage of annual runoff from the drainage area that will be captured and stored for irrigation purposes. The captured runoff volume is considered to be reduced due to irrigation and subsequent infiltration/evapotranspiration. The percentage of runoff volume infiltrated, evapotranspired, or irrigated by these BMPs also represents the percentage of pollutant loading that is removed as a result of BMP implementation. The infiltrated volume was also estimated for infiltration-based

BMPs and multiplied by an adjustment factor to compute a potential groundwater recharge volume to represent potential water supply benefits. This value is based on a modeling analysis of groundwater recharge performed by Munévar and Mariño (in the Central California region), which showed that on average approximately 65 percent of infiltrated water reaches the water table and is therefore available for water supply (Munévar and Mariño, 1999). Therefore, the potential water supply volume provided by infiltration BMPs was calculated to be 65 percent of the modeled infiltration volume in SWMM.

Appendix D - Multiple Benefits Analysis

D.1 Multiple Benefits for MSWRP Modeled Projects

As previously outlined in section 4.6 and required by SWRP Guidelines, metrics for the MSWRP modeled projects were quantified using assumed design information and modeling results for the benefit categories outlined in the SWRP. Qualitative metrics for the benefit categories were then combined with the quantitative scores to determine multi-benefit indices. For group 1 and group 2 identified projects, a modified multiple benefit approach based on the process for MSWRP modeled projects was used, where the benefit indices were based solely on qualitative assessments of each project's ability to achieve multi-benefits, as the detail needed to quantify all benefits have not yet been developed.

Scores for each benefit category (benefit scores) identified in the SWRP Guidelines were determined as described in Table D-1. Quantitative results from conceptual design and modeling were used to calculate quantitative benefit scores. Project quantitative benefit scores were normalized by dividing quantitative results (e.g. pollutant loads) by the maximum value for all projects and multiplying normalized values by five, yielding scores ranging from zero to five[10]. These scores based on quantitative metrics were used to calculate quantitative benefit scores for water quality, water supply, flood control and environmental benefits as appropriate, as described in Table D-1. Water quality quantitative benefit scores differed slightly from the other benefit categories, in that a quantitative score ranging from one to five was determined for each modeled pollutant. Scores for each pollutant were then weighted by the pollutant priority weights for the relevant watershed to determine an overall water quality quantitative benefit score for each project.

A qualitative benefit score from zero to five was also determined for certain criteria, based on the project concept, aspects of the location of the project (soil infiltration rate, proximity to groundwater basin, etc.), and best professional judgement to reflect the effectiveness of the project at achieving each benefit. The qualitative scores are consistent between MSWRP modeled projects as well as identified group 1 and group 2 projects to allow for comparison between project groups if desired for setting implementation priorities. The overall benefit scores for water supply, flood control and environmental benefits were calculated by multiplying the quantitative and qualitative scores and dividing by five to yield a final benefit score between zero and five. Water quality benefits are based solely on the quantitative scores and pollutant treatment priority weights, while community benefits are based entirely on a qualitative score.

[10] To avoid scores being skewed by projects with significantly higher quantified benefits, all projects with benefits considered upper limit outliers (defined as values greater than the median value + [1.5 x interquartile range] for all project benefits analyzed) were excluded from this analysis. Instead, all projects with benefits greater than the upper limit outlier, for any given pollutant, were automatically given a score of five.

Finally, in order to determine a multi-benefit index for each project, each benefit category was assigned a weight according to its relative importance to stakeholders. The following weights were initially applied to each benefit category and may be revised based on stakeholder input:

- Water quality: 50%
- Water supply: 20%
- Flood management: 10%
- Environmental: 10%
- Community: 10%

The benefit scores were multiplied by the assigned benefit weights and summed to calculate a multi-benefit index between one and five. This approach is similar in concept to the ASCE award-winning Los Angeles Countywide BMP prioritization methodology (www.LABMPmethod.org).

Potential environmental and community benefits of SWRP projects are identified in Table D-2 and Table D-3. The projects were given credit for each benefit if it satisfies the evaluation criteria for that benefit in Table D-2 and Table D-3. The qualitative scores for environmental and community benefits were selected based on the number of main and additional benefits that each project is expected to provide, as defined in the SWRP guidelines.

Table D-1. Multi-benefit Scoring Guidance

Benefit Category	Description	Scoring
Water Quality	Potential to address water quality priorities	Score will be calculated based on quantitative metric of benefit multiplied by a qualitative pollutant multiplier **Quantitative metric**: Pollutant load reduction (lb/year or 10^{12} MPN/year for fecal coliform) will be used to calculate a weighted score for each project based on qualitative watershed specific water quality priorities. **Quantitative pollutant priority weights**: 3=TMDL pollutants: 2=303(d) pollutants 1=All other pollutants

Benefit Category	Description	Scoring
Water Supply	Maximize infiltration, supplement groundwater, or reuse of captured stormwater or dry weather runoff	Score will be calculated based on quantitative metric of benefit multiplied by a qualitative multiplier describing the effectiveness of the project at meeting that metric. **Quantitative metric**: Potential Water Supply Volume (acre-ft/yr) **Qualitative score** 0=No infiltration or planned reuse 2.5=Improved water efficiency through implementation of drought tolerant vegetation and/or removal of high water need vegetation 5=Potential reuse of infiltrated water that is captured/treated or capture reuse project
Flood Management	Minimize runoff / discharge	Score will be calculated based on quantitative metric of benefit multiplied by a qualitative multiplier describing the effectiveness of the project at meeting that metric **Quantitative metric**: Runoff volume captured[11] (cu-ft/yr) **Qualitative score**: 0=No flooding problem known to occur locally 2.5=Minor flooding issues known to occur locally 5=Major flooding issues known to occur locally
Environmental	Environmental benefits of project, listed in ***Table D-2***	Score will be calculated based on a quantitative metric of benefit multiplied by a qualitative score. **Quantitative metric**: Square feet of habitat/urban green space created (represented by BMP footprint) **Qualitative score**: A qualitative score will be determined by the number of benefits in ***Table D-2***, as follows. 0=No environmental benefit 2.5=Medium environmental benefit 5=High environmental benefit

[11] Runoff volume metric used in lieu of peak flow since peak flow is not available.

Benefit Category	Description	Scoring
Community	Community benefits of project, listed in ***Table D-3***	A qualitative score will be determined by the number of benefits in ***Table D-3***, as follows. 0=No community benefit 2.5=Medium community benefit 5=High community benefit

Table D-2. List of potential environmental benefits

Project includes benefit? (Y/N)	Benefit Description	Evaluation Criteria
Main Benefits		
	Environmental and habitat protection and improvement, including: • Wetland enhancement/creation • Riparian enhancement; and/or • Instream flow enhancement	• Parcel is located near a water body and could enhance or restore aquatic existing habitat • BMP concept creates a water feature that could create habitat (e.g. constructed wetland) • Parcel or BMP concept can be developed in a way that enhances or creates habitat or provides other environmental restoration (e.g. opportunity to plant native species)
	Increased urban green space	• Parcel is located in an urban area • Undeveloped space on parcel could be converted to green space or BMP concept includes plantings (e.g. bioretention)
Additional Benefits		
	Reduced energy use, greenhouse gas emissions, urban heat island effect, or provides carbon sink	• BMP concept increases water supply through infiltration or capture reuse and reduces energy used for importing water • Project creates green space
	Reestablishment of natural hydrograph	• Project reduces runoff and helps restore stream flow to predevelopment conditions

Table D-3. List of potential community benefits

Project includes benefit? (Y/N)	Benefit Description	Evaluation Criteria
Main Benefits		
	Employment opportunities	• Project requires operation and maintenance
	Public education	• Project includes signage or other opportunities to educate the public about stormwater and water quality, water supply, environmental protection or other aspects of the project.
Additional Benefits		
	Community involvement	• Project implementation will engage community
	Enhance or create recreational and public use areas	• Project is located in an existing public space or park • Project provides aesthetic benefits • Project includes recreational facilities (e.g. bike paths)
	Socio-economic benefits	• Project is located in a residential area and may improve home property values • Project is located in a commercial area and may benefit local businesses • Project is located in a disadvantaged or low income area
	Health benefits	• Project will increase green space that will improve air quality • Project provides recreation opportunities that encourage physical exercise

Multiple benefit indices for projects identified in the MSWRP were developed using estimated annual pollutant load reductions, runoff volume captured and potential water supply volume, in addition to approximate BMP footprint, shown in Table 10. The quantitative benefit scores for all MSWRP projects are shown in Table D-5. This includes quantitative water quality benefit scores for each individual pollutant, which were combined with the priority pollutant weights (based on TMDL or 303(d) listed pollutants) to determine the water quality weighted benefit score, and the

water supply, flood management, and environmental quantitative benefit scores. Priority pollutant weights for each watershed are shown in Table D-4.

Table D-6 shows qualitative scores for each MSWRP project for water supply, flood management, environmental, and community benefits. The final benefit scores for each benefit category, which combine the quantitative and qualitative benefit scores[12], and the final multi-benefit indices are shown in Table D-7.

Table D-4. Priority Pollutant Weight Scores

Watershed	Pollutant Weights (TMDL = 3, 303(d) = 2, others = 1)											
	TSS	TP	Diss P	NH3	NO3	TKN	Diss Cu	Tot Cu	Tot Pb	Diss Zn	Tot Zn	Fecal Coliform
Ventura River	1	1	1	1	3	3	1	1	1	1	1	2
Santa Clara River	1	1	1	3	3	1	2	2	1	1	1	3
Calleguas Creek	1	1	1	3	3	3	3	3	1	3	3	2
Malibu Creek	1	3	3	3	3	3	1	1	2	1	1	3
Oxnard Coastal	1	1	1	2	2	2	1	1	1	1	1	3
Ventura Coastal	1	1	1	1	1	1	1	1	1	1	1	2

[12] With the exception of the water quality score, which combines the quantitative scores for each pollutant analyzed with quantitative pollutant priority weights for each pollutant to determine the overall water quality weighted quantitative score.

Table D-5. Quantitative Scores for MSWRP Modeled Projects

Location (Project ID)	BMP Type	Watershed	Quantitative Benefit Score															
			Quantitative Pollutant Water Quality Score												Water Quality (weighted)	Water Supply	Flood Management	Environ-mental
			TSS	TP	Diss P	NH3	NO3	TKN	Diss Cu	Tot Cu	Tot Pb	Diss Zn	Tot Zn	Fecal Coliform				
City of Camarillo (M-CC01)	Infiltration Basin	Calleguas Creek	1.4	1.5	1.6	1.5	1.1	1.6	1.6	1.6	1.6	1.8	2.2	1.5	5.0	1.3	2.1	1.4
City of Ventura (M-VC01)	Infiltration Trench	Ventura Coastal	0.45	0.45	0.44	0.40	0.50	0.38	0.47	0.47	0.34	0.63	0.68	0.37	3.3	0.59	0.59	0.39
County of Ventura (M-VR02)	Subsurface Infiltration System	Ventura River	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	2.7	5.0	5.0	5.0
County of Ventura (Piru) (SCR03)	Infiltration Basin	Santa Clara River	4.3	4.3	4.0	3.6	4.8	3.9	3.7	3.9	3.9	3.8	5.0	3.5	5.0	3.3	5.0	5.0
City of Fillmore (M-SCR01)	Infiltration Basin	Santa Clara River	0.95	0.89	0.96	0.82	0.54	0.89	0.97	0.93	0.89	1.1	1.3	0.88	1.6	0.81	1.2	1.0
City of Moorpark (M-CC02)	Infiltration Basin	Calleguas Creek	3.9	3.7	3.7	2.9	2.9	3.5	3.4	3.4	3.7	2.5	3.6	3.5	0.31	3.0	4.6	2.7
City of Ojai (M-VR01)	Subsurface Infiltration System	Ventura River	0.17	0.23	0.22	0.37	0.14	0.25	0.25	0.30	0.26	0.56	0.57	0.12	0.87	0.19	0.28	0.11
City of Oxnard (M-OC01)	Infiltration Basin	Oxnard Coastal	1.4	1.7	1.8	2.0	1.6	1.8	1.8	1.8	1.7	2.8	3.1	1.6	5.0	2.6	2.6	3.2
City of Port Hueneme (M-OC02)	Infiltration Basin	Oxnard Coastal	3.6	3.6	3.7	2.9	2.1	3.5	3.4	3.3	3.7	2.7	3.9	3.5	3.3	4.7	4.8	4.6
City of Santa Paula (M-SCR02)	Infiltration Basin	Santa Clara River	2.7	2.5	2.6	2.5	1.8	2.5	2.9	2.8	2.6	5.0	5.0	2.4	0.48	3.6	3.5	1.1
City of Simi Valley (M-CC03)	Subsurface Storage Tank (rainwater harvesting)	Calleguas Creek	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	2.0	5.0	5.0	5.0
City of Thousand Oaks (M-MC01)	Subsurface Storage Tank (rainwater harvesting)	Malibu Creek	2.2	1.4	1.4	1.2	1.3	1.4	1.2	1.4	1.5	1.5	1.8	1.3	1.4	1.5	2.4	5.0

Table D-6. Qualitative Scores for MSWRP Projects

Location (Project ID)	BMP Type	Watershed	Qualitative Benefit Score (0, 2.5, or 5)			
			Water Supply	Flood Management	Environmental	Community
City of Camarillo (M-CC01)	Infiltration Basin	Calleguas Creek	5	2.5	2.5	2.5
City of Ventura (M-VC01)	Infiltration Trench	Ventura Coastal	5	2.5	2.5	2.5
County of Ventura (M-VR02)	Subsurface Infiltration System	Ventura River	5	2.5	2.5	2.5
County of Ventura (Piru) (M-SCR03)	Infiltration Basin	Santa Clara River	5	2.5	2.5	2.5
City of Fillmore (M-SCR01)	Infiltration Basin	Santa Clara River	5	2.5	2.5	2.5
City of Moorpark (M-CC02)	Infiltration Basin	Calleguas Creek	5	2.5	2.5	2.5
City of Ojai (M-VR01)	Subsurface Infiltration System	Ventura River	5	2.5	2.5	2.5
City of Oxnard (M-OC01)	Infiltration Basin	Oxnard Coastal	5	2.5	2.5	2.5
City of Port Hueneme (M-OC02)	Infiltration Basin	Oxnard Coastal	5	2.5	2.5	2.5
City of Santa Paula (M-SCR02)	Infiltration Basin	Santa Clara River	5	2.5	2.5	2.5
City of Simi Valley (M-CC03)	Subsurface Storage Tank (rainwater harvesting)	Calleguas Creek	5	2.5	2.5	2.5
City of Thousand Oaks (M-MC01)	Subsurface Storage Tank (rainwater harvesting)	Malibu Creek	5	2.5	2.5	2.5

Table D-7. Final Benefit Scores and Multi-Benefit Indices for MSWRP Projects

Location (Project ID)	BMP Type	Watershed	Benefit Scores					Multi-Benefit Index
			Water Quality	Water Supply	Flood Management	Environ-mental	Com-munity	
City of Camarillo (M-CC01)	Infiltration Basin	Calleguas Creek	5.0	1.3	1.1	0.71	2.5	**3.2**
City of Ventura (M-VC01)	Infiltration Trench	Ventura Coastal	3.3	0.59	0.29	0.20	2.5	**2.1**
County of Ventura (M-VR02)	Subsurface Infiltration System	Ventura River	2.7	5.0	2.5	2.5	2.5	**3.1**
County of Ventura (Piru) (M-SCR03)	Infiltration Basin	Santa Clara River	5.0	3.3	2.5	2.5	2.5	**3.9**
City of Fillmore (M-SCR01)	Infiltration Basin	Santa Clara River	1.6	0.81	0.62	0.52	2.5	**1.3**
City of Moorpark (M-CC02)	Infiltration Basin	Calleguas Creek	0.31	3.0	2.3	1.3	2.5	**1.4**
City of Ojai (M-VR01)	Subsurface Infiltration System	Ventura River	0.87	0.19	0.14	0.054	2.5	**0.7**
City of Oxnard (M-OC01)	Infiltration Basin	Oxnard Coastal	5.0	2.6	1.3	1.6	2.5	**3.6**
City of Port Hueneme (M-OC02)	Infiltration Basin	Oxnard Coastal	3.3	4.7	2.4	2.3	2.5	**3.3**
City of Santa Paula (M-SCR02)	Infiltration Basin	Santa Clara River	0.48	3.6	1.7	0.54	2.5	**1.4**
City of Simi Valley (M-CC03)	Subsurface Storage Tank (rainwater harvesting)	Calleguas Creek	2.0	5.0	2.5	2.5	2.5	**2.8**
City of Thousand Oaks (M-MC01)	Subsurface Storage Tank (rainwater harvesting)	Malibu Creek	1.4	1.5	1.2	2.5	2.5	**1.6**

D.2 Multiple Benefits for Previously Identified Projects

The multiple benefit scoring process developed for evaluating new projects that were identified and developed (to a conceptual level) for the MSWRP was adapted and applied to those identified projects from other sources. Benefit scores for these projects were developed based on the same qualitative process used for MSWRP modeled projects, however quantitative metrics, such as the volume captured, were not available for all of these projects. Thus, the benefit scores for water quality, water supply, flood management, environmental, and community are represented by a score from zero to five based on a qualitative assessment of a specific project type implemented in the identified parcel at achieving each benefit, independent of size or scale of the project. Table D-8 shows how the scoring process was adapted for projects for which BMP concept designs have not been developed (group 1 or 2 identified projects).

Table D-8. Multi-benefit scoring guidance for Non-MSWRP projects

Benefit Category	Description	Scoring
Water Quality	Potential to address water quality priorities	0=No pollutant removal 2.5=Partial removal in discharge 5=Full removal of captured/diverted flow
Water Supply	Maximize infiltration, supplement groundwater, or reuse of captured stormwater or dry weather runoff	0=No infiltration or planned reuse 2.5=Improved water efficiency through implementation of drought tolerant vegetation and/or removal of high water need vegetation 5=Potential reuse of infiltrated water that is captured/treated or capture reuse project
Flood Management	Minimize runoff / discharge	0=No flooding problem 2.5=Minor flooding issues 5=Major flooding issues
Environmental	Environmental benefits of project, listed in ***Table D-2***.	Score will be determined by the number of benefits in ***Table D-2***, as follows. 0=No environmental benefit 2.5=Medium environmental benefit 5=High environmental benefit
Community	Community benefits of project, listed in ***Table D-3***	Score will be determined by the number of benefits in ***Table D-3***, as follows. 0=No community benefit 2.5=Medium environmental benefit

Benefit Category	Description	Scoring
		5=High environmental benefit

The multi-benefit scoring guidance for non-MSWRP projects located within the various watersheds are shown in Table D-9 through Table D-13.

Table D-9. Multi-Benefit Scoring for Non-MSWRP Projects in the Santa Clara River Watershed

Project	Project ID	Qualitative Benefit Scores (0, 2.5, or 5)					Multi-Benefit Index
		Water Quality	Water Supply	Flood Management	Environ-mental	Com-munity	
Group 1 Identified Projects							
City of Santa Paula Infiltration Basin	SCR01	5	5	0	2.5	2.5	**4.0**
City of Ventura - Subsurface Infiltration Basin	SCR02	5	5	0	0	2.5	**4.0**
County of Ventura - County Maintenance Yard Infiltration Basin	SCR03	5	5	0	2.5	2.5	**4.0**
City of Oxnard - Infiltration Basin	SCR04	5	5	0	2.5	2.5	**4.0**
City of Fillmore - Infiltration Basin 1	SCR05	5	5	0	2.5	2.5	**4.0**
City of Fillmore - Infiltration Basin 2	SCR06	5	5	0	2.5	2.5	**4.0**
Sierra Club - A stormwater management pilot project	SCR07	5	5	0	5	5	**4.5**
United Water - Ferro Basin	SCR08	5	5	0	2.5	2.5	**4.0**
Caltrans - Saticoy Infiltration basin	SCR09	5	5	0	0	2.5	**3.8**
Group 2 Identified Projects							
None							

Table D-10. Multi-Benefit Scoring for Non-MSWRP Projects in the Calleguas Creek Watershed

Project	Project ID	Qualitative Benefit Scores (0, 2.5, or 5)					Multi-Benefit Index
		Water Quality	Water Supply	Flood Management	Environ-mental	Com-munity	
Group 1 Identified Projects							
Calleguas Creek IP Project TO-1 (capture and reuse)	CC01	5	5	2.5	2.5	2.5	**4.3**
Calleguas Creek IP Project TO-2 (capture and reuse)	CC02	5	5	2.5	2.5	2.5	**4.3**
Calleguas Creek IP Project UC-1 (infiltration)	CC03	5	5	2.5	5	2.5	**4.5**
Calleguas Creek IP Project UC-2 (infiltration)	CC04	5	5	2.5	5	2.5	**4.5**
Calleguas Creek IP Project CM-1 (infiltration)	CC05	5	5	2.5	5	2.5	**4.5**
Calleguas Creek IP Project CM-2 (capture and reuse)	CC06	5	5	2.5	2.5	2.5	**4.3**
Calleguas Creek IP Project SV-1 (capture and reuse)	CC07	5	5	2.5	2.5	2.5	**4.3**
Calleguas Creek IP Project SV-2 (infiltration)	CC08	5	5	2.5	5	2.5	**4.5**
Calleguas Creek IP Project MP-1 (infiltration)	CC09	5	5	2.5	5	2.5	**4.5**
Calleguas Creek IP Project MP-2 (infiltration)	CC10	5	5	2.5	5	2.5	**4.5**
Calleguas Creek IP Project MP-3 (infiltration)	CC11	5	5	2.5	5	2.5	**4.5**
Tierra Rejada Rd Improvements	CC16	2.5	0	5	2.5	2.5	**2.3**
Old Town drainage	CC17	5	5	5	0	0	**4.0**
Cerro Vista Detention Basin	CC18	5	5	0	2.5	2.5	**4.0**
Group 2 Identified Projects							
Arroyo Simi Grade Stabilization	CC12	2.5	0	5	0	2.5	**2.0**
Calleguas Creek Low Flow Channel	CC13	2.5	0	0	2.5	2.5	**1.8**
Conejo Mountain Creek Detention Basins 2-5 at Dos Vientos	CC14	5	5	2.5	0	2.5	**4.0**

Project	Project ID	Qualitative Benefit Scores (0, 2.5, or 5)					Multi-Benefit Index
		Water Quality	Water Supply	Flood Management	Environ-mental	Com-munity	
Gabbert Channel Restoration	CC15	2.5	5	2.5	0	2.5	**2.8**
Watershed Management Strategy Study Projects	CC19	2.5	5	5	2.5	2.5	**3.3**

Table D-11. Multi-Benefit Scoring for Non-MSWRP Projects in the Ventura River Watershed

Project	Project ID	Qualitative Benefit Scores (0, 2.5, or 5)					Multi-Benefit Index
		Water Quality	Water Supply	Flood Management	Environ-mental	Com-munity	
Group 1 Identified Projects							
Foster Park Infrastructure and Bank Protection and Restoration	VR01	0	0	2.5	5	5	**1.3**
Ojai Unified School District Stormwater LID Project	VR08	5	5	0	2.5	5	**4.3**
The Thacher Creek Equestrian Instream Flow and Water Quality Project	VR09	5	5	0	2.5	5	**4.3**
Group 2 Identified Projects							
Stormwater Retrofit Demonstrations (LID and Green Streets)	VR02	5	5	0	0	5	**4.0**
Stormwater Parking Lot Retrofits	VR03	2.5	5	0	0	0	**2.3**
Riparian Habitat and Wetland Restoration	VR04	2.5	5	2.5	5	5	**3.5**
Watershed Corps	VR05	2.5	5	2.5	0	5	**3.0**
Infiltration System Installations	VR06	5	5	0	0	0	**3.5**
Overflow Ponds	VR07	2.5	5	2.5	0	0	**2.5**
Ventura Water San Jon/Prince Barranca Urban Stormwater/Flood Control Retrofit Pilot Project	VR10	2.5	5	5	0	0	**2.8**

Table D-12. Multi-Benefit Scoring for Non-MSWRP Projects in the Malibu Creek Watershed

Project	Project ID	Qualitative Benefit Scores (0, 2.5, or 5)					Multi-Benefit Index
		Water Quality	Water Supply	Flood Management	Environ-mental	Com-munity	
Group 1 Identified Projects							
None							
Group 2 Identified Projects							
Distributed BMPs	MC01	5	5	0	5	5	**4.5**
Low flow diversion to sewer	MC02	5	0	0	2.5	0	**2.8**

Table D-13. Multi-Benefit Scoring for Non-MSWRP Projects in the Coastal Watersheds

Project	Project ID	Qualitative Benefit Scores (0, 2.5, or 5)					Multi-Benefit Index
		Water Quality	Water Supply	Flood Management	Environ-mental	Com-munity	
Group 1 Identified Projects							
Development Retrofit Area	CHB01	2.5	0	0	2.5	2.5	**1.8**
Harbor Park Redevelopment	CHB02	5	0	0	5	5	**3.5**
Group 2 Identified Projects							
None							

Appendix E - MSWRP Updates

E.1 Santa Clara River Watershed MSWRP Updates

E.2 Calleguas Creek Watershed MSWRP Updates

Additional MSWRP Project - City of Camarillo - Stormwater Diversion to Water Restoration Plan Feasibility Study

Project Name	Project ID	Project Type	Brief Description of Project	Location		Address	Watershed	Project Owner	Project Partners	Representative Contact Name	Representative Contact Email	Primary Benefit	Secondary Benefit	Land own... committed to maintenance ?	Date Project Added
				Lat	Long										
Stormwater Diversion to Water Reclamation Plant Feasibility Study		Other	The study will investigate the feasibility of sending dry weather storm drain flows to the Camarillo Sanitary District Water Reclamation Plant for treatment and use as recylced water for irrigation purposes.	34.195474	-119.002348	Various location throughout the City which would divert flows to the Water Reclamation Plant located at 150 Howard Road, Camarillo, CA	Calleguas Creek	City of Camarillo		Ken Matsuoka	Kmatsuoka@cityofcamarillo.org	Water Quality	Water Supply	Yes	2/7/2022

Qualitative Benefit Scores				
Water Quality	Water Supply	Flood Management	Environmental	Community
5	2.5	2.5	0	2.5

Project Name	Project ID	Project Type	Watershed	Qualitative Benefit Score					Multi-Benefit Index	Prioritizatic (Low, Medium, or High)
				Water Quality (0, 2.5, or 5)	Water Supply (0 or 5)	Flood Management (0, 2.5, or 5)	Environmental (0, 2.5, or 5)	Community (0, 2.5, or 5)		
Stormwater Diversion to Water Reclamation Plant Feasibility Study		Other	Calleguas Creek	5	2.5	2.5	0	2.5	3.5	High

E.3 Ventura River Watershed MSWRP Updates

E.4 Malibu Creek Watershed MSWRP Updates

E.5 Coastal Watershed MSWRP Updates

Appendix F – Sierra Watershed Progressive Project Descriptions

The Thacher Creek Equestrian Instream Flow and Water Quality Project

Ojai, CA

Background information:

After 1880, Ojai Valley was settled by Americans who developed ranches that consisted primarily of dryland crops including walnut and citrus (Magney 2005). This led to the installation of water diversions and wells shortly after to increase crop yield. As a result, there was an increase in population which created a greater need for water. As this need arose, pavements, flood drains, culverts, and diversions were constructed around the Valley. In the 1970s, surface water was transferred into drainages by conduit systems that were constructed. The above-mentioned infrastructure decreases the amount of groundwater infiltration, quantity of surface water, and diminishes surface water quality.

Thacher Creek is tributary to San Antonio Creek, which is tributary to the Ventura River, a Core One watershed for the recovery of southern steelhead (NOAA 2011). The Ventura watershed is 225.8 square miles in area and contains two large dams on upstream tributaries to the Ventura River that serve as a steelhead passage barrier to excellent upstream habitat. The Matilija Dam, constructed in 1947 for water supply and flood control, is now almost completely filled with sediment and no longer serves its original purpose. The Casitas Dam, constructed in 1959 to form Lake Casitas, is the primary supplier of water in the watershed. The Ventura River watershed is unique in that it receives no imported waters.

The San Antonio Creek Subwatershed encompasses 50.1 sq. miles. The upper watershed is located primarily within the Los Padres National Forest (see San Antonio Creek Subwatershed Map in “Other Documents”). Much of the middle watershed is comprised of the city of Ojai, population 7,461 (2010 census), and surrounding agriculture. The most common agriculture practices found in the Ojai basin are citrus and avocado orchards. The lower subwatershed contains mostly undeveloped mountain terrain.

Historically, the Ventura River supported a returning adult steelhead run of 5,000 individuals (NOAA 2011). Southern California steelheads were seen in the Ojai Valley in the early 1900’s in San Antonio and Ojai Creek (Magney 2005). There are reports of fishing and capture of southern California steelhead at Ojai Creek in the late 1940’s, as well as adult southern steelhead recorded at San Antonio Creek in 2013. Currently, it is estimated that less than 500 adults from this ESU return to coastal habitat that runs from the Santa Maria River in northern Santa Barbara County to the Mexican border (NOAA 2011). Following the construction of Matilija Dam and Casitas Dam, San Antonio Creek has become the most viable creek in the Ventura River watershed for southern steelhead spawning and rearing habitat (NOAA 2011). Please see The Thacher School Water Management Plan page 9 for further background information on the Ojai basin in relation to the Ventura River Watershed.

Introduction:

The Thacher Creek Equestrian Instream Flow and Water Quality Project will aid in restoring degraded Steelhead habitat by increasing instream and base flows during dry months, decreasing nutrient loading during storm events while reducing discharge of sediment and high scouring events within high priority drainages and riparian areas of the Ventura River Watershed. The project is designed to reduce the amount of water diverted from the San Antonio Subwatershed through a change in water source, by storing approximately 580,600 to 837,055 gallons of captured rainwater, annually, depending on precipitation levels (drought to average respectively) while slowing, reusing and infiltrating erosive and problematic stormwater flows downstream into upland habitat restoration Low Impact Development based bioswales and vegetated infiltration basins. This water conservation project will create an alternative supply of water that will cover 100% of all water needs of the equestrian center from watering to washing, and therefore will be able to confidently leave the conserved water, even in drought, instream for the southern Steelhead recovery.

Objectives:

a. Purpose of the project:

This project will reduce or eliminate the need for diverting surface flows from Thacher Creek, a tributary to San Antonio Creek, during certain low flow periods when water supplies are most stressed, while concurrently slowing and infiltrating intensive stormwater onsite. This will enhance seasonal water base flows in Thacher Creek, San Antonio Creek and ultimately the Ventura River Watershed to support high quality habitat for the endangered southern California Steelhead Trout.

Stormwater flows on the Thacher Equestrian site will also be captured and water quality will be improved in Thacher Creek by infiltrating the stormwater through Low Impact Development (LID) tools such as vegetated bioswales which will also aid in groundwater recharge to the stressed Ojai Groundwater Basin.
This project is a critical step in a ten year water conservation and reuse phasing plan, The Thacher School Water Management Plan (TSWMP), which emphasizes its reliance on adjacent tributary Senior Creek waters by 72-89%. As the TSWMP (attached) illustrates, the project will enable the Thacher School to decrease its dependency on Thacher Creek and proceed to the next step of conserving nearby Senior Creek Canyon waters. The improved instream flows for Thacher Creek will have a direct impact on increasing instream flows for Senior Creek Canyon waters. This project will serve as a 'proof of concept' for those exploring opportunities to improve the watershed. The implementation of this TSWMP will create a model through collaborative partnerships and available funding opportunities.

Set in a resident high school tied to local and nationwide communities, these tools will demonstrate and promote the integral connections of watershed dynamics, land use management, stewardship and water conservation. There are three restoration elements being employed and will be discussed in the following bullet points below:

1) Rainwater Capture: In order to provide an alternative to surface flow diversions, this element will utilize 23 tanks of various sizes to achieve a working tank balance of water suitable to management of the Equestrian Unit. The 21 smaller and locally placed tanks will overflow to the larger gravity fed 300,000g tank, as to conserve all overflows during locally common high intensive storm events. These tank levels will be wirelessly tracked and used as an educational tool for the resident students, instructors, visitors and community programs. Pumps and a relay will ensure availability of water supply, and although on a separate distribution system, cross connection safety will be employed with backflow preventer installation. Additionally, in certain precipitation regimes (see Simulated Tank Balance on PL101) the excess tank captured flows are slated for irrigation that will reduce dependency on Thacher Creek surface diversions. First flush filters and 'quiet' plumbing (PL503) will be used at noted junctures to assure high water quality standards inside the tanks.

Seismic tie-downs, a must in California, are included and will be inherent within the ring beams constructed for the two larger tanks by the tank contractor (included in tank bid). The general contractor, responsible for installing gutters on two buildings assisting tank pad grading, will monitor seismic tied down holds and inspected by the Ventura County Building Inspector through the permitting process. Hobo temperature gages will be installed on tank series to monitor high volume to surface ratio temperatures inside tanks.

2) Stormwater Capture: As a nutrient TMDL is focused on Ventura River, stormwater capture and reduced sediment/nutrient loading is imperative for local livestock operations. One quarter of all stormwater caught will be slowed and reused through the Rainwater Capture element described above. Another quarter of all stormwater will be slowed through use of common Low Impact Development (LID) techniques, such as vegetated bioswales, or infiltration basins, as show on concept plans page PL501. Integrating proper LID earthworks (led a General Contractor and handwork by the CCC) with phytoremediation of correct plant choice and added biochar has shown to be extremely effective at reducing pathogen, nutrient and sediment loading to our watersheds. From this, over 3300 plants will be utilized from native growers, along with locally sourced mulch to cool soils and to add

necessary carbon to process nutrients for plant uptake. Overflow flex pipe will lead these basins in series to overflow from one to the other as to not interfere with management and operations of the Equestrian Unit and lessen maintenance. No gravels, only mulch will be used, except on rock aprons (see PL501) where riprap will be used in higher grades. Mulch combined with biochar is lower maintenance frequency for these LID based techniques. Irrigation, plant culling, and erosion control BMPs installation will be directed by a Water Reuse LID Consultant and local Restoration Specialist who will guide California Conservation Corp members on correct planting techniques.

3) Section 1707 Application: This technique is employed to ensure The Thacher Creek diversion flows are protected and left in stream for beneficial uses. These materials include legal fees, due diligence and stakeholder meetings to shepherd the application through the SWRCB process. After a Section 1600 DFW permit is filed, pressure transducers will monitor flow events, and a valve for the diversion will be added to halt diversions from April until October of each year. Hobo sensors will also be added to note upstream and downstream.

Location

The proposed water conservation measure at The Thacher School will improve instream flows, water quality and therefore critical spawning and migration habitat for the federally endangered southern California steelhead (Oncorhynchus mykiss) in the Ventura River and San Antonio Creek Watersheds. Alternative water sources are crucial to stop dependency on surface diversions, which this project will employ. In the fourth year of increasing drought, the need to demonstrate and actualize water reuse, conservation and reduction in stormwater runoff is paramount. In cumulative, reducing surface diversion by substituting rainwater capture can be a viable return on investment to steelhead fisheries, in many situations.

San Antonio is an important feeder creek for southern steelhead; it provides the best potential for accessible rearing habitat in the entire Ventura River Watershed (Entrix 2003). Increasing water quantity and quality in Thacher Creek, which runs into San Antonio Creek, will benefit the entire San Antonio Creek Subwatershed. Limiting factors to southern California steelhead recovery include: water quality and quantity in the form of riparian dysfunction, sediment yield, spawning and rearing habitat, and fish passage. These are necessary improvements needed to sustain southern California steelhead in this watershed.

Presently, San Antonio Creek Subwatershed provides the largest portion of the available southern California steelhead rearing habitat in Ventura River Watershed (Entrix 2003). Increasing the quality of habitat in this Subwatershed is a critical short-term restoration need for the survival of southern California steelhead (CEMAR 2010).

Increasing water quantity into Ventura River Watershed is particularly important as California is currently being affected by the effects of a multi-year drought. The closest rain gauge from The Thacher School (about 5 miles away) reveals that the area has received 9.04 inches of rain this season (updated March 26, 2015 on the Ventura County Watershed Protection District website). The 2012-13 year was recorded as the 6th driest year historically (1906-2015) at 9.07 inches of rain and 2013-14 was the 7th driest year with 9.16 inches. This trend reveals that in the future, Ventura County may experience prolonged periods of decreased precipitation levels due to the change in climate that is occurring. Because of this projection, it is increasingly important to limit the amount of water diversions in the Ventura River Watershed while increasing ways to mitigate more intensive focused deleterious storm event runoff, as this project will demonstrate.

Lack of flow or low flow conditions in the San Antonio Subwatershed is listed as a limiting factor to southern California steelhead recovery in the Ventura River Watershed Technical Investigation (2003). Immediately downstream of Thacher Creek, habitat within San Antonio Creek is considered the best southern California steelhead habitat in the Ventura River Watershed, although this reach is unavailable to steelhead when it goes dry (Entrix 2003).

Water temperature, nutrient loads, and pool habitat for southern California steelhead are limiting factors within the Ventura River Watershed (Entrix 2003). Surface water temperatures in the Ventura River Watershed are gauged between 23-25 degrees Celsius which can be extremely stressful to steelhead (Entrix 2003). In addition to temperature, high nutrient loads in San Antonio watershed have been recorded because of the presence of horses on adjacent parcels (Entrix 2003). This influx of nutrients decreases dissolved oxygen, which is another factor that can increase stress levels for southern California steelhead. San Antonio Creek lacks deep pools that are beneficial for steelhead habitat due to fine sediment aggregation (Entrix 2003). An increase of southern California steelhead is possible if stream flow is provided and habitats are restored to the historical levels.

PROPOSED

Project Catalog

OUSD Stormwater LID Project

1)

1)

TASK TIMELINES*

OUSD Stormwater LID Project

1)

2016

June 10 **Selection due back to Sierra Watershed Progressive (SWP) based on this project catalog to be edited, agreed to for inclusion into SWRGP Prop 1 proposal.** Bond monies (and other non-state monies spent prior to November 2014 should be noted for match where possible. Match detail requirements will not be needed until award and contracting. All outstanding match (50%) on selected projects will be the responsibility of OUSD for grant monies to be dispersed.

June 22 Draft SWRGP proposal to OUSD. Stormwater planning need identified.

July 1 Edits on proposal returned to Sierra Watershed Progressive (SWP) for finalization.

July 8 Proposal due date, SWP will upload proposal to FAAST system.

2017

Jan 15 Expected award notices/or edits for next reiteration for subsequent grant reapplication.

*Note: **These dates are critical for successful submission and turn-around time. Contact us at: aimee@sierrawatershedprogressive.com for any questions.**

PRELIMINARY PROJECT RANKING

OUSD Stormwater LID Project

1) Use this table to see valued benefits to OUSD, as well as ranking for SWRGP Prop 1 Grant ask. Note: water savings, stormwater calculations are draft/preliminary pending more data.
2) Note that ROI is based on preliminary construction/planning budgets, within 20% error.
3) Construction time frame for grant is 4 years, including planning.

PROJECT	Project Area	Infiltration/Groundwater Recharge	Potable Water Savings	Water Quality/TMDL	Elevates Flooding Impacts	Educational/Curriculum Building	Rainwater to Food Irrigation	Decreases Impervious Surfaces	Ambient Temperature Mitigation	Reduced Energy Consumption (Classroom Shading)	Habitat Generation	PLATE SCORE (1-10)	Stormwater*potable*plate/$ WEIGHTED ROI SCORE	Stormwater*potable*plate/$ WEIGHTED ROI SCORE	Stormwater Reuse g/y	Potable Water Cons g/y
Asphalt Removal/Naturescapes Playground	TOPA TOPA	x	x	x	x	x		x	x	x	x	9	4	6	695,128 1	
Permeable Pavement Parking Lot	TOPA TOPA	x		x	x	x		x	x			6	1	3	222,634 1	
Bioswale Center School	TOPA TOPA	x	x	x	x	x			x	x	x	8	0	4		
Bioswale Upper Playground	TOPA TOPA	x	x	x	x	x			x	x	x	8	1	3	47,660 1	
Rainwater Capture for Food for Thought Garden Project	TOPA TOPA	x	x	x	x	x	x		x	x	x	9	4	7	113,000	113,000
Bioswale Front School	TOPA TOPA	x	x	x	x	x			x	x	x	8	1	4	141,467	3,420
Bioswale Heavy Metal Remediation Parking Lot	TOPA TOPA	x		x	x	x		x	x		x	7	3	6	470,988	11,400
Bioswale Corridor Project	TOPA TOPA	x	x	x	x	x		x	x	x	x	8	3	6	63,041	7,600
Asphalt Removal Playground	MATILIJA JR HIGH	x		x	x	x		x	x	x	x	8	1	4	172,696 1	
Permeable Pavement Parking Lot	MATILIJA JR HIGH	x		x	x	x	x	x	x			7	2	4	722,182 1	
Rainwater Capture for Food for Thought Garden Project	MATILIJA JR HIGH	x	x	x	x	x	x	x	x	x	x	10	7	9	228,000	152,000
Rainwater Capture for Ocean Friendly Gardens Project, Irrigation and Toilet Reuse	MATILIJA JR HIGH	x	x	x	x	x			x		x	7	5	6	716,000	230,000
Bioswale Lower Athletic Field/Erosion Control	MATILIJA JR HIGH	x	x	x	x	x			x		x	7	10	8	3,100,000 1	
Rainwater Capture for Irrigation Reuse	NORDOFF HIGH SCHOOL	x	x	x	x	x	x	x	x	x	x	10	4	7	183,600	136,000
Rainwater Capture for Library Toilet and Food for Thought Garden	NORDOFF HIGH SCHOOL	x	x	x	x	x		x	x	x	x	9	3	6	391,900	233,300
Stormwater Bioswale Overflow to Ojai Meadows Preserve	NORDOFF HIGH SCHOOL	x		x	x	x		x			x	8	12	9	1,800,000 1	
Bioswale Heavy Metal Remediation Parking Lot	NORDOFF HIGH SCHOOL	x	x	x	x	x		x	x		x	8	3	5	114,383 1	
Grasscrete Parking Lot	NORDOFF HIGH SCHOOL	x		x	x	x		x	x			6	2	4	1,844,423	11,400
Pool deck replacement - Permeable Pavers	NORDOFF HIGH SCHOOL	x		x	x	x						4	n/a	n/a	170,000	
Bioswale Corridor Project	MEINERS OAKS ELEMENTARY	x	x	x	x	x		x	x	x	x	8	13	11	1,200,000	
Rainwater Capture for Food for Thought Garden Project	MEINERS OAKS ELEMENTARY	x	x	x	x	x	x	x	x		x	9	2	5	85,000	
Nature Play Scapes with Irrigation Stormwater Reuse	MEINERS OAKS ELEMENTARY	x	x	x	x	x	x	x	x	x	x	10	8	9	3,515,589 1	
	0															
Project TOTALS**															12,484,120	900,128
G/y to acre ft/yr															38.31	2.76

PROJECT	Project Area	Stormwater Reuse	Potable Water Cons g/y	SWRGP Ask	Total Match	TOTAL Project	Staff source notes
Asphalt Removal/Naturescapes Playground	TOPA TOPA	695,128	1	$ 184,900	$	184,900	Cutting up asphalt and intercepting sheet flow prior to classroom bank.
Permeable Pavement Parking Lot	TOPA TOPA	222,634	1	$ 233,000	$	233,000	Front parking lot, need percolation, underground utility info. Grasscrete?
Bioswale Center School	TOPA TOPA			$ 90,434	$	90,434	Near Food for Thought/Outdoor Lunch seating area.
Bioswale Upper Playground	TOPA TOPA	47,660	1	$ 32,000	$	32,000	Along roadway prior to soccer field.
Rainwater Capture for Food for Thought Garden Project	TOPA TOPA	113,000	113,000	$ 51,557	$	51,557	Tank near lunch seating area and off classroom bank to slow nusiance flooding and get potable irrigation savings.
Bioswale Front School	TOPA TOPA	141,467	3,420	$ 246,020	$	246,020	Near flagpole, lessen irrigation need and dissipate flooding, while recharging groundwater.
Bioswale Heavy Metal Remediation Parking Lot	TOPA TOPA	470,988	11,400	$ 92,000	$	92,000	Use biochar to mitigate hydrocarbons prior to overflow to municipal drain system
Bioswale Corridor Project	TOPA TOPA	65,041	7,600	$ 22,000.00	$	22,000	Modifying corridor topography and to slow stormwater and infiltrate to new and existing plantings.
Asphalt Removal Playground	MATILIJA JR HIGH	172,696	1	$ 229,000	$	229,000	Cutting up asphalt and intercepting sheet flow below gymnasium, and intercepting hazardous ubsurface flows.
Permeable Pavement Parking Lot	MATILIJA JR HIGH	722,182	1	$ 393,220	$	393,220	Upper parking and "drop off" lane to lessen flows through campus below.
Rainwater Capture for Food for Thought Garden Project	MATILIJA JR HIGH	228,000	152,000	$ 54,000	$	54,000	Rainwater capture off Science buildings in mid-campus for conspicuous learning activity and water reuse
Rainwater Capture for Ocean Friendly Gardens Project, Irrigation and Toilet Reuse	MATILIJA JR HIGH	716,000	230,000	$ 181,356	$	181,356	Rainwater capture off gymnasium for gymnasium toilet flushing as well as for adjacent Ocean Friendly Gardens Project irrigation as well as other new shade plantings in playground area downslope.
Bioswale Lower Athletic Field/Erosion Control	MATILIJA JR HIGH	3,100,000	1	$ 320,000	$	320,000	Lowest point on property bioswale and infiltration basin, reconfiguring point source of drainage and adding plantings for roadside esthetics and shade during athletic events.
Rainwater Capture for Irrigation Reuse	NORDOFF HIGH SCHOOL	183,600	136,000	$ 89,000	$	89,000	Rainwater Capture of off Gym for irrigation, overflow to Ojai Meadows Preserve
Rainwater Capture for Library Toilet and Food for Thought Garden	NORDOFF HIGH SCHOOL	391,900	235,300	$ 243,600.00	$	243,600	Rainwater Capture of Library building for toilet flushing, garden and overflow to Ojai Meadows Preserve.
Stormwater Bioswale Overflow to Ojai Meadows Preserve	NORDOFF HIGH SCHOOL	1,800,000	1	$ 148,000.00	$	148,000	Overland flow interception with overflow to Ojai Meadows Preserve.
Bioswale Heavy Metal Remediation Parking Lot	NORDOFF HIGH SCHOOL	114,383	1	$ 45,000.00	$	45,000	On contour vegetated bioswales within primary parking lot.
Grasscrete Parking Lot	NORDOFF HIGH SCHOOL	1,844,423	11,400	$ 857,587.50	$	857,588	Front parking lot, need percolation, underground utility info. Grasscrete?
Pool deck replacement - Permeable Pavers	NORDOFF HIGH SCHOOL	170,000					Need more info, size, construction plans, surface slopes, etc.
Bioswale Corridor Project	MEINERS OAKS ELEMENTARY	1,200,000		$ 90,434.05	$	90,434	Modifying corridor topography and to slow stormwater and infiltrate to new and existing plantings.
Rainwater Capture for Food for Thought Garden Project	MEINERS OAKS ELEMENTARY	85,000		$ 50,910.08	$	50,910	Rainwater capture off perimerter classroom buildings to provide garden irrigation.
Nature Play Scapes with Irrigation Stormwater Reuse	MEINERS OAKS ELEMENTARY	3,515,389	1	$ 420,000	$	420,000	Decreasing overall amount of impervious heat trapping asphalt with nature play area and shaded landscapes that aide in nusiance stormwater and recharging groundwater.
	0						
Project TOTALS**		**12,484,120**	**900,128**	**$ 4,074,019**	**$ 2,037,010**	**$ 6,111,029**	
G/y to acre ft/yr		38.31	2.76	Percentage of Match	50%		

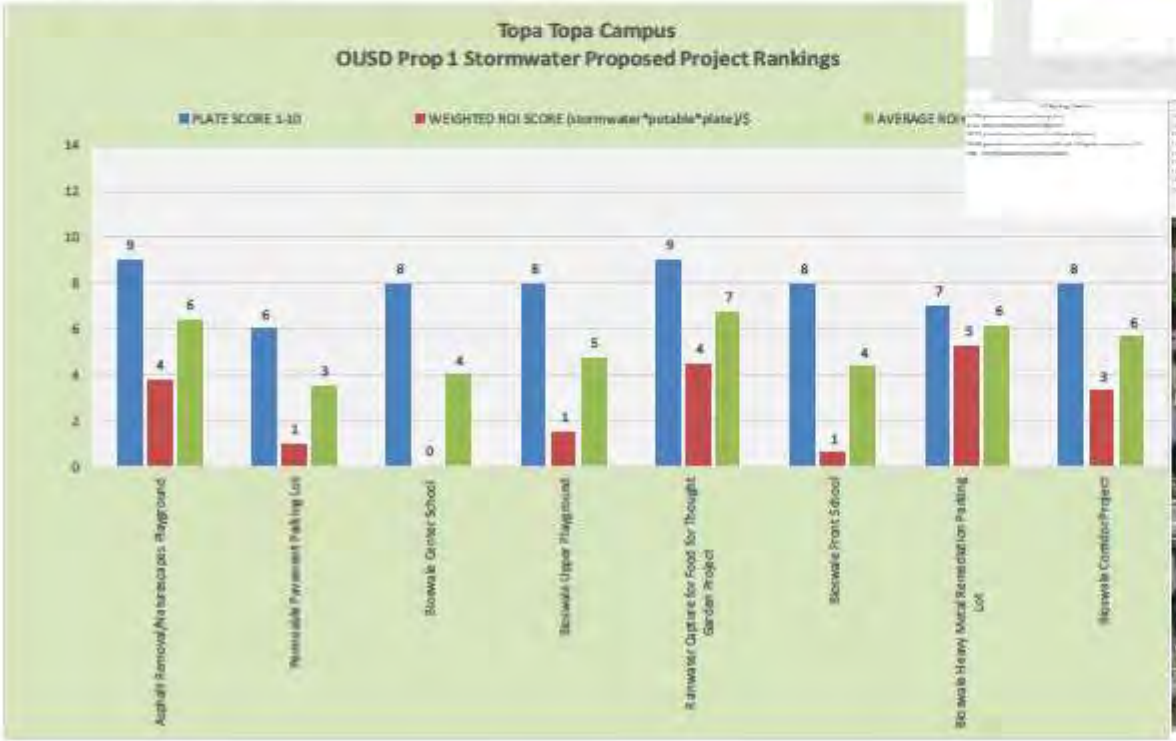
*Not all DAC in OUSD District

** Includes performance monitoring, administration, and reporting

TOPA TOPA ELEMENTARY

OUSD Stormwater LID Project

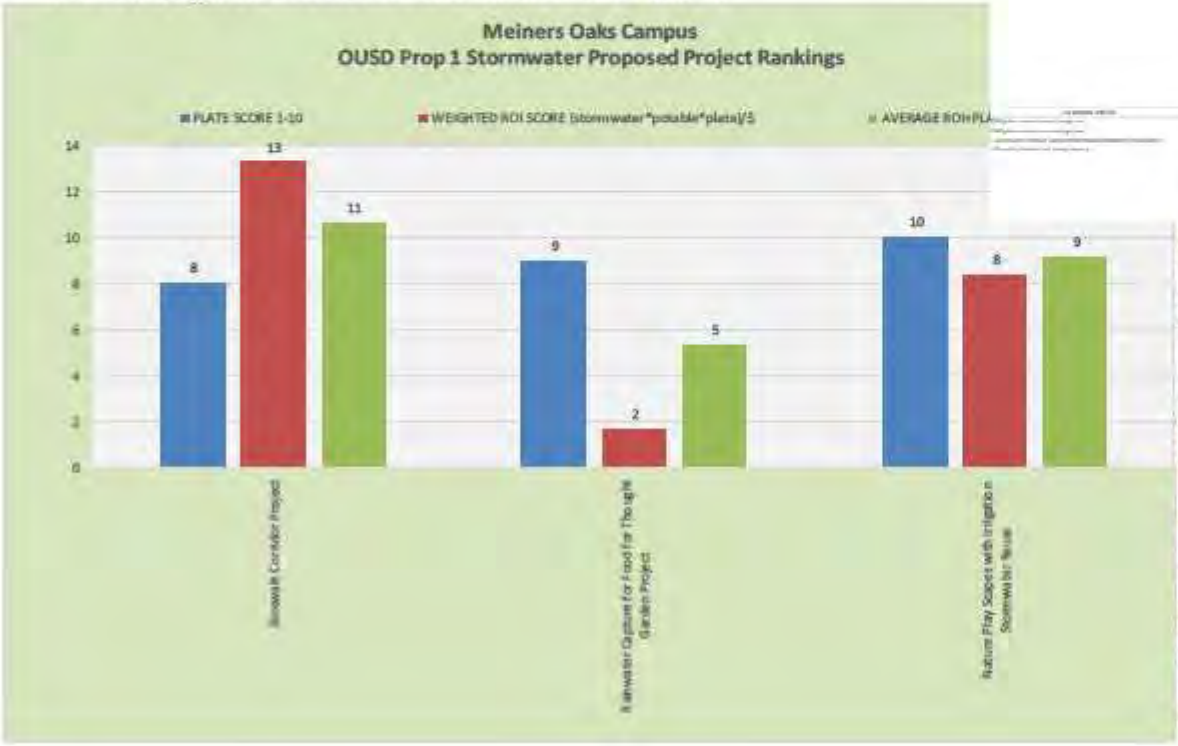
1) Graphs visual ranking system, showing PLATE SCORE (count of benefits achieved 1-10), as well as simplest ROI (water savings/$). GREEN AVERAGE bars represent aggregated average of both scores.
2) This quick ranking system is to guide decision making and inform on multi-beneficial uses of implemented solutions.
3) Topa Topa has more projects identified as flooding maintenance and concerns were highest in number and volume at this site.



MEINERS OAKS ELEMENTARY

OUSD Stormwater LID Project

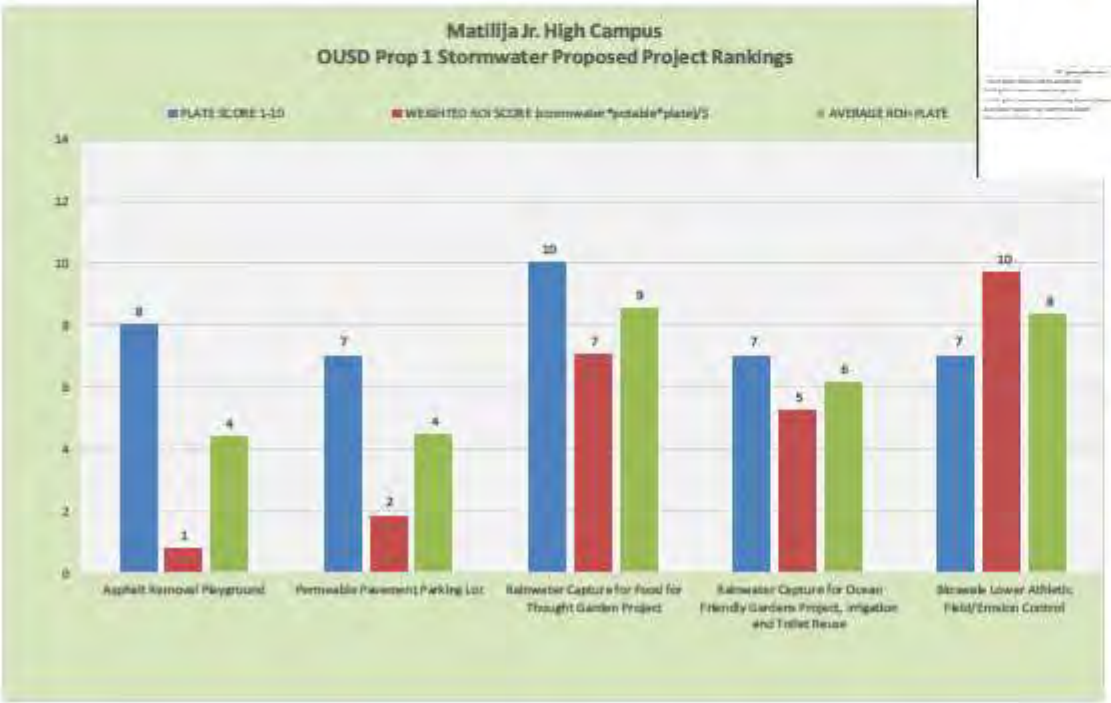
1) Graphs visual ranking system, showing PLATE SCORE (count of benefits achieved 1-10), as well as simplest ROI (water savings/$). GREEN AVERAGE bars represent aggregated average of both scores.
2) This quick ranking system is to guide decision making and inform on multi-beneficial uses of implemented solutions.
3) Meiners Oaks was looked at lightly per uncertain future use. However, it is a prime candidate for LID Stormwater projects to assist in maintenance and environmental concerns.



Matilija Jr. High

OUSD Stormwater LID Project

1) Graphs visual ranking system, showing PLATE SCORE (count of benefits achieved 1-10), as well as simplest ROI (water savings/$). GREEN AVERAGE bars represent aggregated average of both scores.
2) This quick ranking system is to guide decision making and inform on multi-beneficial uses of implemented solutions.
3) Matilija has a myriad of flooding concerns and asphalt undercutting that can be addressed through simple measures listed here. Additionally it is a prime location for resource science-based demonstration projects.



NORDOFF High School

OUSD Stormwater LID Project

1) Graphs visual ranking system, showing PLATE SCORE (count of benefits achieved 1-10), as well as simplest ROI (water savings/$). GREEN AVERAGE bars represent aggregated average of both scores.
2) This quick ranking system is to guide decision making and inform on multi-beneficial uses of implemented solutions.
3) Nordoff High School acting as a community center and adjacent to Ojai Meadow Preserve, is a prime location to mitigate and solve stormwater problems that contribute to the major flooding onsite as well as downslope in the Ojai community. Large asphalt parking lots, new library and pool construction can all be tied into stormwater solutions.