Template

City of Hesperia
Regulated Project
Water Quality Management Plan

For:

Tentative Tract No. 22450

Prepared for:

ZAB, LLC

16502 Walnut Street, Suite C

Hesperia, CA 92345

Luis Benites

Prepared by:

Capstone Engineering

9530 Hageman Road, Suite B223

Bakerfield, CA, 93312

661-230-9034

Submittal Date: 7-26-2021

Revision No. and Date: 12-3-2021

Revision No. and Date: _____

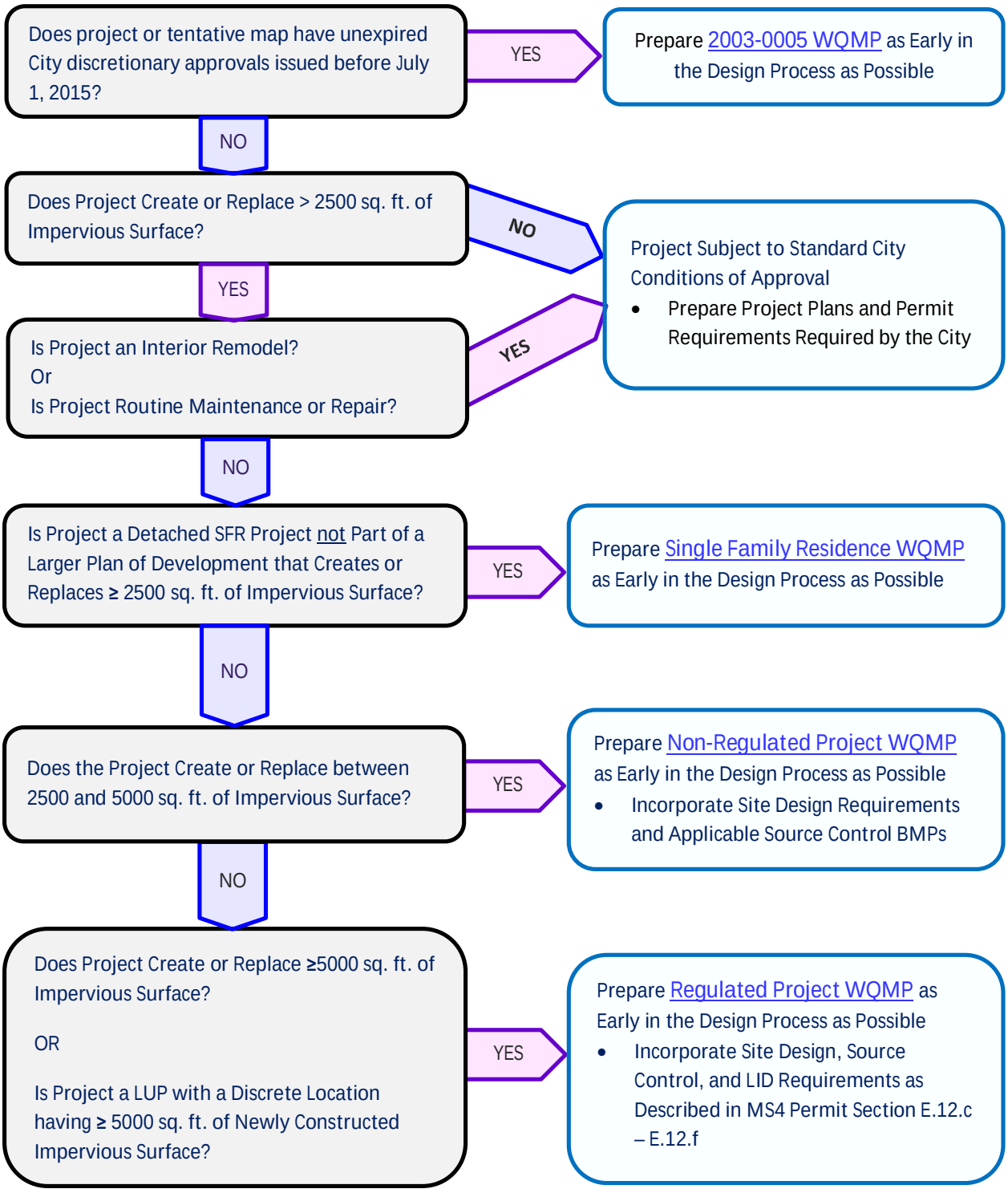
Revision No. and Date: _____

Revision No. and Date: _____

Final Approval Date:_____

March 2017

Project WQMP Selection Diagram



Project Owner's Certification

This WQMP has been prepared for Tentative Tract 22450 by Capstone Engineering. The WQMP includes requirements of the Phase II Small MS4 NPDES General Permit (Water Quality Order 2013-0001) (MS4 Permit) and the City of Hesperia (City). The undersigned, while it owns the subject property, shall implement the provisions of this plan and shall ensure that this WQMP is amended as appropriate to reflect up-to-date conditions on the site consistent with the MS4 Permit. Once the undersigned transfers its interest in the property, its successors in interest and the City shall be notified of the transfer. The new owner shall implement the provisions of this plan and shall ensure that this WQMP is amended as appropriate to reflect up-to-date conditions on the site consistent with the MS4 Permit. A copy of the approved WQMP shall be available on the subject site in perpetuity.

"I certify under a penalty of law that the provisions (implementation, operation, maintenance, and funding) of the WQMP have been accepted and that the plan will be transferred to future successors."

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	
Tract/Parcel Map Number(s):	Tentative Tract 22450	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			Tentative Tract 22450

Owner's Signature		
Owner Name:	Luis Benites	
Title	Owner	
Company	Zab, LLC	
Address	16502 Walnut Street, Suite C, Hesperia,CA 92345	
Email		
Telephone #	909-731-3668	
Signature	Date	

WQMP Preparer's Certification

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	
Tract/Parcel Map Number(s):	Tentaitve Tract 22450	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 3046-011-07, 3046-011-08

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan were prepared under my oversight and meet the requirements of the California State Water Resources Control Board Order No. 2013-0001-DWQ."

Engineer:		PE Stamp Below
Title	Civil Engineer	
Company	Capstone Engineering	
Address	9530 Hageman Road, Suite B223	
Email	abell@capstonepe.com	
Telephone #	661-204-1379	
Signature		
Date	12-10-2021	

Table of Contents

Section I Introduction

This WQMP template has been prepared specifically to implement requirements of the Phase II Small MS4 NPDES General Permit; Water Quality Order 2013-0001 (MS4 Permit). This location is within the jurisdiction of the Lahontan Regional Water Quality Control Board (LRWQCB). This document should not be confused with the City of Hesperia Non-Regulated Project WQMP Template or the 2003-0005 WQMP Template.

Section 1 Permit(s) and Project Information

Form 1-1 Project Information					
Project Name	Tentative Tract 16570				
Project Owner Contact Name:	Luis Benites				
Mailing Address:	16502 Walnut Street, Suite C, Hesperia, CA 92345	E-mail Address:		Telephone:	
Permit/Application Number(s): (Obtain from City staff)		Tract/Parcel Map Number(s):	Tentative Tract 22450/APN 3046-011-07, 3046-011-08		
Additional Information/ Comments:					
Site coordinates take GPS measurement at approximate center of site	Latitude 34.409482	Longitude -117.369603	Thomas Bros Map page		
Provide summary of WQMP conditions	This site is conditioned to develop a WQMP based on the City of Heperias Regulated Project WQMP template. The DCV for the project is 11,420 ft3. The drainage report sized the mitigation voluem based on 13.5 ft3 of storage for 100 ft2 of imperviousness. This volume was estimated to be 25,872 ft3. The infiltration basin proposed includes 27,209 ft3 of storage. This volume is consistent with the size and deisgn of the basin that was approved with the tentaive map in 2007. The amount of storage based on 13.5 ft3 of storage per 100 ft2 of impervious is greater than the DCV and is more conservative than what is required by the WQMP. Additionally the City has recommended incorporatin of on lot teatment for Lots 6 thru 14 that front Palm Street. The onlot systems will include a combination of infiltration basin and soil ammendment strip. The onlot mitigation for lots 6-14 (DA 2 to DA 10) will also be sized per the drainage report to provide 13.5 ft3 of storage per 100 ft2 of imperviousness. The drainage report governs that size of the mitigation provided onsite.				

Section 2 Project Description

2.1 Project Information

The WQMP requires Project information needed to determine the applicable development category, pollutants of concern, watershed description, and long term maintenance responsibilities for the project. This information will be used in conjunction with the information in Section 3, Site Description, to establish the performance criteria and Section 4, to select the LID BMP or other BMP for the project.

2.1.1 Project Sizing Categorization

Projects that create and/or replace ≥ 5,000 square feet of impervious surface are Regulated Projects.

Form 2.1-1 Description of Proposed Project

1 Development Project Category (Select all that apply):					
☒ #1: New development involving the creation of 5,000 sq. ft. or more of impervious surface collectively over entire site	☐ #2: Significant re-development involving the addition or replacement of 5,000 sq. ft. or more of impervious surface on an already developed site	☐ #3: Road Project – any road, sidewalk, or bicycle lane project that creates greater than 5,000 sq. ft. of contiguous impervious surface	☐ #4: LUPs – linear underground/overhead projects that has a discrete location with 5,000 sq. ft. or more new constructed impervious surface		
☐ #5: Non-Regulated Project (Project Total Square Feet > 2,500 but < 5,000 sq.) Do not use this WQMP Template. Use the "Non-Regulated Project WQMP" Template.					
2 Project Area (sq. ft.):	413,020	3 Number of Dwelling Units:	36	4 SIC Code:	1521
5 Is Project going to be phased? Yes ☐ No ☒ If yes, ensure that the WQMP evaluates each phase as a distinct DMA, requiring LID BMPs to address runoff at time of completion.					

2.2 Property Ownership/Management

Describe the ownership/management of all portions of the project and site. State whether any infrastructure will transfer to public agencies (City, County, Caltrans, etc.) after project completion. State if a homeowners or property owners association will be formed and be responsible for the long-term maintenance of project stormwater facilities. Describe any lot-level stormwater features that will be the responsibility of individual property owners.

Form 2.2-1 Property Ownership/Management

Describe property ownership/management responsible for long-term maintenance of WQMP stormwater facilities:
Lots will be owned and managed by private home owers. The proposed basin and storm drain facilities including the dry well and infiltration basin will be maintained by the City of Hesperia.

Describe any infrastructure that will transfer to a public agency: ☐ N/A
2-10' Catch basins, 18" RCP Storm Drain, Dry Well and Infiltration basin will transfer to City of Hesperia

Will a property owners association be responsible for long-term BMP maintenance? ☐Yes ☒No If yes, list association and BMPs to be maintained.

Describe lot-level features that will be maintained by individual property owners: ☒ N/A
No onlot features

2.3 Potential Stormwater Pollutants

BMPs for pollutant-generating activities and sources shall be designed consistent with recommendations from the CASQA Stormwater BMP Handbook for New Development and Redevelopment (or equivalent manual or resource if recommended by the City).

Complete Form 2.3-1: determine and describe expected stormwater pollutants of concern based on land uses and site activities using Table 2-1, below.

Form 2.3-1 Pollutants of Concern

Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	Source include defaction from animals, waste facilties
Nutrients - Phosphorous	E ☒	N ☐	Sources include Fertilizer application, atmospheric deposition, animal feces.
Nutrients - Nitrogen	E ☒	N ☐	Sources include Fertilizer application
Sediment	E ☒	N ☐	Sources include erosion of soil and degradation of pavement
Metals	E ☒	N ☐	Sources include metal fencing and roofs, vehicle parts and components, fuel and oils.
Oil and Grease	E ☒	N ☐	Sources include automobiles and machinery.
Trash/Debris	E ☒	N ☐	Sources include anthropogenic waste
Pesticides / Herbicides	E ☒	N ☐	Sources include pesticide and herbicide application
Organic Compounds	E ☒	N ☐	Sources include pesticide and herbicide application, pertoleum derived chemicals
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

Table 2-1: Pollutants of Concern for Project Categories and Land Uses

Regulated Project Categories and/or Project Features	General Pollutant Categories							
	Pathogen Indicators (Bacterial / Virus)	Metals	Nutrients	Toxic Organic Compounds	Pesticides / Herbicides	Sediments / Total Suspended Solids	Trash & Debris	Oil & Grease
Detached Residential Development	E	N	E	N	E	E	E	E
Attached Residential Development	E	N	E	N	E	E	E	E(2)
Commercial / Industrial Development	E(3)	E(5)	E(1)	E	E(1)	E(1)	E	E
Automotive Repair Shops	N	E	N	E	N	N	E	E
Restaurants	E	E(2)	E(1)	N	E(1)	E(1)(2)	E	E
Hillside Development (>5,000 ft^2)	E	N	E	N	E	E	E	E
Streets and Parking Lots (>5,000 ft^2)	E(4)	E	E(1)	E	E(1)	E	E	E
Retail Gasoline Outlets	N	E	N	E	N	N	E	E

E = Expected to be a concern in stormwater runoff
N = Not expected to be a concern in stormwater runoff
(1) Expected pollutant if landscaping or open area is present on site, otherwise not expected.
(2) Expected pollutant if the project includes uncovered parking areas, otherwise not expected.
(3) Expected pollutant if land use involves food or animal waste products, otherwise not expected.
(4) Bacterial indicators are routinely detected in pavement runoff.
(5) Expected pollutant if outdoor storage or metal roofs, otherwise not expected.

Section 3 Site and Watershed Description

Describe and evaluate the physical conditions and limitations of the site and its receiving waters to determine the applicability of potential BMPs. Provide a Site Map which shows how the developed portions of the project site are divided into discrete Drainage Management Areas (DMAs); in order to manage runoff from each DMA using Site Design Measures, Source Controls and/or Storm Water Treatment and Baseline Hydromodification Measures[1]. Complete Form 3.1 for each DMA on the project site-use extra form copies as needed. Complete Form 3-2 to describe the watershed attributes for the project site. Use additional copies of Form 3-2 if needed for different DMAs.

Provide the following information in the Project Description:

- For the entire parcel, list and describe the proposed land uses, the area of each land use, and the estimated imperviousness for each land use.
- List and show on the Site Map where facilities will be located and what activities will be conducted:
  - § List what kinds of materials and products will be used (if known), how and where materials will be received and stored (if applicable), and what kinds of wastes will be generated (if any).
  - § Describe all paved areas, including the type of parking areas.
  - § Describe all landscaped areas and open space areas (if any).
- For commercial and industrial projects:
  - § Provide the Standard Industrial Classification (SIC) Code which best describes the facilities operations.
  - § Describe the type of use (or uses) for each building or tenant space (if known).
  - § If the project includes food preparation, cooking, and eating areas, specify the location and type of area.
  - § Describe delivery areas and loading docks (specify location, design, if below grade, and types of materials expected to be transferred).
  - § Describe outdoor materials storage areas (describe and depict location(s), specify type(s) of materials expected to be stored).
  - § Describe activities that will be routinely conducted outdoors.
  - § Describe any activities associated with equipment or vehicle maintenance and repair, including washing or cleaning.
  - § Indicate the number of service bays or number of fueling islands/fuel pumps, if applicable.

[1] Hydromodification controls apply only to projects that create or replace ≥ 1-acre of impervious area. In addition, the hydromodification requirement is met for projects which comply with Onsite Drainage Impact Prevention conditions to control peak discharge for the 10-year, 24-hour storm event.

- Provide Detailed Narrative Project Description (including Project areas; Land uses; Land cover; and Design elements):

  The project proposes to develop 0.78 acres of undeveloped desert property into a commercial development (47% Impeviousness) that will consist of a Commercial Building and associated parking lot. Drainage improvments will include a stormwater stormtech chamber system, parking lot concrete curb and gutter and v gutters. Stormwater will be conveyed to the stormtech chamber on the northereasterly section of the site.

- Provide a site map showing the Drainage Management Area(s) as described above, showing drainage pathways and the proposed site design, source control, LID, and/or Storm Water Treatment BMPs. Also show any subareas within the DMAs.

  The comprehensive Site Map required for Section 6 can be used here.

  SEE WQMP Exhibit

Form 3-1: Existing Hydrologic Characteristics for Drainage Area 1[2]				
For sub-watershed DMAs within Drainage Area 1, provide the following information:	DMA A	DMA B	DMA C	DMA D
[1] DMA drainage area (ft^2)	413,020			
[2] Existing site impervious area (ft^2)	0			
[3] Antecedent moisture condition For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf	3			
[4] Hydrologic soil group Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf	A			
[5] Longest flowpath length (ft)	845			
[6] Longest flowpath slope (ft/ft)	0.01-.02			
[7] Current land cover type(s) Select from Fig C-3 of Hydrology Manual	Desert Brush			
[8] Pre-developed pervious area condition: Based on the extent of wet season vegetated cover: good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating	Poor			

[2] Add additional sheets as needed.

Site Characteristics

Fill out table with relevant information and include information regarding BMP sizing, suitability, and feasibility, as applicable.

Form 3-2 Site Characteristics	
Precipitation Zone	Desert / Arid
Topography	Topogrpahy Drains to the northeast at 1 - 2 %
Drainage Patterns/Connections	Drainage patterns are governed by surface topography which drains to the northeast to Mesa Avenue .
Soil Type, Geology, and Infiltration Properties	Hesperia Loamy Fine Sand
Hydrogeologic (Groundwater) Conditions	According to California department of water resources depth to groundwater is approximately 270 feet
Geotechnical Conditions (relevant to infiltration)	Ksat rates are estimated to be 2-6 inches/hr
Off-Site Drainage	None
Utility and Infrastructure Information	

Watershed Description

Fill out table: indicate the Receiving Waters and any Environmentally Sensitive Areas.

<table>
<tr><th colspan="5">Form 3-3 Watershed Description for Drainage Area</th></tr>
<tr><td rowspan="6">Receiving waters</td><td>X</td><td>Check One</td><td>Distance from Project</td><td>Direction</td></tr>
<tr><td></td><td>Mojave River</td><td>8,900 ft</td><td>West</td></tr>
<tr><td></td><td>Antelope Valley Wash</td><td></td><td></td></tr>
<tr><td></td><td>Oro Grande Wash</td><td></td><td></td></tr>
<tr><td></td><td>Unnamed Wash</td><td></td><td></td></tr>
<tr><td></td><td>MPD Drainage Channel</td><td></td><td></td></tr>
<tr><td>Applicable TMDLs
http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml</td><td colspan="4">None</td></tr>
<tr><td>303(d) listed impairments
http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml</td><td colspan="4">Mojave River
Mojave Forks Reservoir Outlet to Upper Narrows:
• Fluoride
Upper Narrows to Lower Narrows:
• Fluoride
• Sulfates
• Total Dissolved Solids</td></tr>
<tr><td>Environmentally Sensitive Areas (ESA) (habitat, plant/animal species)
Refer to Watershed Mapping Tool – http://sbcounty.permitrack.com/WAP,
Or other reference relevant to the Mojave River Watershed; such areas may fall under the jurisdiction of other resource agencies</td><td colspan="4">None</td></tr>
</table>

Section 4 Best Management Practices (BMP)

4.1 Site Assessment, Site Design Measures, and Source Control BMPs

Regulated Projects shall conduct a Site Assessment, implement Site Design measures, and implement Source Control BMPs that address site-specific pollutant sources.

4.1.1 Site Assessment

Fill out Form 4.1-1 to show the assessment of how Project site conditions such as soils, vegetation, and flowpaths influence the placement of buildings and paved surfaces at the project, to facilitate capture and treatment of runoff. Regulated Projects must evaluate site conditions and must consider optimizing overall site design using the methods in Form 4.1-1. Use as much space as needed for complete explanation.

4.1.2 Site Design Measures

Use Form 4.1-2 to identify site design measures to reduce runoff generation and reduce the required Design Capture Volume; based on the objective of achieving infiltration, evapotranspiration and/or harvesting/reuse of the 85th percentile 24-hour storm runoff event. Site design measures shall be used to reduce the amount of runoff, to the extent technically feasible, for which retention and runoff is required. Describe the site design measures and drainage plan for each Drainage Management Area in the following Forms, including:

- A narrative of site design measures utilized or rationale for not using practices
- A narrative of how site plan incorporates preventive site design measures
- Include an attached Site Plan layout which shows how preventive site design measures are included in the WQMP
- Provide specific information for each site design measure as it applies to the project
- An explanation of how Site Design practices are incorporated into the project or a rationale for not incorporating them into the project

Form 4.1-1: Site Assessment Checklist

Site Assessment

For site assessment elements below: if yes, explain how preventive site design practices are addressed in project site plan. If no, explain why not included in the project and select other LID BMPs as needed to meet volume or flow design requirements

Define the development envelope and protected areas, identifying areas that are most suitable for development and areas to be left undisturbed:

Yes ☒ No ☐

Explanation: Of the 9.5 acre drainage area only 40% plus is proposed to reamina in a pervious condition. There are no sensitive areas onsite.

Concentrate development on portions of the site with less permeable soils and preserve areas that can promote infiltration:

Yes ☒ No ☐

Explanation: Infiltration basin proposed in northwest corner where Hydrologic soil type exists.

Limit overall impervious coverage of the site with paving and roofs:

Yes ☒ No ☐

Explanation: The proposed project will be limit impervious surfaces to 51% of the total project area

Preserve significant trees:

Yes ☐ No ☒

Tree Planting and Preservation - planting and preservation of healthy, established trees that include both evergreens and deciduous, as applicable.

Explanation: No trees exist onsite.

Conform the site layout along natural landforms:

Yes ☒ No ☐

Explanation: Development will preserve existing topographic patterns and draina the site to the northeast.

Avoid excessive grading and disturbance of vegetation and soils:

Yes ☒ No ☐

Explanation: Grading will be limited to the footprint of the proposed project

Replicate the site's natural drainage patterns:

Yes ☒ No ☐

Explanation: Existing Drainage patterns will be preserved

Detain and retain runoff throughout the site:

Yes ☒ No ☐

Explanation: Onsite flows will be retained and infiltrated through the retention basin. A dry well will be constructed in the infiltation basin to facilitate rapid drawdown and infiltration of soils. Onlot infiltration basins to be provided for lots 6-14.

Stake off areas that will be used for landscaping to minimize compaction during construction:

Yes ☒ No ☐

Explanation: The SWPPP will identify landscape areas where compaction should be limited.

Form 4.1-2: Site Design Measures Checklist

Site Design Measures

For site design elements below: if yes, explain how site design practices are addressed in project site plan. If no, explain why not included in the project and select other LID BMPs as needed to meet volume or flow design requirements

Set back development from creeks or washes, wetlands, and riparian habitats:
Yes ☐ No ☒
A vegetated area including trees, shrubs, and herbaceous vegetation that exists or is established to protect a stream system, lake reservoir, or coastal estuarine area.

Explanation: No creek, washes, wetalnds or riparien areas onsite.

Soil Quality Improvement and Maintenance - improvement and maintenance of soil through soil amendments and creation of microbial community:
Yes ☒ No ☐
Explanation: Soil ammendments will be added per the landscape architects direction.

Rooftop and Impervious Area Disconnection (Impervious Area Dispersion: HSC-2) - rerouting of rooftop drainage pipes to engineered permeable/bioretention areas instead of the storm sewer:
Yes ☒ No ☐
Explanation: Rooftops will be routed through front and side yard pervious landscaping prior to discharge.

Porous Pavement - pavement that allows runoff to pass through it, thereby reducing the runoff from a site and surrounding areas and filtering pollutants:
Yes ☐ No ☒
Explanation: Porous pavement was not considered for this site due to the heavy amounts of windblown sediment that occur at the site and financial constraints

Engineered Arid-Region Rock Swales or Vegetated Swales (bioretention/biofiltration) – a vegetated or rock-lined, open-channel management practice designed to treat and attenuate stormwater runoff:
Yes ☐ No ☒
Explanation: Concrete gutters are proposed for this project.

Rain Barrels and Cisterns – system that collects and stores stormwater runoff from a roof or other impervious surface:
Yes ☐ No ☒
Explanation: Due to financial constraints rain barrels or cisterns were not considrered for this project.

The MS4 Permit (Section E.12.b) requires consideration of cisterns and green roofs. However, these BMPs are typically not practical in this region. Engineered vegetated swales may be used provided measures are taken to maximize the amount of drought tolerant vegetation. The project proponent should use locally recommended vegetation types for landscaping which can be found in the following references:

City of Hesperia:

Approved Plant List - http://www.cityofhesperia.us/DocumentCenter/Home/View/384

San Bernardino County Special Districts:

Guide to High Desert Landscaping - http://www.specialdistricts.org/Modules/ShowDocument.aspx?documentid=795

Recommended High-Desert Plants - http://www.specialdistricts.org/modules/showdocument.aspx?documentid=553

Mojave Water Agency:

Desert Ranch: http://www.mojavewater.org/files/desertranchgardenprototype.pdf

Summertree: http://www.mojavewater.org/files/Summertree-Native-Plant-Brochure.pdf

Thornless Garden: http://www.mojavewater.org/files/thornlessgardenprototype.pdf

Mediterranean Garden: http://www.mojavewater.org/files/mediterraneangardenprototype.pdf

Lush and Efficient Garden: http://www.mojavewater.org/files/lushandefficientgardenprototype.pdf

Alliance for Water Awareness and Conservation (AWAC) outdoor tips – http://hdawac.org/save-outdoors.html

4.1.3 Source Control BMPs

Non-structural and structural source control BMPs are required for all Regulated Projects. Complete Forms 4.1-3 and 4.1-4 to describe specific source control BMPs which are required to be used in the WQMP or to explain why a certain source-control BMP is not applicable. All source control BMPs must be implemented for projects with the respective specific types of potential pollutant sources or activities.

The identified list of source control BMPs corresponds to the CASQA Stormwater BMP Handbook for New Development and Redevelopment.

Form 4.1-3 Non-Structural Source Control BMPs				
Identifier	Name	Check One		If not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	☒	☐	
N2	Activity Restrictions	☒	☐	
N3	Landscape Management BMPs	☒	☐	
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☒	☐	
N7	Spill Contingency Plan	☒	☐	
N8	Underground Storage Tank Compliance	☐	☒	No storage is proposed to be stored underground
N9	Hazardous Materials Disclosure Compliance	☒	☐	

Form 4.1-3 Non-Structural Source Control BMPs

Identifier	Name	Check One		If not applicable, state reason
		Included	Not Applicable	
N10	Uniform Fire Code Implementation	☒	☐	
N11	Litter/Debris Control Program	☒	☐	
N12	Employee Training	☒	☐	
N13	Housekeeping of Loading Docks	☐	☒	No loading docks
N14	Catch Basin Inspection Program	☒	☐	
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	No other non structural measures are proposed

Form 4.1-4 Structural Source Control BMPs

Identifier	Name	Check One		If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	No outdoor material storage areas are proposed
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	No dock areas
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☒	☐	
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No Vehicle wash areas
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No outdoor processing areas

Form 4.1-4 Structural Source Control BMPs

Identifier	Name	Check One		If not applicable, state reason
		Included	Not Applicable	
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No equipment wash areas
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No fueling areas
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☒	☐	
S14	Wash water control for food preparation areas	☒	☒	
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No community car wash

4.2 Treatment BMPs

All site runoff from impervious areas must be addressed by onsite treatment BMPs. Any runoff from areas within DMAs that is not addressed by proposed Site Design measures and Source Control BMPs must be directed to one or more onsite BMPs designed to infiltrate, evapotranspire, and/or bioretain the design capture volume as specified in 4.2.1.1, which include:

Infiltration/Bioretention BMPs

- Bioretention: Basin; Rain Garden; Linear Landscape Area; Planter Box
- Infiltration: Basin; Trench; Rock Landscape Feature; Pervious Pavement/Pavers

The BMPs must be demonstrated to be at least as effective as a bioretention system with the following design parameters:

1) Maximum surface loading rate of 5 inches per hour, based on the flow rates calculated. A sizing factor of 4% of tributary impervious area may be used.

2) Minimum surface reservoir volume equal to surface area times a depth of 6 inches.

3) Minimum planting medium depth of 18 inches. The planting medium must sustain a minimum infiltration rate of 5 inches per hour throughout the life of the project and must maximize runoff retention and pollutant removal. A mixture of sand (60%-70%) meeting the specifications of American Society for Testing and Materials (ASTM) C33 and compost (30%-40%) may be used.

4) Subsurface drainage/storage (gravel: Class 2 permeable material) layer with an area equal to the surface area and having a minimum depth of 12 inches.

5) Underdrain with discharge elevation at top of gravel layer. Underdrain is optional for Class A and B soils.

6) No compaction of soils beneath the facility, or ripping/loosening of soils if compacted.

7) No liners or other barriers interfering with infiltration.

8) Appropriate plant palette per resources in section 4.1.2, above.

All BMPs must include pretreatment features recommended in CASQA Handbooks or equivalent guidance.

If the Project Engineer determines that it is infeasible to infiltrate, evapotranspire, and/or bioretain the entire design capture volume, alternate treatment BMPs may be proposed to address any remaining portion of the DCV. Subject to City approval of any Project BMP infeasibility determination, the following BMPs may be considered:

Biotreatment/Treatment BMPs

- Biofiltration: Bioretention/Planterbox with Underdrain
- Filtration: Vegetated Buffer/Filter Strip; Swale; Trench with Underdrain

- Settling/Sedimentation: Detention Basin; Extended Detention Basin
- Other BMP designs subject to City approval

BMP designs must be consistent with the most current version of the following Guidance Resources:

- CASQA Stormwater BMP Handbook for New Development and Redevelopment
- Riverside County Design Handbook for Low Impact Development Best Management Practices: http://www.floodcontrol.co.riverside.ca.us/NPDES/LIDBMP.aspx

BMPs must be sized using the methods in this WQMP Template.

If the project has more than one outlet for stormwater runoff, then complete additional versions of these forms for each DMA / outlet.

4.2.1 Project Specific Hydrology Characterization[3]

The Project WQMP must meet the performance standards for post-development hydrology as specified in Section E.12.e.ii.c of the MS4 Permit. These standards include runoff volume and flow rates for water quality control (referred to as LID design capture volume and design flow rates).

Methods include:

4.2.1.1 Volume-Based Design Standard

For LID BMP Design Capture Volume (DCV), use the P_6 method (Form 4.2-1). For pre- and post-development hydrologic calculation, use methods in the San Bernardino Hydrology Manual: the Rational Method approach for projects ≤ 640 acres; for projects greater than 640 acres (1.0 mi^2), the Unit Hydrograph Method (San Bernardino County Hydrology Manual Section E) shall be used.

[3] Projects will also be required to comply with City flood protection requirements for Onsite and Offsite Drainage Impact Mitigation.

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume		
① Project area (for DMA) (ft^2): SEE ATTACHMENT E for DCV Calculations	②Imperviousness after applying preventative site design practices (Imp %):	③Runoff Coefficient (Rc): _ $R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$
④ Determine 1-hour rainfall depth for a 2-year return period $P_{2yr-1hr}$ (in): http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
⑤ Compute P_6, Mean 6-hr Precipitation (inches): P_6 = Item 4 *C_1, where C_1 = 1.2371		
⑥ Drawdown Rate Use 24 hours as the default condition.		24-hrs ☐ 48-hrs ☐
⑦ Compute design capture volume, DCV (ft^3): DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) Compute separate DCV for each outlet from the project site per site map from Form 3-1		

Show calculations in detail - attach a separate sheet of calculations and a table that summarizes the sizing parameters including size of impervious areas, relevant hydrologic characteristics, and design capture volume (s) for each BMP and contributing drainage management area, and demonstrates that the design criteria have been satisfied.

Retention volumes provided by implementation of site design measures can be credited to offset a portion of the required onsite LID Design Capture Volume.

Any proposed retention/detention basins or underground systems must be reviewed and approved by the City Engineer. The proposed design shall meet City Standards and design criteria established by the City Engineer. A soils percolation test will be required for all onsite retention systems, using methods in Appendix A of the Riverside County Design Handbook for Low Impact Development Best Management Practices; available online at: http://www.floodcontrol.co.riverside.ca.us/NPDES/LIDBMP.aspx

4.2.1.2 Flow Based Design Criteria

Flow-based BMPs should be designed and sized to provide treatment for the estimated range of flow rates expected from the DMA for the BMP. Calculate the target BMP flow rate, Q, using the formula:

$$Q = C^* I * A$$

Where: Q = flow in $ft.^3/s$

I = rainfall intensity = 0.2 inches/hour[1]

A = Drainage Area in acres

C = composite runoff coefficient for the DMA

[1] Use the default value of I = 0.2 inches/hour; or use project-specific I-value that will ensure flow-based BMPs will effectively treat (or pre-treat) flows prior to discharge into onsite retention BMP(s) which must meet volume retention standard provided in 4.2.1.1.

Show calculations in detail - attach a separate sheet of calculations and a table that summarizes the sizing parameters including size of impervious areas, relevant hydrologic characteristics, and design flow rate (s) for each BMP and contributing drainage management area, and demonstrates that the design criteria have been satisfied.

4.3 BMP Selection and Sizing

Complete the following forms for each project site DMA to document that the proposed treatment (LID/Infiltration/Bioretention) BMPs conform to the project DCV. Use additional form sheets as necessary to describe the entire site. The forms help compute the following for onsite LID BMPs:

- Site Design BMPs (Form 4.3-1)
- Retention and Infiltration BMPs (Form 4.3-3) or
- Biotreatment BMPs (Form 4.3-4).

At the end of each form, additional fields facilitate the determination of the extent of mitigation provided by the specific BMP category, allowing for use of the next category of BMP in the hierarchy, if necessary.

Complete Form 4.3-1 to determine the feasibility of applicable Site Design BMPs, and, if their implementation is feasible, the extent of mitigation of the DCV.

Evaluate the use of combinations of LID BMPs, including all applicable Site Design BMPs, to maximize on-site retention of the DCV.

4.3.1 Site Design BMP

The MS4 Permit (Section E.12.e) emphasizes the use of LID preventive measures. Site design measures shall be used to reduce the amount of runoff, to the extent technically feasible, for which retention and runoff is required. Therefore, all applicable Site Design Measures shall be provided except where they are mutually exclusive with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of Site Design BMPs; if a project cannot feasibly meet BMP sizing requirements overall or cannot fully address hydromodification, then the feasibility of all applicable Site Design BMPs must be evaluated as part of demonstrating that the BMP

system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-1 to identify and calculate estimated retention volume from implementing site design BMP.

Form 4.3-1 Site Design BMPs

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☒ No ☐ If yes, complete Items 2-5; If no, proceed to Item 6	DMA 2 BMP Type Ammended Soil Strip	DMA 3 BMP Type Ammedned Soil Stript Chamber	DMA 4 BMP Type Infiltration Chamber (Use additional forms for more BMPs)
2 Total impervious area draining to pervious area (ft^2)	2964	2964	2827
3 Ratio of pervious area receiving runoff to impervious area	0.084	0.084	0.088
4 Retention volume achieved from impervious area dispersion (ft^3) V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff	10.4	10.4	10.4
5 Sum of retention volume achieved from impervious area dispersion (ft^3): 0 $V_{retention}$ =Sum of Item 4 for all BMPs			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot bioretention): Yes ☒ No ☐ If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14	DA 2 DMA BMP Type Onlot Infiltration Basin	DA 3 DMA BMP Type Onlot Infiltration Basin	DA 4 DMA BMP Type Onlot Infiltration Basin (Use additional forms for more BMPs)
7 Ponding surface area (ft^2)	433	433	433
8 Ponding depth (ft) (min. 0.5 ft.)	0.5	0.5	0.5
9 Surface area of amended soil/gravel (ft^2)	433	433	433
10 Average depth of amended soil/gravel (ft) (min. 1 ft.)	1.0	1.0	1.0
11 Average porosity of amended soil/gravel	40	40	40
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ = (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)	389.7	389.7	389.7
13 Runoff volume retention from on-lot infiltration (ft^3): $V_{retention}$ =Sum of Item 12 for all BMPs			
14 Implementation of Street Trees: Yes ☐ No ☒ If yes, complete Items 14-18. If no, proceed to Item 19	DMA BMP Type	DMA BMP Type	DMA BMP Type (Use additional forms for more BMPs)
15 Number of Street Trees			
16 Average canopy cover over impervious area (ft^2)			
17 Runoff volume retention from street trees (ft^3) $V_{retention}$ = Item 15 * Item 16 * (0.05/12) runoff retention = 0.05 in			

Form 4.3-1 Site Design BMPs

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ If yes, complete Items 2-5; If no, proceed to Item 6	DA 5 DMA BMP Type Ammended Soil Strip	DA 6 DMA BMP Type Ammended Soil Strip	DA 7 DMA BMP Type Ammended Soil Strip (Use additional forms for more BMPs)
2 Total impervious area draining to pervious area (ft^2)	2964	2827	2964
3 Ratio of pervious area receiving runoff to impervious area	0.084	0.088	0.084
4 Retention volume achieved from impervious area dispersion (ft^3) V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff	10.4	10.4	10.4
5 Sum of retention volume achieved from impervious area dispersion (ft^3): 0 $V_{retention}$ =Sum of Item 4 for all BMPs			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14	DA 5 DMA BMP Type Onlot Infiltration Basin	DA 6 DMA BMP Type Onlot Infiltration Basin	DA 7 DMA BMP Type Onlot Infiltration Basin (Use additional forms for more BMPs)
7 Ponding surface area (ft^2)	433	433	433
8 Ponding depth (ft) (min. 0.5 ft.)	0.5	0.5	0.5
9 Surface area of amended soil/gravel (ft^2)	433	433	433
10 Average depth of amended soil/gravel (ft) (min. 1 ft.)	1	1	1
11 Average porosity of amended soil/gravel	40	40	40
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ = (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)	389.7	389.7	389.7

Form 4.3-1 Site Design BMPs

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ If yes, complete Items 2-5; If no, proceed to Item 6	DA 8 DMA BMP Type Ammended Soil Strip	DA 9 DMA BMP Type Ammended Soil Strip	DA 10 DMA BMP Type Ammended Soil Strip (Use additional forms for more BMPs)
2 Total impervious area draining to pervious area (ft^2)	2827	2964	2827
3 Ratio of pervious area receiving runoff to impervious area	0.088	0.084	0.088
4 Retention volume achieved from impervious area dispersion (ft^3) V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff	10.4	10.4	10.4
5 Sum of retention volume achieved from impervious area dispersion (ft^3): 0 $V_{retention}$ =Sum of Item 4 for all BMPs			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14	DA 8 DMA BMP Type Onlot Infiltration Basin	DA 9 DMA BMP Type Onlot Infiltration Basin	DA 10 DMA BMP Type Onlot Infiltration Basin (Use additional forms for more BMPs)
7 Ponding surface area (ft^2)	433	433	433
8 Ponding depth (ft) (min. 0.5 ft.)	0.5	0.5	0.5
9 Surface area of amended soil/gravel (ft^2)	433	433	433
10 Average depth of amended soil/gravel (ft) (min. 1 ft.)	1.0	1.0	1.0
11 Average porosity of amended soil/gravel	40	40	40
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ = (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)	389.7	389.7	389.7

Form 4.1-2: Site Design Measures Checklist

Site Design Measures

For site design elements below: if yes, explain how site design practices are addressed in project site plan. If no, explain why not included in the project and select other LID BMPs as needed to meet volume or flow design requirements

Set back development from creeks or washes, wetlands, and riparian habitats:
Yes ☐ No ☒
A vegetated area including trees, shrubs, and herbaceous vegetation that exists or is established to protect a stream system, lake reservoir, or coastal estuarine area.

Explanation: No creek, washes, wetalnds or riparien areas onsite.

Soil Quality Improvement and Maintenance - improvement and maintenance of soil through soil amendments and creation of microbial community:
Yes ☒ No ☐
Explanation: Soil ammendments will be added per the landscape architects direction.

Rooftop and Impervious Area Disconnection (Impervious Area Dispersion: HSC-2) - rerouting of rooftop drainage pipes to engineered permeable/bioretention areas instead of the storm sewer:
Yes ☒ No ☐
Explanation: Rooftops will be routed through front and side yard pervious landscaping prior to discharge.

Porous Pavement - pavement that allows runoff to pass through it, thereby reducing the runoff from a site and surrounding areas and filtering pollutants:
Yes ☐ No ☒
Explanation: Porous pavement was not considered for this site due to the heavy amounts of windblown sediment that occur at the site and financial constraints

Engineered Arid-Region Rock Swales or Vegetated Swales (bioretention/biofiltration) – a vegetated or rock-lined, open-channel management practice designed to treat and attenuate stormwater runoff:
Yes ☐ No ☒
Explanation: Concrete gutters are proposed for this project.

Rain Barrels and Cisterns – system that collects and stores stormwater runoff from a roof or other impervious surface:
Yes ☐ No ☒
Explanation: Due to financial constraints rain barrels or cisterns were not considrered for this project.

18 Runoff volume retention from street tree BMPs (ft3):	$V_{retention}$ = Sum of Item 17 for all BMPs
19 Total Retention Volume from Site Design BMPs: 0	Sum of Items 5, 13 and 18

4.3.2 Retention/Infiltration BMPs

Use Form 4.3-2 to compute the volume of runoff captured by proposed onsite retention/infiltration BMPs. Volume retention estimates are sensitive to the percolation rate used, which determines the amount of runoff that can be infiltrated within the specified drawdown time. The infiltration safety factor reduces field measured percolation to account for potential inaccuracy associated with field measurements, declining BMP performance over time, and compaction during construction.

4.3.2.1 Allowed Variations for Special Site Conditions

The bioretention system design parameters of this Section may be adjusted for the following special site conditions:

1) Facilities located within 10 feet of structures or other potential geotechnical hazards established by the geotechnical expert for the project may incorporate an impervious cutoff wall between the bioretention facility and the structure or other geotechnical hazard.

2) Facilities with documented high concentrations of pollutants in underlying soil or groundwater, facilities located where infiltration could contribute to a geotechnical hazard, and facilities located on elevated plazas or other structures may incorporate an impervious liner and may locate the underdrain discharge at the bottom of the subsurface drainage/storage layer (this configuration is commonly known as a “flow-through planter”).

3) Facilities located in areas of high groundwater, highly infiltrative soils or where connection of underdrain to a surface drain or to a subsurface storm drain are infeasible, may omit the underdrain.

4) Facilities serving high-risk areas such as fueling stations, truck stops, auto repairs, and heavy industrial sites must provide adequate pretreatment to address pollutants of concern; these high-risk areas should be isolated from storm water runoff or bioretention areas to prevent any chance of spill migration.

Form 4.3-2 Infiltration LID BMP - including underground BMPs (per DMA)

1 Remaining LID DCV not met by site design BMP (ft^3): 9694 V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item19

BMP Type Use columns to the right to compute runoff volume retention from proposed infiltration BMP - Use additional forms for more BMPs	DMA 1 BMP Type Infiltration Basin	DMA BMP Type	DMA 3 BMP Type Infiltration Basin (Use additional forms for more BMPs)
2 Infiltration rate of underlying soils (in/hr)	4		
3 Infiltration safety factor (from percolation test method below*)	2		
4 Design percolation rate (in/hr) P_{design} = Item 2 / Item 3	2		
5 Ponded water drawdown time (hr) Copy Item 6 in Form 4.2-1	48		
6 Maximum ponding depth (ft) 6 ft maximum per City code	6		
7 Ponding Depth (ft) d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6	8.1		
8 Infiltrating surface area, SA_{BMP} (ft^2)	1427.8		
9 Amended soil depth, d_{media} (ft) If applicable Only included in certain BMP types	0		
10 Amended soil porosity	0		
11 Gravel depth, d_{media} (ft) Only included in certain BMP types	0		
12 Gravel porosity	0		
13 Duration of storm as basin is filling (hrs) Typical ~ 3hrs	3		
14 Above Ground Retention Volume (ft^3) $V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]	27,209.7		
15 Underground Retention Volume (ft^3) Volume determined using manufacturer's specifications and calculations	0		

16 Total Retention Volume from LID Infiltration BMPs: 27,209.7 (Sum of Items 14 and 15 for all infiltration BMPs included in plan)

17 Fraction of DCV achieved with infiltration BMP: 100+% Retention% = Item 16 / Form 4.2-1 Item 7

18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐

*Appendix A of the Riverside County Design Handbook for Low Impact Development Best Management Practices; available online at: http://www.floodcontrol.co.riverside.ca.us/NPDES/LIDBMP.aspx

4.3.3 Biotreatment BMP

Biotreatment BMPs may be considered if the full LID DCV cannot be met by maximizing retention and infiltration. A key consideration when using biotreatment BMP is the effectiveness of the proposed BMP in addressing the pollutants of concern for the project).

Use Form 4.3-3 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV. Biotreatment computations are included as follows:

- Use Form 4.3-4 to compute biotreatment in small volume based biotreatment BMP (e.g. bioretention w/underdrains);
- Use Form 4.3-5 to compute biotreatment in large volume based biotreatment BMP (e.g. extended detention);
- Use Form 4.3-6 to compute sizing criteria for flow-based biotreatment BMP (e.g. bioswales)

Form 4.3-3 Selection and Evaluation of Biotreatment BMP (per DMA)

1 Remaining LID DCV not met by site design , or infiltration, BMP for potential biotreatment (ft^3): 0 Form 4.2-1 Item 7 - Form 4.3-2 Item 19 – Form 4.3-3 Item 16	List pollutants of concern Copy from Form 2.3-1.	
2 Biotreatment BMP Selected (Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes	Volume-based biotreatment Use Forms 4.3-5 and 4.3-6 to compute treated volume ☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Dry extended detention	Flow-based biotreatment Use Form 4.3-7 to compute treated flow ☐ Rock or Vegetated swale ☐ Vegetated buffer/filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): Form 4.3-5 Item 15 + Form 4.3-6 Item 13	4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): Item 1 – Item 3	5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % Item 4 / Item 1
6 Flow-based biotreatment BMP capacity provided (cfs):		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds for the proposed category of development: ☐		

Form 4.3-4 Volume Based Biotreatment (DA 1) – Bioretention and Planter Boxes with Underdrains

Biotreatment BMP Type (Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)	DMA BMP Type	DMA BMP Type	DMA BMP Type (Use additional forms for more BMPs)
1 Pollutants addressed with BMP List all pollutants of concern that will be effectively reduced through specific Unit Operations and Processes			
2 Amended soil infiltration rate Typical ~ 5.0			
3 Amended soil infiltration safety factor Typical ~ 2.0			
4 Amended soil design percolation rate (in/hr) P_{design} = Item 2 / Item 3			
5 Ponded water drawdown time (hr) Copy Item 6 from Form 4.2-1			
6 Maximum ponding depth (ft) 6 ft maximum per City code			
7 Ponding Depth (ft) d_{BMP} = Minimum of (1/12 * Item 4 * Item 5) or Item 6			
8 Amended soil surface area (ft^2)			
9 Amended soil depth (ft)			
10 Amended soil porosity, n			
11 Gravel depth (ft)			
12 Gravel porosity, n			
13 Duration of storm as basin is filling (hrs) Typical ~ 3hrs			
14 Biotreated Volume (ft^3) $V_{biotreated}$ = Item 8 * [(Item 7/2) + (Item 9 * Item 10) +(Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]			
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: Sum of Item 14 for all volume-based BMPs included in this form			

Form 4.3-5 Volume Based Biotreatment (per DMA) – Extended Detention

Biotreatment BMP Type Extended dry detention, or other comparable proprietary BMP. If BMP includes multiple modules (E.g. forebay and main basin), provide separate estimates for storage and pollutants treated in each module.	DMA BMP Type		DMA BMP Type (Use additional forms for more BMPs)	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes				
2 Bottom width (ft)				
3 Bottom length (ft)				
4 Bottom area (ft^2) A_{bottom} = Item 2 * Item 3				
5 Side slope (ft/ft)				
6 Depth of storage (ft)				
7 Water surface area (ft^2) $A_{surface}$ =(Item 2 + (2 * Item 5 * Item 6)) * (Item 3 + (2 * Item 5 * Item 6))				
8 Storage volume (ft^3) For BMP with a forebay, ensure fraction of total storage is within ranges specified in BMP specific fact sheets V =Item 6 / 3 * [Item 4 + Item 7 + (Item 4 * Item 7)^0.5]				
9 Drawdown Time (hrs) Copy Item 6 from Form 2.1				
10 Outflow rate (cfs) Q_{BMP} = (Item $8_{forebay}$ + Item 8_{basin}) / (Item 9 * 3600)				
11 Duration of design storm event (hrs)				
12 Biotreated Volume (ft^3) $V_{biotreated}$ = (Item $8_{forebay}$ + Item 8_{basin}) +(Item 10 * Item 11 * 3600)				
13 Total biotreated volume from extended detention : (Sum of Item 12 for all BMP included in plan)				

Form 4.3-6 Flow Based Biotreatment (per DMA)			
Biotreatment BMP Type Vegetated swale, vegetated filter strip, or other comparable proprietary BMP	DMA BMP Type	DMA BMP Type	DMA BMP Type (Use additional forms for more BMPs)
1 Pollutants addressed with BMP List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes			
2 Flow depth for water quality treatment (ft) BMP specific			
3 Bed slope (ft/ft) BMP specific,			
4 Manning's roughness coefficient			
5 Bottom width (ft)			
6 Side Slope (ft/ft) BMP specific			
7 Cross sectional area (ft^2) A = (Item 5 * Item 2) + (Item 6 * Item 2^2)			
8 Water quality flow velocity (ft/sec) V = Form 4.3-5 Item 6 / Item 7			
9 Hydraulic residence time (min)			
10 Length of flow based BMP (ft) L = Item 8 * Item 9 * 60			
11 Water surface area at water quality flow depth (ft^2) SA_{top} = (Item 5 + (2 * Item 2 * Item 6)) * Item 10			

4.3.5 Conformance Summary

Complete Form 4.3-7 to demonstrate how on-site LID DCV is met with proposed site design, infiltration, and/or biotreatment BMP. The bottom line of the form is used to describe the basis for infeasibility determination for on-site LID BMP to achieve full LID DCV, and provides methods for computing remaining volume to be addressed in an alternative compliance plan. If the project has more than one outlet, then complete additional versions of this form for each outlet.

Form 4.3-7 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)

1 Total LID DCV for the Project DA-1 (ft^3): 9,694 Copy Item 7 in Form 4.2-1

2 On-site retention with site design BMP (ft^3): 0 Copy Item18 in Form 4.3-2

3 On-site retention with LID infiltration BMP (ft^3): 27,209.7 Copy Item 16 in Form 4.3-3

4 On-site biotreatment with volume based biotreatment BMP (ft^3): Copy Item 3 in Form 4.3-4

5 Flow capacity provided by flow based biotreatment BMP (cfs): Copy Item 6 in Form 4.3-4

6 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design or infiltration BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized

§ On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐
If yes, Form 4.3-1 Items 7 and 8 were both checked yes

7 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} = (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%

- Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following measures of equivalent effectiveness are demonstrated:
  1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐
  2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐
  3) Equal or greater protection against shock loadings and spills; ☐
  4) Equal or greater accessibility and ease of inspection and maintenance. ☐

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 2)

1 Total LID DCV for the Project DA-1 (ft^3): 197 Copy Item 7 in Form 4.2-1

2 On-site retention with site design BMP (ft^3): 0 Copy Item18 in Form 4.3-2

3 On-site retention with LID infiltration BMP (ft^3):389.7 Copy Item 16 in Form 4.3-3

4 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 Copy Item 3 in Form 4.3-4

5 Flow capacity provided by flow based biotreatment BMP (cfs): 0 Copy Item 6 in Form 4.3-4

6 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design or infiltration BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

7 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} = (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%

- Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated:
  1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐
  2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐
  3) Equal or greater protection against shock loadings and spills; ☐
  4) Equal or greater accessibility and ease of inspection and maintenance. ☐

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 3)

1 Total LID DCV for the Project DA-1 (ft^3): 194 Copy Item 7 in Form 4.2-1

2 On-site retention with site design BMP (ft^3): 0 Copy Item18 in Form 4.3-2

3 On-site retention with LID infiltration BMP (ft^3): 389.7 Copy Item 16 in Form 4.3-3

4 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 Copy Item 3 in Form 4.3-4

5 Flow capacity provided by flow based biotreatment BMP (cfs): 0 Copy Item 6 in Form 4.3-4

6 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design or infiltration BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

7 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} = (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%

- Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated:
  1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐
  2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐
  3) Equal or greater protection against shock loadings and spills; ☐
  4) Equal or greater accessibility and ease of inspection and maintenance. ☐

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 4)

1 Total LID DCV for the Project DA-1 (ft^3): 187 Copy Item 7 in Form 4.2-1

2 On-site retention with site design BMP (ft^3): 0 Copy Item18 in Form 4.3-2

3 On-site retention with LID infiltration BMP (ft^3): 389.7 Copy Item 16 in Form 4.3-3

4 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 Copy Item 3 in Form 4.3-4

5 Flow capacity provided by flow based biotreatment BMP (cfs): 0 Copy Item 6 in Form 4.3-4

6 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design or infiltration BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

7 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} = (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%

- Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated:
  1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐
  2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐
  3) Equal or greater protection against shock loadings and spills; ☐
  4) Equal or greater accessibility and ease of inspection and maintenance. ☐

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 5)

1 Total LID DCV for the Project DA-1 (ft^3): 194 Copy Item 7 in Form 4.2-1

2 On-site retention with site design BMP (ft^3): 0 Copy Item18 in Form 4.3-2

3 On-site retention with LID infiltration BMP (ft^3): 389.7 Copy Item 16 in Form 4.3-3

4 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 Copy Item 3 in Form 4.3-4

5 Flow capacity provided by flow based biotreatment BMP (cfs): 0 Copy Item 6 in Form 4.3-4

6 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design or infiltration BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

7 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} = (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%

- Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated:
  1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐
  2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐
  3) Equal or greater protection against shock loadings and spills; ☐
  4) Equal or greater accessibility and ease of inspection and maintenance. ☐

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 6)

1 Total LID DCV for the Project DA-1 (ft^3): 187 Copy Item 7 in Form 4.2-1

2 On-site retention with site design BMP (ft^3): 0 Copy Item18 in Form 4.3-2

3 On-site retention with LID infiltration BMP (ft^3): 389.7 Copy Item 16 in Form 4.3-3

4 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 Copy Item 3 in Form 4.3-4

5 Flow capacity provided by flow based biotreatment BMP (cfs): 0 Copy Item 6 in Form 4.3-4

6 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design or infiltration BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

7 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} = (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%

- Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated:
  1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐
  2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐
  3) Equal or greater protection against shock loadings and spills; ☐
  4) Equal or greater accessibility and ease of inspection and maintenance. ☐

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 7)

1 Total LID DCV for the Project DA-1 (ft^3): 194 Copy Item 7 in Form 4.2-1

2 On-site retention with site design BMP (ft^3): 0 Copy Item18 in Form 4.3-2

3 On-site retention with LID infiltration BMP (ft^3): 389.7 Copy Item 16 in Form 4.3-3

4 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 Copy Item 3 in Form 4.3-4

5 Flow capacity provided by flow based biotreatment BMP (cfs): 0 Copy Item 6 in Form 4.3-4

6 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design or infiltration BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

7 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} = (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%

- Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated:
  1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐
  2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐
  3) Equal or greater protection against shock loadings and spills; ☐
  4) Equal or greater accessibility and ease of inspection and maintenance. ☐

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 8)

1 Total LID DCV for the Project DA-1 (ft^3): 187 Copy Item 7 in Form 4.2-1

2 On-site retention with site design BMP (ft^3): 0 Copy Item18 in Form 4.3-2

3 On-site retention with LID infiltration BMP (ft^3): 389.7 Copy Item 16 in Form 4.3-3

4 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 Copy Item 3 in Form 4.3-4

5 Flow capacity provided by flow based biotreatment BMP (cfs): 0 Copy Item 6 in Form 4.3-4

6 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design or infiltration BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

7 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} = (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%

- Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated:
  1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐
  2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐
  3) Equal or greater protection against shock loadings and spills; ☐
  4) Equal or greater accessibility and ease of inspection and maintenance. ☐

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 9)

1 Total LID DCV for the Project DA-1 (ft^3): 194 Copy Item 7 in Form 4.2-1

2 On-site retention with site design BMP (ft^3): 0 Copy Item18 in Form 4.3-2

3 On-site retention with LID infiltration BMP (ft^3): 389.7 Copy Item 16 in Form 4.3-3

4 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 Copy Item 3 in Form 4.3-4

5 Flow capacity provided by flow based biotreatment BMP (cfs): 0 Copy Item 6 in Form 4.3-4

6 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design or infiltration BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

7 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} = (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%

- Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated:
  1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐
  2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐
  3) Equal or greater protection against shock loadings and spills; ☐
  4) Equal or greater accessibility and ease of inspection and maintenance. ☐

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 10)

1 Total LID DCV for the Project DA-1 (ft^3): 192 Copy Item 7 in Form 4.2-1

2 On-site retention with site design BMP (ft^3): 0 Copy Item18 in Form 4.3-2

3 On-site retention with LID infiltration BMP (ft^3): 389.7 Copy Item 16 in Form 4.3-3

4 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 Copy Item 3 in Form 4.3-4

5 Flow capacity provided by flow based biotreatment BMP (cfs): 0 Copy Item 6 in Form 4.3-4

6 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design or infiltration BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

7 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} = (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%

- Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated:
  1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐
  2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐
  3) Equal or greater protection against shock loadings and spills; ☐
  4) Equal or greater accessibility and ease of inspection and maintenance. ☐

Section 5 Inspection and Maintenance Responsibility for Post-Construction BMPs

All BMPs included as part of the project WQMP are required to be maintained through regular scheduled inspection and maintenance. Fully complete Form 5-1 summarizing all BMPs included in the WQMP. Attach additional forms as needed. The WQMP shall also include a detailed Operation and Maintenance Plan for all BMPs and a Maintenance Agreement prepared using the Template in Attachment A. The Maintenance Agreement must also be attached to the WQMP.

Note that the Maintenance Agreement must be completed, signed, notarized, and submitted to the City before construction permits are issued, and must be recorded before final inspection and submitted to the City

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Lot A Infiltratio n Basin	City of Hesperia	Biannual inspection, Remove when sediment accumulation exceeds 6 inches	biannual
Dry Well Seepage Pit	City of Hesperia	Biannual inspection, Remove when sediment accumulation exceeds 50% of settling chamber	biannual
Roadway	City of Hesperia	Clear and remove accumulated sand and debris in parking lots. Sweep pavement in lue of using hose or water spray.Ensure stormwater runoff is not impeded by deposit of debris and accumulated sediment. Inspeciton and maintenance to be performed by cityu staff.	Monthly
Storm Drain Stencil	City of Hesperia	Storm Drain stencil to be inpsected annually for degradation and wear. Faded or worn stencil that is not legible shall be repainted to ensure stencil is legible.	Anually
Onlot Infiltratio n Basins	Private property owner	Biannual inspection, Remove when sediment accumulation exceeds 3 inches	biannual

Section 6 WQMP Attachments

6.1 BMP Exhibit (Site Plan)

Include a BMP Exhibit (Site Plan), at a size no less than 24" by 36," which includes the following minimum information:

- Insert in the title block (lower right hand corner) of BMP Exhibit: the WQMP Number (assigned by staff) and the grading/building or Planning Application permit numbers
- Project location (address, tract/lot number(s), etc.)
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Locations of Structural Source Control, LID, and Treatment BMPs
- Drainage delineations and flow information
- Delineate the area being treated by each structural BMP
- GIS coordinates for LID and Treatment Control BMPs
- Drainage connections
- BMP details
- Preparer name and stamp
- Operations and Maintenance Plan as Plan Notes

Please do not include any areas outside of the project area or any information not related to drainage or water quality. The approved BMP Exhibit (Site Plan) shall be submitted as a plan sheet on all grading and building plan sets submitted for plan check review and approval. The BMP Exhibit shall be at the same size as the rest of the plan sheets in the submittal and shall have an approval stamp and signature prior to plan check submittal.

6.2 Operation and Maintenance Plan

Develop and attach an Operation and Maintenance Plan for the project BMPs. The Operation and Maintenance Plan must address the following concerns:

- What maintenance activities is/are needed based on BMP design features and operation?
- How frequently will maintenance be performed?
- What conditions will trigger maintenance activities?
- Who is/are responsible for these activities?

- What inspections are required, and what must be inspected?
- How frequently will inspections be required to be conducted?
- Who will conduct inspections?
- What inspection and maintenance records will be kept and be available for review?

Detailed descriptions of BMP maintenance activities are provided in these references:

Chapter 5 in the Riverside County WQMP Guidance Document:
http://www.waterboards.ca.gov/santaana/water_issues/programs/stormwater/docs/rcpermit/wqmp/final/Santa_Ana_WQMP_FINAL.pdf

Los Angeles County Stormwater BMP Operations and Maintenance Manual :
http://dpw.lacounty.gov/DES/design_manuals/StormwaterBMPDesignandMaintenance.pdf

6.3 Electronic Data Submittal

Minimum requirements include submittal of PDF exhibits in addition to hard copies. Format must not require specialized software to open.

6.4 Maintenance Agreement

Attach Maintenance Agreement for BMPs to the WQMP.

6.5 Other Supporting Documentation

§ Activity Restriction – CC&R's & Lease Agreements; if applicable

6.6 Submittal and Recordation of Water Quality Management Plan

Following approval of the Final Project-Specific WQMP, two copies of the approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) shall be submitted. In addition, these documents shall be submitted in a PDF format.

Each approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) shall be recorded in the San Bernardino County Clerk-Recorder's Office, prior to close-out of grading and/or building permit. Educational Materials are not required to be included.

Attachment A

WQMP Maintenance Agreement Template

RECORDING REQUESTED BY:
City of Hesperia
Development Services Department

AND WHEN RECORDED MAIL TO:
City of Hesperia
Development Services Department
9700 Seventh Avenue
Hesperia, CA 92345

SPACE ABOVE THIS LINE FOR RECORDER'S USE

COVENANT AND AGREEMENT REGARDING WATER QUALITY MANAGEMENT PLAN AND STORMWATER BEST MANAGEMENT PRACTICES TRANSFER, ACCESS AND MAINTENANCE

THIS PAGE ADDED TO PROVIDE ADEQUATE SPACE FOR RECORDING INFORMATION

Covenant and Agreement Regarding Water Quality Management Plan and Stormwater Best Management Practices Transfer, Access and Maintenance

OWNER NAME: _____

PROPERTY ADDRESS: _____

_____

APN: _____

THIS AGREEMENT is made and entered into in

_____ , California, this _____ day of

_____ , by and between

_____ , hereinafter

referred to as Owner, and the CITY OF HESPERIA, a political subdivision of the State of California, hereinafter referred to as "the City";

WHEREAS, the Owner owns real property ("Property") in the State of California, County of San Bernardino, located at [STREET ADDRESS] within the City of Hesperia, more commonly referred to as San Bernardino County Tax Assessor Parcel No. [APN Number] specifically described in Exhibit "A" and depicted in Exhibit "B", each of which is attached hereto and incorporated herein by this reference; and

WHEREAS, at the time of initial approval of the development project known as

_____ within the Property described herein, the City required the project to employ Best Management Practices, hereinafter referred to as "BMPs," to minimize pollutants in urban runoff; and

WHEREAS, the Owner has chosen to install and/or implement BMPs as described in the Water Quality Management Plan, dated _____, on file with the City and incorporated herein by this reference, hereinafter referred to as "WQMP", to minimize pollutants in stormwater and urban runoff and to minimize other adverse impacts of stormwater and urban runoff; and

WHEREAS, said WQMP has been certified by the Owner and reviewed and approved by the City; and

WHEREAS, the Owner is aware that periodic and continuous maintenance, including, but not necessarily limited to, filter material replacement and sediment removal, is required to assure peak performance of all BMPs in the WQMP and that, furthermore, such maintenance activity will require compliance with all Local, State, or Federal laws and regulations, including those pertaining to confined space and waste disposal methods, in effect at the time such maintenance occurs.

NOW THEREFORE, it is mutually stipulated and agreed as follows:

1. Owner shall comply with the WQMP.

2. All maintenance or replacement of any BMPs specified within the approved WQMP is the sole responsibility of the Owner in accordance with the terms of this Agreement.

3. Owner hereby provides the City's designee complete access, of any duration, to the BMPs and their immediate vicinity at any time, upon reasonable notice, or in the event of emergency, as determined by the City, no advance notice, for the purpose of inspection, sampling, testing of the BMPs, and in case of emergency, to undertake all necessary repairs or other preventative measures at owner's expense as provided in paragraph 5 below. The City shall make every effort at all times to minimize or avoid interference with Owner's use of the Property. Denial of access to any premises or facility that contains WQMP features is a breach of this Agreement and may also be a violation of the Clean Water Act, the California Water Code, and/or the City's NPDES Permit Implementation regulations. If there is reasonable cause to believe that an illicit discharge or breach of this Agreement is occurring on the premises then the authorized enforcement agency may seek issuance of a search warrant from any court of competent jurisdiction in addition to other enforcement actions. Owner recognizes that the City may perform routine and regular inspections, as well as emergency inspections, of the BMPs. Owner or Owner's successors or assigns shall pay City for all costs incurred by City in the inspection, sampling, testing of the BMPs within thirty (30) calendar days of City invoice.

4. Owner shall use its best efforts diligently to maintain all BMPs in a manner assuring peak performance at all times. All reasonable precautions shall be exercised by Owner and Owner's representative or contractor in the removal and extraction of any material(s) from the BMPs and the ultimate disposal of the material(s) in a manner consistent with all relevant laws and regulations in effect at the time. As may be requested from time to time by the City, the Owner shall provide the City with documentation identifying the material(s) removed, the quantity, and disposal destination, testing construction or reconstruction.

5. In the event Owner, or its successors or assigns, fails to accomplish the necessary maintenance contemplated by this Agreement, within five (5) business days of being given written notice by the City, the City is hereby authorized to cause any maintenance necessary to be done and charge the entire cost and expense against the Property and/or to the Owner or Owner's successors or assigns, including administrative costs, attorney's fees and interest thereon at the maximum rate authorized by the City Code from the date of the notice of expense until paid in full. Owner or Owner's successors or assigns shall pay City within thirty (30) calendar days of City invoice.

6. The City may require the owner to post security in form and for a time period satisfactory to the City to guarantee the performance of the obligations stated herein. Should the Owner fail to perform the obligations under the Agreement, the City may, in the case of a cash bond, act for the Owner using the proceeds from it, or in the case of a surety bond, require the surety (ies) to perform the obligations of this Agreement.

7. The City agrees, from time to time, within ten (10) business days after request of Owner, to execute and deliver to Owner, or Owner's designee, an estoppel certificate requested by Owner, stating that this Agreement is in full force and effect, and that Owner is not in default hereunder with regard to any maintenance or payment obligations (or specifying in detail the nature of Owner's default). Owner shall pay all costs and expenses incurred by the City in its investigation of whether to issue an estoppel certificate within thirty (30) calendar days after receipt of a City invoice and prior to the City's issuance of such certificate. Where the City cannot issue an estoppel certificate, Owner shall pay the City within thirty (30) calendar days of receipt of a City invoice.

8. Owner shall not change any BMPs identified in the WQMP without an amendment to this Agreement approved by authorized representatives of both the City and the Owner.

9. City and Owner shall comply with all applicable laws, ordinances, rules, regulations, court orders and government agency orders now or hereinafter in effect in carrying out the terms of this Agreement. If a provision of this Agreement is terminated or held to be invalid, illegal or unenforceable, the validity, legality and enforceability of the remaining provisions shall remain in full effect.

10. In addition to any remedy available to City under this Agreement, if Owner violates any term of this Agreement and does not cure the violation within the time already provided in this Agreement, or, if not provided, within thirty (30) calendar days, or within such time authorized by the City if said cure reasonably requires more than the subject time, the City may bring an action at law or in equity in a court of competent jurisdiction to enforce compliance by the Owner with the terms of this Agreement. In such action, the City may recover any damages to which the City may be entitled for the violation, enjoin the violation by temporary or permanent injunction without the necessity of proving actual damages or the inadequacy of otherwise available legal remedies, or obtain other equitable relief, including, but not limited to, the restoration of the Property and/or the BMPs identified in the WQMP to the condition in which it/they existed prior to any such violation or injury.

11. This Agreement shall be recorded in the Office of the Recorder of San Bernardino County, California, at the expense of the Owner and shall constitute notice to all successors and assigns of the title to said Property of the obligation herein set forth, and also a lien in such amount as will fully reimburse the City, including interest as herein above set forth, subject to foreclosure in event of default in payment.

12. In event of legal action occasioned by any default or action of the Owner, or its successors or assigns, then the Owner and its successors or assigns agree(s) to hold the City harmless and pay all costs incurred by the City in enforcing the terms of this Agreement, including reasonable attorney's fees and costs, and that the same shall become a part of the lien against said Property.

13. It is the intent of the parties hereto that burdens and benefits herein undertaken shall constitute covenants that run with said Property and constitute a lien there against.

14. The obligations herein undertaken shall be binding upon the heirs, successors, executors, administrators and assigns of the parties hereto. The term "Owner" shall include not only the present Owner, but also its heirs, successors, executors, administrators, and assigns. Owner shall notify any successor to title of all or part of the Property about the existence of

this Agreement. Owner shall provide such notice prior to such successor obtaining an interest in all or part of the Property. Owner shall provide a copy of such notice to the City at the same time such notice is provided to the successor.

15. Time is of the essence in the performance of this Agreement.

16. Any notice to a party required or called for in this Agreement shall be served in person, or by deposit in the U.S. Mail, first class postage prepaid, to the address set forth below. Notice(s) shall be deemed effective upon receipt, or seventy-two (72) hours after deposit in the U.S. Mail, whichever is earlier. A party may change a notice address only by providing written notice thereof to the other party.

17. Owner agrees to indemnify, defend (with counsel reasonably approved by the City) and hold harmless the City and its authorized officers, employees, agents and volunteers from any and all claims, actions, losses, damages, and/or liability arising out of this Agreement from any cause whatsoever, including the acts, errors or omissions of any person and for any costs or expenses incurred by the City on account of any claim except where such indemnification is prohibited by law. This indemnification provision shall apply regardless of the existence or degree of fault of indemnitees. The Owner's indemnification obligation applies to the City's "active" as well as "passive" negligence but does not apply to the City's "sole negligence" or "willful misconduct" within the meaning of Civil Code Section 2782, or to any claims, actions, losses, damages, and/or liabilities, to the extent caused by the acts or omissions of any third party contractors undertaking any work (other than field inspections) or other maintenance on the Property on behalf of the City under this Agreement.

[REMAINDER OF THIS PAGE INTENTIONALLY LEFT BLANK]

IF TO CITY:

City of Hesperia

9700 Seventh Avenue

Hesperia, CA 92345

IF TO OWNER:

IN WITNESS THEREOF, the parties hereto have affixed their signatures as of the date first written above.

OWNER:
Signature: _____

Name: _____

Title: _____

Date: _____

FOR: Maintenance Agreement, dated _____, for the project known as _____ _____ (APN)_____, As described in the WQMP dated _____.

OWNER:

Signature: _____

Name: _____

Title: _____

Date: _____

NOTARIES ON FOLLOWING PAGE

A notary acknowledgement is required for recordation.

ACCEPTED BY:

Director of Development Services

Date: _____

Attachment: Notary Acknowledgement

ATTACHMENT 1

(Notary Acknowledgement)

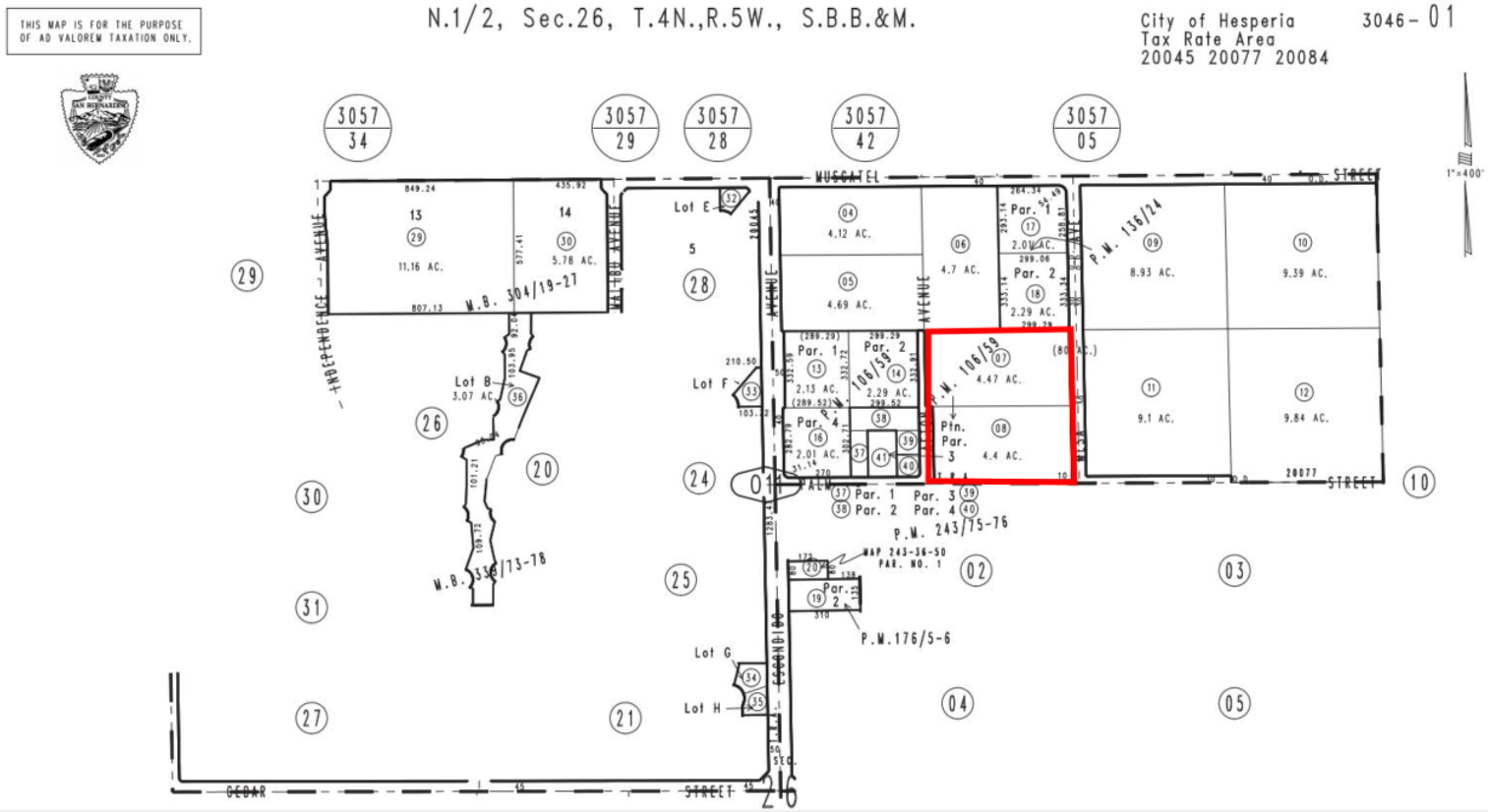
EXHIBIT A

(Legal Description)

N 1/2 SE 1/4 NW 1/4 NE 1/4 SEC 26 TP 4N R 5W EX ST
S 1/2 SE 1/4 NW 1/4 NE 1/4 SEC 26 TP 4N R 5W EX ST

EXHIBIT B

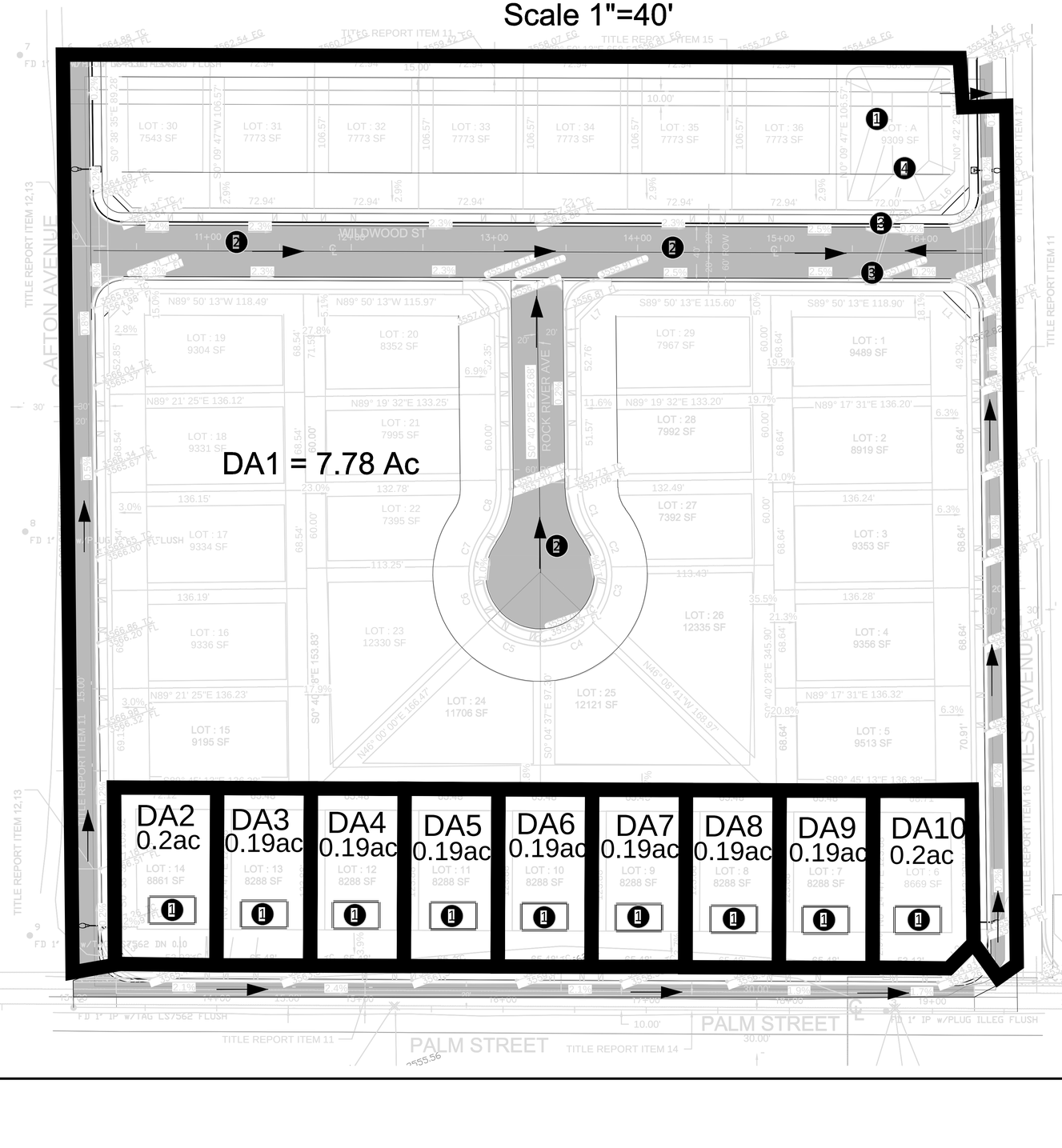
(Map/illustration)



Attachment B - WQMP Exhibit

WQMP EXHIBIT

Scale 1"=40'



N

LEGEND

- DA 1 BOUNDARY
- FLOW DIRECTION
- Onlot Basin

BMP NOTES

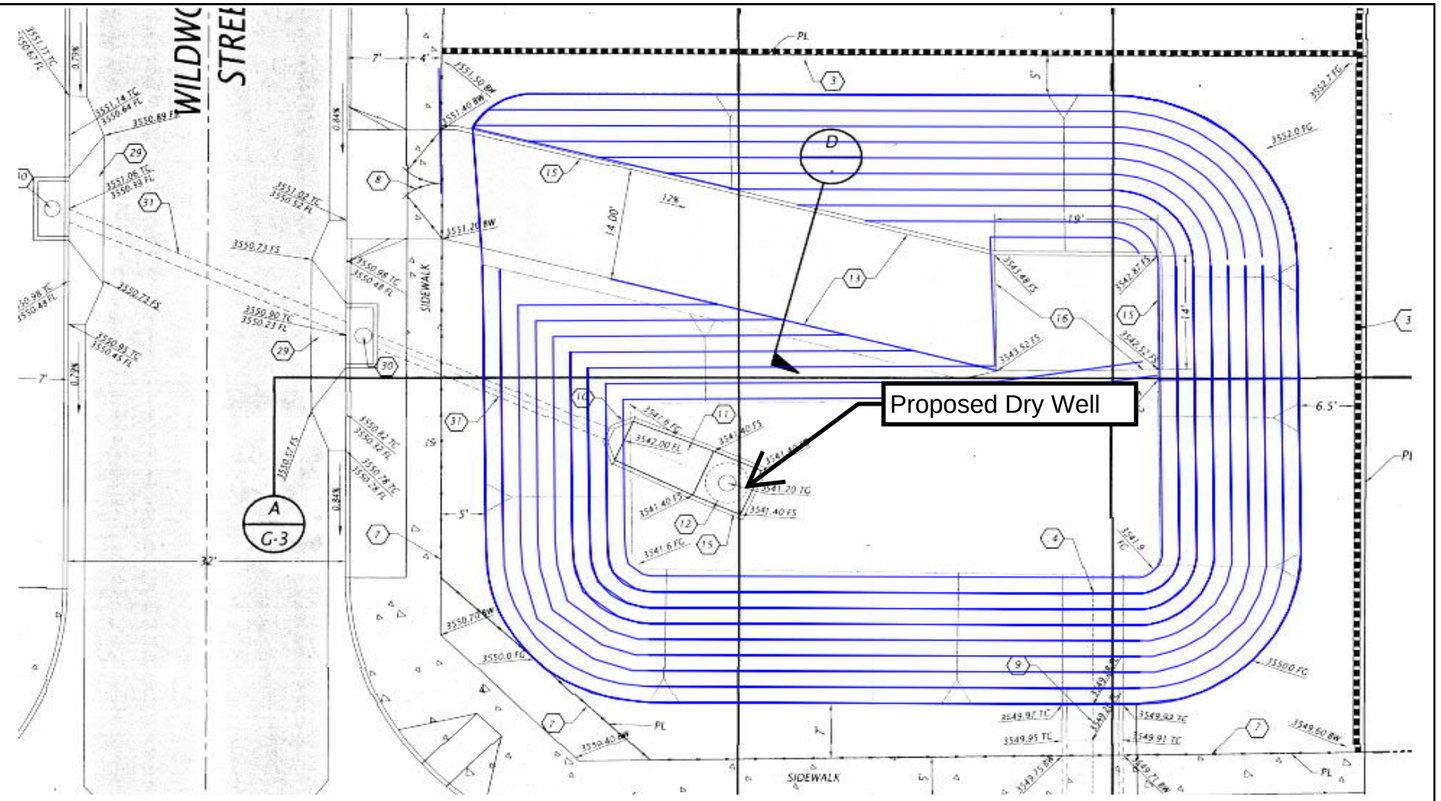
1. INFILTRATION BASIN MANAGED PER TC-11
2. STREET TO BE SWEPT MONTHLY
3. STORMDRAIN SIGNAGE "DRAINS TO WATERWAY"
4. DRY WELL/SEEPAGE PIT

NOTE: IMPERVIOUS AREA
DISCONNECTION WILL EXIST ON EACH LOT

INFILTRATION BASIN EXHIBIT

Basin Storage

Elevation (ft)	Depth (ft)	Area (ft2)	Volume (ft3)	Total Volume (FT3)	Location
3541.2	0.0	0.0	0.0	0.0	Basin Invert
3541.9	0.7	1427.8	499.7	499.7	Base of Slope
3549.3	8.1	5810.7	26710.0	27209.7	Spillway Invert
3550.0	8.8	6994.0	4481.6	31691.4	Top of Basin



Attachment C – AMC Exhibit

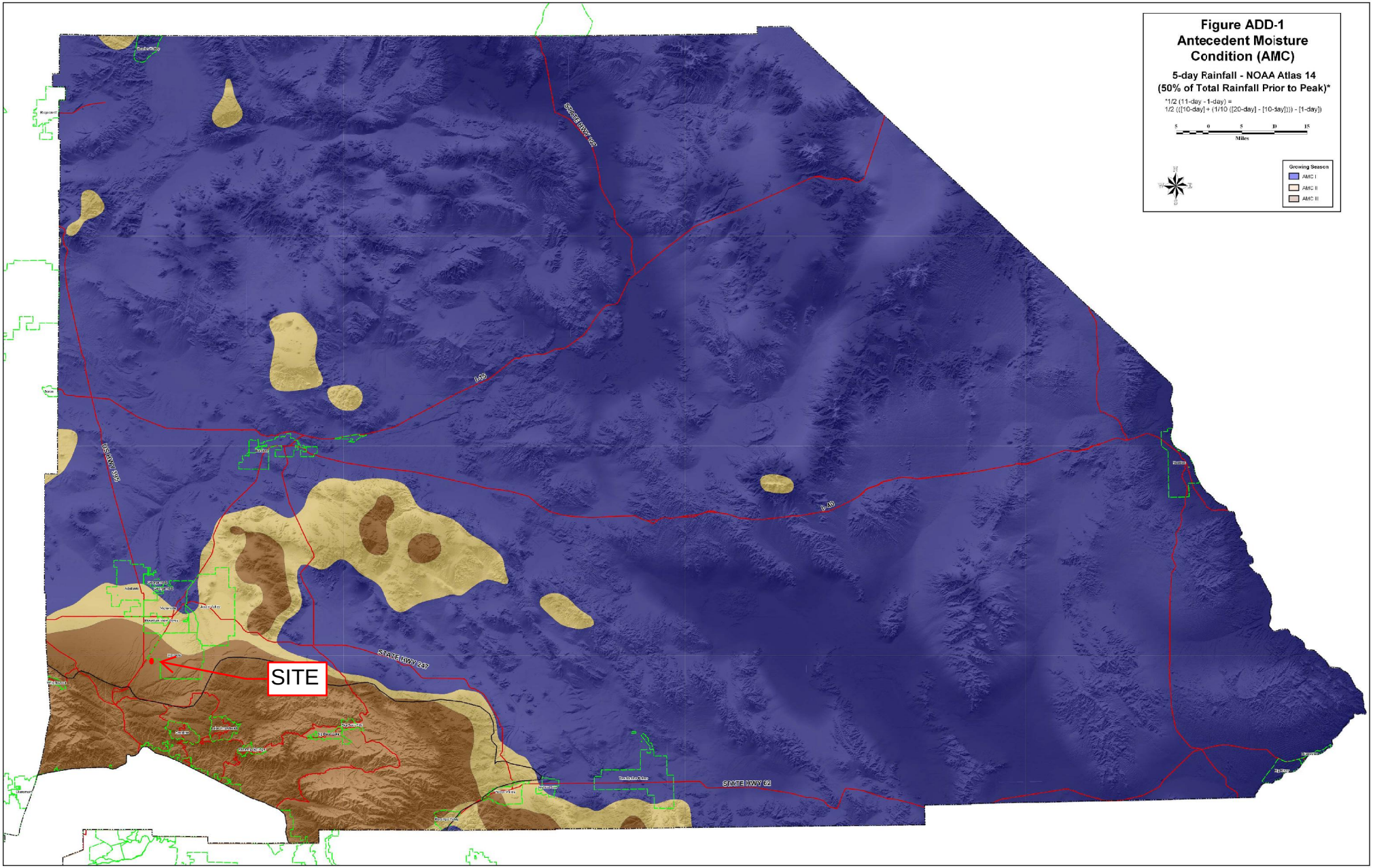


Figure ADD-1
Antecedent Moisture Condition (AMC)
5-day Rainfall - NOAA Atlas 14
(50% of Total Rainfall Prior to Peak)*
*1/2 (11-day - 1-day) =
1/2 ([10-day] + (1/10 ([20-day] - [10-day]))) - [1-day])
5 0 5 10 15
Miles
Growing Season
AMC I
AMC II
AMC III
STATE HWY 237
I-35
US HWY 385
I-40
STATE HWY 237
STATE HWY 92
SITE

Attachment D – Websoil Survey

Map Scale: 1:1,670 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 12, May 27, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 26, 2019—Jul 8, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
134	HESPERIA LOAMY FINE SAND, 2 TO 5 PERCENT SLOPES	9.7	100.0%
Totals for Area of Interest		**9.7**	**100.0%**

San Bernardino County, California, Mojave River Area

134—HESPERIA LOAMY FINE SAND, 2 TO 5 PERCENT SLOPES

Map Unit Setting

National map unit symbol: hks7
Elevation: 200 to 4,000 feet
Mean annual precipitation: 6 to 9 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 150 to 250 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Hesperia and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hesperia

Setting

Landform: Fan aprons
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite sources

Typical profile

H1 - 0 to 6 inches: loamy fine sand
H2 - 6 to 60 inches: sandy loam, coarse sandy loam
H2 - 6 to 60 inches:

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: High (about 11.3 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A

Ecological site: R030XE006CA - COARSE LOAMY
Hydric soil rating: No

Minor Components

Cajon
Percent of map unit: 5 percent
Hydric soil rating: No

Wrightwood
Percent of map unit: 5 percent
Hydric soil rating: No

Bull trail
Percent of map unit: 3 percent
Hydric soil rating: No

Unnamed soils
Percent of map unit: 2 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 12, May 27, 2020

Attachment E – Water Quality Calculations Summary Spreadsheet

SAN BERNARDINO COUNTY STORMWATER PROGRAM
MODEL WATER QUALITY MANAGEMENT PLAN GUIDANCE

Estimating Volume- and Flow-based BMP Design Runoff Quantities

BMP Drainage Area designation	Area, A	Impervious area ratio, i	Region	NOAA Atlas 14 Precipitation Depth (2-yr 1-Hr Rainfall)	Factor of Safety[1]	Volume-based BMP drawdown time[2]	Composite runoff coefficient, C_{BMP}	Intensity regression coefficient, I	Design rainfall intensity, I_{BMP}	Flow-based BMP treatment flowrate, Q	6-hour rainfall regression coefficient	6-hour mean storm rainfall, P_6	Drawdown time regression constant, a	Maximized detention volume, P_0	Target capture volume, V_0	Target capture volume, V_0
	acres		(Valley, Mountain, or Desert)	inches/hour		(24 or 48) hours			inches/hour	cfs		inches		inches	acre-feet	ft^3
DA 1	7.78	0.45	Desert	0.45	2	48	0.31	0.3250	0.30	0.71	1.2371	0.56	1.963	0.34	0.223	9694
DA 2	0.20	0.35	Desert	0.45	2	48	0.25	0.3250	0.30	0.01	1.2371	0.56	1.963	0.28	0.005	197
DA 3	0.19	0.37	Desert	0.45	2	48	0.26	0.3250	0.30	0.01	1.2371	0.56	1.963	0.29	0.004	194
DA 4	0.19	0.35	Desert	0.45	2	48	0.25	0.3250	0.30	0.01	1.2371	0.56	1.963	0.28	0.004	187
DA 5	0.19	0.37	Desert	0.45	2	48	0.26	0.3250	0.30	0.01	1.2371	0.56	1.963	0.29	0.004	194
DA 6	0.19	0.35	Desert	0.45	2	48	0.25	0.3250	0.30	0.01	1.2371	0.56	1.963	0.28	0.004	187
DA 7	0.19	0.37	Desert	0.45	2	48	0.26	0.3250	0.30	0.01	1.2371	0.56	1.963	0.29	0.004	194
DA 8	0.19	0.35	Desert	0.45	2	48	0.25	0.3250	0.30	0.01	1.2371	0.56	1.963	0.28	0.004	187
DA 9	0.19	0.37	Desert	0.45	2	48	0.26	0.3250	0.30	0.01	1.2371	0.56	1.963	0.29	0.004	194
DA 10	0.20	0.32	Desert	0.45	2	48	0.24	0.3250	0.30	0.01	1.2371	0.56	1.963	0.26	0.004	192
														Total		11420.20

Regression Coefficients for Intensity (I) and 6-hour mean storm rainfall (P_6)			
Quantity	Valley	Mountain	Desert
	85% upper confidence limits		
I	0.2787	0.3614	0.3250
P_6	1.4807	1.9090	1.2371

Drawdown Time Regression Constant, a	
Time	a
hours	
24	1.582
48	1.963

Attachment F – CASQA BMPs

Infiltration Basin TC-11

Design Considerations

- Soil for Infiltration
- Slope
- Aesthetics

Targeted Constituents

☑	Sediment	■
☑	Nutrients	■
☑	Trash	■
☑	Metals	■
☑	Bacteria	■
☑	Oil and Grease	■
☑	Organics	■

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

Description

An infiltration basin is a shallow impoundment that is designed to infiltrate stormwater. Infiltration basins use the natural filtering ability of the soil to remove pollutants in stormwater runoff. Infiltration facilities store runoff until it gradually exfiltrates through the soil and eventually into the water table. This practice has high pollutant removal efficiency and can also help recharge groundwater, thus helping to maintain low flows in stream systems. Infiltration basins can be challenging to apply on many sites, however, because of soils requirements. In addition, some studies have shown relatively high failure rates compared with other management practices.

California Experience

Infiltration basins have a long history of use in California, especially in the Central Valley. Basins located in Fresno were among those initially evaluated in the National Urban Runoff Program and were found to be effective at reducing the volume of runoff, while posing little long-term threat to groundwater quality (EPA, 1983; Schroeder, 1995). Proper siting of these devices is crucial as underscored by the experience of Caltrans in siting two basins in Southern California. The basin with marginal separation from groundwater and soil permeability failed immediately and could never be rehabilitated.

Advantages

- Provides 100% reduction in the load discharged to surface waters.
- The principal benefit of infiltration basins is the approximation of pre-development hydrology during which a

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

significant portion of the average annual rainfall runoff is infiltrated and evaporated rather than flushed directly to creeks.

- If the water quality volume is adequately sized, infiltration basins can be useful for providing control of channel forming (erosion) and high frequency (generally less than the 2-year) flood events.

Limitations

- May not be appropriate for industrial sites or locations where spills may occur.
- Infiltration basins require a minimum soil infiltration rate of 0.5 inches/hour, not appropriate at sites with Hydrologic Soil Types C and D.
- If infiltration rates exceed 2.4 inches/hour, then the runoff should be fully treated prior to infiltration to protect groundwater quality.
- Not suitable on fill sites or steep slopes.
- Risk of groundwater contamination in very coarse soils.
- Upstream drainage area must be completely stabilized before construction.
- Difficult to restore functioning of infiltration basins once clogged.

Design and Sizing Guidelines

- Water quality volume determined by local requirements or sized so that 85% of the annual runoff volume is captured.
- Basin sized so that the entire water quality volume is infiltrated within 48 hours.
- Vegetation establishment on the basin floor may help reduce the clogging rate.

Construction/Inspection Considerations

- Before construction begins, stabilize the entire area draining to the facility. If impossible, place a diversion berm around the perimeter of the infiltration site to prevent sediment entrance during construction or remove the top 2 inches of soil after the site is stabililized. Stabilize the entire contributing drainage area, including the side slopes, before allowing any runoff to enter once construction is complete.
- Place excavated material such that it can not be washed back into the basin if a storm occurs during construction of the facility.
- Build the basin without driving heavy equipment over the infiltration surface. Any equipment driven on the surface should have extra-wide ("low pressure") tires. Prior to any construction, rope off the infiltration area to stop entrance by unwanted equipment.
- After final grading, till the infiltration surface deeply.
- Use appropriate erosion control seed mix for the specific project and location.

Performance

As water migrates through porous soil and rock, pollutant attenuation mechanisms include precipitation, sorption, physical filtration, and bacterial degradation. If functioning properly, this approach is presumed to have high removal efficiencies for particulate pollutants and moderate removal of soluble pollutants. Actual pollutant removal in the subsurface would be expected to vary depending upon site-specific soil types. This technology eliminates discharge to surface waters except for the very largest storms; consequently, complete removal of all stormwater constituents can be assumed.

There remain some concerns about the potential for groundwater contamination despite the findings of the NURP and Nightingale (1975; 1987a,b,c; 1989). For instance, a report by Pitt et al. (1994) highlighted the potential for groundwater contamination from intentional and unintentional stormwater infiltration. That report recommends that infiltration facilities not be sited in areas where high concentrations are present or where there is a potential for spills of toxic material. Conversely, Schroeder (1995) reported that there was no evidence of groundwater impacts from an infiltration basin serving a large industrial catchment in Fresno, CA.

Siting Criteria

The key element in siting infiltration basins is identifying sites with appropriate soil and hydrogeologic properties, which is critical for long term performance. In one study conducted in Prince George's County, Maryland (Galli, 1992), all of the infiltration basins investigated clogged within 2 years. It is believed that these failures were for the most part due to allowing infiltration at sites with rates of less than 0.5 in/hr, basing siting on soil type rather than field infiltration tests, and poor construction practices that resulted in soil compaction of the basin invert.

A study of 23 infiltration basins in the Pacific Northwest showed better long-term performance in an area with highly permeable soils (Hilding, 1996). In this study, few of the infiltration basins had failed after 10 years. Consequently, the following guidelines for identifying appropriate soil and subsurface conditions should be rigorously adhered to.

- Determine soil type (consider RCS soil type 'A, B or C' only) from mapping and consult USDA soil survey tables to review other parameters such as the amount of silt and clay, presence of a restrictive layer or seasonal high water table, and estimated permeability. The soil should not have more than 30% clay or more than 40% of clay and silt combined. Eliminate sites that are clearly unsuitable for infiltration.

- Groundwater separation should be at least 3 m from the basin invert to the measured ground water elevation. There is concern at the state and regional levels of the impact on groundwater quality from infiltrated runoff, especially when the separation between groundwater and the surface is small.

- Location away from buildings, slopes and highway pavement (greater than 6 m) and wells and bridge structures (greater than 30 m). Sites constructed of fill, having a base flow or with a slope greater than 15% should not be considered.

- Ensure that adequate head is available to operate flow splitter structures (to allow the basin to be offline) without ponding in the splitter structure or creating backwater upstream of the splitter.

- Base flow should not be present in the tributary watershed.

Secondary Screening Based on Site Geotechnical Investigation

- At least three in-hole conductivity tests shall be performed using USBR 7300-89 or Bouwer-Rice procedures (the latter if groundwater is encountered within the boring), two tests at different locations within the proposed basin and the third down gradient by no more than approximately 10 m. The tests shall measure permeability in the side slopes and the bed within a depth of 3 m of the invert.

- The minimum acceptable hydraulic conductivity as measured in any of the three required test holes is 13 mm/hr. If any test hole shows less than the minimum value, the site should be disqualified from further consideration.

- Exclude from consideration sites constructed in fill or partially in fill unless no silts or clays are present in the soil boring. Fill tends to be compacted, with clays in a dispersed rather than flocculated state, greatly reducing permeability.

- The geotechnical investigation should be such that a good understanding is gained as to how the stormwater runoff will move in the soil (horizontally or vertically) and if there are any geological conditions that could inhibit the movement of water.

Additional Design Guidelines

(1) Basin Sizing - The required water quality volume is determined by local regulations or sufficient to capture 85% of the annual runoff.

(2) Provide pretreatment if sediment loading is a maintenance concern for the basin.

(3) Include energy dissipation in the inlet design for the basins. Avoid designs that include a permanent pool to reduce opportunity for standing water and associated vector problems.

(4) Basin invert area should be determined by the equation:

$$A = \frac{WQV}{kt}$$

where A = Basin invert area (m^2)

WQV = water quality volume (m^3)

k = 0.5 times the lowest field-measured hydraulic conductivity (m/hr)

t = drawdown time (48 hr)

(5) The use of vertical piping, either for distribution or infiltration enhancement shall not be allowed to avoid device classification as a Class V injection well per 40 CFR146.5(e)(4).

Maintenance

Regular maintenance is critical to the successful operation of infiltration basins. Recommended operation and maintenance guidelines include:

- Inspections and maintenance to ensure that water infiltrates into the subsurface completely (recommended infiltration rate of 72 hours or less) and that vegetation is carefully managed to prevent creating mosquito and other vector habitats.
- Observe drain time for the design storm after completion or modification of the facility to confirm that the desired drain time has been obtained.
- Schedule semiannual inspections for beginning and end of the wet season to identify potential problems such as erosion of the basin side slopes and invert, standing water, trash and debris, and sediment accumulation.
- Remove accumulated trash and debris in the basin at the start and end of the wet season.
- Inspect for standing water at the end of the wet season.
- Trim vegetation at the beginning and end of the wet season to prevent establishment of woody vegetation and for aesthetic and vector reasons.
- Remove accumulated sediment and regrade when the accumulated sediment volume exceeds 10% of the basin.
- If erosion is occurring within the basin, revegetate immediately and stabilize with an erosion control mulch or mat until vegetation cover is established.
- To avoid reversing soil development, scarification or other disturbance should only be performed when there are actual signs of clogging, rather than on a routine basis. Always remove deposited sediments before scarification, and use a hand-guided rotary tiller, if possible, or a disc harrow pulled by a very light tractor.

Cost

Infiltration basins are relatively cost-effective practices because little infrastructure is needed when constructing them. One study estimated the total construction cost at about $2 per ft (adjusted for inflation) of storage for a 0.25-acre basin (SWRPC, 1991). As with other BMPs, these published cost estimates may deviate greatly from what might be incurred at a specific site. For instance, Caltrans spent about $18/ft^3 for the two infiltration basins constructed in southern California, each of which had a water quality volume of about 0.34 ac.-ft. Much of the higher cost can be attributed to changes in the storm drain system necessary to route the runoff to the basin locations.

Infiltration basins typically consume about 2 to 3% of the site draining to them, which is relatively small. Additional space may be required for buffer, landscaping, access road, and fencing. Maintenance costs are estimated at 5 to 10% of construction costs.

One cost concern associated with infiltration practices is the maintenance burden and longevity. If improperly maintained, infiltration basins have a high failure rate. Thus, it may be necessary to replace the basin with a different technology after a relatively short period of time.

References and Sources of Additional Information

Caltrans, 2002, BMP Retrofit Pilot Program Proposed Final Report, Rpt. CTSW-RT-01-050, California Dept. of Transportation, Sacramento, CA.

Galli, J. 1992. *Analysis of Urban BMP Performance and Longevity in Prince George's County, Maryland*. Metropolitan Washington Council of Governments, Washington, DC.

Hilding, K. 1996. Longevity of infiltration basins assessed in Puget Sound. *Watershed Protection Techniques* 1(3):124–125.

Maryland Department of the Environment (MDE). 2000. *Maryland Stormwater Design Manual*. http://www.mde.state.md.us/environment/wma/stormwatermanual. Accessed May 22, 2002.

Metzger, M. E., D. F. Messer, C. L. Beitia, C. M. Myers, and V. L. Kramer. 2002. The Dark Side Of Stormwater Runoff Management: Disease Vectors Associated With Structural BMPs. Stormwater 3(2): 24-39.

Nightingale, H.I., 1975, "Lead, Zinc, and Copper in Soils of Urban Storm-Runoff Retention Basins," American Water Works Assoc. Journal. Vol. 67, p. 443-446.

Nightingale, H.I., 1987a, "Water Quality beneath Urban Runoff Water Management Basins," Water Resources Bulletin, Vol. 23, p. 197-205.

Nightingale, H.I., 1987b, "Accumulation of As, Ni, Cu, and Pb in Retention and Recharge Basin Soils from Urban Runoff," Water Resources Bulletin, Vol. 23, p. 663-672.

Nightingale, H.I., 1987c, "Organic Pollutants in Soils of Retention/Recharge Basins Receiving Urban Runoff Water," Soil Science Vol. 148, pp. 39-45.

Nightingale, H.I., Harrison, D., and Salo, J.E., 1985, "An Evaluation Technique for Ground-water Quality Beneath Urban Runoff Retention and Percolation Basins," Ground Water Monitoring Review, Vol. 5, No. 1, pp. 43-50.

Oberts, G. 1994. Performance of Stormwater Ponds and Wetlands in Winter. *Watershed Protection Techniques* 1(2): 64–68.

Pitt, R., et al. 1994, *Potential Groundwater Contamination from Intentional and Nonintentional Stormwater Infiltration*, EPA/600/R-94/051, Risk Reduction Engineering Laboratory, U.S. EPA, Cincinnati, OH.

Schueler, T. 1987. *Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs*. Metropolitan Washington Council of Governments, Washington, DC.

Schroeder, R.A., 1995, *Potential For Chemical Transport Beneath a Storm-Runoff Recharge (Retention) Basin for an Industrial Catchment in Fresno, CA*, USGS Water-Resource Investigations Report 93-4140.

Southeastern Wisconsin Regional Planning Commission (SWRPC). 1991. *Costs of Urban Nonpoint Source Water Pollution Control Measures*. Southeastern Wisconsin Regional Planning Commission, Waukesha, WI.

U.S. EPA, 1983, *Results of the Nationwide Urban Runoff Program: Volume 1 – Final Report*, WH-554, Water Planning Division, Washington, DC.

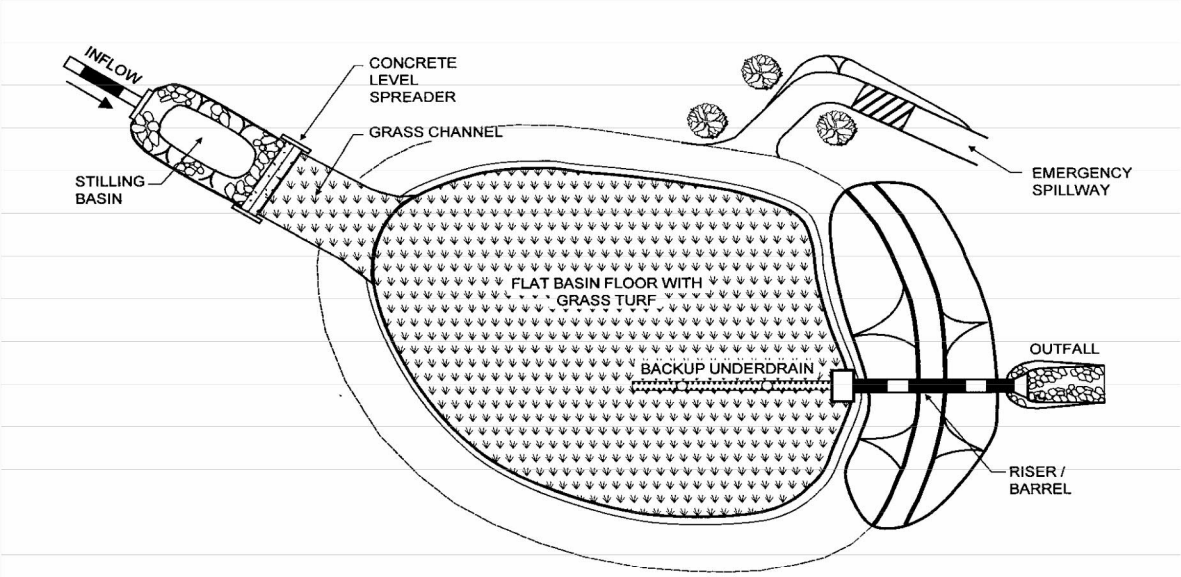
Watershed Management Institute (WMI). 1997. *Operation, Maintenance, and Management of Stormwater Management Systems*. Prepared for U.S. Environmental Protection Agency Office of Water, Washington, DC.

Information Resources

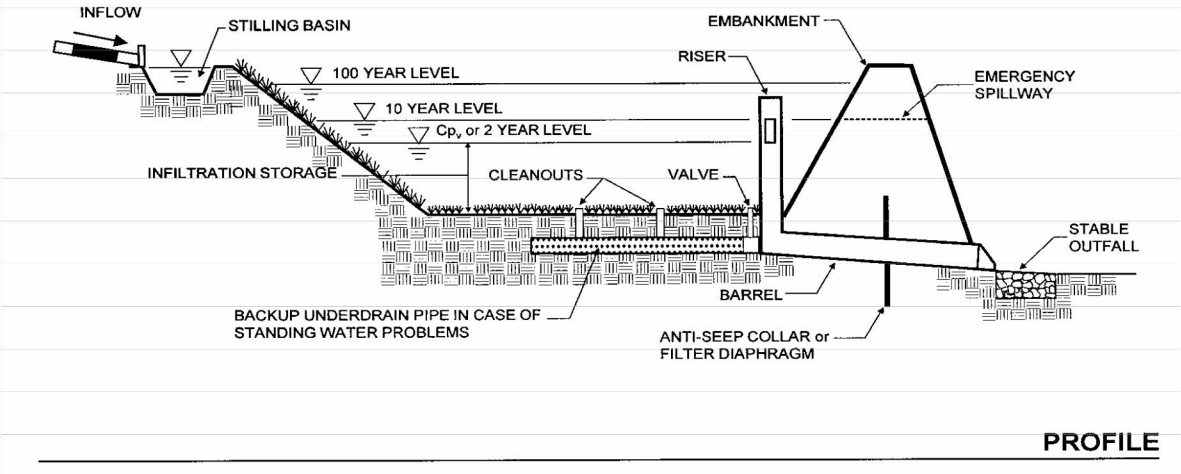
Center for Watershed Protection (CWP). 1997. *Stormwater BMP Design Supplement for Cold Climates*. Prepared for U.S. Environmental Protection Agency Office of Wetlands, Oceans and Watersheds. Washington, DC.

Ferguson, B.K., 1994. *Stormwater Infiltration*. CRC Press, Ann Arbor, MI.

USEPA. 1993. *Guidance to Specify Management Measures for Sources of Nonpoint Pollution in Coastal Waters*. EPA-840-B-92-002. U.S. Environmental Protection Agency, Office of Water, Washington, DC.



PLAN VIEW



PROFILE

Site Design & Landscape Planning SD-10

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- ☑ Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

SD-10 Site Design & Landscape Planning

Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.

- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.

- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.

- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.

- Promote natural vegetation by using parking lot islands and other landscaped areas.

- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.

- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of “ redevelopment” must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under “designing new installations” above should be followed.

SD-10 Site Design & Landscape Planning

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Storm Drain Signage SD-13

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include “NO DUMPING

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.
- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Drainage System Maintenance SC-74

Photo Credit: Geoff Brosseau

Objectives

- Contain
- Educate
- Reduce/Minimize

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff that may contain certain pollutants. Maintaining catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis will remove pollutants, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

Approach

Suggested Protocols

Catch Basins/Inlet Structures

- Municipal staff should regularly inspect facilities to ensure the following:
  - Immediate repair of any deterioration threatening structural integrity.
  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
  - Stenciling of catch basins and inlets (see SC-75 Waste Handling and Disposal).
- Clean catch basins, storm drain inlets, and other conveyance structures in high pollutant load areas just before the wet season to remove sediments and debris accumulated during the summer.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Record the amount of waste collected.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed of. Do not dewater near a storm drain or stream.
- Except for small communities with relatively few catch basins that may be cleaned manually, most municipalities will require mechanical cleaners such as eductors, vacuums, or bucket loaders.

Storm Drain Conveyance System

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Collect flushed effluent and pump to the sanitary sewer for treatment.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge from cleaning a storm drain pump station or other facility to reach the storm drain system.
- Conduct quarterly routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.
- Sample collected sediments to determine if landfill disposal is possible, or illegal discharges in the watershed are occurring.

Open Channel

- Consider modification of storm channel characteristics to improve channel hydraulics, to increase pollutant removals, and to enhance channel/creek aesthetic and habitat value.
- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a steam or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies

(SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS

Illicit Connections and Discharges

- During routine maintenance of conveyance system and drainage structures field staff should look for evidence of illegal discharges or illicit connections:
  - Is there evidence of spills such as paints, discoloring, etc.
  - Are there any odors associated with the drainage system
  - Record locations of apparent illegal discharges/illicit connections
  - Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of up gradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
  - Once the origin of flow is established, require illicit discharger to eliminate the discharge.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties
- Post "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

- The State Department of Fish and Game has a hotline for reporting violations called Cal TIP (1-800-952-5400). The phone number may be used to report any violation of a Fish and Game code (illegal dumping, poaching, etc.).
- The California Department of Toxic Substances Control's Waste Alert Hotline, 1-800-69TOXIC, can be used to report hazardous waste violations.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.
- Only properly trained individuals are allowed to handle hazardous materials/wastes.
- Train municipal employees from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report illegal dumping.
- Train municipal employees and educate businesses, contractors, and the general public in proper and consistent methods for disposal.
- Train municipal staff regarding non-stormwater discharges (See SC-10 Non-Stormwater Discharges).

Spill Response and Prevention

- Refer to SC-11, Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- Cleanup activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.
- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and disposal of flushed effluent to sanitary sewer may be prohibited in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Municipal codes should include sections prohibiting the discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.
- Private property access rights may be needed to track illegal discharges up gradient.

- Requirements of municipal ordinance authority for suspected source verification testing for illicit connections necessary for guaranteed rights of entry.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget. A careful study of cleaning effectiveness should be undertaken before increased cleaning is implemented. Catch basin cleaning costs are less expensive if vacuum street sweepers are available; cleaning catch basins manually can cost approximately twice as much as cleaning the basins with a vacuum attached to a sweeper.

- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary. Encouraging reporting of illicit discharges by employees can offset costs by saving expense on inspectors and directing resources more efficiently. Some programs have used funds available from "environmental fees" or special assessment districts to fund their illicit connection elimination programs.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.

- Identifying illicit discharges requires teams of at least two people (volunteers can be used), plus administrative personnel, depending on the complexity of the storm sewer system.

- Arrangements must be made for proper disposal of collected wastes.

- Requires technical staff to detect and investigate illegal dumping violations, and to coordinate public education.

Supplemental Information

Further Detail of the BMP

Storm Drain flushing

Sanitary sewer flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in sanitary sewer systems. The same principles that make sanitary sewer flushing effective can be used to flush storm drains. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as to an open channel, to another point where flushing will be initiated, or over to the sanitary sewer and on to the treatment facilities, thus preventing re-suspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. The deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to

cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce the impacts of stormwater pollution, a second inflatable device, placed well downstream, may be used to re-collect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to re-collect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75 percent for organics and 55-65 percent for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm drain flushing.

Flow Management

Flow management has been one of the principal motivations for designing urban stream corridors in the past. Such needs may or may not be compatible with the stormwater quality goals in the stream corridor.

Downstream flood peaks can be suppressed by reducing through flow velocity. This can be accomplished by reducing gradient with grade control structures or increasing roughness with boulders, dense vegetation, or complex banks forms. Reducing velocity correspondingly increases flood height, so all such measures have a natural association with floodplain open space. Flood elevations laterally adjacent to the stream can be lowered by increasing through flow velocity.

However, increasing velocity increases flooding downstream and inherently conflicts with channel stability and human safety. Where topography permits, another way to lower flood elevation is to lower the level of the floodway with drop structures into a large but subtly excavated bowl where flood flows we allowed to spread out.

Stream Corridor Planning

Urban streams receive and convey stormwater flows from developed or developing watersheds. Planning of stream corridors thus interacts with urban stormwater management programs. If local programs are intended to control or protect downstream environments by managing flows delivered to the channels, then it is logical that such programs should be supplemented by management of the materials, forms, and uses of the downstream riparian corridor. Any proposal for steam alteration or management should be investigated for its potential flow and stability effects on upstream, downstream, and laterally adjacent areas. The timing and rate of flow from various tributaries can combine in complex ways to alter flood hazards. Each section of channel is unique, influenced by its own distribution of roughness elements, management activities, and stream responses.

Flexibility to adapt to stream features and behaviors as they evolve must be included in stream reclamation planning. The amenity and ecology of streams may be enhanced through the landscape design options of 1) corridor reservation, 2) bank treatment, 3) geomorphic restoration, and 4) grade control.

Corridor reservation - Reserving stream corridors and valleys to accommodate natural stream meandering, aggradation, degradation, and over bank flows allows streams to find their own form and generate less ongoing erosion. In California, open stream corridors in recent urban developments have produced recreational open space, irrigation of streamside plantings, and the aesthetic amenity of flowing water.

Bank treatment - The use of armoring, vegetative cover, and flow deflection may be used to influence a channel's form, stability, and biotic habitat. To prevent bank erosion, armoring can be done with rigid construction materials, such as concrete, masonry, wood planks and logs, riprap, and gabions. Concrete linings have been criticized because of their lack of provision of biotic habitat. In contrast, riprap and gabions make relatively porous and flexible linings. Boulders, placed in the bed reduce velocity and erosive power.

Riparian vegetation can stabilize the banks of streams that are at or near a condition of equilibrium. Binding networks of roots increase bank shear strength. During flood flows, resilient vegetation is forced into erosion-inhibiting mats. The roughness of vegetation leads to lower velocity, further reducing erosive effects. Structural flow deflection can protect banks from erosion or alter fish habitat. By concentrating flow, a deflector causes a pool to be scoured in the bed.

Geomorphic restoration – Restoration refers to alteration of disturbed streams so their form and behavior emulate those of undisturbed streams. Natural meanders are retained, with grading to gentle slopes on the inside of curves to allow point bars and riffle-pool sequences to develop. Trees are retained to provide scenic quality, biotic productivity, and roots for bank stabilization, supplemented by plantings where necessary.

A restorative approach can be successful where the stream is already approaching equilibrium. However, if upstream urbanization continues new flow regimes will be generated that could disrupt the equilibrium of the treated system.

Grade Control - A grade control structure is a level shelf of a permanent material, such as stone, masonry, or concrete, over which stream water flows. A grade control structure is called a sill, weir, or drop structure, depending on the relation of its invert elevation to upstream and downstream channels.

A sill is installed at the preexisting channel bed elevation to prevent upstream migration of nick points. It establishes a firm base level below which the upstream channel can not erode.

A weir or check dam is installed with invert above the preexisting bed elevation. A weir raises the local base level of the stream and causes aggradation upstream. The gradient, velocity, and erosive potential of the stream channel are reduced. A drop structure lowers the downstream invert below its preexisting elevation, reducing downstream gradient and velocity. Weirs and drop structure control erosion by dissipating energy and reducing slope velocity.

When carefully applied, grade control structures can be highly versatile in establishing human and environmental benefits in stabilized channels. To be successful, application of grade control structures should be guided by analysis of the stream system both upstream and downstream from the area to he reclaimed.

Examples

The California Department of Water Resources began the Urban Stream Restoration Program in 1985. The program provides grant funds to municipalities and community groups to implement stream restoration projects. The projects reduce damages from streambank aid watershed instability arid floods while restoring streams' aesthetic, recreational, and fish and wildlife values.

In Buena Vista Park, upper floodway slopes are gentle and grassed to achieve continuity of usable park land across the channel of small boulders at the base of the slopes.

The San Diego River is a large, vegetative lined channel, which was planted in a variety of species to support riparian wildlife while stabilizing the steep banks of the floodway.

References and Resources

Ferguson, B.K. 1991. Urban Stream Reclamation, p. 324-322, Journal of Soil and Water Conservation.

Los Angeles County Stormwater Quality. Public Agency Activities Model Program. On-line: http://ladpw.org/wmd/npdes/public_TC.cfm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Orange County Stormwater Program
http://www.ocwatersheds.com/StormWater/swp_introduction.asp

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP) Municipal Activities Model Program Guidance. 2001. Project Clean Water. November.

United States Environmental Protection Agency (USEPA). 1999. Stormwater Management Fact Sheet Non-stormwater Discharges to Storm Sewers. EPA 832-F-99-022. Office of Water, Washington, D.C. September.

United States Environmental Protection Agency (USEPA). 1999. Stormwater O&M Fact Sheet Catch Basin Cleaning. EPA 832-F-99-011. Office of Water, Washington, D.C. September.

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Illegal Dumping Control. On line: http://www.epa.gov/npdes/menuofbmps/poll_7.htm

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Storm Drain System Cleaning. On line: http://www.epa.gov/npdes/menuofbmps/poll_16.htm

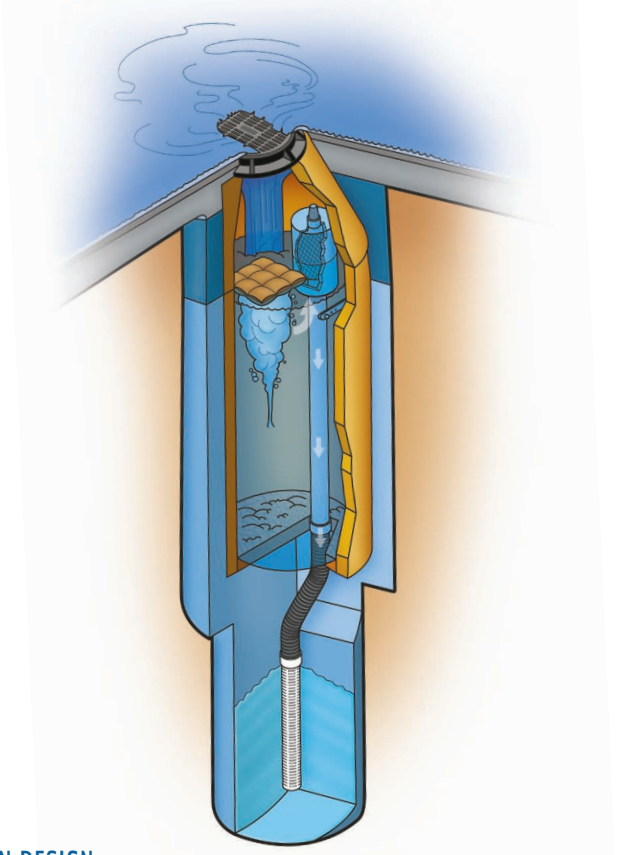
Attachment G – Maxwell Dry Well Reference Information

MaxWell® IV DRAINAGE SYSTEM

Product Information and Design Features

TORRENT® RESOURCES

The ***MaxWell® IV,*** as manufactured and installed exclusively by Torrent Resources Incorporated, is the industry standard for draining landscaped developments and paved areas. This patented system incorporates the latest refinements in pre-treatment technology.



PROVEN DESIGN

Since 1974, nearly 65,000 MaxWell® Systems have proven their value as a cost-effective solution in a wide variety of drainage applications. They are accepted by state and municipal agencies and are a standard detail in numerous drainage manuals.

ADVANCED PRE-TREATMENT

Industry research, together with Torrent Resources' own experience, have shown that initial storm drainage flows have the greatest impact on system performance. This "first flush" occurs during the first few minutes of runoff, and carries the majority of sediment and debris. This results in the need for effective processing of runoff from landscaped and paved surfaces. In the ***MaxWell® IV,*** preliminary treatment is provided through collection and separation in a deep, large-volume chamber where silt and other heavy particles settle to the bottom. The standard MaxWell IV System has over 1,500 gallons of capacity to contain sediment and debris carried by incoming water. Floating trash, paper, pavement oil, etc. are effectively stopped by the **PureFlo®** Debris Shield on top of the overflow pipe. Water is drained from the system by rising up to the top of the overflow pipe and under the Debris Shield. The solid metal shields are equipped with an internal screen to filter suspended matter and are vented to prevent siphoning of floating surface debris. The drainage assembly returns the cleaned water into the surrounding soil through the **FloFast®** Drainage Screen.

ABSORBENT TECHNOLOGY

The MaxWell IV settling chamber is equipped with an absorbent sponge to provide prompt removal of pavement oils. These floating pillow-like devices are 100% water repellent and literally wick petrochemical compounds from the water. Each sponge has a capacity of up to 128 ounces to accommodate effective, long-term treatment. The absorbent is completely inert and will safely remove runoff constituents down to rainbow sheens that are typically no more than one molecule thick.

SECURITY FEATURES

MaxWell IV Systems include bolted, theft-deterrent, cast iron gratings and covers as standard security features. Special inset castings that are resistant to loosening from accidental impact are available for use in landscaped applications. Machined mating surfaces and "Storm Water Only" wording are standard.

THE MAXWELL FIVE-YEAR WARRANTY

Innovative engineering, quality materials and exacting construction are standard with every MaxWell System designed, manufactured and installed by Torrent Resources Incorporated. The MaxWell Drainage System Warranty is the best in the industry and guarantees against failures due to workmanship or materials for a period of five years from date of completion.

Manufactured and Installed Exclusively by Torrent Resources Incorporated

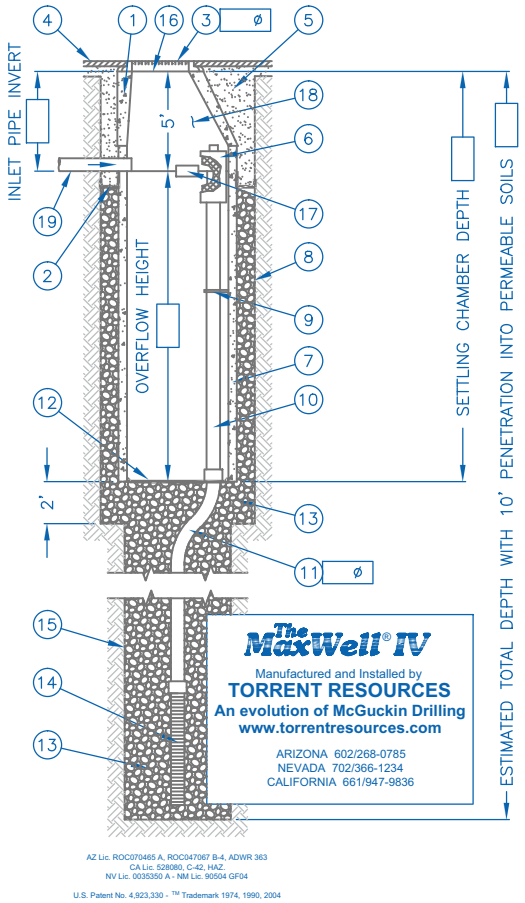
Please see reverse side for additional information

U.S. Patent No. 4,923,330

MAXWELL® IV DRAINAGE SYSTEM DETAIL AND SPECIFICATIONS

ITEM NUMBERS

1. **Manhole Cone** - Modified Flat Bottom.
2. **Moisture Membrane** - 6 Mil. Plastic. Applies only when native material is used for backfill. Place membrane securely against eccentric cone and hole sidewall.
3. **Bolted Ring & Grate** - Diameter as shown. Clean cast iron with wording **"Storm Water Only"** in raised letters. **Bolted in 2 locations** and secured to cone with mortar. Rim elevation ±0.02' of plans.
4. **Graded Basin or Paving** (by Others).
5. **Compacted Base Material** - 1-Sack Slurry except in landscaped installtions with no pipe connections.
6. **PureFlo® Debris Shield** - Rolled 16 ga. steel X 24" length with vented anti-siphon and Internal .265" Max. SWO flattened expanded steel screen X 12" length. **Fusion bonded epoxy coated.**
7. **Pre-cast Liner** - 4000 PSI concrete 48" ID. X 54" OD. **Center in hole** and align sections **to maximize bearing surface.**
8. **Min. 6' Ø Drilled Shaft.**
9. **Support Bracket** - Formed 12 Ga. steel. **Fusion bonded epoxy coated.**
10. **Overflow Pipe** - Sch. 40 PVC mated to drainage pipe at base seal.
11. **Drainage Pipe** - ADS highway grade with TRI-A coupler. **Suspend pipe** during backfill operations to prevent buckling or breakage. Diameter as noted.
12. **Base Seal** - Geotextile or concrete slurry.
13. **Rock** - Washed, sized between 3/8" and 1-1/2" to **best complement soil conditions.**
14. **FloFast® Drainage Screen** - Sch. 40 PVC 0.120" slotted well screen with 32 slots per row/ft.Diameter varies 120" overall length with TRI-B coupler.
15. **Min. 4' Ø Shaft** - Drilled to **maintain permeability** of drainage soils.
16. **Fabric Seal** - U.V. resistant geotextile - **to be removed by customer** at project completion.
17. **Absorbent** – Hydrophobic Petrochemical Sponge. Min. to 128 oz. capacity.
18. **Freeboard Depth** Varies with inlet pipe elevation. Increase settling chamber depth as needed to maintain all inlet pipe elevations above overflow pipe inlet.
19. **Optional Inlet Pipe** (Maximum 4", by Others). Extend moisture membrane and compacted base material or 1 sack slurry backfill below pipe invert.



AZ Lic. ROC070465 A, ROC047067 B-4, ADWR 363
CA Lic. 528080, C-42, HAZ.
NV Lic. 0035350 A - NM Lic. 90504 GF04

U.S. Patent No. 4,923,330 - ™ Trademark 1974, 1990, 2004

The referenced drawing and specifications are available on CAD either through our office or web site. This detail is copyrighted (2004) but may be used as is in construction plans without further release. For information on product application, individual project specifications or site evaluation, contact our Design Staff for no-charge assistance in any phase of your planning.

CALCULATING MAXWELL IV REQUIREMENTS

The type of property, soil permeability, rainfall intensity and local drainage ordinances determine the number and design of MaxWell Systems. For general applications draining retained stormwater, use one standard **MaxWell IV** per the instructions below for up to 3 acres of landscaped contributory area, and up to 1 acre of paved surface. For larger paved surfaces, subdivision drainage, nuisance water drainage, connecting pipes larger than 4" Ø from catch basins or underground storage, or other demanding applications, refer to our **MaxWell® Plus** System. For industrial drainage, including gasoline service stations, our **Envibro® System** may be recommended. For additional considerations, please refer to **"Design Suggestions For Retention And Drainage Systems"** or consult our Design Staff.

COMPLETING THE MAXWELL IV DRAWING

To apply the **MaxWell IV** drawing to your specific project, simply fill in the blue boxes per instructions below. For assistance, please consult our Design Staff.

' ESTIMATED TOTAL DEPTH

The Estimated Total Depth is the approximate depth required to achieve 10 continuous feet of penetration into permeable soils. Torrent utilizes specialized **"crowd"** equipped drill rigs to penetrate difficult, cemented soils and to reach permeable materials at depths up to **180 feet.** Our extensive database of drilling logs and soils information is available for use as a reference. Please contact our Design Staff for site-specific information on your project.

' SETTLING CHAMBER DEPTH

On MaxWell IV Systems of over 30 feet overall depth and up to 0.25cfs design rate, the **standard** Settling Chamber Depth is **18 feet.** For systems exposed to greater contributory area than noted above, extreme service conditions, or that require higher design rates, chamber depths up to 25 feet are recommended.

' OVERFLOW HEIGHT

The Overflow Height and Settling Chamber Depth determine the effectiveness of the settling process. The higher the overflow pipe, the deeper the chamber, the greater the settling capacity. For normal drainage applications, an overflow height of **13 feet** is used with the standard settling chamber depth of **18 feet**. Sites with higher design rates than noted above, heavy debris loading or unusual service conditions require greater settling capacities

"Ø DRAINAGE PIPE

This dimension also applies to the **PureFlo®** Debris Shield, the **FloFast®** Drainage Screen, and fittings. The size selected is based upon system design rates, soil conditions, and the need for adequate venting. Choices are 6", 8", or 12" diameter. Refer to "Design Suggestions for Retention and Drainage Systems" for recommendations on which size best matches your application.

"Ø BOLTED RING & GRATE

Standard models are quality cast iron and available to fit 24" Ø or 30" Ø manhole openings. All units are bolted in two locations with wording "Storm Water Only" in raised letters. For other surface treatments, please refer to "Design Suggestions for Retention and Drainage Systems."

"Ø INLET PIPE INVERT

Pipes up to 4" in diameter from catch basins, underground storage, etc. may be connected into the settling chamber. Inverts deeper than 5 feet will require additional settling chamber depth to maintain effective overflow height.

TORRENT RESOURCES INCORPORATED
1509 East Elwood Street, Phoenix Arizona 85040~1391
phone 602~268~0785 fax 602~268~0820
Nevada 702~366~1234
AZ Lic. ROC070465 A, ROC047067 B-4; ADWR 363
CA Lic. 528080 A, C-42, HAZ ~ NV Lic. 0035350 A ~ NM Lic. 90504 GF04

TORRENT RESOURCES (CA) INCORPORATED
phone 661~947~9836
CA Lic. 886759 A, C-42
www.TorrentResources.com
An evolution of McGuckin Drilling

The watermark for drainage solutions.®

TORRENT® RESOURCES

NOT THE NEW WATER FEATURE YOU HAD IN MIND FOR YOUR PROPERTY?

TORRENT RESOURCES

Drywells • Storm Drains • Catch Basins • Culverts • Headwalls • Underground Storage Tanks • Jet-Rod

SERVICE + MAINTENANCE

TORRENT RESOURCES STORMWATER SOLUTIONS

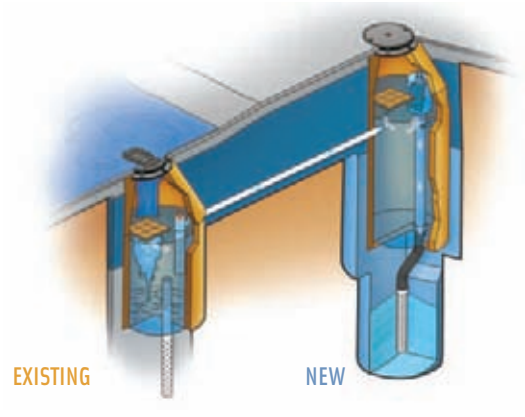
The Need for Maintenance

Like any other part of your infrastructure, drywells and other storm drain components need periodic maintenance to function at optimum levels. Over time, silt, sediment and debris build up in the system and reduce the drainage capability. This leads to water standing for periods of time longer than the state requirement. It also inconveniences customers at retail locations and residential areas. With Arizona leading the nation in cases of West Nile Virus and other diseases carried by mosquitoes, standing water is a particular concern. A lack of maintenance can eventually lead to costly repair to the system as well as the basins and parking lots in which they inhabit.

The Cleaning Process

The process starts with a thorough inspection of the drywells and other storm drain components. If the systems need to be serviced, it is imperative they are cleaned by someone familiar with the interworking of a drywell and compliant with the strict regulations of the ADEQ. The highly qualified Torrent Resources team offers:

• Certified Confined Space Entry • Disposal at an Approved Facility • Top of Line Equipment • Licensed, Bonded and Insured



Drywell Restoration

If your property has a non-functioning drywell, Torrent Resources has a solution. By adding a new drywell to your existing system, we effectively convert the single chamber drywell into a new state-of-the-art MaxWell® Plus system (shown in the illustration to the left).

The existing structure remains to receive water and trap additional debris while directing the treated flow to the new drywell. This retrofit makes the entire system far superior to the original design.

Industry Leader

As the Valley's #1 drywell contractor with over 65,000 systems installed, Torrent Resources has defined drywell design, installation, service and maintenance. Our drainage systems are specified by most Civil Engineers and Municipalities in the Southwest. With the largest, state-of-the-art equipment in the market, experienced construction crews and professional field supervisors, we are your experts when it comes to drainage solutions.

SERVICE AND MAINTENANCE IS ONE EASY CALL OR CLICK AWAY

TORRENT RESOURCES 40 YEARS

Torrent Resources Incorporated

1509 E. Elwood Street Phoenix, Arizona 85040

Phone: 602-268-0785 • Fax: 602-268-0820

www.cleanmydrywell.com

ROC070465A • ROC047067B-4 • ADWR 363

www.CleanMyDrywell.com

SCHEDULE YOUR FREE INITIAL DRAINAGE SITE REVIEW TODAY.