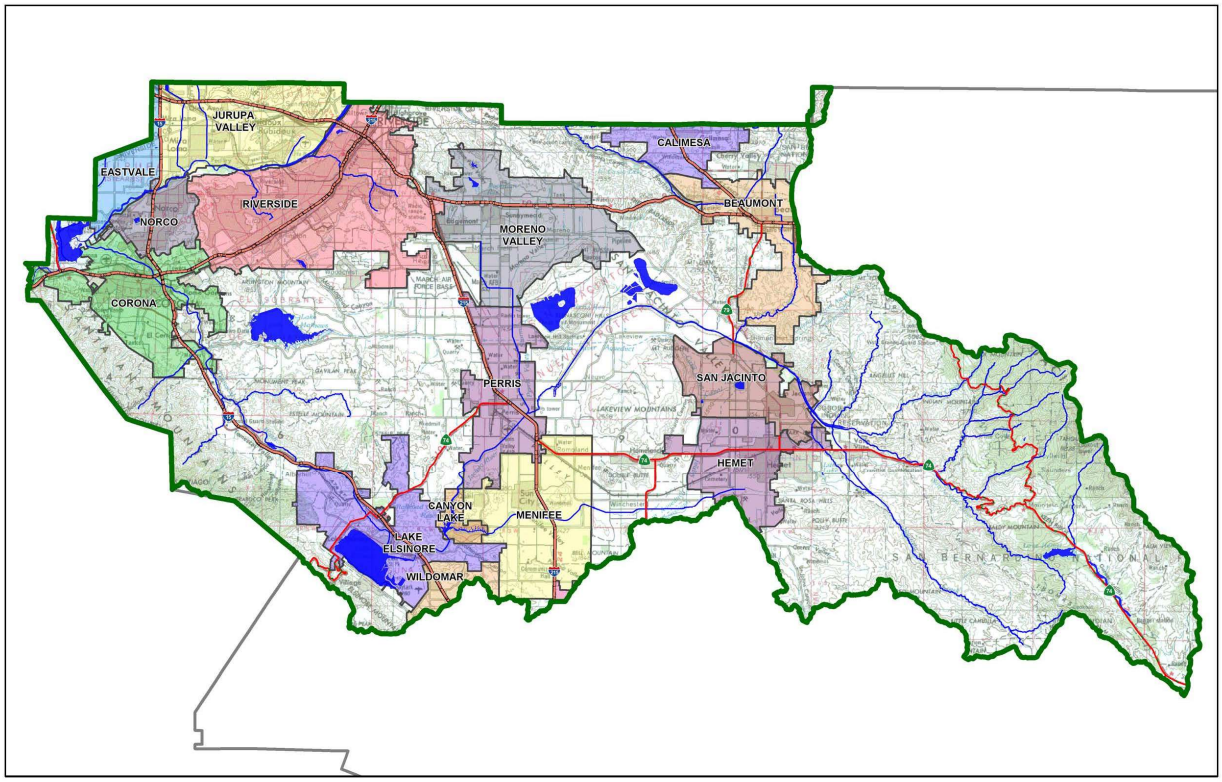
Project Specific Water Quality Management Plan

*A Template for Projects located within the **Santa Ana Watershed** Region of Riverside County*

Project Title: TPM 37859

Public Works No:

Design Review/Case No:



☒ **Preliminary**
☐ **Final**

Original Date Prepared: January, 2024

Revision Date(s): _

Prepared for Compliance with
Regional Board Order No. **R8-2010-0033**

Contact Information:

Prepared for: Steven Walker
Communities
7111 Indiana Ave.
Riverside, CA 92504

Prepared by:
Woodard Group
1485 Spruce St. Ste. "M"
Riverside, CA 92507
(951) 907-5077
Attn: Andrew C. Woodard, PE

OWNER'S CERTIFICATION

This Project-Specific Water Quality Management Plan (WQMP) has been prepared for Steven Walker Communities by **Woodard Group** for the TTM37859 project.

This WQMP is intended to comply with the requirements of the County of Riverside for the subdivision of 10 acres in the Highgrove community in the County of Riverside, Planning Case No. _____ which includes the requirement for the preparation and implementation of a Project-Specific WQMP.

The undersigned, while owning the property/project described in the preceding paragraph, shall be responsible for the implementation and funding of this WQMP and will ensure that this WQMP is amended as appropriate to reflect up-to-date conditions on the site. In addition, the property owner accepts responsibility for interim operation and maintenance of Stormwater BMPs until such time as this responsibility is formally transferred to a subsequent owner. This WQMP will be reviewed with the facility operator, facility supervisors, employees, tenants, maintenance and service contractors, or any other party (or parties) having responsibility for implementing portions of this WQMP. At least one copy of this WQMP will be maintained at the project site or project office in perpetuity. The undersigned is authorized to certify and to approve implementation of this WQMP. The undersigned is aware that implementation of this WQMP is enforceable under the City of Riverside Water Quality Ordinance (Municipal Code Section 14.12.315).

"I, the undersigned, certify under penalty of law that the provisions of this WQMP have been reviewed and accepted and that the WQMP will be transferred to future successors in interest."

Owner's Signature	Date
Steve Berzansky	Owner
Owner's Printed Name	Owner's Title/Position

PREPARER'S CERTIFICATION

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan meet the requirements of Regional Water Quality Control Board Order No. **R8-2010-0033** and any subsequent amendments thereto."

Preparer's Signature	Date
Andrew C. Woodard, PE	Principal
Preparer's Printed Name	Preparer's Title/Position

Preparer's Licensure:

Table of Contents

List of Tables

List of Appendices

Section A: Project and Site Information

TTM37743 is the proposed subdivision of 10 acres in the community of Highgrove, County of Riverside. The project proposes 72 residential development lots that include open space area, private streets, recreational structure and two (2) bioretention's.

PROJECT INFORMATION		
Type of Project:	Residential	
Planning Area:	Community of Highgrove, County of Riverside	
Community Name:	Highgrove	
Development Name:	TTM37859	
PROJECT LOCATION		
Latitude & Longitude (DMS): 34°0'59.22"N, 117°18'44.58"W		
Project Watershed and Sub-Watershed: Santa Ana; Santa Ana River, Reach 3		
APN(s): 255-150-001		
Map Book and Page No.: MB 8, Page 66		
PROJECT CHARACTERISTICS		
Proposed or Potential Land Use(s)	SFR	
Proposed or Potential SIC Code(s)	1521	
Area of Impervious Project Footprint (SF)	216,118	
Total Area of proposed Impervious Surfaces within the Project Limits (SF)/or Replacement	216,118	
Does the project consist of offsite road improvements?	☒ Y	☐ N
Does the project propose to construct unpaved roads?	☐ Y	☒ N
Is the project part of a larger common plan of development (phased project)?	☐ Y	☒ N
EXISTING SITE CHARACTERISTICS		
Total area of existing Impervious Surfaces within the project limits (SF)	0	
Is the project located within any MSHCP Criteria Cell?	☐ Y	☒ N
If so, identify the Cell number:	NA	
Are there any natural hydrologic features on the project site?	☐ Y	☒ N
Is a Geotechnical Report attached?	☒ Y	☐ N
If no Geotech. Report, list the NRCS soils type(s) present on the site (A, B, C and/or D)	NA	
What is the Water Quality Design Storm Depth for the project?	0.70	

A.1 Maps and Site Plans

Appendix 1 includes a map of the local vicinity and existing site. In addition, WQMP Site Plan, located in Appendix 1, includes the following:

- Drainage Management Areas
- Proposed Structural BMPs
- Drainage Path
- Drainage Infrastructure, Inlets, Overflows
- Source Control BMPs
- Buildings, Roof Lines, Downspouts
- Impervious Surfaces
- Standard Labeling

A.2 Receiving Waters

In order of upstream to downstream, the receiving waters that the project site is tributary to are as follows. A map of the receiving waters is included in Appendix 1.

Table A.1 Identification of Receiving Waters

Receiving Waters	Hydrologic Unit	EPA Approved 303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
Santa Ana River, Reach 3	801.21	Pathogens, Copper, Lead	AGR, GWR, REC1, REC2, WARM, WILD, RARE	2 miles

Note: Proximate receiving waters are identified in bold.

See Receiving Waters Diagram in Appendix 1

A.3 Additional Permits/Approvals required for the Project:

Table A.2 Other Applicable Permits

Agency	Permit Required	
State Department of Fish and Game, 1602 Streambed Alteration Agreement	☐ Y	☒ N
State Water Resources Control Board, Clean Water Act (CWA) Section 401 Water Quality Cert.	☐ Y	☒ N
US Army Corps of Engineers, CWA Section 404 Permit	☐ Y	☒ N
US Fish and Wildlife, Endangered Species Act Section 7 Biological Opinion	☐ Y	☒ N
Statewide Construction General Permit Coverage	☒ Y	☐ N
Statewide Industrial General Permit Coverage	☐ Y	☒ N
Western Riverside MSHCP Consistency Approval (e.g., JPR, DBESP)	☐ Y	☒ N
Other *(please list in the space below as required)*		
County of Riverside Conditional Use Permit	☐ Y	☒ N
County of Riverside Design Review	☒ Y	☐ N
County of Riverside Building Permit	☒ Y	☐ N
County of Riverside Grading Permit	☒ Y	☐ N
County of Riverside Construction Permit	☒ Y	☐ N

Section B: Optimize Site Utilization (LID Principles)

Does the project identify and preserve existing drainage patterns? If so, how? If not, why?

Yes, the site generally drains from the east to the west, and the proposed drainage pattern will match the existing drainage pattern and connect via on-site storm drain to the existing 42" municipally maintained storm drain system.

Does the project identify and protect existing vegetation? If so, how? If not, why?

No, there is no existing vegetation on-site. Landscaping is proposed per County of Riverside standards.

Does the project identify and preserve natural infiltration capacity? If so, how? If not, why?

Yes, the existing site infiltrates using the natural infiltration capacity of the existing topsoil. Roof runoff will be directed into vegetated swales which will drain into bioretention.

Does the project identify and minimize impervious area? If so, how? If not, why?

Yes, the proposed houses will be set as close to the street as possible to reduce the footprint of the driveways. The roofs and driveways are the only proposed impervious surfaces. The rest of the area on each lot will be proposed vegetation.

Does the project identify and disperse runoff to adjacent pervious areas? If so, how? If not, why?

Yes, roof runoff will be directed into vegetated swales which will drain into the curb and gutter and then to a bioretention. Only overflow from the bioretention will be collected in on-site storm drain system that will connect to the municipally maintained storm drain system.

Section C: Delineate Drainage Management Areas (DMAs)

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s)	Area (Sq. Ft.)	DMA Type
1	Mixed Surface – SFR 60% Impervious	223349	D
2	Mixed Surface – SFR 60% Impervious	48362	D

Table C.2 Type 'D', Areas Draining to BMPs

DMA Name or ID	BMP Name or ID
1	Bioretention - 1
2	Bioretention - 2

Section D: Implement LID BMPs

D.1 Infiltration Applicability

Is there an approved downstream 'Highest and Best Use' for stormwater runoff (ref: Chapter 2.4.4 of the WQMP Guidance Document)? ☐ Y ☒ N

Geotechnical Report

A Geotechnical Report is required by the City of Riverside to confirm present and past site characteristics that may affect the use of Infiltration BMPs, see Appendix 3.

Is this project classified as a small project consistent with the requirements of Chapter 2 of the WQMP Guidance Document? ☐ Y ☒ N

Infiltration Feasibility

Table D.1 Infiltration Feasibility

Does the project site…	YES	NO
…have any DMAs with a seasonal high groundwater mark shallower than 10 feet?		X
If Yes, list affected DMAs:		
…have any DMAs located within 100 feet of a water supply well?		X
If Yes, list affected DMAs:		
…have any areas identified by the geotechnical report as posing a public safety risk where infiltration of stormwater could have a negative impact?		X
If Yes, list affected DMAs:		
…have measured in-situ infiltration rates of less than 1.6 inches / hour?		X
If Yes, list affected DMAs:		
…have significant cut and/or fill conditions that would preclude in-situ testing of infiltration rates at the final infiltration surface?		X
If Yes, list affected DMAs:		
…geotechnical report identify other site-specific factors that would preclude effective and safe infiltration?		X
Describe here:		

D.2 Harvest and Use Assessment

The following conditions apply*:*

☐ Reclaimed water will be used for the non-potable water demands for the project.

☐ Downstream water rights may be impacted by Harvest and Use as approved by the Regional Board (verified with the City of Riverside).

☐ The Design Capture Volume will be addressed using Infiltration Only BMPs. (Harvest and Use BMPs are still encouraged, but are not required as the Design Capture Volume will be infiltrated or evapotranspired).

☒ None of the above.

Harvest and Use BMPs need NOT be assessed for the site.

D.3 Bioretention and Biotreatment Assessment

Other LID Bioretention and Biotreatment BMPs as described in Chapter 2.4.7 of the WQMP Guidance Document are feasible on nearly all development sites with sufficient advance planning.

For the project, the following applies:

☒ LID Bioretention/Biotreatment BMPs will be used for some or all DMAs of the project as noted below in Section D.4

☐ A site-specific analysis demonstrating the technical infeasibility of all LID BMPs has been performed and is included in Appendix 5.

☒ None of the above.

D.4 Feasibility Assessment Summaries

Table D.2 LID Prioritization Summary Matrix

DMA Name/ID	LID BMP Hierarchy				No LID (Alternative Compliance)
	1. Infiltration	2. Harvest and use	3. Bioretention	4. Biotreatment	
DMA-1	☐	☐	☒	☐	☐
DMA-2	☐	☐	☒	☐	☐

D.5 LID BMP Sizing

Table D.3 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Bioretention – 1*		
	[A]		[B]	[C]	[A] x [C]			
1	*223,349*	*Mixed*	*0.6*	*0.41*	*91,333.7*	*Design Storm Depth (in)*	*Design Capture Volume,* $\mathbf{V_{BMP}}$ *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
	$A_T = \Sigma[A]$				$\Sigma = [D]$	[E]	$[F] = \frac{[D]x[E]}{12}$	[G]
	223,349				91,333.7	0.70	5,343	5,671

[B], [C] are obtained from Section 2.3.1 of the WQMP Guidance Document
[E] is obtained from Exhibit A of the WQMP Guidance Document
[G] is obtained from LID BMP design procedure sheet, placed in Appendix 6

Table D.4 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Bioretention - 2*		
	[A]		[B]	[C]	[A] x [C]			
2	*136,848*	*Mixed*	*0.6*	*0.41*	*55,961*	*Design Storm Depth (in)*	*Design Capture Volume,* $\mathbf{V_{BMP}}$ *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
	$A_T = \Sigma[A]$				$\Sigma = [D]$	[E]	$[F] = \frac{[D]x[E]}{12}$	[G]
	136,848				55,961	0.70	3,274	3,375

[B], [C] are obtained from Section 2.3.1 of the WQMP Guidance Document
[E] is obtained from Exhibit A of the WQMP Guidance Document
[G] is obtained from LID BMP design procedure sheet, placed in Appendix 6

Section E: Alternative Compliance (LID Waiver Program)

LID BMPs are expected to be feasible on virtually all projects. Where LID BMPs have been demonstrated to be infeasible as documented in Section D, other Treatment Control BMPs must be used (subject to confirmation of LID waiver approval by the Regional Board). For the project, the following applies:

☒ LID Principles and LID BMPs have been incorporated into the site design to fully address all Drainage Management Areas. No alternative compliance measures are required for this project and thus this Section is not required to be completed.

- *Or* -

☐ The following Drainage Management Areas are unable to be addressed using LID BMPs. A site-specific analysis demonstrating technical infeasibility of LID BMPs has been approved by the Regional Board and included in Appendix 5. Additionally, no downstream regional and/or sub-regional LID BMPs exist or are available for use by the project. The alternative compliance measures on the following pages are being implemented to ensure that any pollutant loads expected to be discharged by not incorporating LID BMPs, are fully mitigated.

Section F: Hydromodification

F.1 Hydrologic Conditions of Concern (HCOC) Analysis

The project DOES NOT create a Hydrologic Condition of Concern, MEETING the criteria for HCOC Exemption as shown below:

HCOC EXEMPTION 1: The Priority Development Project disturbs less than one acre. The Copermittee has the discretion to require a Project-Specific WQMP to address HCOCs on projects less than one acre on a case by case basis. The disturbed area calculation should include all disturbances associated with larger common plans of development.

Does the project qualify for this HCOC Exemption? ☐ Y ☒ N

HCOC EXEMPTION 2: The volume and time of concentration[1] of storm water runoff for the post-development condition is not significantly different from the pre-development condition for a 2-year return frequency storm (a difference of 5% or less is considered insignificant) using one of the following methods to calculate:

- Riverside County Hydrology Manual
- Technical Release 55 (TR-55): Urban Hydrology for Small Watersheds (NRCS 1986), or derivatives thereof, such as the Santa Barbara Urban Hydrograph Method
- Other methods acceptable to the Co-Permittee

Does the project qualify for this HCOC Exemption? ☐ Y ☐ N

Results included in Table F.1 below and hydrologic analysis included in Appendix 7.

Table F.1 Hydrologic Conditions of Concern Summary

	2 year – 24 hour		
	Pre-condition	**Post-condition**	**% Difference**
Time of Concentration	15.5	13.4	14.5%
Flow (CFS)	4.78	5.41*	-12.4%
Volume (Cubic Feet)	24,731	26,349-9,046** =17,303	-35.3%

[1] Time of concentration is defined as the time after the beginning of the rainfall when all portions of the drainage basin are contributing to flow at the outlet.

* mitigated flow. See mitigated post condition in Appendix 6.

** 9,046 = proposed volume of bioretention area.

HCOC EXEMPTION 3: All downstream conveyance channels to an adequate sump (Prado Dam, Santa Ana River) that will receive runoff from the project are engineered and regularly maintained to ensure design flow capacity; no sensitive stream habitat areas will be adversely affected; or are not identified on the Co-Permittees Hydromodification Sensitivity Maps.

Does the project qualify for this HCOC Exemption? ☐ Y ☒ N

F.2 HCOC Mitigation

As an alternative to the HCOC Exemption Criteria above, HCOC criteria is considered mitigated if the project meets one of the following conditions, as indicated:

☐ a. Additional LID BMPS are implemented onsite or offsite to mitigate potential erosion or habitat impacts as a result of HCOCs. This can be conducted by an evaluation of site-specific conditions utilizing accepted professional methodologies published by entities such as the California Stormwater Quality Association (CASQA), the Southern California Coastal Water Research Project (SCCRWP), or other Co-Permittee approved methodologies for site-specific HCOC analysis.

☐ b. The project is developed consistent with an approved Watershed Action Plan that addresses HCOC in Receiving Waters.

☐ c. Mimicking the pre-development hydrograph with the post-development hydrograph, for a 2-year return frequency storm. Generally, the hydrologic conditions of concern are not significant, if the post-development hydrograph is no more than 10% greater than pre-development hydrograph. In cases where excess volume cannot be infiltrated or captured and reused, discharge from the site must be limited to a flow rate no greater than 110% of the pre-development 2-year peak flow.

☒ d. None of the above.

Section G: Source Control BMPs

The following table identifies the potential sources of runoff pollutants for this project and specifies how they are addressed through permanent controls and operational BMPs:

Table G.1 Permanent and Operational Source Control Measures

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
On-site storm drain inlets	Mark all inlets with the words "Only Rain Down the Storm Drain" or similar.	Maintain and periodically repaint or replace inlet marking. Lease agreements shall include the following: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."
Landscape/Outdoor Pesticide Use	Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution.	Landscaping shall be maintained with minimum or no pesticides. Homeowners shall be provided the "Residential Development Packets" created by the Riverside County Flood Control District.
Roofing Gutters	Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.	N/A
Sidewalks and Driveways	N/A	Homeowners/Renters shall sweep sidewalks and driveways regularly.

Section H: Construction Plan Checklist

Table H.1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Plan Sheet Number(s)	Latitude / Longitude
1	DMA 1 Bioretention	CGP-1	34° 01'02"N, 117°18’48"W
2	DMA 2 Bioretention	CGP-1	34° 01'60"N, 117°18'44"W

Section I: Operation, Maintenance and Funding

As required by the City of Riverside, the following Operation, Maintenance and Funding details are provided as summarized:

1. A means to finance and implement facility maintenance in perpetuity, including replacement cost.
2. Acceptance of responsibility for maintenance from the time the BMPs are constructed until responsibility for operation and maintenance is legally transferred.
3. An outline of general maintenance requirements for the Stormwater BMPs selected.
4. Figures delineating and designating pervious and impervious areas, location, and type of Stormwater BMP, and tables of pervious and impervious areas served by each facility.
5. A separate list and location of self-retaining areas or areas addressed by LID Principles that do not require specialized O&M or inspections but will require typical landscape maintenance as noted in Chapter 5, pages 85-86, in the WQMP Guidance.

See Appendix 9 for a detailed Stormwater BMP Operation and Maintenance Plan that sets forth a maintenance schedule for each of the Stormwater BMPs built on site, and an agreement assigning responsibility for maintenance and providing for inspections and certification.

Maintenance Mechanism: **Covenant & Agreement**

Will the proposed BMPs be maintained by a Home Owners' Association (HOA) or Property Owners Association (POA)?

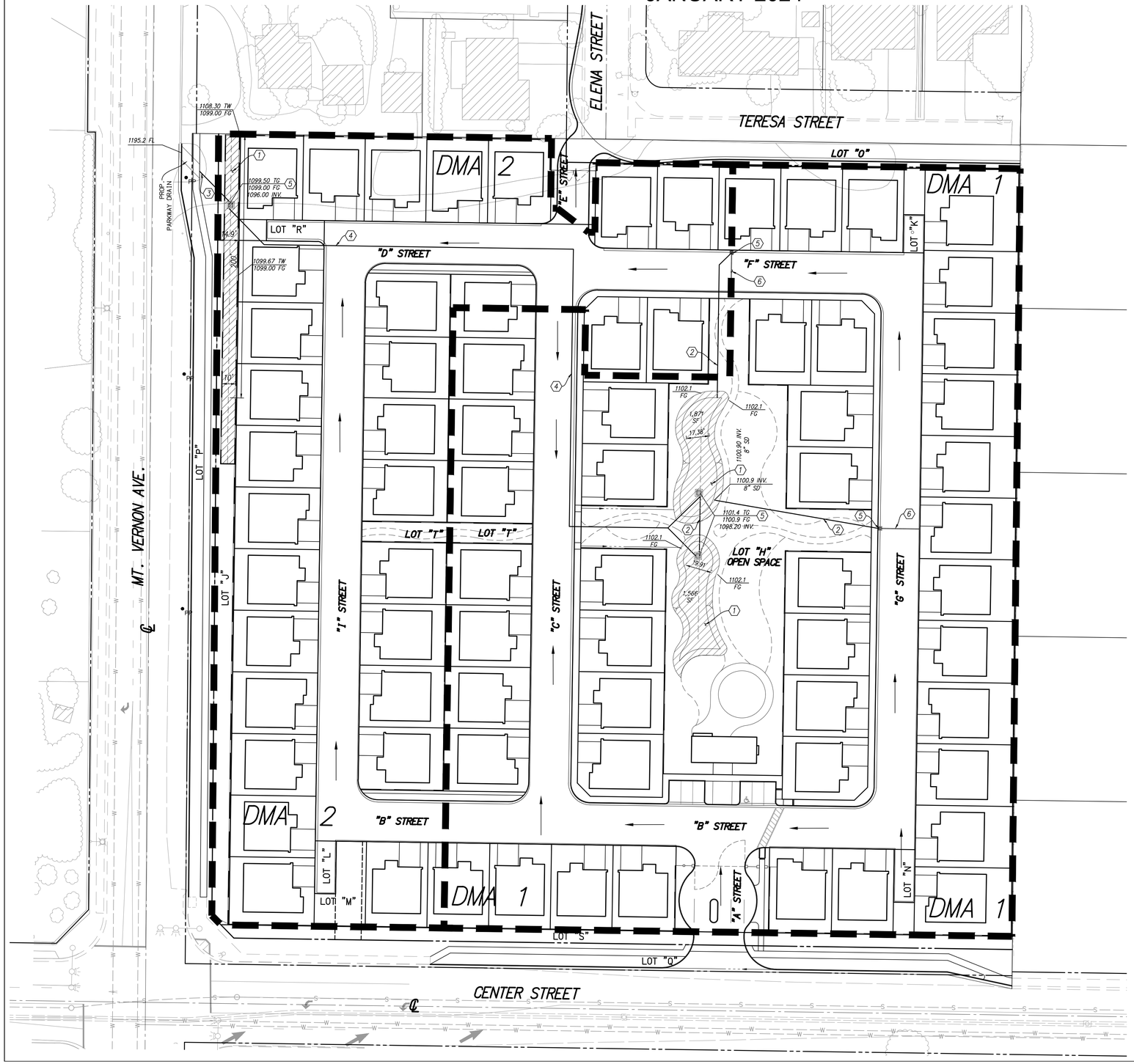
☒ Y ☐ N

Operation and Maintenance Plan and Maintenance Mechanism is included in Appendix 9. Educational materials for those personnel that will be maintaining the proposed BMPs within this Project-Specific WQMP are included in Appendix 10.

Appendix 1: Maps and Site Plans

Location Map, WQMP Site Plan and Receiving Waters Map

WQMP SITE PLAN
TPM 37859 AT MT. VERNON AVENUE
COUNTY OF RIVERSIDE
JANUARY 2024



LEGEND

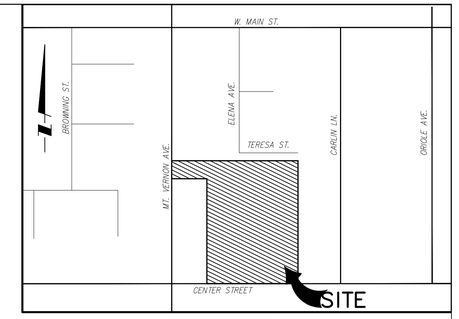
- EXISTING PROPERTY LINE
- PROPOSED RIGHT OF WAY
- EXISTING RIGHT OF WAY
- EXISTING CENTERLINE
- PROPOSED CURB
- EXISTING CURB
- PROPOSED SIDEWALK
- EXISTING SIDEWALK
- EXISTING DIRT ROAD
- PROPOSED PARKING STRIPE
- EXISTING EASEMENT
- EXISTING CONTOUR MAJOR
- EXISTING CONTOUR MINOR
- EXISTING FENCE
- EXISTING BUILDING
- EXISTING CONCRETE
- 12" SD — PROPOSED UNDERGROUND UTILITY
- 12" SD — EXISTING UNDERGROUND UTILITY
- EXISTING EDGE OF PAVEMENT
- PROPOSED EDGE OF PAVEMENT
- 915 — EXISTING CONTOUR ELEVATION
- ×901.5 — EXISTING SPOT ELEVATION

ABBREVIATIONS

R/W	RIGHT OF WAY	FG	FINISH GRADE
P/L	PROPERTY LINE	TG	TOP OF GRATE
EXIST.	EXISTING	INV.	INVERT
PROP.	PROPOSED	S.D.	STORM DRAIN
S.F.	SQUARE FEET	EG	EXISTING GROUND
D/W	DRIVEWAY	T.B.R.	TO BE REMOVED
S/W	SIDEWALK	P.I.P.	PROTECT IN PLACE
M.H.	MANHOLE	P.P.	POWER POLE
FS	FINISH SURFACE	F.H.	FIRE HYDRANT
TC	TOP OF CURB FLOW LINE	L/S	LANDSCAPE

BMP LEGEND

- PROPOSED AC PAVEMENT
- PROPOSED LANDSCAPE
- PROPOSED CONCRETE
- (1) PROPOSED LANDSCAPE BIORETENTION
- DIRECTION OF FLOW
- PROPOSED DRAINAGE MANAGEMENT AREA BOUNDARY
- (2) PROPOSED 8" STORM DRAIN PIPE
- (3) PROPOSED 12" STORM DRAIN PIPE
- (4) PROPOSED 18" STORM DRAIN PIPE
- (5) PROPOSED DRAIN INLET
- (6) PROPOSED TRENCH DRAIN



VICINITY MAP

SECTION 9, TOWNSHIP 2 SOUTH, RANGE 4 WEST
NOT TO SCALE

CIVIL ENGINEER

WOODARD GROUP
1485 SPRUCE ST. STE. SUITE "M"
RIVERSIDE, CA 92507
PH: (951) 907-5077

OWNER/APPLICANT

STEVEN WALKER COMMUNITIES
7111 INDIANA AVE. STE. 300
RIVERSIDE, CA 92504

SOILS ENGINEER & GEOLOGIST

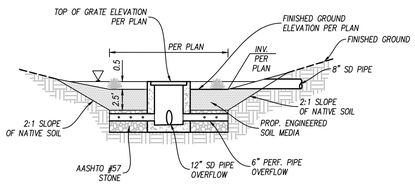
SOILS SOUTHWEST, INC.
897 VIA LATA, SUITE N
COLTON, CA 92324
PH: (909) 370-0474
FAX: (951) 688-5200

ARCHITECT

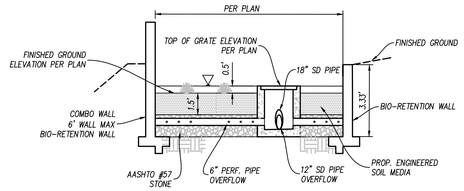
KTGY ARCHITECTURE + PLANNING
17911 VON KARMEN AVENUE,SUITE 200
IRVINE, CA 92614
PH: (949) 221-6209

LOT DRAINAGE MANAGEMENT AREAS

DMA ID	SURFACE TYPE	AREA (SQ. FT.)
1	MIXED 60% IMPERVIOUS	223,349
2	MIXED 60% IMPERVIOUS	136,848



BIORETENTION-1 (DMA 1)
NOT TO SCALE



BIORETENTION-2 (DMA 2)
NOT TO SCALE

40' 20' 0 40' 80'
GRAPHIC SCALE
SCALE: 1" = 40'

PREPARED BY:

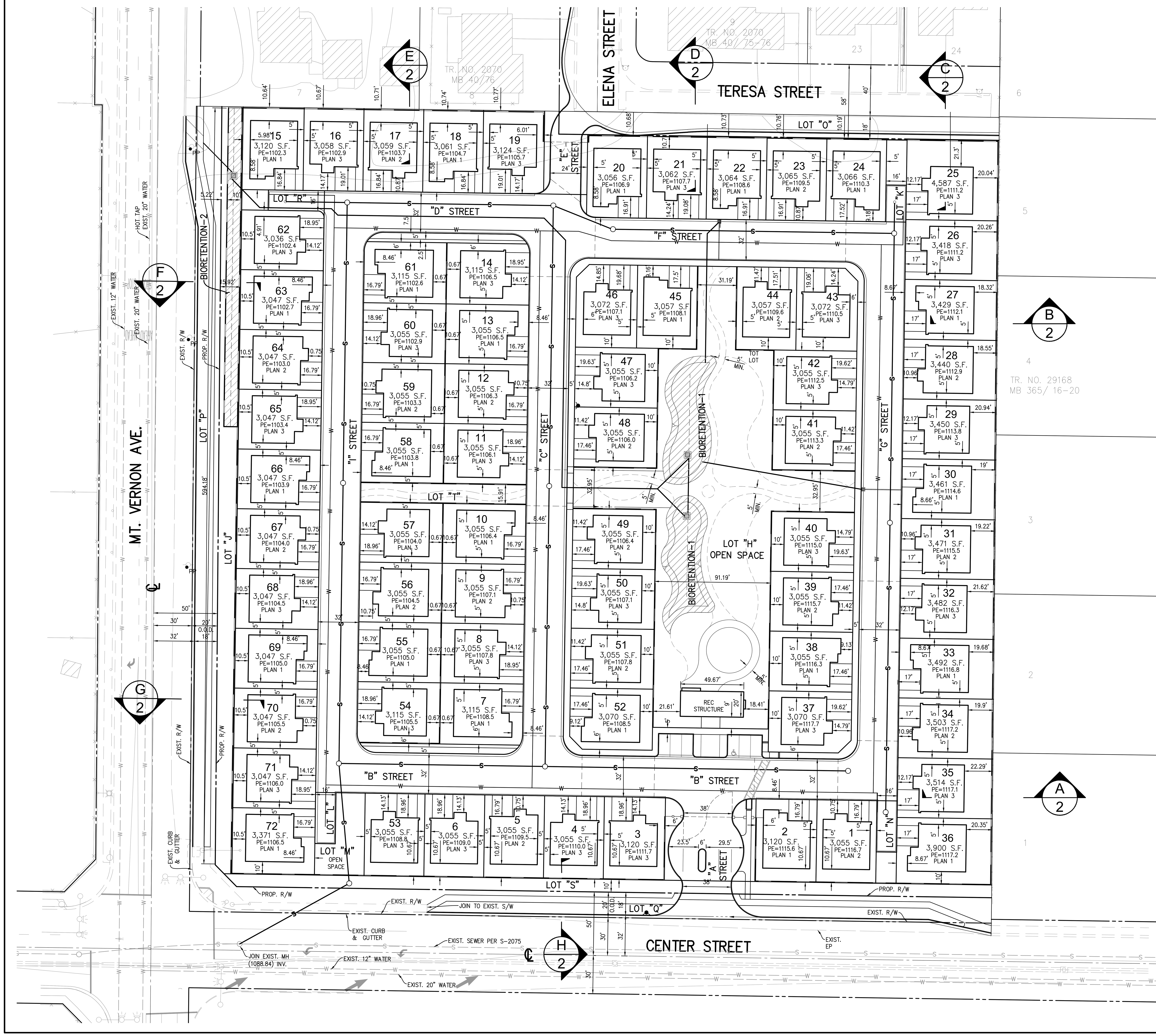
woodard group

COUNTY OF RIVERSIDE
TPM 37859 AT CENTER ST. AND MT. VERNON AVE.
WQMP SITE PLAN

Appendix 2: Construction Plans

Grading and Drainage Plans

RESIDENTIAL PLOT PLAN - PPT200017
PARCEL 1, TENTATIVE TRACT MAP 37743
APN: 255-150-001



CIVIL ENGINEER
WOODARD GROUP
ANDREW WOODARD
1485 SPRUCE ST., SUITE "M"
RIVERSIDE, CA 92507
PHONE: (951) 907-5077

OWNER/APPLICANT
STEVEN WALKER COMMUNITIES
7111 INDIANA AVE. STE. 300
RIVERSIDE, CA 92504

NOTE: THE SUBDIVISION MAP INCLUDES THE ENTIRE CONTIGUOUS OWNERSHIP OF THE LAND DIVIDER/APPLICANT.

SOILS ENGINEER & GEOLOGIST
ADVANCED GEOTECHNICAL SOLUTIONS, INC.
485 CORPORATE DRIVE, SUITE B,
ESCONDIDO, CA 92029
PH: (714) 786-5661
CONTACT: JOHN DONOVAN

ARCHITECTS
FOR RESIDENTIAL:
KTGY ARCHITECTURE + PLANNING
17911 VON KARMEN AVENUE, SUITE 200
IRVINE, CA 92614
PH: (949) 221-6209

TOPOGRAPHY SOURCE
INLAND AERIAL SURVEY, INC.
7117 ARLINGTON AVENUE
RIVERSIDE, CA 92503
PH: (951) 687-4252
FAX: (951) 687-4120

LEGAL DESCRIPTION
THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 9; TOWNSHIP 2 SOUTH, RANGE 4 WEST, SBM, RECORDS OF RIVERSIDE COUNTY.

ZONING/LAND USE
EXISTING ZONING: .... R-1 - ONE-FAMILY DWELLINGS
EXISTING LAND USE: .... CD:MDR - COMM. DEVELOPMENT MED. DENS. RESIDENTIAL
PROPOSED ZONING: .... SAME NO CHANGE
PROPOSED LAND USE: .... CD:HDR - HIGH DENSITY. RESIDENTIAL

ASSESSOR PARCEL NO

BOOK	PAGE	PARCELS
255	150	001

PROJECT SUMMARY
APN:255-150-001 .... 9.17 ACRES ; 399,261 S.F.
LOTS 1-72 .... 5.22 ACRES ; 227,290 S.F.
STREET "A" .... 0.11 ACRES ; 4,627 S.F.
STREET "B" .... 0.44 ACRES ; 18,976 S.F.
STREET "C" .... 0..33 ACRES ; 14,209 S.F.
STREET "D" .... 0.15 ACRES ; 6,320 S.F.
STREET "E" .... 0.04 ACRES ; 1,813 S.F.
STREET "F" .... 0.27 ACRES ; 11,803 S.F.
STREET "G" .... 0.33 ACRES ; 14,197 S.F.
LOT "H" (OPEN SPACE) .... 0.77 ACRES ; 33,483 S.F.
STREET "I" .... 0.29 ACRES ; 12,657 S.F.
LOT "J" (BIORETENTION AREA 2) .... 0.21 ACRES ; 8,993 S.F.
LOT "K" (OPEN AREA AT END OF ST. "G") .... 0.02 ACRES ; 1,044 S.F.
LOT "L" (OPEN AREA AT END OF ST. "I") .... 0.01 ACRES ; 643 S.F.
LOT "M" (OPEN SPACE AREA) .... 0.04 ACRES ; 1,892 S.F.
LOT "N" (OPEN AREA AT END OF ST. "G") .... 0.02 ACRES ; 1,040 S.F.
LOT "O" (OFF-SITE O.O.D. AT TERESA ST.) .... 0.14 ACRES ; 6,228 S.F.
LOT "P" (OFF-SITE O.O.D. AT MT. VERNON AVE.) .... 0.29 ACRES ; 12,530 S.F.
LOT "Q" (OFF-SITE O.O.D. AT CENTER ST.) .... 0.29 ACRES ; 12,476 S.F.
LOT "R" (OPEN AREA AT END OF ST. "D") .... 0.02 ACRES ; 1,043 S.F.
LOT "S" (LANDSCAPE AT CENTER ST.) .... 0.14 ACRES ; 5,984 S.F.
LOT "T" (OPEN SPACE.) .... 0.05 ACRES ; 2,068 S.F.

GROSS AREA: .... 9.17 ACRES ; 399,261 S.F.
NET AREA: .... 8.45 ACRES ; 368,027 S.F.
AREA DISTURBED: .... 8.45 ACRES ; 368,027 S.F

EARTHWORK QUANTITIES

CUT (RAW)	5,700 CY
FILL (RAW)	16,000 CY
IMPORT	10,300 CY

VICINITY MAP
SECTION 9, TOWNSHIP 2 SOUTH, RANGE 4 WEST
NOT TO SCALE

LEGEND
EXISTING PROPERTY LINE
PROPOSED RIGHT OF WAY
EXISTING RIGHT OF WAY
EXISTING CENTERLINE
PROPOSED CURB
EXISTING CURB
PROPOSED SIDEWALK
EXISTING SIDEWALK
EXISTING DIRT ROAD
PROPOSED PARKING STRIPE
EXISTING EASEMENT
EXISTING CONTOUR MAJOR
EXISTING CONTOUR MINOR
EXISTING FENCE
EXISTING BUILDING
EXISTING CONCRETE
12" SD — PROPOSED UNDERGROUND UTILITY
12" SD — EXISTING UNDERGROUND UTILITY
EXISTING EDGE OF PAVEMENT
PROPOSED EDGE OF PAVEMENT
915 — EXISTING CONTOUR ELEVATION
×901.5 — EXISTING SPOT ELEVATION

OPEN SPACE SUMMARY

	TOTAL AREA	OPEN SPACE AREA REQUIRED	OPEN SPACE PROVIDED
	278,617 S.F.	111,447 S.F.	119,208 S.F.
LOT COVERAGE (%)		40%	43%

PARKING SUMMARY

LOT NUMBER	PRIVATE/ONSITE PARKING AREA	TOTAL SPACES	PUBLIC/OFFSITE PARKING AREA	TOTAL SPACES
1-72	4/LOT (2@ GARAGE) (2 @ D/W)	288		
OFF-SITE			6	214
SUM				294

MARK	REVISIONS	DATE	BY

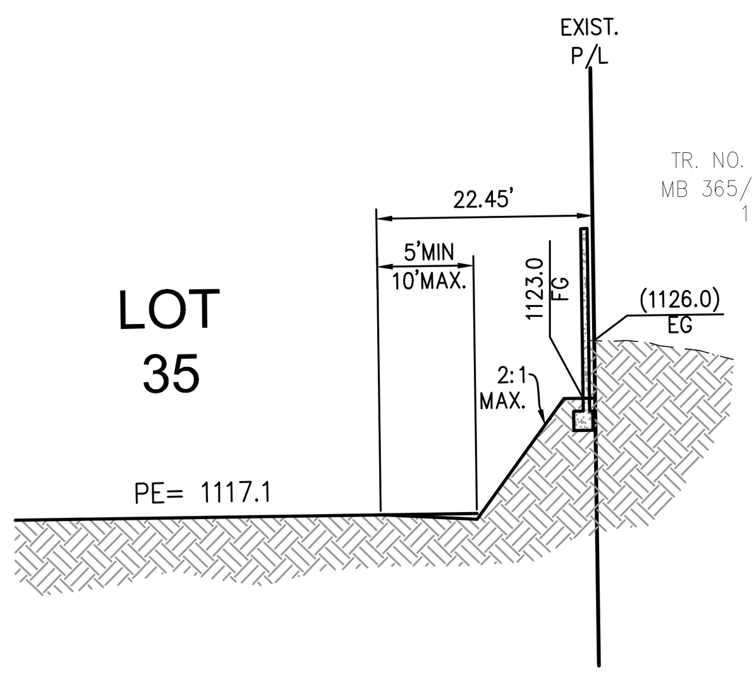
RESIDENTIAL PLOT PLAN - PPT200017
PARCEL 1, TENTATIVE TRACT MAP 37743

FOR: STEVEN WALKER COMMUNITIES

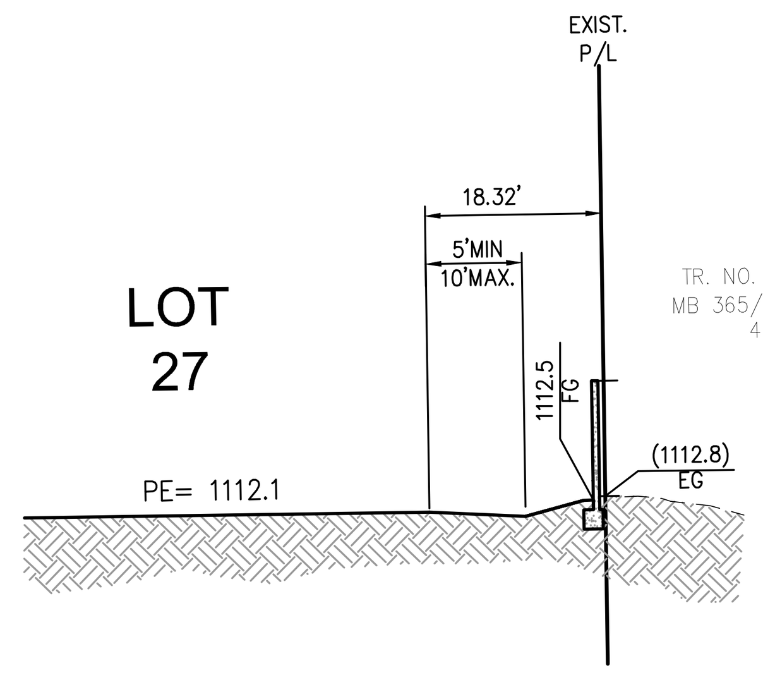
SCALE:	1"=40'
DATE:	1/2024
DESIGNED:	JC
CHECKED:	AW
PLN CK REF:	
F.B.	

woodard group

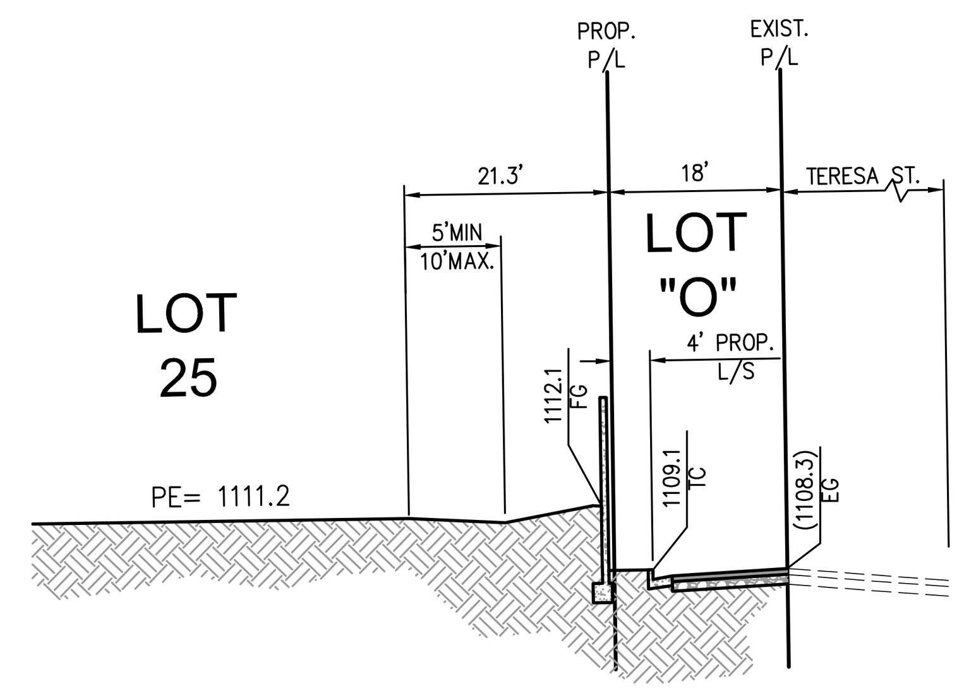
W.O. 1043
SHEET 1 OF 2 SHEETS
DWG. NO. 1043



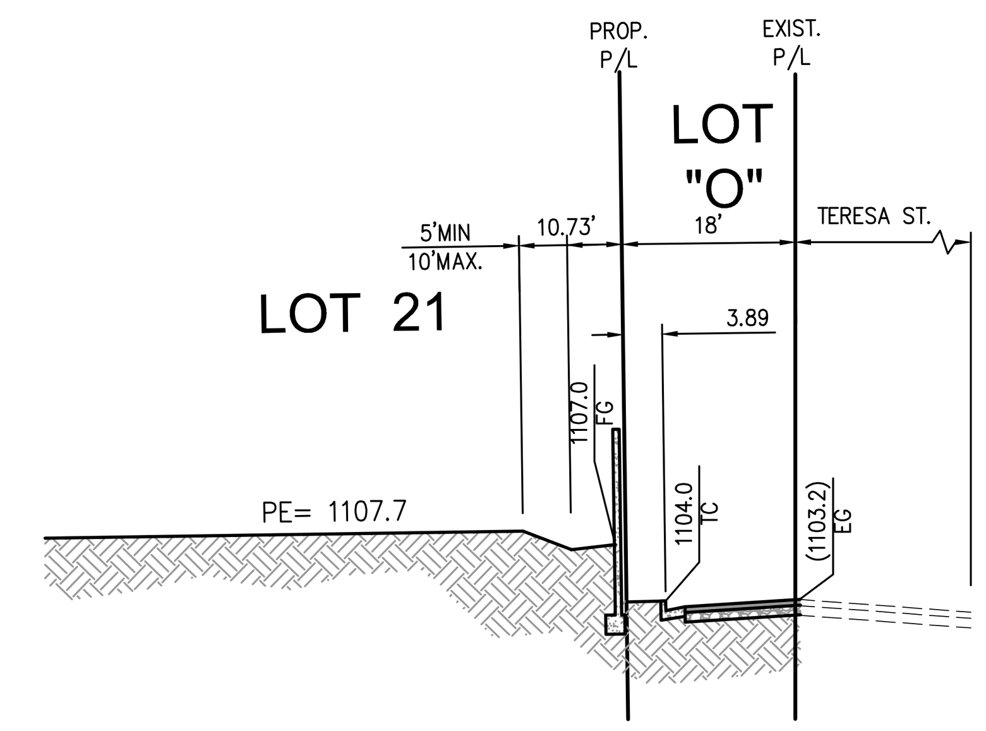
SECTION "A–A"
HORZ.:1"=20'
VERT.:1"=2'



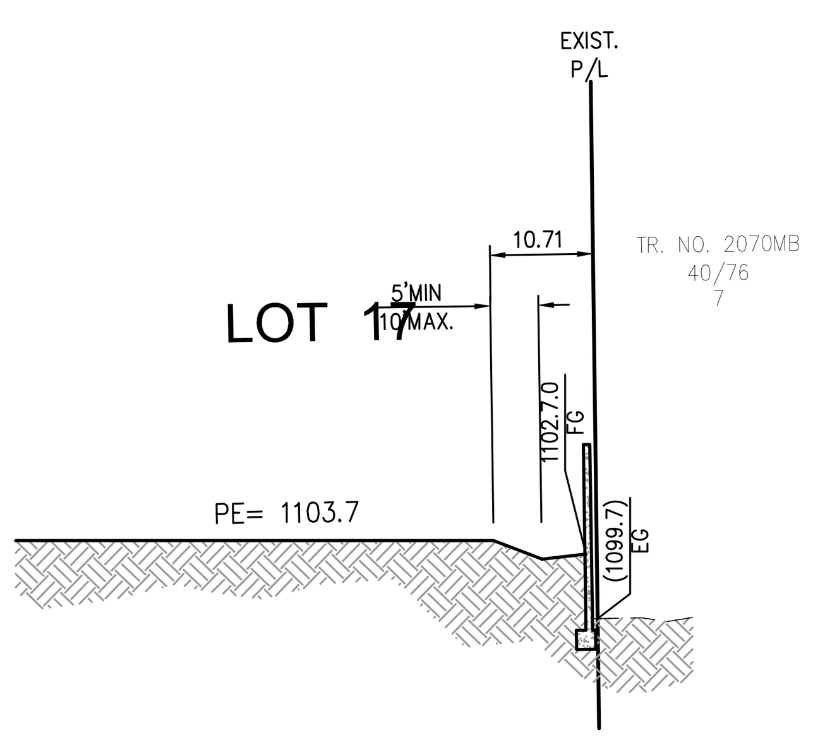
SECTION "B–B"
HORZ.:1"=20'
VERT.:1"=2'



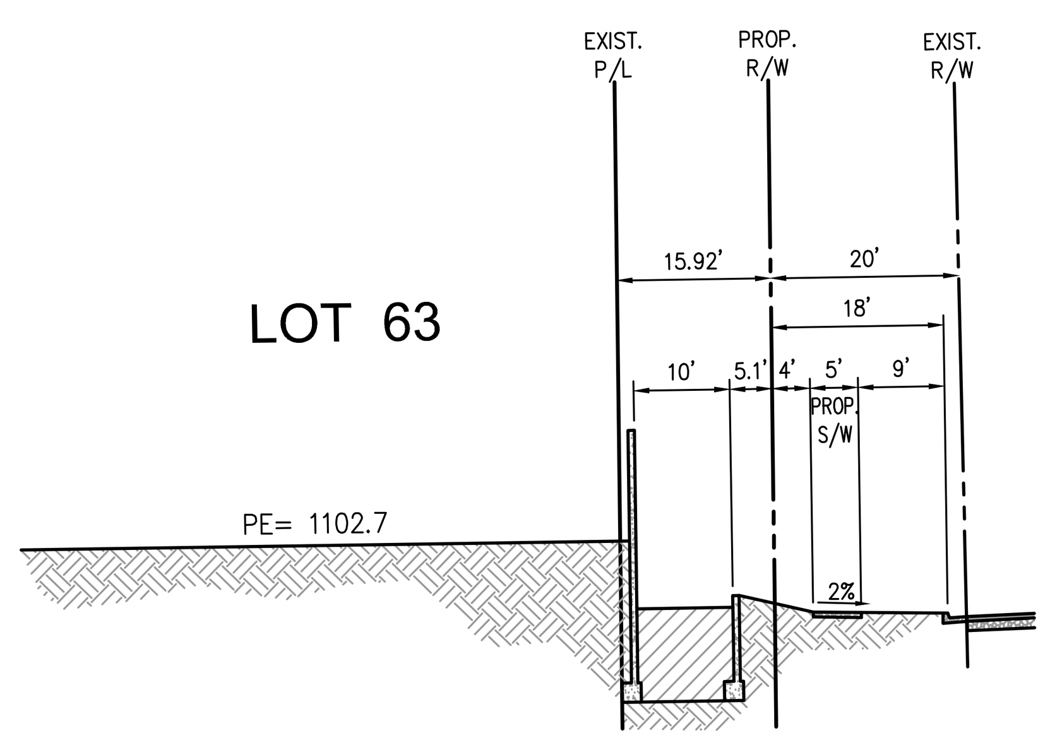
SECTION "C–C"
HORZ.:1"=20'
VERT.:1"=2'



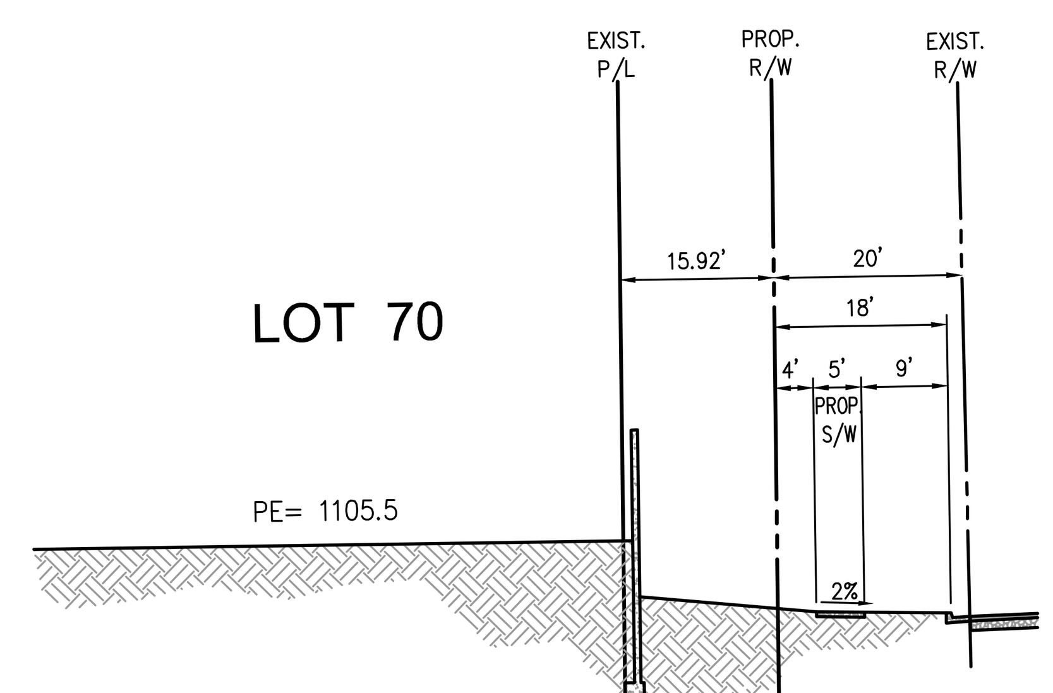
SECTION "D–D"
HORZ.:1"=20'
VERT.:1"=2'



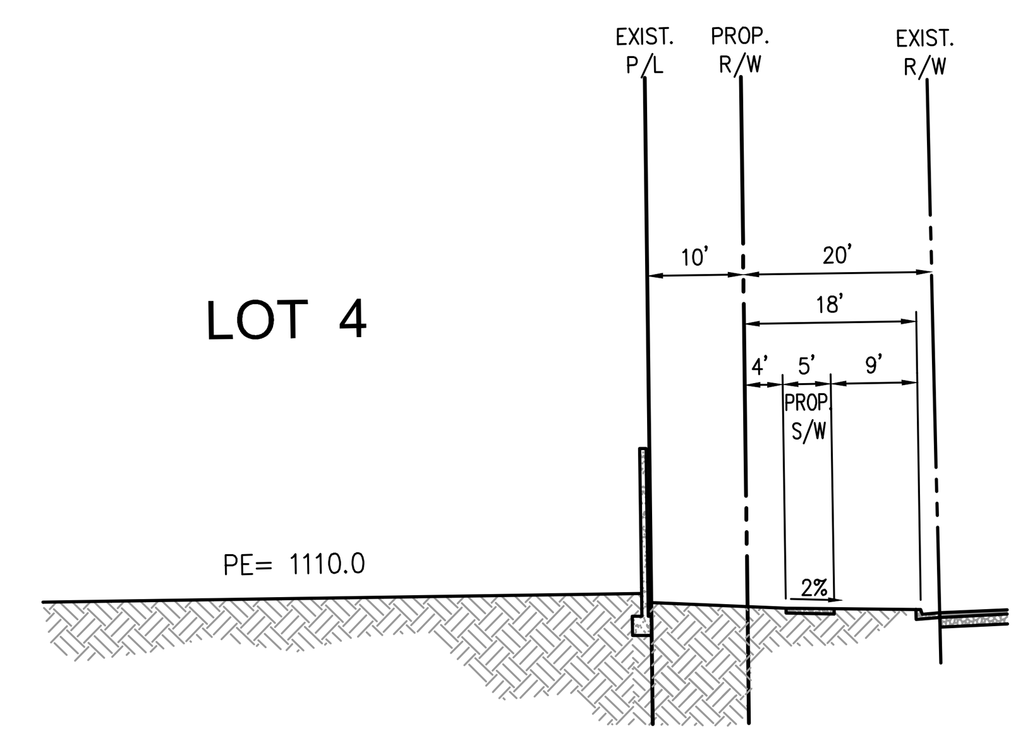
SECTION "E–E"
HORZ.:1"=20'
VERT.:1"=2'



SECTION "F–F"
HORZ.:1"=20'
VERT.:1"=2'



SECTION "G–G"
HORZ.:1"=20'
VERT.:1"=2'



SECTION "H–H"
HORZ.:1"=20'
VERT.:1"=2'

MARK	REVISIONS	DATE	BY

RESIDENTIAL PLOT PLAN - PPT200017
PARCEL 1, TENTATIVE TRACT MAP 37743

FOR: STEVEN WALKER COMMUNITIES

SCALE:	1"=40'	W.O. 1043
DATE:	1/2024	SHEET 2
DESIGNED:	JC	OF 2 SHEETS
CHECKED:	AW	DWG. NO. 1043
PLN CK REF:		
F.B.		

woodard group

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

geomat **GeoMat Testing Laboratories, Inc.**

Soil Engineering, Environmental Engineering, Materials Testing, Geology

February 19, 2020

Project No. 20004-01

TO: Steven Walker Communities
7111 Indiana Avenue
Suite 300
Riverside, California 92504

SUBJECT: Basic Soil Infiltration Report, Tentative Tracts 37743 and 37859, Northeast Corner of Center Street and Mt. Vernon Avenue, Highgrove Area, Riverside County, California

This report provides a summary of the geotechnical engineering services conducted to support evaluation of the feasibility of infiltration at approximately 8 feet below existing ground surface, at the subject site. The purpose of our services was to complete four insitu infiltration tests utilizing the percolation testing procedure in boreholes to evaluate the feasibility of infiltration for disposal of stormwater runoff following the falling head method.

If you should have any questions regarding this report, please do not hesitate to call our office. We appreciate this opportunity to be of service.

Submitted for GeoMat Testing Laboratories, Inc.

Haytham Nabilsi, GE 2375
Project Engineer, Exp. 12/31/2020

Art Martinez
Staff Engineer

LICENSED PROFESSIONAL ENGINEER
HAYTHAM NABILSI
GE 2375
GEOTECHNICAL
STATE OF CALIFORNIA

Distribution: (3) Addressee

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Scope of Work

GeoMat Testing Laboratories, Inc. was retained to provide geotechnical engineering services to support the project. Our scope of work consisted of the following specific tasks:

1) Drill and conduct four infiltration tests utilizing the shallow boring percolation testing per the Riverside County LID Design Handbook.
2) Complete laboratory gradation analysis and testing of selected soil samples.
3) Complete data analysis.
4) Preparation of this report summarizing our findings, conclusions, and recommendations. The report includes:
   - Site plan showing the location of exploratory boreholes and infiltration tests.
   - Summary of site conditions observed at the testing locations.
   - Results of the laboratory testing.
   - Discussion of the results of insitu infiltration testing.
   - A discussion of the surficial soil and anticipated groundwater conditions at the site.
   - Evaluation of the feasibility of infiltration.
   - Recommendations for infiltration facility.

1.2 Existing Site Conditions

The subject site is located on the northeast corner of Mt. Vernon Avenue and Center Street, in the Highgrove area of Riverside County, California. Access onsite can be made from either Mt. Vernon Avenue or Center Street which are both paved roads but with curb and gutter improvements limited to a small section existing near the intersection. The geographical relationship of the site and surrounding vicinity is shown on our Site Location Map, Figure 1.

The site is generally square in shape measuring approximately 630 feet long and wide. The site is generally undeveloped covered in light seasonal grasses.

1.3 Proposed Development

We understand that the site is proposed for an infiltration system consisting of chambers to capture stormwater runoff for onsite disposal. The location of the chambers was provided to this office. No other details were provided at the time this report was completed.

2 SUMMARY OF GEOTECHNICAL CONDITIONS

2.1 Exploratory Boreholes

The subsurface exploration conducted for this project consisted of 4 exploratory boreholes drilled on June 29, 2005 (see Plate 1) by Soils Southwest, Inc. The boreholes were advanced to a maximum depth of 31 feet below existing ground surface. The boreholes were logged during drilling by a geotechnical engineer of Soils Southwest, Inc. and is presented in Appendix B of this report.

2.2 Subsurface Findings

The subsurface material encountered at the tested locations boring location is briefly described below. Detailed descriptions are provided in the Borehole Logs (Appendix B).

Based on the exploratory borings conducted by Soils Southwest, Inc., the exposed surficial material is generally classified as poorly-graded sand with silt (USCS “SP-SM”) and poorly-graded sand (USCS “SP”). The soil encountered at the infiltration locations and depths were found to consist of clayey sand (USCS “SC”).

2.3 Groundwater

Groundwater study is not within the scope of this work. Groundwater was not encountered in any of the exploratory borings. The Department of Water Resources shows depth to groundwater at 158 feet below ground surface in a well off Sanrive Avenue located roughly one mile west from the site. Depth to groundwater is not expected to impact the site development.

Please note that the potential for rain or irrigation water locally seeping through from elevated areas and showing up near grades cannot be precluded. Our experience indicates that surface or near-surface groundwater conditions can develop in areas where groundwater conditions did not exist prior to site development, especially in areas where a substantial increase in surface water infiltration results from landscape irrigation. Fluctuations in perched water elevations are likely to occur in the future due to variations in precipitation, temperature, consumptive uses, and other factors including mounding of perched water over bedrock. Mitigation for nuisance shallow seeps moving from elevated lower areas will be needed if encountered. These mitigations may include subdrains, horizontal drains, toe drains, french drains, heel drains or other devices.

2.4 Laboratory Testing

Sieve analysis was performed on select soil samples obtained from the infiltration test boreholes for the purpose of classification. Test results are shown in Appendix C.

2.5 Geologic Findings

Topographically, the site is relatively flat with no abrupt major grade changes. Based on the Geologic Map of the Riverside East/South 1/2 of San Bernardino South Quadrangles, the site area, prior to development, was mapped as older alluvial fan deposits.

3 INFILTRATION TESTING

Infiltration tests were conducted at a depth of approximately 8 feet below existing ground surface. The infiltration testing was performed in general accordance with the guidelines published in the Riverside County, Low Impact Development BMP Design Handbook procedures.

A CME-55 mobile drill rig equipped with 8-inch hollow stem augers was used to drill the test holes. A 4-inch-diameter perforated PVC casing wrapped with filter fabric was placed in the boreholes. Gravel was placed around the bottom portion of the pipe for stability of the borehole. Gravel was also placed in the bottom of the borehole.

The boreholes were presoaked prior to the percolation testing. Presoaking was conducted using five-gallon water bottles. Infiltration testing was conducted the next day.

Prior to testing, the tests boreholes were screened for sandy soil criteria. None of the test holes met the sandy soil criteria. Testing was conducted from a fixed reference point for six hours with readings taken every 30 minutes. The measurements were taken by filling up the test hole with water and allowing the water to percolate. The drop of water level was recorded.

3.1 Infiltration Test Results

The following summarizes the result of the infiltration feasibility study.

Test No.	Test Depth Below Ground Surface	Percolation Raw Rate (in/hr)	Adjusted Infiltration Rate (in/hr)
P-1	96”	11.00	1.14
P-2	96”	13.00	1.39
P-3	96”	10.50	1.08
P-4	96”	12.50	1.32

The percolation rate is the rate in horizontal and vertical direction. This percolation rate is adjusted using Porchet Method to obtain the adjusted water infiltration rate. Refer to Appendix D for test results.

A safety factor should be applied to this rate by the design engineer. Safety factor discussion is in the following paragraph.

3.2 Factors of Safety

Long-term infiltration rates may be reduced significantly by factors such as soil variability and inaccuracy in the infiltration rate measurement. The correction factor for site variability is between 3 and 10. Safety factors for operating the system, maintenance, siltation, biofouling, etc. should also be considered by the design civil engineer at his discretion. Minimum safety factor required by the County of Riverside for tests conducted when deep exploratory borehole has been drilled at the site is 3.

4 CONCLUSIONS

- In our opinion, water infiltration is expected to occur slow at the tested depth and locations onsite.
- The test results may be utilized when the bottom of the infiltration system will be located within the native alluvial soil observed/tested. Should this system be located in the undocumented fill or a different soil type, the infiltration characteristics will be different than those observed during the infiltration testing. The infiltration rate recommended above is based on the assumption that only clean water will be introduced to the subsurface profile. Any fines, debris, or organic materials could significantly impact the infiltration rate.
- Filter fabric should be used whenever aggregates are placed against native soils. Only washed aggregates are allowed.
- Infiltration water should not be allowed to saturate pavement and concrete structures subgrade soils. Infiltration should not be allowed in fill areas.
- Please note that soils in infiltration areas should not be subject to compaction during construction.
- The proposed system by the civil engineer should be constructed and maintained in accordance with manufacturer guidelines.
- Groundwater was not encountered in any of the exploratory boring conducted up to 31 feet below ground surface.

5 RECOMMENDATIONS

An important consideration for infiltration facilities is that, during construction, great care must be taken not to reduce the infiltrative capacity of the soil in the facility through compaction by heavy equipment or by using the infiltration area as a sediment trap.

Infiltration facilities should be constructed late in the site development after soils (that might erode and clog the units) have been stabilized or should be protected (by flagging) until site work is completed.

Infiltration facilities should be sited with the following guidelines:

INFILTRATION FACILITY MINIMUM SETBACKS	
Setback From	Minimum Distance
Property Lines and Public Right of Way	5 feet
Structures	15 feet or within a 1:1 plane drawn up from the bottom of foundation
Slopes	H/2, 5 feet minimum (H: is slope height)
Private drinking water wells	100 feet

Ferrous metal pipes should be protected from potential corrosion by bituminous coating, etc. We recommend that all utility pipes be nonmetallic and/or corrosion resistant. Recommendations should be verified by soluble sulfate and corrosion testing of soil samples obtained from specific locations during construction.

If applicable, 4- to 6-inch diameter observation well(s), with locking cap, extending vertically into the system's bottom is suggested as an observation point. Observation well(s) should be checked regularly and after large storm event. Once performance stabilizes, frequency of monitoring may be reduced.

GeoMat Testing Laboratories should observe the subgrade of excavation. Additional laboratory testing including but not limited to grain size analysis, sand equivalent, sulfate content, etc. should be conducted during construction.

5.1 Location of Infiltration Systems

The use of on-site storm water infiltration systems carries a risk of creating adverse geotechnical conditions. Increasing the moisture content of the soil can cause the soil to lose internal shear strength and increase its compressibility, resulting in a change in the designed engineering properties. Overlying structures and pavements in the infiltration areas could potentially be damaged due to saturation of subgrade soils. It should also be noted that utility trenches which happen to collect storm water can also serve as conduits to transmit storm water toward the structure, depending on the slope of the utility trench. Therefore, consideration should also be given to the proposed locations of underground utilities which may pass near the proposed infiltration systems.

6 LIMITATION OF INFILTRATION SYSTEMS

This report has been prepared as an instrument of service for use by the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, structural engineer, and/or civil engineer.

The reproduction and distribution of this report must be authorized by the client. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur.

The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between trench locations and sample depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted.

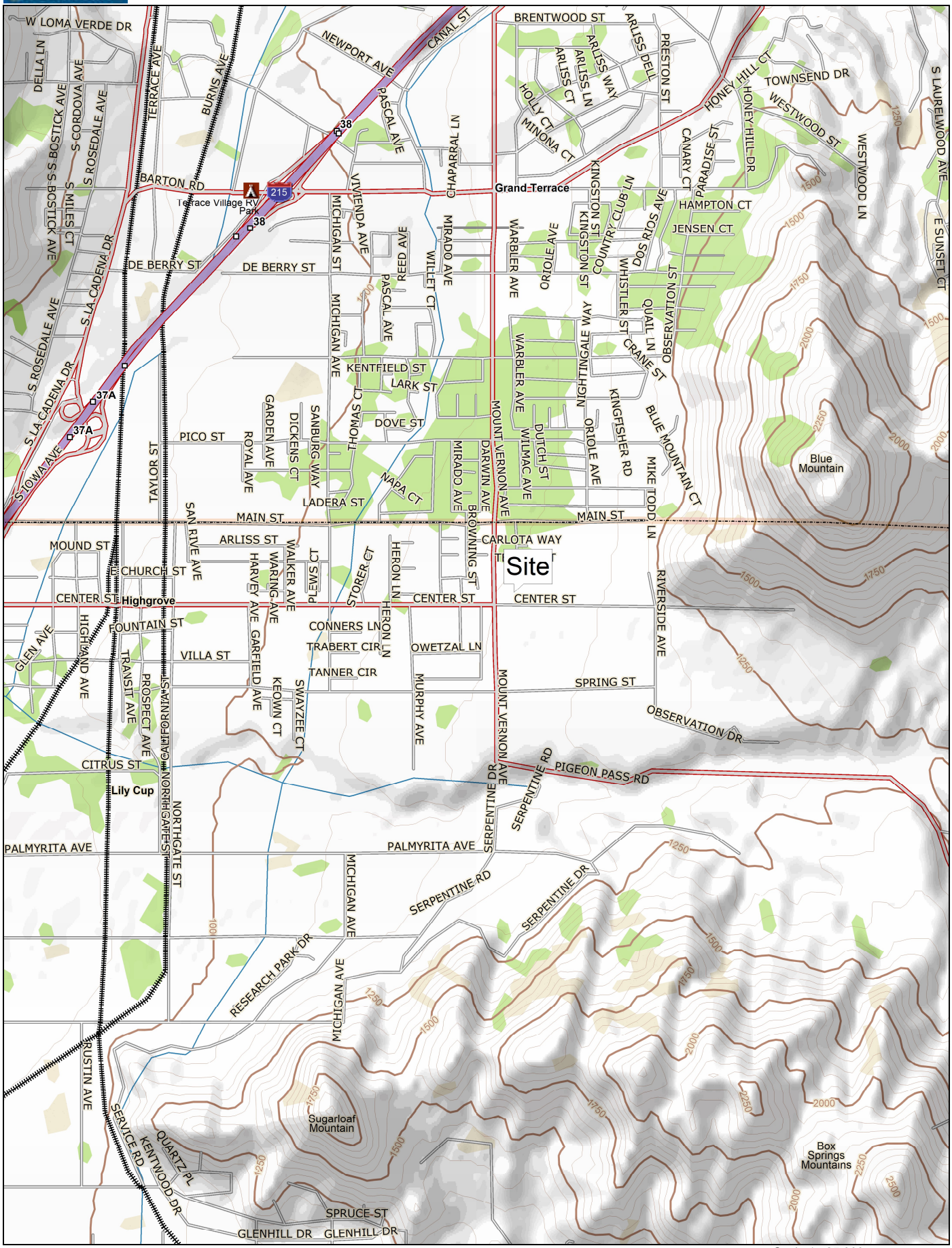
The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

7 USE OF THIS REPORT

This report was prepared for the exclusive use of the owner and design team for specific application to the proposed site. The use by others, or for the purposes other than intended, is at the user's sole risk.

The findings, conclusions, and recommendations presented herein are based on our understanding of the project and on subsurface conditions observed during our site work. Within the limitations of scope, schedule, and budget, the conclusions and recommendations presented in this report were prepared in accordance with generally accepted geotechnical engineering principles and practices in the area at the time the report was prepared. We make no other warranty either expressed or implied.

We appreciate this opportunity to provide geotechnical services on this project and look forward to assisting the Project Team as the design progresses. If you have any questions or comments regarding the information contained in this report, or if we may be of further services, please call us at (951) 688-5400.



Data use subject to license.

www.delorme.com

TN

MN (11.6°E)

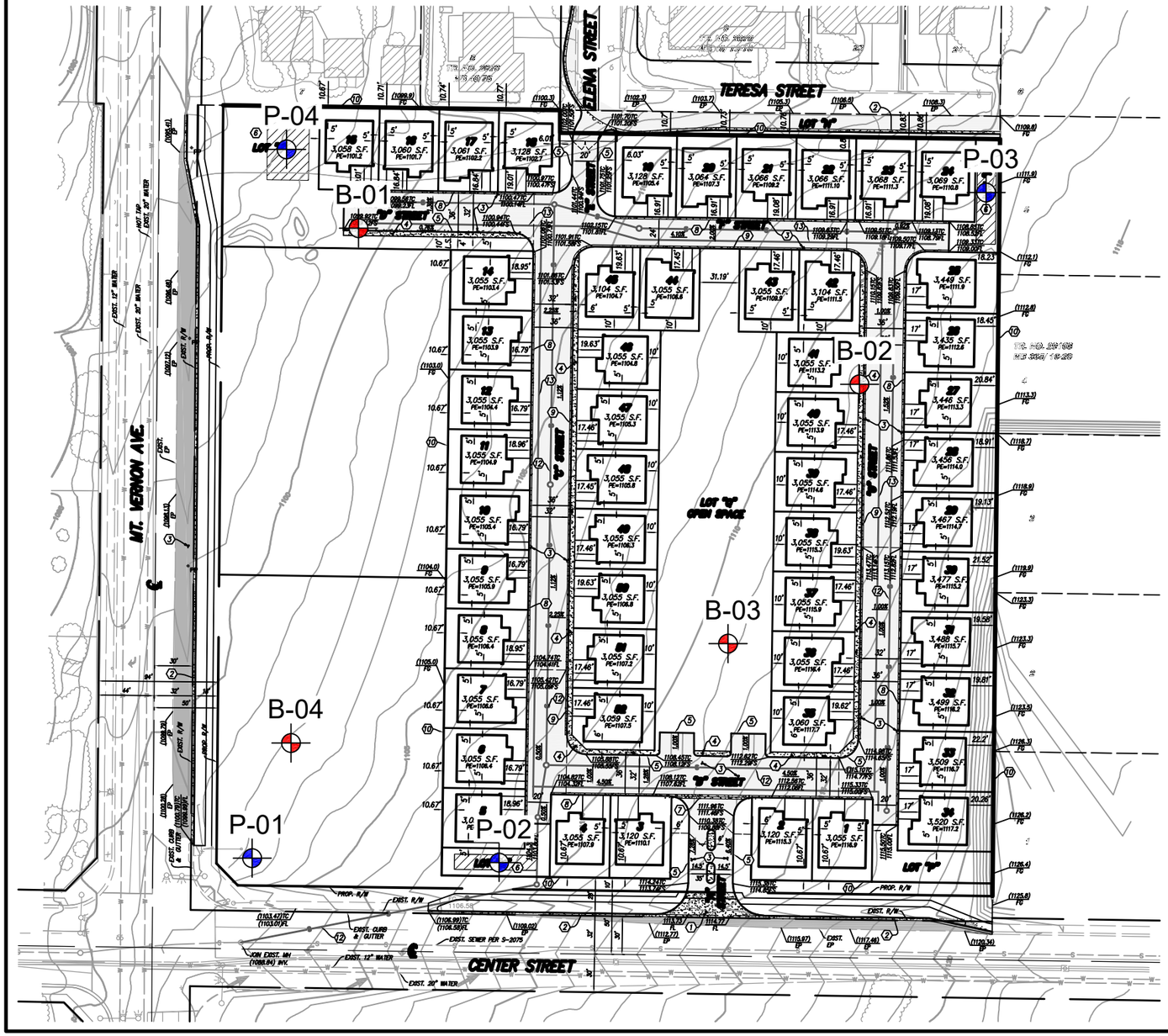
Figure 1

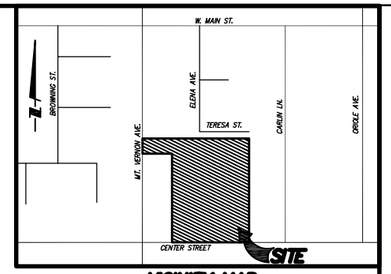
Scale 1 : 25,000

1" = 2,083.3 ft

Data Zoom 13-0

CONCEPTUAL GRADING PLAN
TENTATIVE PARCEL MAP 37859
APN: 255-150-001





VICINITY MAP
SECTION 9, TOWNSHIP 2 SOUTH, RANGE 4 WEST
NOT TO SCALE

CIVIL ENGINEER
B & W CONSULTING ENGINEERS
ANDREW WOODARD
15865 RANCHO VIEJO DRIVE
RIVERSIDE, CA 92506
PHONE: (951) 907-5077

OWNER/APPLICANT
STEVEN WALKER COMMUNITIES
7111 INDIANA AVE. STE. 300
RIVERSIDE, CA 92504

SOILS ENGINEER & GEOLOGIST
SOILS SOUTHWEST, INC.
897 MA LATA, SUITE N
COLTON, CA 92324
PH: (909) 370-0474
FAX: (951) 688-5200

ARCHITECT
KTGY ARCHITECTURE + PLANNING
17911 VON KARMEN AVENUE,SUITE 200
IRVINE, CA 92614
PH: (949) 221-6209

LEGAL DESCRIPTION
THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 9; TOWNSHIP 2 SOUTH, RANGE 4 WEST, SBM, RECORDS OF RIVERSIDE COUNTY.

ASSESSOR PARCEL NO

BOOK	PAGE	PARCELS
255	150	001

LEGEND

- EXISTING PROPERTY LINE
- PROPOSED RIGHT OF WAY
- EXISTING RIGHT OF WAY
- EXISTING CENTERLINE
- PROPOSED CURB
- EXISTING CURB
- PROPOSED SIDEWALK
- EXISTING SIDEWALK
- EXISTING DIRT ROAD
- PROPOSED PARKING STRIPE
- EXISTING EASEMENT
- EXISTING CONTOUR MAJOR
- EXISTING CONTOUR MINOR
- EXISTING FENCE
- EXISTING BUILDING
- EXISTING CONCRETE
- PROPOSED UNDERGROUND UTILITY
- EXISTING UNDERGROUND UTILITY
- EXISTING EDGE OF PAVEMENT
- PROPOSED EDGE OF PAVEMENT
- EXISTING CONTOUR ELEVATION
- EXISTING SPOT ELEVATION
- PROPOSED AC PAVEMENT
- PROPOSED LANDSCAPE
- PROPOSED CONCRETE
- PROPOSED LANDSCAPE INFILTRATION TRENCH

CONSTRUCTION NOTES

1. PROPOSED DRIVEWAY APPROACH PER COUNTY OF RIVERSIDE STD. NO. 207A
2. PROPOSED CURB AND GUTTER PER COUNTY OF RIVERSIDE STD. NO. 200.
3. PROPOSED AC PAVING, PROPOSED PRIVATELY MAINTAINED ROAD.
4. PROPOSED CONCRETE HARDSCAPE
5. PROPOSED 6" CURB ONLY
6. PROPOSED INFILTRATION TRENCH AREA.
7. PROPOSED 3" WIDE CONCRETE RIBBON GUTTER
8. PROPOSED ROLLED CURB WITH GUTTER.
9. PROPOSED ROLLED CURB.
10. PROPOSED COMBINATION RETAINING/FREE STANDING WALL.
11. PROPOSED LANDSCAPE
12. PROPOSED SEWER LINE.
13. PROPOSED WATER LINE.

MARK	REVISIONS	DATE	BY

CONCEPTUAL GRADING PLAN
TENTATIVE PARCEL MAP 37859

FOR: STEVEN WALKER COMMUNITIES

SCALE:	1"=40'
DATE:	12/2019
DESIGNED:	AW
CHECKED:	AW
PLN CK REF:	
F.B.	

B&W CONSULTING ENGINEERS, INC.

W.O.	1043
SHEET	1
OF	2 SHEETS
DWG. NO.	100.001

LEGEND:

B-04 ⊕ EXPLORATORY BORING (SSI, 2005)

P-04 ⊕ INFILTRATION TEST

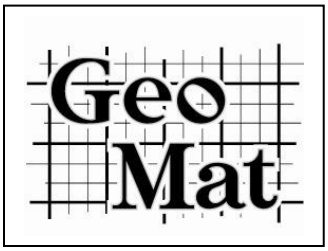
ALL LOCATIONS ARE APPROXIMATE

EXPLORATORY TEST PIT LOCATION MAP
TENTATIVE TRACTS 37743 AND 37859
RIVERSIDE COUNTY, CALIFORNIA

geomat

DRAWN BY: AM	DATE: JANUARY 2020	PLATE 1
SCALE: 1" = 100' (APPROXIMATE SCALE, 11"X17" SHEET)	PROJECT NO.: 20004-01	

APPENDIX A



REFERENCES

Advanced Geotechnical Solutions, Inc. “Updated Geotechnical Investigation and Review of Rough Grading Plans, Tract 32989, Highgrove Area, County of Riverside, California,” Report No. 1612-03-B-1, Report Dated January 6, 2017.

Dibblee, T.W., and Minch, J.A., 2003, Geologic map of the Riverside East/south 1/2 of San Bernardino South quadrangles, San Bernardino and Riverside County, California: Dibblee Geological Foundation, Dibblee Foundation Map DF-109, scale 1:24,000

Riverside County, Stormwater Quality Best Management Practice, Design Handbook, July 21, 2006

Riverside County, Design handbook for Low Impact Development Best Management Practices, September 2011.

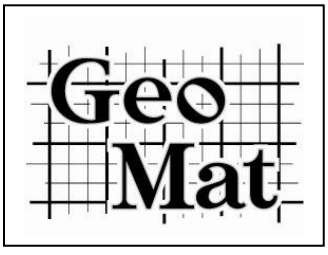
Riverside County, Water Quality Management Plan for Urban Runoff, Santa Ana River Region, Santa Margarita River Region, September 17, 2004

California Stormwater Quality Association, Stormwater Best Management Practice, Handbook, Jan. 2003.

Water Quality Control Plan, Santa Ana River Basin (8), California Regional Water Quality Control Board, Santa Ana Region, 1995,

California Stormwater Quality Association (QASCA), California Stormwater BMP Handbook, Infiltration Trench, TC-10 Design Considerations

APPENDIX B



Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING B-1

Project: Victoria Homes / Tr.32989		**Job No.:** 05156-F
Logged By: John	**Boring Diam.:** 8"	**Date:** 29 Jun 05

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP-SM			Weeds
								Sand - Lt brn, silty, dry, fine to med., pebbles, slighlty porous (Max 133 pcf @ 9.0%)
							2	
		4.0	107	80				
							4	
7					SP		6	- Lt brn, slightly silty, fine to med. coarse, pebbles, rock frag., slightly porous
							8	
		4.5	120	90				
							10	
20								- Lt brn, slightly silty, fine to med., pebbles
							12	

Groundwater: None
Approx. Depth of Bedrock: None
Datum: N/A
Elevation: N/A

Site Location
NEC Center & Mt Vernon
Riverside County

Plate #

Bulk/Grab sample | California sampler | Standard penetration test

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING B-1

Project: Victoria Homes / Tr.32989		**Job No.:** 05156-F
Logged By: John	**Boring Diam.:** 8"	**Date:** 29 Jun 05

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
							14	
25							16	
							18	
27							20	- Yellow brn, fine to med. coarse, rock frag.
							22	
							24	
23							26	
							28	- Lt brn, fine to med. coarse, pebbles,

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING B-1

Project: Victoria Homes / Tr.32989		**Job No.:** 05156-F
Logged By: John	**Boring Diam.:** 8"	**Date:** 29 Jun 05

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
								rock frag.
							30	
24								
								- End of boring @ 31'
								No bedrock
								No groundwater
							32	
							34	
							36	
							38	
							40	
							42	
							44	

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING B-2

Project: Victoria Homes / Tr.32989			**Job No.:** 05156-F
Logged By: John	**Boring Diam.:** 8"		**Date:** 29 Jun 05

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP			Weeds
								Sand - Brn, dry, fine to med., pebbles, slighlty porous, slightly silty
							2	
10								
							4	
		8.0	117	88				
							6	
							8	
27								
							10	
							12	
								- Lt brn, fine to med. coarse, pebbles, rock frag.
12								

Groundwater: None
Approx. Depth of Bedrock: None
Datum: N/A
Elevation: N/A

Site Location

NEC Center & Mt Vernon
Riverside County

Plate #

Bulk/Grab sample California sampler Standard penetration test

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING B-2

Project: Victoria Homes / Tr.32989		Job No.: 05156-F
Logged By: John	Boring Diam.: 8"	Date: 29 Jun 05

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
							14	
								- Lt brn, med. to coarse
							16	
							18	
25								
					SP-SM			- Lt brn, silty, fine to med., pebbles
							20	
								- End of boring @ 20' No bedrock No groundwater
							22	
							24	
							26	
							28	

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING B-3

Project: Victoria Homes / Tr.32989			**Job No.:** 05156-F
Logged By: John	**Boring Diam.:** 8"		**Date:** 29 Jun 05

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP			Weeds
								Sand - Brn, slightly silty, dry, fine to med., pebbles, slightly porous
							2	
							4	
18								
							6	
							8	
16								- Scattered rock 1", moist
							10	
							12	

Groundwater: None
Approx. Depth of Bedrock: None
Datum: N/A
Elevation: N/A

Site Location
NEC Center & Mt Vernon
Riverside County

Plate #

Bulk/Grab sample | California sampler | Standard penetration test

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING B-3

Project: Victoria Homes / Tr.32989		Job No.: 05156-F
Logged By: John	Boring Diam.: 8"	Date: 29 Jun 05

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
							14	
					SP-SM			- Lt brn, silty, moist, fine to med., coarse, pebbles, rock frag.
27							16	
								- End of boring @ 16' No bedrock No groundwater
							18	
							20	
							22	
							24	
							26	
							28	

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING B-4

Project: Victoria Homes / Tr.32989		**Job No.:** 05156-F
Logged By: John	**Boring Diam.:** 8"	**Date:** 29 Jun 05

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP			Weeds Sand - Brn, slightly silty, dry, fine to med., pebbles, slighlty porous
							2	
3								- Very loose
							4	
							6	
					SP-SM			- Brn, silty, fine to med. coarse, moist
6							8	
					SP			- Gray brn, fine to med. coarse, rock frag., pebbles, moist, slightly silty
							10	
		8.0	126	95				
							12	

Groundwater: None
Approx. Depth of Bedrock: None
Datum: N/A
Elevation: N/A

Site Location
NEC Center & Mt Vernon
Riverside County

Plate #

Bulk/Grab sample California sampler Standard penetration test

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING B-4

Project: Victoria Homes / Tr.32989		**Job No.:** 05156-F
Logged By: John	**Boring Diam.:** 8"	**Date:** 29 Jun 05

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
27							14	- Lt brn, slightly silty, fine to med. coarse, pebbles, rock frag.
							16	- End of boring @ 16' No bedrock No groundwater
							18	
							20	
							22	
							24	
							26	
							28	

KEY TO SYMBOLS

Symbol Description

Strata symbols

Poorly graded sand with silt

Poorly graded sand

Soil Samplers

Bulk/Grab sample

California sampler

Standard penetration test

Notes:

1. Exploratory borings were drilled on 29 Jun 05 using a 4-inch diameter continuous flight power auger.

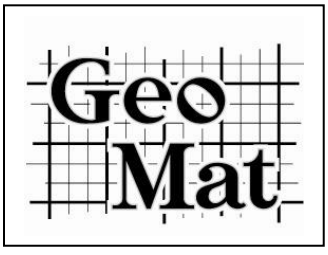
2. No free water was encountered at the time of drilling or when re-checked the following day.

3. Boring locations were taped from existing features and elevations extrapolated from the final design schematic plan.

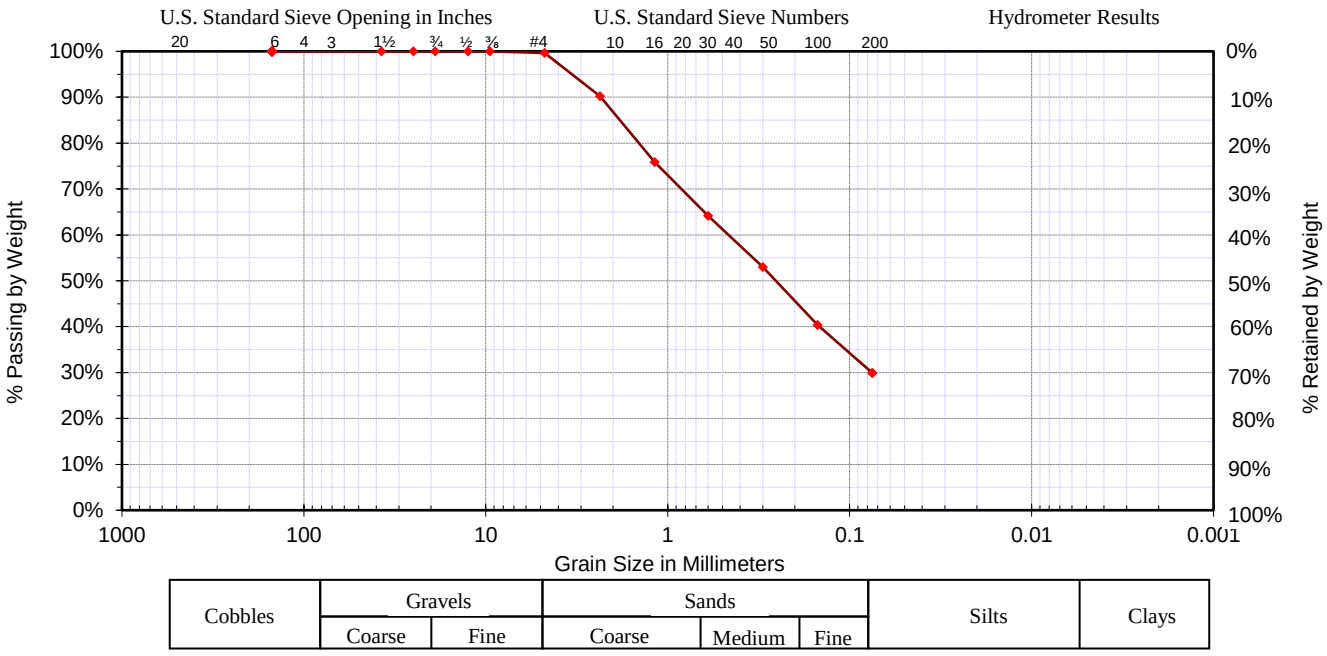
4. These logs are subject to the limitations, conclusions, and recommendations in this report.

5. Results of tests conducted on samples recovered are reported on the logs.

APPENDIX C



LABORATORY TEST RESULTS

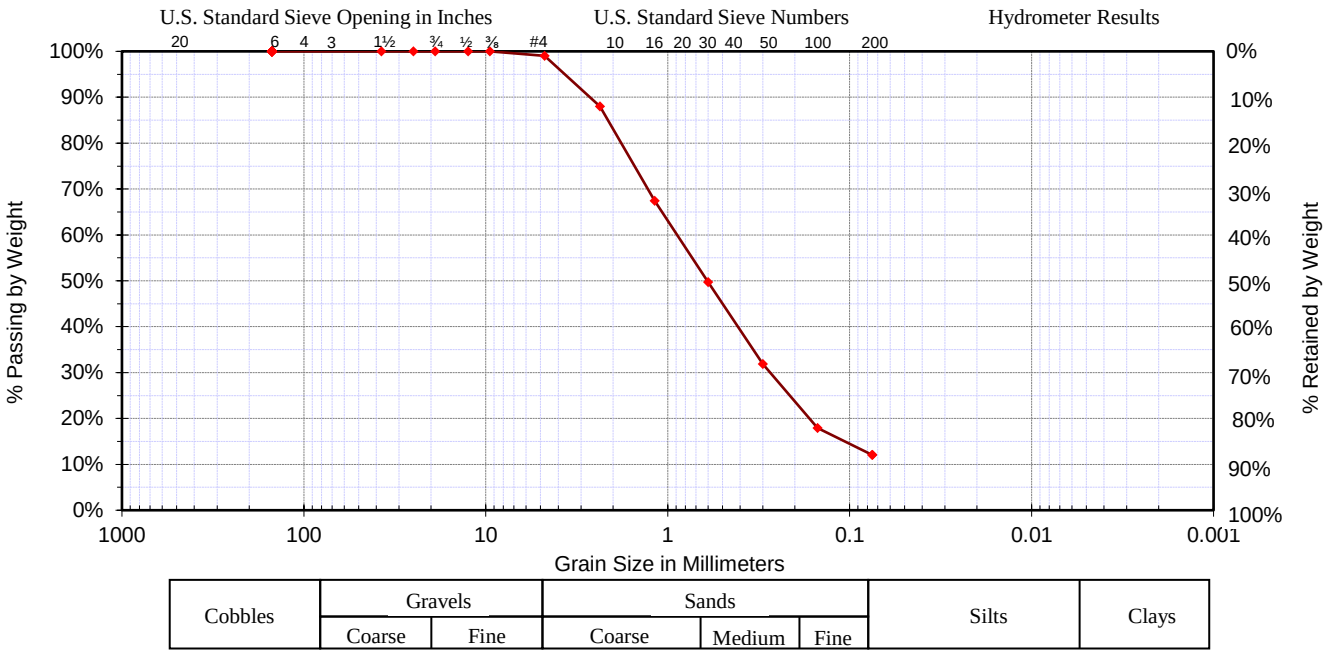


Date :	01/20/20	D_{10} =	0.03	**Classification**	% Gravel
Sample #:		D_{30} =	0.08	SC, Clayey Sand	0.34%
Sample ID:	P1	D_{60} =	0.49		% Sand
Source:	Bulk	C_C =	0.47	**Specifications**	69.76%
Project:	Tentative Tracts 37743 & 37859	C_{U} =	19.48	custom specs 1	% Silt & Clay
Location:	Highgrove Area, Riverside County, California	Liquid Limit=	n/a		29.90%
Boring #:	P1	Plastic Limit=	n/a	Fineness Modulus	Sample Moisture
Depth:		Plasticity Index=	n/a	1.77	**8.8%**

Coarse Section		Actual Cumulative	Interpolated Cumulative		
Sieve Size		Percent	Percent	Specs	Specs
US	Metric	Passing	Passing	Max	Min
6.00"	150.00		100.0%		
4.00"	100.00		100.0%		
3.00"	75.00		100.0%		
2.50"	63.00		100.0%		
2.00"	50.00		100.0%		
1.75"	45.00		100.0%		
1.50"	37.50	100.0%	100.0%		
1.25"	31.50		100.0%		
1.00"	25.00	100.0%	100.0%		
7/8"	22.40		100.0%		
3/4"	19.00	100.0%	100.0%		
5/8"	16.00		100.0%		
1/2"	12.50	100.0%	100.0%		
3/8"	9.50	100.0%	100.0%		
1/4"	6.30		99.8%		
#4	4.75	99.7%	99.7%		

Fines Section		Actual Cumulative	Interpolated Cumulative		
Sieve Size		Percent	Percent	Specs	Specs
US	Metric	Passing	Passing	Max	Min
#4	4.750	99.7%	99.7%		
#8	2.360	90.2%	90.2%		
#10	2.000		85.8%		
#16	1.180	75.9%	75.9%		
#20	0.850		69.2%		
#30	0.600	64.1%	64.1%		
#40	0.425		57.6%		
#50	0.300	53.0%	53.0%		
#60	0.250		48.8%		
#80	0.180		42.9%		
#100	0.150	40.4%	40.4%		
#140	0.106		34.2%		
#170	0.090		32.0%		
#200	0.075	29.9%	29.9%		
#270	0.053				

LABORATORY TEST RESULTS

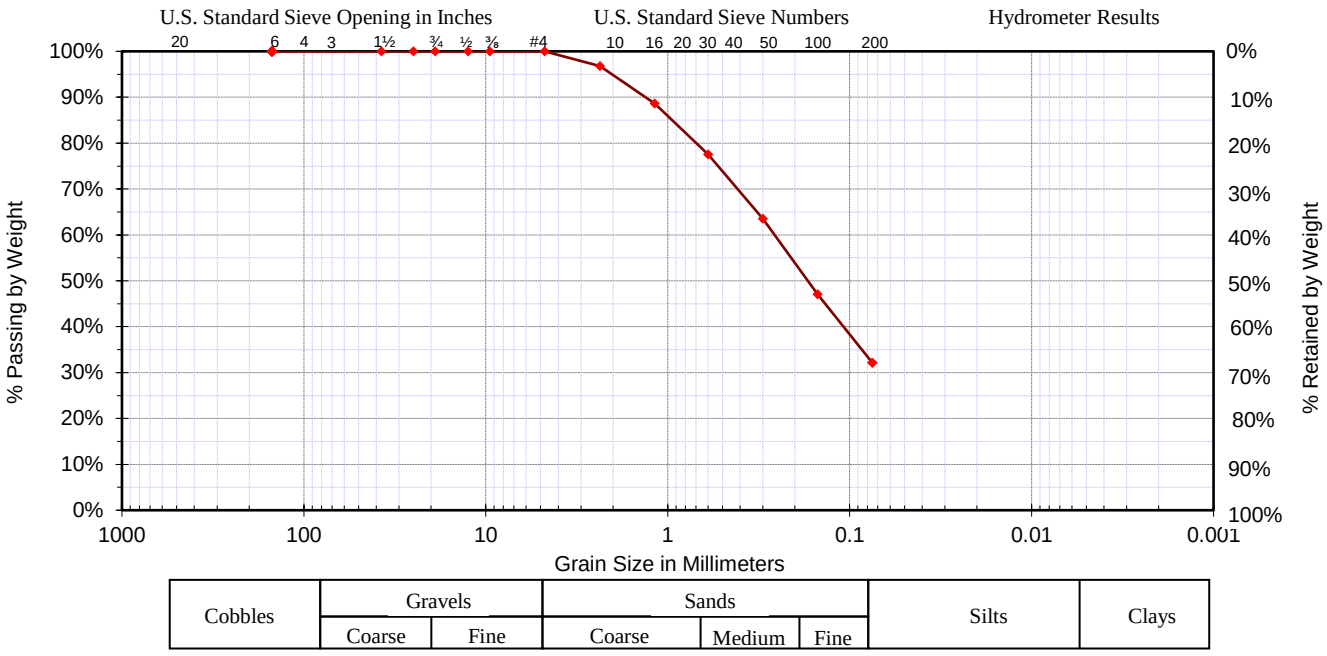


Date :	01/20/20	D_{10} =	0.06	**Classification**	% Gravel
Sample #:		D_{30} =	0.28	SC, Clayey Sand	0.98%
Sample ID:	P2	D_{60} =	0.94		% Sand
Source:	Bulk	C_C =	1.34	**Specifications**	86.99%
Project:	Tentative Tracts 37743 & 37859	C_{U} =	15.03	custom specs 1	% Silt & Clay
Location:	Highgrove Area, Riverside County, California	Liquid Limit=	n/a		12.03%
Boring #:	P2	Plastic Limit=	n/a	Fineness Modulus	Sample Moisture
Depth:		Plasticity Index=	n/a	2.46	**10.2%**

Coarse Section		Actual Cumulative	Interpolated Cumulative		
Sieve Size		Percent	Percent	Specs	Specs
US	Metric	Passing	Passing	Max	Min
6.00"	150.00		100.0%		
4.00"	100.00		100.0%		
3.00"	75.00		100.0%		
2.50"	63.00		100.0%		
2.00"	50.00		100.0%		
1.75"	45.00		100.0%		
1.50"	37.50	100.0%	100.0%		
1.25"	31.50		100.0%		
1.00"	25.00	100.0%	100.0%		
7/8"	22.40		100.0%		
3/4"	19.00	100.0%	100.0%		
5/8"	16.00		100.0%		
1/2"	12.50	100.0%	100.0%		
3/8"	9.50	100.0%	100.0%		
1/4"	6.30		99.3%		
#4	4.75	99.0%	99.0%		

Fines Section		Actual Cumulative	Interpolated Cumulative		
Sieve Size		Percent	Percent	Specs	Specs
US	Metric	Passing	Passing	Max	Min
#4	4.750	99.0%	99.0%		
#8	2.360	88.0%	88.0%		
#10	2.000		81.7%		
#16	1.180	67.4%	67.4%		
#20	0.850		57.4%		
#30	0.600	49.7%	49.7%		
#40	0.425		39.3%		
#50	0.300	31.8%	31.8%		
#60	0.250		27.2%		
#80	0.180		20.7%		
#100	0.150	17.9%	17.9%		
#140	0.106		14.5%		
#170	0.090		13.2%		
#200	0.075	12.0%	12.0%		
#270	0.053				

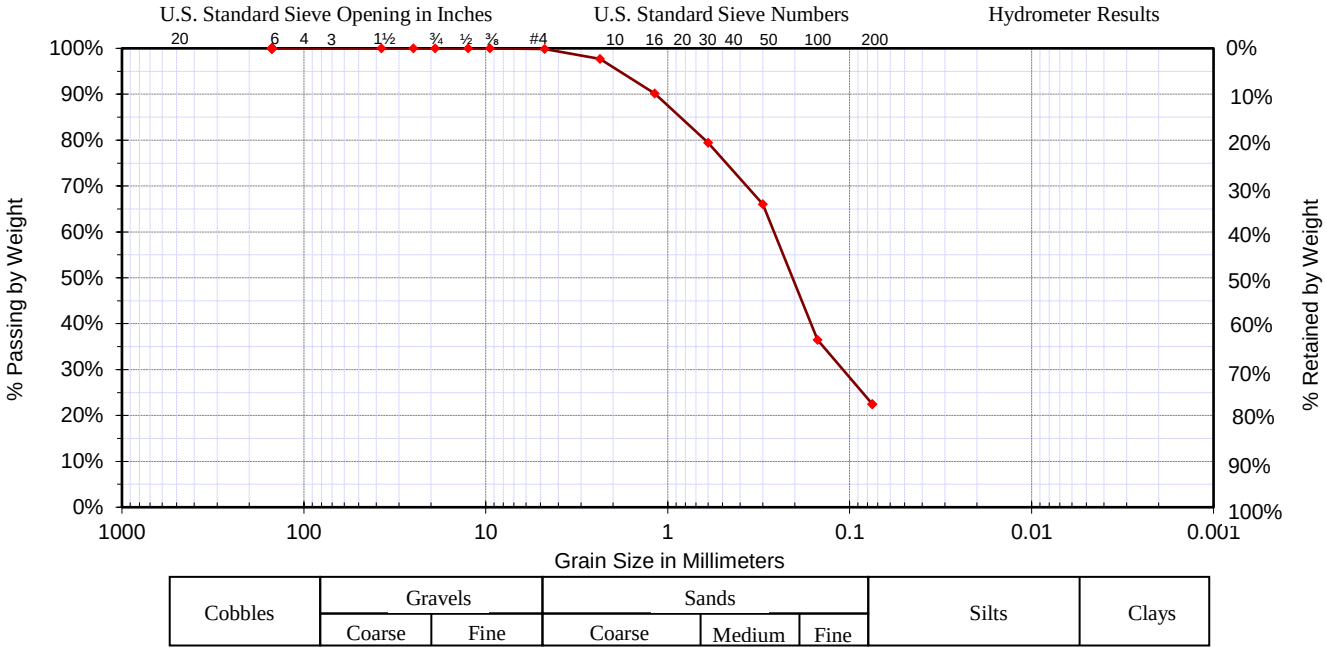
LABORATORY TEST RESULTS



Date :	01/20/20	D_{10} =	0.02	**Classification**	% Gravel
Sample #:		D_{30} =	0.07	SC, Clayey Sand	0.00%
Sample ID:	P3	D_{60} =	0.27		% Sand
Source:	Bulk	C_C =	0.78	**Specifications**	67.87%
Project:	Tentative Tracts 37743 & 37859	C_{U} =	11.48	custom specs 1	% Silt & Clay
Location:	Highgrove Area, Riverside County, California	Liquid Limit=	n/a		32.13%
Boring #:	P3	Plastic Limit=	n/a	Fineness Modulus	Sample Moisture
Depth:		Plasticity Index=	n/a	1.26	**7.2%**

Coarse Section		Actual Cumulative	Interpolated Cumulative			Fines Section		Actual Cumulative	Interpolated Cumulative		
Sieve Size		Percent	Percent	Specs	Specs	Sieve Size		Percent	Percent	Specs	Specs
US	Metric	Passing	Passing	Max	Min	US	Metric	Passing	Passing	Max	Min
6.00"	150.00		100.0%			#4	4.750	100.0%	100.0%		
4.00"	100.00		100.0%			#8	2.360	96.8%	96.8%		
3.00"	75.00		100.0%			#10	2.000		94.3%		
2.50"	63.00		100.0%			#16	1.180	88.6%	88.6%		
2.00"	50.00		100.0%			#20	0.850		82.3%		
1.75"	45.00		100.0%			#30	0.600	77.5%	77.5%		
1.50"	37.50	100.0%	100.0%			#40	0.425		69.4%		
1.25"	31.50		100.0%			#50	0.300	63.5%	63.5%		
1.00"	25.00	100.0%	100.0%			#60	0.250		58.0%		
7/8"	22.40		100.0%			#80	0.180		50.3%		
3/4"	19.00	100.0%	100.0%			#100	0.150	47.0%	47.0%		
5/8"	16.00		100.0%			#140	0.106		38.3%		
1/2"	12.50	100.0%	100.0%			#170	0.090		35.1%		
3/8"	9.50	100.0%	100.0%			#200	0.075	32.1%	32.1%		
1/4"	6.30		100.0%			#270	0.053				
#4	4.75	100.0%	100.0%								

LABORATORY TEST RESULTS

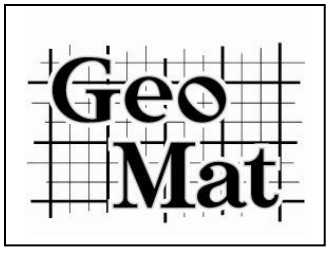


Date :	01/20/20	D_{10} =	0.03	**Classification**	% Gravel
Sample #:		D_{30} =	0.12	SC, Clayey Sand	0.17%
Sample ID:	P4	D_{60} =	0.27		% Sand
Source:	Bulk	C_C =	1.48	**Specifications**	77.37%
Project:	Tentative Tracts 37743 & 37859	$C_{U=}$	8.07	custom specs 1	% Silt & Clay
Location:	Highgrove Area, Riverside County, California	Liquid Limit=	n/a		22.47%
Boring #:	P4	Plastic Limit=	n/a	Fineness Modulus	Sample Moisture
Depth:		Plasticity Index=	n/a	1.30	**7.2%**

Coarse Section		Actual Cumulative	Interpolated Cumulative		
Sieve Size		Percent	Percent	Specs	Specs
US	Metric	Passing	Passing	Max	Min
6.00"	150.00		100.0%		
4.00"	100.00		100.0%		
3.00"	75.00		100.0%		
2.50"	63.00		100.0%		
2.00"	50.00		100.0%		
1.75"	45.00		100.0%		
1.50"	37.50	100.0%	100.0%		
1.25"	31.50		100.0%		
1.00"	25.00	100.0%	100.0%		
7/8"	22.40		100.0%		
3/4"	19.00	100.0%	100.0%		
5/8"	16.00		100.0%		
1/2"	12.50	100.0%	100.0%		
3/8"	9.50	100.0%	100.0%		
1/4"	6.30		99.9%		
#4	4.75	99.8%	99.8%		

Fines Section		Actual Cumulative	Interpolated Cumulative		
Sieve Size		Percent	Percent	Specs	Specs
US	Metric	Passing	Passing	Max	Min
#4	4.750	99.8%	99.8%		
#8	2.360	97.7%	97.7%		
#10	2.000		95.4%		
#16	1.180	90.1%	90.1%		
#20	0.850		84.0%		
#30	0.600	79.4%	79.4%		
#40	0.425		71.6%		
#50	0.300	66.0%	66.0%		
#60	0.250		56.2%		
#80	0.180		42.4%		
#100	0.150	36.5%	36.5%		
#140	0.106		28.3%		
#170	0.090		25.3%		
#200	0.075	22.5%	22.5%		
#270	0.053				

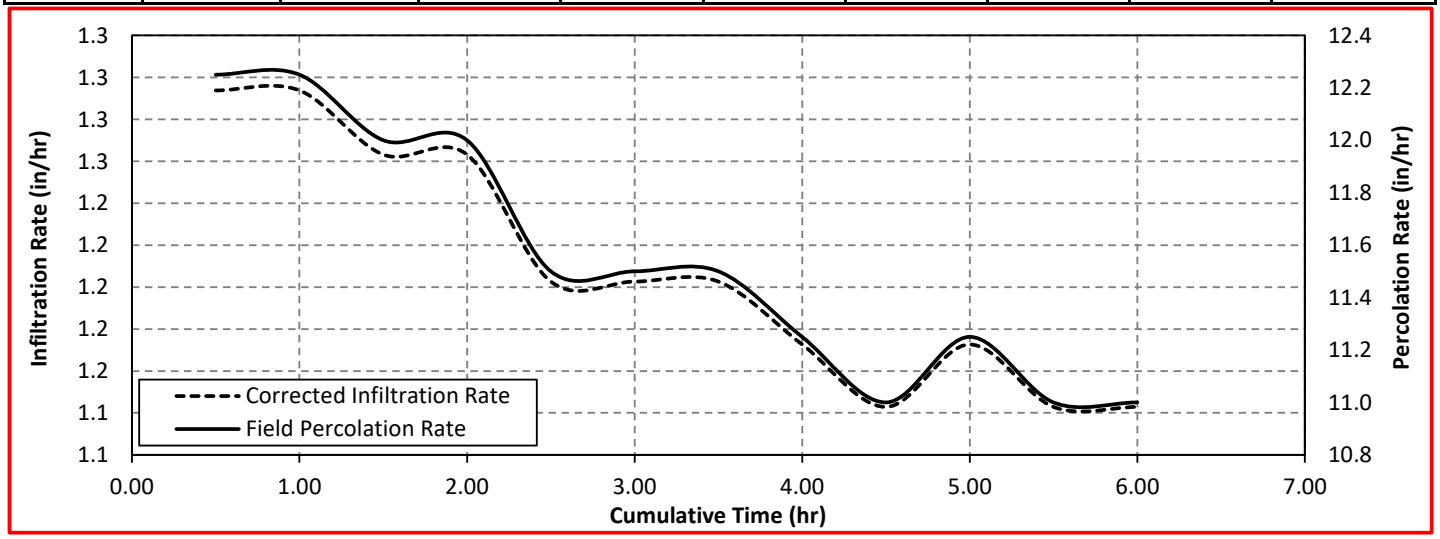
APPENDIX D



PERCOLATION TEST - P-1

Project No.	20004-01	Project Name	Tentative Tract 37743 & 37859, Highgrove, CA		
Project Location	Tentative Tract 37743 & 37859, Highgrove, CA			Soak Method	5 gallons
Drilling Date	1/20/2020	Soak Date	2/2/2020	Depth of Hole (in)	96
Testing Date	2/3/2020	Borehole Diameter (in)	8	Test Refill Depth (in)	20

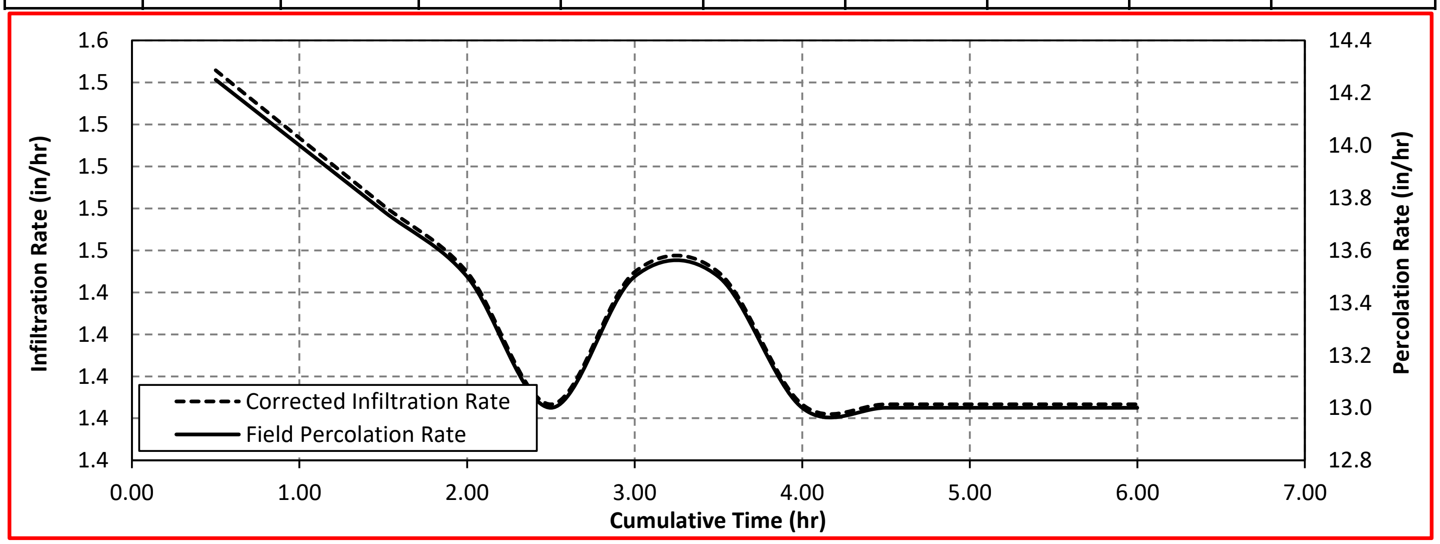
CRITERIA	TIME	TIME INTERVAL (min)	D_0, INITIAL DEPTH TO WATER (in)	D_f, FINAL DEPTH TO WATER (in)	ΔH, WATER DROP (in)	AVERAGE WETTED DEPTH (in)	PERC RATE (min/in)	PERC RATE (in/hr)	CORRECTED* INFILTRATION RATE (in/hr)
Sandy Soil Criteria						*Corrected utilizing the Porchet Method			
						Was Sandy Soil Criteria Met?			NO
Percolation Test Data	0:00:00	0:30:00	76	82.125	6.125	16.9375	4.90	12.25	1.29
	0:30:00	30.00							
	0:00:00	0:30:00	76	82.125	6.125	16.9375	4.90	12.25	1.29
	0:30:00	30.00							
	0:00:00	0:30:00	76	82	6	17	5.00	12.00	1.26
	0:30:00	30.00							
	0:00:00	0:30:00	76	82	6	17	5.00	12.00	1.26
	0:30:00	30.00							
	0:00:00	0:30:00	76	81.75	5.75	17.125	5.22	11.50	1.20
	0:30:00	30.00							
	0:00:00	0:30:00	76	81.75	5.75	17.125	5.22	11.50	1.20
	0:30:00	30.00							
	0:00:00	0:30:00	76	81.75	5.75	17.125	5.22	11.50	1.20
	0:30:00	30.00							
	0:00:00	0:30:00	76	81.625	5.625	17.1875	5.33	11.25	1.17
	0:30:00	30.00							
	0:00:00	0:30:00	76	81.5	5.5	17.25	5.45	11.00	1.14
	0:30:00	30.00							
	0:00:00	0:30:00	76	81.625	5.625	17.1875	5.33	11.25	1.17
	0:30:00	30.00							
	0:00:00	0:30:00	76	81.5	5.5	17.25	5.45	11.00	1.14
	0:30:00	30.00							
	0:00:00	0:30:00	76	81.5	5.5	17.25	5.45	11.00	1.14
	0:30:00	30.00							



PERCOLATION TEST - P-2

Project No.	20004-01	Project Name	Tentative Tract 37743 & 37859, Highgrove, CA		
Project Location	Tentative Tract 37743 & 37859, Highgrove, CA			Soak Method	5 gallons
Drilling Date	1/20/2020	Soak Date	2/2/2020	Depth of Hole (in)	96
Testing Date	2/3/2020	Borehole Diameter (in)	8	Test Refill Depth (in)	20

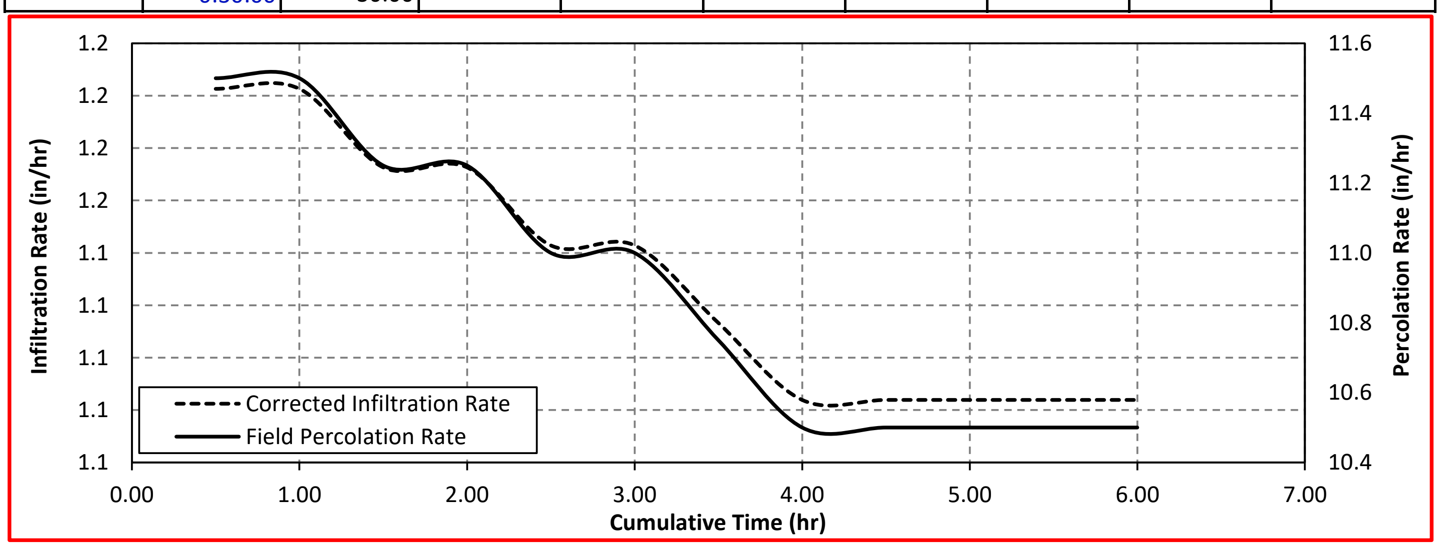
CRITERIA	TIME	TIME INTERVAL (min)	D_0, INITIAL DEPTH TO WATER (in)	D_f, FINAL DEPTH TO WATER (in)	ΔH, WATER DROP (in)	AVERAGE WETTED DEPTH (in)	PERC RATE (min/in)	PERC RATE (in/hr)	CORRECTED* INFILTRATION RATE (in/hr)
Sandy Soil Criteria						*Corrected utilizing the Porchet Method			
						Was Sandy Soil Criteria Met?			NO
Percolation Test Data	0:00:00	0:30:00	76	83.125	7.125	16.4375	4.21	14.25	1.55
	0:30:00	30.00							
	0:00:00	0:30:00	76	83	7	16.5	4.29	14.00	1.51
	0:30:00	30.00							
	0:00:00	0:30:00	76	82.875	6.875	16.5625	4.36	13.75	1.48
	0:30:00	30.00							
	0:00:00	0:30:00	76	82.75	6.75	16.625	4.44	13.50	1.45
	0:30:00	30.00							
	0:00:00	0:30:00	76	82.5	6.5	16.75	4.62	13.00	1.39
	0:30:00	30.00							
	0:00:00	0:30:00	76	82.75	6.75	16.625	4.44	13.50	1.45
	0:30:00	30.00							
	0:00:00	0:30:00	76	82.75	6.75	16.625	4.44	13.50	1.45
	0:30:00	30.00							
	0:00:00	0:30:00	76	82.5	6.5	16.75	4.62	13.00	1.39
	0:30:00	30.00							
	0:00:00	0:30:00	76	82.5	6.5	16.75	4.62	13.00	1.39
	0:30:00	30.00							
	0:00:00	0:30:00	76	82.5	6.5	16.75	4.62	13.00	1.39
	0:30:00	30.00							
	0:00:00	0:30:00	76	82.5	6.5	16.75	4.62	13.00	1.39
	0:30:00	30.00							
	0:00:00	0:30:00	76	82.5	6.5	16.75	4.62	13.00	1.39
	0:30:00	30.00							



PERCOLATION TEST - P-3

Project No.	20004-01	Project Name	Tentative Tract 37743 & 37859, Highgrove, CA
Project Location	Tentative Tract 37743 & 37859, Highgrove, CA	Soak Method	5 gallons
Drilling Date	1/20/2020	Soak Date	2/2/2020
Depth of Hole (in)	96		
Testing Date	2/3/2020	Borehole Diameter (in)	8
Test Refill Depth (in)	20		

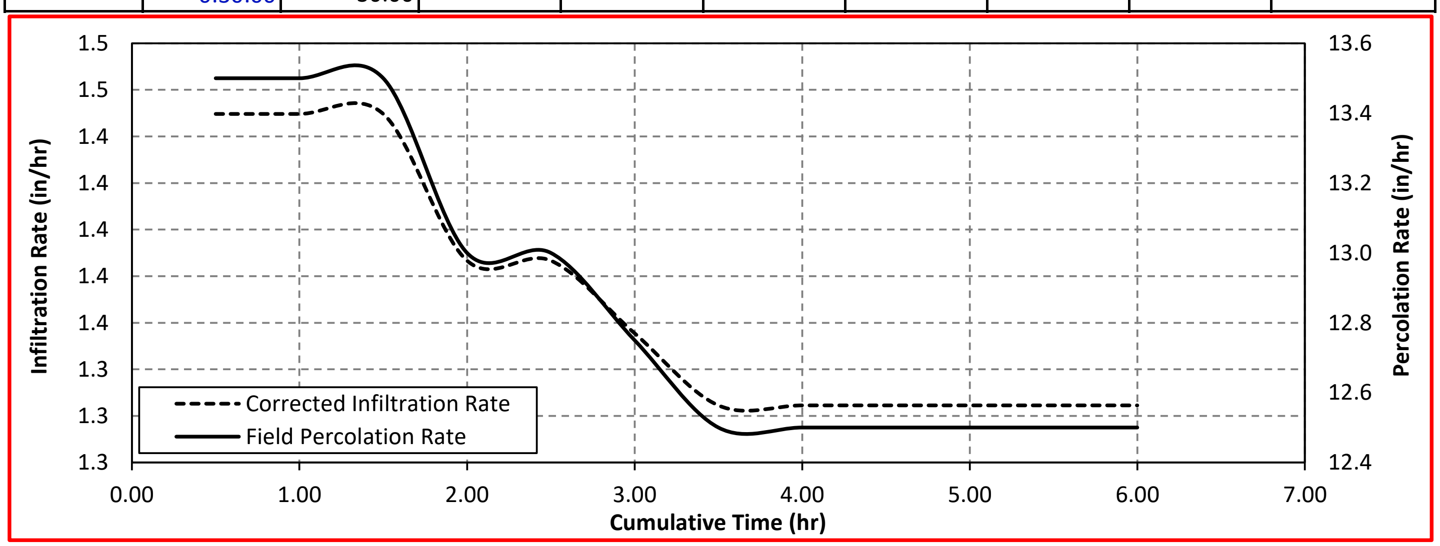
CRITERIA	TIME	TIME INTERVAL (min)	D_0, INITIAL DEPTH TO WATER (in)	D_f, FINAL DEPTH TO WATER (in)	ΔH, WATER DROP (in)	AVERAGE WETTED DEPTH (in)	PERC RATE (min/in)	PERC RATE (in/hr)	CORRECTED* INFILTRATION RATE (in/hr)
Sandy Soil Criteria						*Corrected utilizing the Porchet Method			
						Was Sandy Soil Criteria Met?			NO
Percolation Test Data	0:00:00	0:30:00	76	81.75	5.75	17.125	5.22	11.50	1.20
	0:30:00	30.00							
	0:00:00	0:30:00	76	81.75	5.75	17.125	5.22	11.50	1.20
	0:30:00	30.00							
	0:00:00	0:30:00	76	81.625	5.625	17.1875	5.33	11.25	1.17
	0:30:00	30.00							
	0:00:00	0:30:00	76	81.625	5.625	17.1875	5.33	11.25	1.17
	0:30:00	30.00							
	0:00:00	0:30:00	76	81.5	5.5	17.25	5.45	11.00	1.14
	0:30:00	30.00							
	0:00:00	0:30:00	76	81.5	5.5	17.25	5.45	11.00	1.14
	0:30:00	30.00							
	0:00:00	0:30:00	76	81.375	5.375	17.3125	5.58	10.75	1.11
	0:30:00	30.00							
	0:00:00	0:30:00	76	81.25	5.25	17.375	5.71	10.50	1.08
	0:30:00	30.00							
	0:00:00	0:30:00	76	81.25	5.25	17.375	5.71	10.50	1.08
	0:30:00	30.00							
	0:00:00	0:30:00	76	81.25	5.25	17.375	5.71	10.50	1.08
	0:30:00	30.00							
	0:00:00	0:30:00	76	81.25	5.25	17.375	5.71	10.50	1.08
	0:30:00	30.00							
	0:00:00	0:30:00	76	81.25	5.25	17.375	5.71	10.50	1.08
	0:30:00	30.00							



PERCOLATION TEST - P-4

Project No.	20004-01	Project Name	Tentative Tract 37743 & 37859, Highgrove, CA		
Project Location	Tentative Tract 37743 & 37859, Highgrove, CA			Soak Method	5 gallons
Drilling Date	1/20/2020	Soak Date	2/2/2020	Depth of Hole (in)	96
Testing Date	2/3/2020	Borehole Diameter (in)	8	Test Refill Depth (in)	20

CRITERIA	TIME	TIME INTERVAL (min)	D_0, INITIAL DEPTH TO WATER (in)	D_f, FINAL DEPTH TO WATER (in)	ΔH, WATER DROP (in)	AVERAGE WETTED DEPTH (in)	PERC RATE (min/in)	PERC RATE (in/hr)	CORRECTED* INFILTRATION RATE (in/hr)
Sandy Soil Criteria						*Corrected utilizing the Porchet Method			
						Was Sandy Soil Criteria Met?			NO
Percolation Test Data	0:00:00	0:30:00	76	82.75	6.75	16.625	4.44	13.50	1.45
	0:30:00	30.00							
	0:00:00	0:30:00	76	82.75	6.75	16.625	4.44	13.50	1.45
	0:30:00	30.00							
	0:00:00	0:30:00	76	82.75	6.75	16.625	4.44	13.50	1.45
	0:30:00	30.00							
	0:00:00	0:30:00	76	82.5	6.5	16.75	4.62	13.00	1.39
	0:30:00	30.00							
	0:00:00	0:30:00	76	82.5	6.5	16.75	4.62	13.00	1.39
	0:30:00	30.00							
	0:00:00	0:30:00	76	82.375	6.375	16.8125	4.71	12.75	1.36
	0:30:00	30.00							
	0:00:00	0:30:00	76	82.25	6.25	16.875	4.80	12.50	1.32
	0:30:00	30.00							
	0:00:00	0:30:00	76	82.25	6.25	16.875	4.80	12.50	1.32
	0:30:00	30.00							
	0:00:00	0:30:00	76	82.25	6.25	16.875	4.80	12.50	1.32
	0:30:00	30.00							
	0:00:00	0:30:00	76	82.25	6.25	16.875	4.80	12.50	1.32
	0:30:00	30.00							
	0:00:00	0:30:00	76	82.25	6.25	16.875	4.80	12.50	1.32
	0:30:00	30.00							
	0:00:00	0:30:00	76	82.25	6.25	16.875	4.80	12.50	1.32
	0:30:00	30.00							



Appendix 4: Historical Site Conditions

Phase I Environmental Site Assessment or Other Information on Past Site Use

Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation

3.5 Bioretention Facility

Type of BMP	LID – Bioretention
Treatment Mechanisms	Infiltration, Evapotranspiration, Evaporation, Biofiltration
Maximum Drainage Area	This BMP is intended to be integrated into a project's landscaped area in a distributed manner. Typically, contributing drainage areas to Bioretention Facilities range from less than 1 acre to a maximum of around 10 acres.
Other Names	Rain Garden, Bioretention Cell, Bioretention Basin, Biofiltration Basin, Landscaped Filter Basin, Porous Landscape Detention

Description

Bioretention Facilities are shallow, vegetated basins underlain by an engineered soil media. Healthy plant and biological activity in the root zone maintain and renew the macro-pore space in the soil and maximize plant uptake of pollutants and runoff. This keeps the Best Management Practice (BMP) from becoming clogged and allows more of the soil column to function as both a sponge (retaining water) and a highly effective and self-maintaining biofilter. In most cases, the bottom of a Bioretention Facility is unlined, which also provides an opportunity for infiltration to the extent the underlying onsite soil can accommodate. When the infiltration rate of the underlying soil is exceeded, fully biotreated flows are discharged via underdrains. Bioretention Facilities therefore will inherently achieve the maximum feasible level of infiltration and evapotranspiration and achieve the minimum feasible (but highly biotreated) discharge to the storm drain system.

Siting Considerations

These facilities work best when they are designed in a relatively level area. Unlike other BMPs, Bioretention Facilities can be used in smaller landscaped spaces on the site, such as:

- ✓ Parking islands
- ✓ Medians
- ✓ Site entrances

Landscaped areas on the site (such as may otherwise be required through minimum landscaping ordinances), can often be designed as Bioretention Facilities. This can be accomplished by:

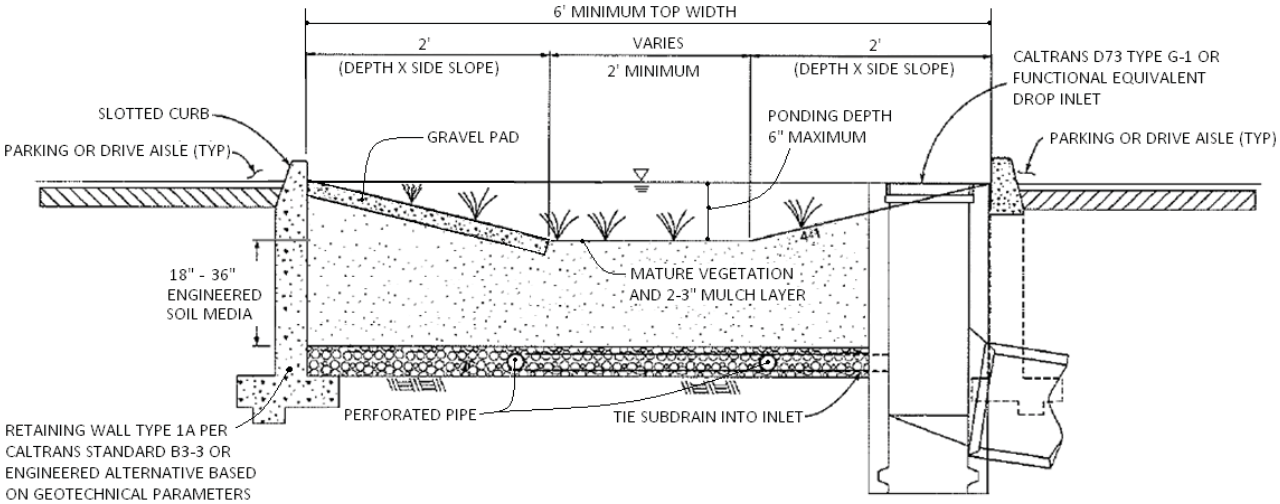
- *Depressing* landscaped areas below adjacent impervious surfaces, rather than elevating those areas
- Grading the site to direct runoff from those impervious surfaces *into* the Bioretention Facility, rather than away from the landscaping
- Sizing and designing the depressed landscaped area as a Bioretention Facility as described in this Fact Sheet

Bioretention Facilities should however not be used downstream of areas where large amounts of sediment can clog the system. Placing a Bioretention Facility at the toe of a steep slope should also be avoided due to the potential for clogging the engineered soil media with erosion from the slope, as well as the potential for damaging the vegetation.

Design and Sizing Criteria

The recommended cross section necessary for a Bioretention Facility includes:

- Vegetated area
- 18' minimum depth of engineered soil media
- 12' minimum gravel layer depth with 6' perforated pipes (added flow control features such as orifice plates may be required to mitigate for HCOC conditions)



While the 18-inch minimum engineered soil media depth can be used in some cases, it is recommended to use 24 inches or a preferred 36 inches to provide an adequate root zone for the chosen plant palate. Such a design also provides for improved removal effectiveness for nutrients. The recommended ponding depth inside of a Bioretention Facility is 6 inches; measured from the flat bottom surface to the top of the water surface as shown in Figure 1.

Because this BMP is filled with an engineered soil media, pore space in the soil and gravel layer is assumed to provide storage volume. However, several considerations must be noted:

- Surcharge storage above the soil surface (6 inches) is important to assure that design flows do not bypass the BMP when runoff exceeds the soil's absorption rate.
- In cases where the Bioretention Facility contains engineered soil media deeper than 36 inches, the pore space within the engineered soil media can only be counted to the 36-inch depth.
- A maximum of 30 percent pore space can be used for the soil media whereas a maximum of 40 percent pore space can be use for the gravel layer.

Figure 1: Standard Layout for a Bioretention Facility

Engineered Soil Media Requirements

The engineered soil media shall be comprised of 85 percent mineral component and 15 percent organic component, by volume, drum mixed prior to placement. The mineral component shall be a Class A sandy loam topsoil that meets the range specified in Table 1 below. The organic component shall be nitrogen stabilized compost[1], such that nitrogen does not leach from the media.

Table 1: Mineral Component Range Requirements

Percent Range	Component
70-80	Sand
15-20	Silt
5-10	Clay

The trip ticket, or certificate of compliance, shall be made available to the inspector to prove the engineered mix meets this specification.

Vegetation Requirements

Vegetative cover is important to minimize erosion and ensure that treatment occurs in the Bioretention Facility. The area should be designed for at least 70 percent mature coverage throughout the Bioretention Facility. To prevent the BMP from being used as walkways, Bioretention Facilities shall be planted with a combination of small trees, densely planted shrubs, and natural grasses. Grasses shall be native or ornamental; preferably ones that do not need to be mowed. The application of fertilizers and pesticides should be minimal. To maintain oxygen levels for the vegetation and promote biodegradation, it is important that vegetation not be completely submerged for any extended period of time. Therefore, a maximum of 6 inches of ponded water shall be used in the design to ensure that plants within the Bioretention Facility remain healthy.

A 2 to 3-inch layer of standard shredded aged hardwood mulch shall be placed as the top layer inside the Bioretention Facility. The 6-inch ponding depth shown in Figure 1 above shall be measured from the top surface of the 2 to 3-inch mulch layer.

Curb Cuts

To allow water to flow into the Bioretention Facility, 1-foot-wide (minimum) curb cuts should be placed approximately every 10 feet around the perimeter of the Bioretention Facility. Figure 2 shows a curb cut in a Bioretention Facility. Curb cut flow lines must be at or above the V_{BMP} water surface level.

[1] For more information on compost, visit the US Composting Council website at: http://compostingcouncil.org/

Figure 2: Curb Cut located in a Bioretention Facility

To reduce erosion, a gravel pad shall be placed at each inlet point to the Bioretention Facility. The gravel should be 1- to 1.5-inch diameter in size. The gravel should overlap the curb cut opening a minimum of 6 inches. The gravel pad inside the Bioretention Facility should be flush with the finished surface at the curb cut and extend to the bottom of the slope.

In addition, place an apron of stone or concrete, a foot square or larger, inside each inlet to prevent vegetation from growing up and blocking the inlet. See Figure 3.

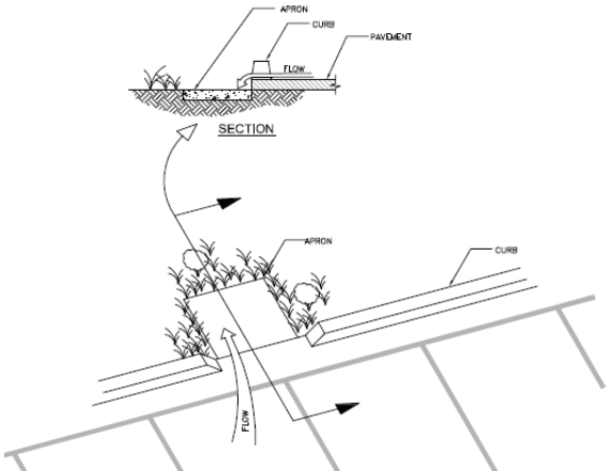


Figure 3: Apron located in a Bioretention Facility

Terracing the Landscaped Filter Basin

It is recommended that Bioretention Facilities be level. In the event the facility site slopes and lacks proper design, water would fill the lowest point of the BMP and then discharge from the basin without being treated. To ensure that the water will be held within the Bioretention Facility on sloped sites, the BMP must be terraced with nonporous check dams to provide the required storage and treatment capacity.

The terraced version of this BMP shall be used on non-flat sites with no more than a 3 percent slope. The surcharge depth cannot exceed 0.5 feet, and side slopes shall not exceed 4:1. Table 2 below shows the spacing of the check dams, and slopes shall be rounded up (i.e., 2.5 percent slope shall use 10' spacing for check dams).

Table 2: Check Dam Spacing

6" Check Dam Spacing	
Slope	**Spacing**
1%	*25'*
2%	*15'*
3%	*10'*

Roof Runoff

Roof downspouts may be directed towards Bioretention Facilities. However, the downspouts must discharge onto a concrete splash block to protect the Bioretention Facility from erosion.

Retaining Walls

It is recommended that Retaining Wall Type 1A, per Caltrans Standard B3-3 or equivalent, be constructed around the entire perimeter of the Bioretention Facility. This practice will protect the sides of the Bioretention Facility from collapsing during construction and maintenance or from high service loads adjacent to the BMP. Where such service loads would not exist adjacent to the BMP, an engineered alternative may be used if signed by a licensed civil engineer.

Side Slope Requirements

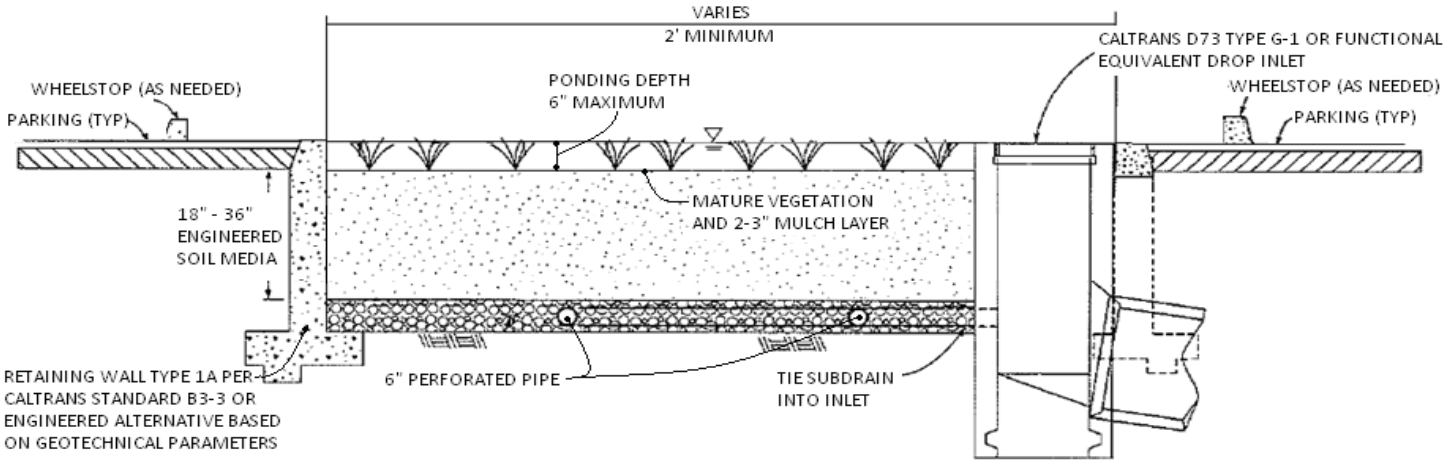
Bioretention Facilities Requiring Side Slopes

The design should assure that the Bioretention Facility does not present a tripping hazard. Bioretention Facilities proposed near pedestrian areas, such as areas parallel to parking spaces or along a walkway, must have a gentle slope to the bottom of the facility. Side slopes inside of a Bioretention Facility shall be 4:1. A typical cross section for the Bioretention Facility is shown in Figure 1.

Bioretention Facilities Not Requiring Side Slopes

Where cars park perpendicular to the Bioretention Facility, side slopes are not required. A 6-inch maximum drop may be used, and the Bioretention Facility must be planted with trees and shrubs to prevent pedestrian access. In this case, a curb is not placed around the Bioretention Facility,

but wheel stops shall be used to prevent vehicles from entering the Bioretention Facility, as shown in Figure 4.



Planter Boxes

Bioretention Facilities can also be placed above ground as planter boxes. Planter boxes must have a minimum width of 2 feet, a maximum surcharge depth of 6 inches, and no side slopes are necessary. Planter boxes must be constructed so as to ensure that the top surface of the engineered soil media will remain level. This option may be constructed of concrete, brick, stone or other stable materials that will not warp or bend. Chemically treated wood or galvanized steel, which has the ability to contaminate stormwater, should not be used. Planter boxes must be lined with an impermeable liner on all sides, including the bottom. Due to the impermeable liner, the inside bottom of the planter box shall be designed and constructed with a cross fall, directing treated flows within the subdrain layer toward the point where subdrain exits the planter box, and subdrains shall be oriented with drain holes oriented down. These provisions will help avoid excessive stagnant water within the gravel underdrain layer. Similar to the in-ground Bioretention Facility versions, this BMP benefits from healthy plants and biological activity in the root zone. Planter boxes should be planted with appropriately selected vegetation.

Figure 5: Planter Box
Source: LA Team Effort

Overflow

An overflow route is needed in the Bioretention Facility design to bypass stored runoff from storm events larger than V_{BMP} or in the event of facility or subdrain clogging. Overflow systems must connect to an acceptable discharge point, such as a downstream conveyance system as shown in Figure 1 and Figure 4. The inlet to the overflow structure shall be elevated inside the Bioretention Facility to be flush with the ponding surface for the design capture volume (V_{BMP}) as shown in Figure 4. This will allow the design capture volume to be fully treated by the Bioretention Facility, and for larger events to safely be conveyed to downstream systems. The overflow inlet shall **not** be located in the entrance of a Bioretention Facility, as shown in Figure 6.

Underdrain Gravel and Pipes

An underdrain gravel layer and pipes shall be provided in accordance with Appendix B – Underdrains.

Figure 6: Incorrect Placement of an Overflow Inlet.

Inspection and Maintenance Schedule

The Bioretention Facility area shall be inspected for erosion, dead vegetation, soggy soils, or standing water. The use of fertilizers and pesticides on the plants inside the Bioretention Facility should be minimized.

Schedule	Activity
Ongoing	• Keep adjacent landscape areas maintained. Remove clippings from landscape maintenance activities. • Remove trash and debris • Replace damaged grass and/or plants • Replace surface mulch layer as needed to maintain a 2-3 inch soil cover.
After storm events	• Inspect areas for ponding
Annually	• Inspect/clean inlets and outlets

Bioretention Facility Design Procedure

1) Enter the area tributary, A_T, to the Bioretention Facility.

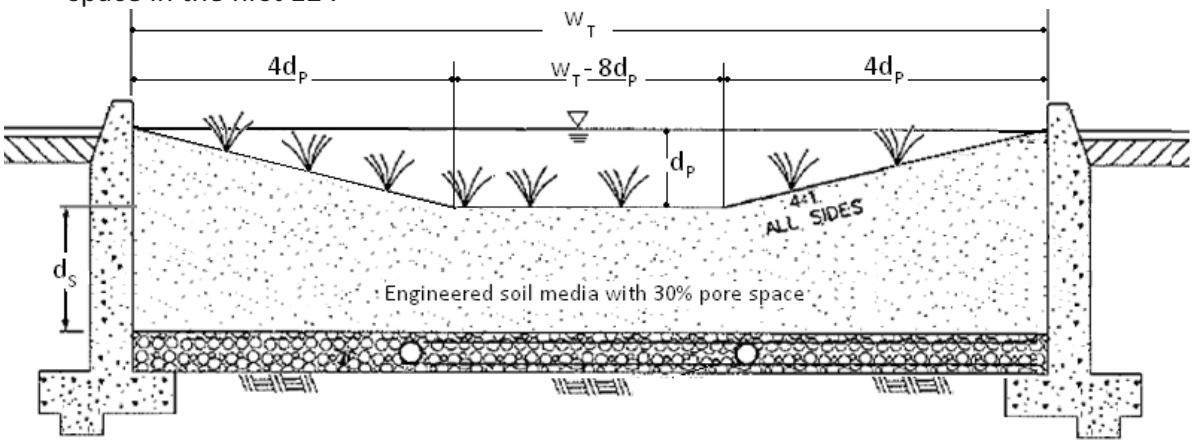
2) Enter the Design Volume, $V_{BMP,}$ determined from Section 2.1 of this Handbook.

3) Select the type of design used. There are two types of Bioretention Facility designs: the standard design used for most project sites that include side slopes, and the modified design used when the BMP is located perpendicular to the parking spaces or with planter boxes that do not use side slopes.

4) Enter the depth of the engineered soil media, d_S. The minimum depth for the engineered soil media can be 18' in limited cases, but it is recommended to use 24' or a preferred 36' to provide an adequate root zone for the chosen plant palette. Engineered soil media deeper than 36' will only get credit for the pore space in the first 36'.

5) Enter the top width of the Bioretention Facility.

6) Calculate the total effective depth, d_E, within the Bioretention Facility. The maximum allowable pore space of the soil media is 30% while the maximum allowable pore space for the gravel layer is 40%. Gravel layer deeper than 12' will only get credit for the pore space in the first 12'.



a. For the design with side slopes the following equation shall be used to determine the total effective depth. Where, d_P is the depth of ponding within the basin.

$$d_E(\text{ft}) = \frac{0.3 \times \left[\left(w_T(\text{ft}) \times d_S(\text{ft})\right) + 4\left(d_P(\text{ft})\right)^2\right] + 0.4 \times 1(\text{ft}) + d_P(\text{ft})\left[4d_P(\text{ft}) + \left(w_T(\text{ft}) - 8d_P(\text{ft})\right)\right]}{w_T(\text{ft})}$$

This above equation can be simplified if the maximum ponding depth of 0.5' is used. The equation below is used on the worksheet to find the minimum area required for the Bioretention Facility:

$$d_E(\text{ft}) = (0.3 \times d_S(\text{ft}) + 0.4 \text{ x } 1(\text{ft})) - \left(\frac{0.7\ (\text{ft}^2)}{w_T(\text{ft})}\right) + 0.5(\text{ft})$$

b. For the design without side slopes the following equation shall be used to determine the total effective depth:

$$d_E(\text{ft}) = d_P(\text{ft}) + [(0.3) \times d_S(\text{ft}) + (0.4) \times 1(\text{ft})]$$

The equation below, using the maximum ponding depth of 0.5', is used on the worksheet to find the minimum area required for the Bioretention Facility:

$$d_E(\text{ft}) = 0.5\ (\text{ft}) + [(0.3) \times d_S(\text{ft}) + (0.4) \times 1(\text{ft})]$$

7) Calculate the minimum surface area, A_M, required for the Bioretention Facility. This does not include the curb surrounding the Bioretention Facility or side slopes.

$$A_M(\text{ft}^2) = \frac{V_{BMP}(\text{ft}^3)}{d_E\ (\text{ft})}$$

8) Enter the proposed surface area. This area shall not be less than the minimum required surface area.

9) Verify that side slopes are no steeper than 4:1 in the standard design, and are not required in the modified design.

10) Provide the diameter, minimum 6 inches, of the perforated underdrain used in the Bioretention Facility. See Appendix B for specific information regarding perforated pipes.

11) Provide the slope of the site around the Bioretention Facility, if used. The maximum slope is 3 percent for a standard design.

12) Provide the check dam spacing, if the site around the Bioretention Facility is sloped.

13) Describe the vegetation used within the Bioretention Facility.

References Used to Develop this Fact Sheet

Anderson, Dale V. "Landscaped Filter Basin Soil Requirements." Riverside, May 2010.

California Department of Transportation. CalTrans Standard Plans. 15 September 2005. May 2010 <http://www.dot.ca.gov/hq/esc/oe/project_plans/HTM/stdplns-met-new99.htm>.

Camp Dresser and McKee Inc.; Larry Walker Associates. California Stormwater Best Management Practice Handbook for New Development and Redevelopment. California Stormwater Quality Association (CASQA), 2004.

Contra Costa Clean Water Program. Stormwater Quality Requirements for Development Applications. 3rd Edition. Contra Costa, 2006.

County of Los Angeles Public Works. Stormwater Best Management Practice Design and Maintenance Manual. Los Angeles, 2009.

Kim, Hunho, Eric A. Seagren and Allen P. Davis. "Engineered Bioretention for Removal of Nitrate from Stormwater Runoff." Water Environment Research 75.4 (2003): 355-366.

LA Team Effort. LA Team Effort: FREE Planter Boxes for Businesses. 2 November 2009. May 2010 <http://lateameffort.blogspot.com/2009/11/free-planter-boxes-for-businesses-est.html>.

Montgomery County Maryland Department of Permitting Services Water Resources Section. Biofiltration (BF). Montgomery County, 2005.

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

United States Environmental Protection Agency. Storm Water Technology Fact Sheet Bioretention. Washington D.C, 1999.

Urban Drainage and Flood Control District. Urban Storm Drainage Criteria Manual Volume 3 - Best Management Practices. Vol. 3. Denver, 2008. 3 vols.

Urbonas, Ben R. Stormwater Sand Filter Sizing and Design: A Unit Operations Approach. Denver: Urban Drainage and Flood Control District, 2002.

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	B & W Consulting Engineers, Inc.	Date	3/19/2019
Designed by	AW	Case No	
Company Project Number/Name	TPM37859		

BMP Identification

BMP NAME / ID: Bioretention - 1 (DMA 1)

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.70 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
1	*223349*	*Mixed Surface Types*	*0.6*	*0.41*	*91333.7*			
	223349	***Total***			**91333.7**	**0.70**	***5343***	***5671***

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	Woodard Group	Date	1/3/2024
Designed by	PR	Case No	
Company Project Number/Name	TPM37859		

BMP Identification

BMP NAME / ID: DMA 2

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.70 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
3	*136848*	*Mixed Surface Types*	*0.6*	*0.41*	*55961*			
	136848	***Total***			**55961**	**0.70**	***3273.7***	***3375***

Notes:

Bioretention Facility - Design Procedure	BMP ID 1	Legend:	Required Entries / Calculated Cells

Company Name:	B & W Consulting Engineers, Inc.	Date:	1/3/2024
Designed by:	PR	County/City Case No.:	

Design Volume

Enter the area tributary to this feature	A_T=	5.1	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	5,343	ft^3

Type of Bioretention Facility Design

○ Side slopes required (parallel to parking spaces or adjacent to walkways)

◉ No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	2.5	ft
Top Width of Bioretention Facility, excluding curb	w_T =	25.0	ft
Total Effective Depth, d_E			
$d_E = [(0.3) \times d_S + (0.4) \times 1] + 0.5$	d_E =	1.65	ft
Minimum Surface Area, A_m			
$A_M\,(ft^2) = \frac{V_{BMP}\,(ft^3)}{d_E\,(ft)}$	A_M =	3,239	ft^2
Proposed Surface Area	A=	3,437	ft^2
Minimum Required Length of Bioretention Facility, L	L =	129.6	ft

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =		:1
Diameter of Underdrain			inches
Longitudinal Slope of Site (3% maximum)			%
6" Check Dam Spacing			feet
Describe Vegetation:			

Notes:

Bioretention Facility - Design Procedure	BMP ID 2	Legend:	Required Entries / Calculated Cells

Company Name: Woodard Group | Date: 1/3/2025

Designed by: PR | County/City Case No.:

Design Volume

Enter the area tributary to this feature	A_T=	3.14	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	3,274	ft^3

Type of Bioretention Facility Design

○ Side slopes required (parallel to parking spaces or adjacent to walkways)

◉ No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	1.5	ft
Top Width of Bioretention Facility, excluding curb	w_T =	10.0	ft
Total Effective Depth, d_E			
$d_E = [(0.3) \times d_S + (0.4) \times 1] + 0.5$	d_E =	1.35	ft
Minimum Surface Area, A_m			
$A_M\,(ft^2) = \frac{V_{BMP}\,(ft^3)}{d_E\,(ft)}$	A_M =	2,425	ft^2
Proposed Surface Area	A=	2,500	ft^2
Minimum Required Length of Bioretention Facility, L	L =	242.5	ft

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =		:1
Diameter of Underdrain			inches
Longitudinal Slope of Site (3% maximum)			%
6" Check Dam Spacing			feet

Describe Vegetation:

Notes:

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

HYDROLOGY AND HYDRAULICS STUDY

FOR

HIGHGROVE COMMERCIAL DEVELOPMENT
N-E CORNER MT. VERNON AND CENTER
COUTY OF RIVERSIDE
CALIFORNIA

OWNER:

Steven Walker Communities
7111 Indiana Ave Ste. 300
Riverside, CA 92504
951-784-0840

PREPARED BY:

1485 Spruce St. Ste "M"
Riverside, CA 92507
951-907-5077

January 2024

TABLE OF CONTENTS

INTRODUCTION

This project is a proposed on a 10 Acre commercial site with a planned to 72 residential lots, recreational building, open spaces, bioretention, associated streets and parking. The site is located on the northwest corner of the intersection of Mt Vernon Avenue and Center Street in the County of Riverside.

METHODOLOGY

The hydrology calculations were performed using the Riverside County Hydrology Manual Rational Method procedures. The hydraulic calculations for the grate inlet and storm drain pipe were performed using the Hydraflow Express Extension for Autodesk AutoCAD Civil 3D program. Included in this report are the existing and proposed condition 2-year, hydrology calculations showing the peak flows to the storm drain system and the hydraulic calculations for grate inlet, storm drain pipe capacity.

EXISTING CONDITIONS

The existing site is currently undeveloped. Under existing condition, flow that originates onsite flow across the project area northwest from Center Street towards Mt Vernon Ave. There is no storm drain onsite and no storm drain on Mt Vernon Ave, so the water sheet flows out to the street. No offsite water enters the site.

CONCLUSION

Hydrology Results

Exist. Q2(cfs) Rational	Exist. Q2(cfs) TR55-24hr	Exist. Vol2(CF) TR55-24hr	Proposed Q2(cfs) Rational	Proposed Q2 (cfs) TR55-24hr	Proposed Vol2(CF) TR55-24hr	Flood Vol (req) (CF)	Water Quality Vol (CF)	Proposed Q2 (CF) TR55-24hr - **Mitigated**
4.78	6.09	24,731	5.41	6.24	26,349	8,617	9,046	1,618

Synthetic Unit Hydrograph results indicate: 2 year-24hr
Pre-development condition=24,731 CF
Post-development condition=26,349 CF
Pre/Post Difference=1,618 CF

Bioretention Capacity
V=9,046(Total Proposed Flood Volume)

9,046 CF is greater than 8,617 CF required.

II. EXISTING HYDROLOGY CALCULATIONS

- 2-Year Storm Hydrology Calculations

PROPOSED HYDROLOGY CALCULATIONS

- 2-Year Storm Hydrology Calculations

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2018 Version 9.0
Rational Hydrology Study Date: 01/08/24 File:PREHG2.out

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6539

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 2.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation = 0.454(In.)
100 year, 1 hour precipitation = 1.080(In.)

Storm event year = 2.0
Calculated rainfall intensity data:
1 hour intensity = 0.454(In/Hr)
Slope of intensity duration curve = 0.5000

++
Process from Point/Station 11.000 to Point/Station 10.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 711.760(Ft.)
Top (of initial area) elevation = 1126.400(Ft.)
Bottom (of initial area) elevation = 1109.500(Ft.)
Difference in elevation = 16.900(Ft.)
Slope = 0.02374 s(percent)= 2.37
TC = k(0.530)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 15.492 min.
Rainfall intensity = 0.893(In/Hr) for a 2.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.633
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000

```
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  78.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =      4.788(CFS)
Total initial stream area =        8.460(Ac.)
Pervious area fraction = 1.000
End of computations, total study area =            8.46 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged RI index number =  78.0
```

U n i t H y d r o g r a p h A n a l y s i s

Study date 01/08/24 File: PREHG2242.out

++

Riverside County Synthetic Unit Hydrology Method
RCFC & WCD Manual date - April 1978

Program License Serial Number 6539

English (in-lb) Input Units Used
English Rainfall Data (Inches) Input Values Used

English Units used in output format

Drainage Area = 8.46(Ac.) = 0.013 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment = 8.46(Ac.) = 0.013 Sq. Mi.
Length along longest watercourse = 711.76(Ft.)
Length along longest watercourse measured to centroid = 355.88(Ft.)
Length along longest watercourse = 0.135 Mi.
Length along longest watercourse measured to centroid = 0.067 Mi.
Difference in elevation = 16.90(Ft.)
Slope along watercourse = 125.3681 Ft./Mi.
Average Manning's 'N' = 0.040
Lag time = 0.064 Hr.
Lag time = 3.85 Min.
25% of lag time = 0.96 Min.
40% of lag time = 1.54 Min.
Unit time = 60.00 Min.
Duration of storm = 24 Hour(s)
User Entered Base Flow = 4.79(CFS)

2 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
8.46	1.94	16.41

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
8.46	4.54	38.41

STORM EVENT (YEAR) = 2.00
Area Averaged 2-Year Rainfall = 1.940(In)
Area Averaged 100-Year Rainfall = 4.540(In)

Point rain (area averaged) = 1.940(In)
Areal adjustment factor = 100.00 %
Adjusted average point rain = 1.940(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
8.460	86.00	0.600

Total Area Entered = 8.46(Ac.)

RI AMC2	RI AMC-2	Infil. Rate (In/Hr)	Impervious (Dec.%)	Adj. Infil. Rate (In/Hr)	Area% (Dec.)	F (In/Hr)
86.0	86.0	0.176	0.600	0.081	1.000	0.081
					Sum (F) =	0.081

Area averaged mean soil loss (F) (In/Hr) = 0.081
Minimum soil loss rate ((In/Hr)) = 0.040
(for 24 hour storm duration)
Soil low loss rate (decimal) = 0.900

U n i t H y d r o g r a p h
MOUNTAIN S-Curve

Unit Hydrograph Data

Unit time period (hrs)	Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)
1 1.000	1556.697	100.000	8.526
		Sum = 100.000	Sum= 8.526

The following loss rate calculations reflect use of the minimum calculated loss rate subtracted from the Storm Rain to produce the maximum Effective Rain value

Unit Time (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr) Max	Low	Effective (In/Hr)
1 1.00	1.20	0.023	(0.140)	0.021	0.002
2 2.00	1.30	0.025	(0.134)	0.023	0.003

3	3.00	1.80	0.035	(0.127)	0.031	0.003	
4	4.00	2.10	0.041	(0.121)	0.037	0.004	
5	5.00	2.80	0.054	(0.115)	0.049	0.005	
6	6.00	2.90	0.056	(0.109)	0.051	0.006	
7	7.00	3.80	0.074	(0.104)	0.066	0.007	
8	8.00	4.60	0.089	(0.098)	0.080	0.009	
9	9.00	6.30	0.122	0.093	(0.110)	0.029	
10	10.00	8.20	0.159	0.088	(0.143)	0.071	
11	11.00	7.00	0.136	0.083	(0.122)	0.053	
12	12.00	7.30	0.142	0.078	(0.127)	0.064	
13	13.00	10.80	0.210	0.073	(0.189)	0.136	
14	14.00	11.40	0.221	0.069	(0.199)	0.152	
15	15.00	10.40	0.202	0.065	(0.182)	0.137	
16	16.00	8.50	0.165	0.061	(0.148)	0.104	
17	17.00	1.40	0.027	(0.057)	0.024	0.003	
18	18.00	1.90	0.037	(0.054)	0.033	0.004	
19	19.00	1.30	0.025	(0.051)	0.023	0.003	
20	20.00	1.20	0.023	(0.048)	0.021	0.002	
21	21.00	1.10	0.021	(0.046)	0.019	0.002	
22	22.00	1.00	0.019	(0.043)	0.017	0.002	
23	23.00	0.90	0.017	(0.042)	0.016	0.002	
24	24.00	0.80	0.016	(0.041)	0.014	0.002	

(Loss Rate Not Used)

Sum = 100.0 Sum = 0.8

Flood volume = Effective rainfall 0.81(In)
times area 8.5(Ac.)/[(In)/(Ft.)] = 0.6(Ac.Ft)
Total soil loss = 1.13(In)
Total soil loss = 0.800(Ac.Ft)
Total rainfall = 1.94(In)
Flood volume = 24730.7 Cubic Feet
Total soil loss = 34845.3 Cubic Feet

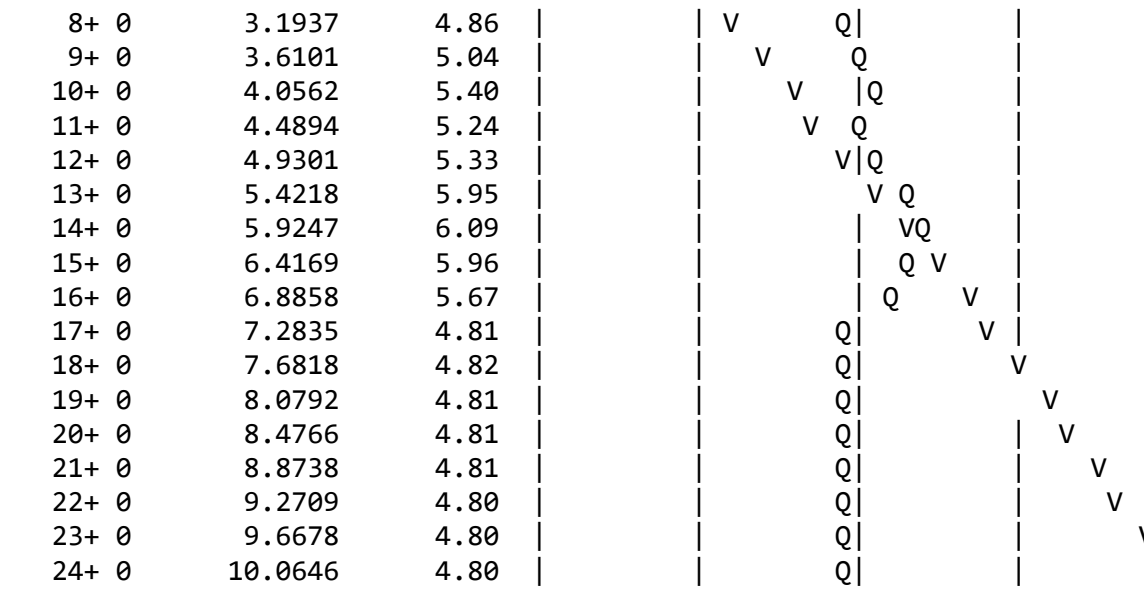
Peak flow rate of this hydrograph = 6.086(CFS)

++

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 60 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
1+ 0	0.3973	4.81	V	|	Q|	|	|
2+ 0	0.7948	4.81	| V	|	Q|	|	|
3+ 0	1.1930	4.82	| V	|	Q|	|	|
4+ 0	1.5916	4.82	| V	|	Q|	|	|
5+ 0	1.9911	4.83	| V	|	Q|	|	|
6+ 0	2.3908	4.84	| V	|	Q|	|	|
7+ 0	2.7917	4.85	| V	Q|	|	|	|


8+ 0 3.1937 4.86
9+ 0 3.6101 5.04
10+ 0 4.0562 5.40
11+ 0 4.4894 5.24
12+ 0 4.9301 5.33
13+ 0 5.4218 5.95
14+ 0 5.9247 6.09
15+ 0 6.4169 5.96
16+ 0 6.8858 5.67
17+ 0 7.2835 4.81
18+ 0 7.6818 4.82
19+ 0 8.0792 4.81
20+ 0 8.4766 4.81
21+ 0 8.8738 4.81
22+ 0 9.2709 4.80
23+ 0 9.6678 4.80
24+ 0 10.0646 4.80

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2018 Version 9.0
Rational Hydrology Study Date: 01/08/24 File:POSTHG2.out

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6539

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 2.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation = 0.454(In.)
100 year, 1 hour precipitation = 1.080(In.)

Storm event year = 2.0
Calculated rainfall intensity data:
1 hour intensity = 0.454(In/Hr)
Slope of intensity duration curve = 0.5000

++
Process from Point/Station 11.000 to Point/Station 10.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 993.000(Ft.)
Top (of initial area) elevation = 1115.500(Ft.)
Bottom (of initial area) elevation = 1095.000(Ft.)
Difference in elevation = 20.500(Ft.)
Slope = 0.02064 s(percent)= 2.06
TC = k(0.390)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 13.393 min.
Rainfall intensity = 0.961(In/Hr) for a 2.0 year storm
SINGLE FAMILY (1/4 Acre Lot)
Runoff Coefficient = 0.665
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000

```
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  56.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Initial subarea runoff =      5.408(CFS)
Total initial stream area =        8.460(Ac.)
Pervious area fraction = 0.500
End of computations, total study area =            8.46 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.500
Area averaged RI index number =  56.0
```

U n i t H y d r o g r a p h A n a l y s i s

Study date 01/08/24 File: POSTHGUH2.out

++

Riverside County Synthetic Unit Hydrology Method
RCFC & WCD Manual date - April 1978

Program License Serial Number 6539

English (in-lb) Input Units Used
English Rainfall Data (Inches) Input Values Used

English Units used in output format

Drainage Area = 8.46(Ac.) = 0.013 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment = 8.46(Ac.) = 0.013 Sq. Mi.
Length along longest watercourse = 993.00(Ft.)
Length along longest watercourse measured to centroid = 496.50(Ft.)
Length along longest watercourse = 0.188 Mi.
Length along longest watercourse measured to centroid = 0.094 Mi.
Difference in elevation = 20.50(Ft.)
Slope along watercourse = 109.0030 Ft./Mi.
Average Manning's 'N' = 0.020
Lag time = 0.042 Hr.
Lag time = 2.55 Min.
25% of lag time = 0.64 Min.
40% of lag time = 1.02 Min.
Unit time = 60.00 Min.
Duration of storm = 24 Hour(s)
User Entered Base Flow = 5.41(CFS)

2 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
8.46	1.94	16.41

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
8.46	4.54	38.41

STORM EVENT (YEAR) = 1.00
Area Averaged 2-Year Rainfall = 1.940(In)
Area Averaged 100-Year Rainfall = 4.540(In)

Point rain (area averaged) = 1.479(In)
Areal adjustment factor = 100.00 %
Adjusted average point rain = 1.479(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
8.460	56.00	0.600

Total Area Entered = 8.46(Ac.)

RI AMC2	RI AMC-2	Infil. Rate (In/Hr)	Impervious (Dec.%)	Adj. Infil. Rate (In/Hr)	Area% (Dec.)	F (In/Hr)
56.0	56.0	0.511	0.600	0.235	1.000	0.235
					Sum (F) =	0.235

Area averaged mean soil loss (F) (In/Hr) = 0.235
Minimum soil loss rate ((In/Hr)) = 0.117
(for 24 hour storm duration)
Soil low loss rate (decimal) = 0.420

U n i t H y d r o g r a p h
MOUNTAIN S-Curve

Unit Hydrograph Data

Unit time period (hrs)	Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)
1 1.000	2353.877	100.000	8.526
		Sum = 100.000	Sum= 8.526

The following loss rate calculations reflect use of the minimum calculated loss rate subtracted from the Storm Rain to produce the maximum Effective Rain value

Unit	Time (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr) Max	Low	Effective (In/Hr)
1	1.00	1.20	0.018	(0.408)	0.007	0.010
2	2.00	1.30	0.019	(0.389)	0.008	0.011

3	3.00	1.80	0.027	(0.370)	0.011	0.015
4	4.00	2.10	0.031	(0.352)	0.013	0.018
5	5.00	2.80	0.041	(0.335)	0.017	0.024
6	6.00	2.90	0.043	(0.318)	0.018	0.025
7	7.00	3.80	0.056	(0.301)	0.024	0.033
8	8.00	4.60	0.068	(0.285)	0.029	0.039
9	9.00	6.30	0.093	(0.270)	0.039	0.054
10	10.00	8.20	0.121	(0.255)	0.051	0.070
11	11.00	7.00	0.104	(0.240)	0.043	0.060
12	12.00	7.30	0.108	(0.227)	0.045	0.063
13	13.00	10.80	0.160	(0.213)	0.067	0.093
14	14.00	11.40	0.169	(0.201)	0.071	0.098
15	15.00	10.40	0.154	(0.189)	0.065	0.089
16	16.00	8.50	0.126	(0.177)	0.053	0.073
17	17.00	1.40	0.021	(0.167)	0.009	0.012
18	18.00	1.90	0.028	(0.157)	0.012	0.016
19	19.00	1.30	0.019	(0.148)	0.008	0.011
20	20.00	1.20	0.018	(0.140)	0.007	0.010
21	21.00	1.10	0.016	(0.133)	0.007	0.009
22	22.00	1.00	0.015	(0.126)	0.006	0.009
23	23.00	0.90	0.013	(0.122)	0.006	0.008
24	24.00	0.80	0.012	(0.118)	0.005	0.007

(Loss Rate Not Used)

Sum = 100.0 Sum = 0.9

Flood volume = Effective rainfall 0.86(In)
times area 8.5(Ac.)/[(In)/(Ft.)] = 0.6(Ac.Ft)
Total soil loss = 0.62(In)
Total soil loss = 0.438(Ac.Ft)
Total rainfall = 1.48(In)
Flood volume = 26348.8 Cubic Feet
Total soil loss = 19080.2 Cubic Feet

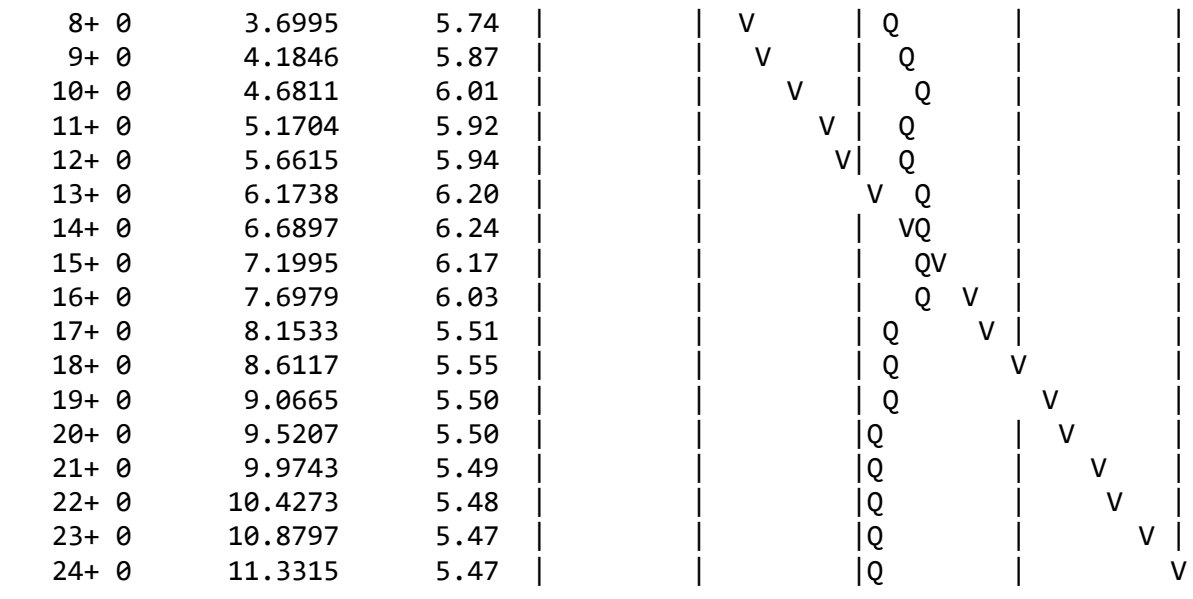
Peak flow rate of this hydrograph = 6.242(CFS)

++

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 60 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
1+ 0	0.4542	5.50	V	|	|Q	|	|
2+ 0	0.9090	5.50	| V	|	| Q	|	|
3+ 0	1.3668	5.54	| V	|	| Q	|	|
4+ 0	1.8265	5.56	| V	|	| Q	|	|
5+ 0	2.2904	5.61	| V	|	| Q	|	|
6+ 0	2.7548	5.62	| V|		| Q	|	|
7+ 0	3.2248	5.69	| V		| Q	|	|


8+ 0 3.6995 5.74
9+ 0 4.1846 5.87
10+ 0 4.6811 6.01
11+ 0 5.1704 5.92
12+ 0 5.6615 5.94
13+ 0 6.1738 6.20
14+ 0 6.6897 6.24
15+ 0 7.1995 6.17
16+ 0 7.6979 6.03
17+ 0 8.1533 5.51
18+ 0 8.6117 5.55
19+ 0 9.0665 5.50
20+ 0 9.5207 5.50
21+ 0 9.9743 5.49
22+ 0 10.4273 5.48
23+ 0 10.8797 5.47
24+ 0 11.3315 5.47

Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 **Potential Sources of Runoff Pollutants**	2 **Permanent Controls—Shown on WQMP Drawings**	3 **Permanent Controls—Listed in WQMP Table and Narrative**	4 **Operational BMPs—Included in WQMP Table and Narrative**
☒ **A.** On-site storm drain inlets	☒ Locations of inlets.	☒ Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch Basin Markers may be available from the Riverside County Flood Control and Water Conservation District, call 951.955.1200 to verify.	☒ Maintain and periodically repaint or replace inlet markings. ☒ Provide stormwater pollution prevention information to new site owners, lessees, or operators. ☒ See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com ☒ Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."
☐ **B.** Interior floor drains and elevator shaft sump pumps		☐ State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.	☐ Inspect and maintain drains to prevent blockages and overflow.
☐ **C.** Interior parking garages		☐ State that parking garage floor drains will be plumbed to the sanitary sewer.	☐ Inspect and maintain drains to prevent blockages and overflow.

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 **Potential Sources of Runoff Pollutants**	2 **Permanent Controls—Shown on WQMP Drawings**	3 **Permanent Controls—Listed in WQMP Table and Narrative**	4 **Operational BMPs—Included in WQMP Table and Narrative**
☐ **D1.** Need for future indoor & structural pest control		☐ Note building design features that discourage entry of pests.	☐ Provide Integrated Pest Management information to owners, lessees, and operators.
☒ **D2.** Landscape/ Outdoor Pesticide Use	☐ Show locations of native trees or areas of shrubs and ground cover to be undisturbed and retained. ☒ Show self-retaining landscape areas, if any. ☒ Show stormwater treatment and hydrograph modification management BMPs. (See instructions in Chapter 3, Step 5 and guidance in Chapter 5.)	☒State that final landscape plans will accomplish all of the following. ☐ Preserve existing native trees, shrubs, and ground cover to the maximum extent possible. ☒ Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution. ☐ Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions. ☒ Consider using pest-resistant plants, especially adjacent to hardscape. ☒ To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	☒ Maintain landscaping using minimum or no pesticides. ☒ See applicable operational BMPs in "What you should know for…..Landscape and Gardening" at http://rcflood.org/stormwater/Downloads/LandscapeGardenBrochure.pdf ☒ Provide IPM information to new owners, lessees and operators.

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 **Potential Sources of Runoff Pollutants**	2 **Permanent Controls—Shown on WQMP Drawings**	3 **Permanent Controls—Listed in WQMP Table and Narrative**	4 **Operational BMPs—Included in WQMP Table and Narrative**
☐ **E.** Pools, spas, ponds, decorative fountains, and other water features.	☐ Show location of water feature and a sanitary sewer cleanout in an accessible area within 10 feet. (Exception: Public pools must be plumbed according to County Department of Environmental Health Guidelines.)	If the Co-Permittee requires pools to be plumbed to the sanitary sewer, place a note on the plans and state in the narrative that this connection will be made according to local requirements.	☐ See applicable operational BMPs in "Guidelines for Maintaining Your Swimming Pool, Jacuzzi and Garden Fountain" at http://rcflood.org/stormwater/
☐ **F.** Food service	☐ For restaurants, grocery stores, and other food service operations, show location (indoors or in a covered area outdoors) of a floor sink or other area for cleaning floor mats, containers, and equipment. ☐ On the drawing, show a note that this drain will be connected to a grease interceptor before discharging to the sanitary sewer.	☐ Describe the location and features of the designated cleaning area. ☐ Describe the items to be cleaned in this facility and how it has been sized to insure that the largest items can be accommodated.	☐ See the brochure, "The Food Service Industry Best Management Practices for: Restaurants, Grocery Stores, Delicatessens and Bakeries" at http://rcflood.org/stormwater/ Provide this brochure to new site owners, lessees, and operators.
☐ **G.** Refuse areas	☐ Show where site refuse and recycled materials will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas. ☐ If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run-on and show locations of berms to prevent runoff from the area. ☐ Any drains from dumpsters, compactors, and tallow bin areas shall be connected to a grease removal device before discharge to sanitary sewer.	☐ State how site refuse will be handled and provide supporting detail to what is shown on plans. ☐ State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.	State how the following will be implemented: ☐ Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☐ **H.** Industrial processes.	☐ Show process area.	☐ If industrial processes are to be located on site, state: "All process activities to be performed indoors. No processes to drain to exterior or to storm drain system."	☐ See Fact Sheet SC-10, "Non-Stormwater Discharges" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com See the brochure "Industrial & Commercial Facilities Best Management Practices for: Industrial, Commercial Facilities" at http://rcflood.org/stormwater/

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☐ **I.** Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.)	☐ Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or run-off from area. ☐ Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners, or vaults. ☐ Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.	Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains. Where appropriate, reference documentation of compliance with the requirements of Hazardous Materials Programs for: • Hazardous Waste Generation • Hazardous Materials Release Response and Inventory • California Accidental Release (CalARP) • Aboveground Storage Tank • Uniform Fire Code Article 80 Section 103(b) & (c) 1991 • Underground Storage Tank www.cchealth.org/groups/hazmat /	☐ See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials " in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 **Potential Sources of Runoff Pollutants**	2 **Permanent Controls—Shown on WQMP Drawings**	3 **Permanent Controls—Listed in WQMP Table and Narrative**	4 **Operational BMPs—Included in WQMP Table and Narrative**
☐ **J.** Vehicle and Equipment Cleaning	☐ Show on drawings as appropriate: (1) Commercial/industrial facilities having vehicle/equipment cleaning needs shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such uses. (2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited on-site and hoses are provided with an automatic shutoff to discourage such use). (3) Washing areas for cars, vehicles, and equipment shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer. (4) Commercial car wash facilities shall be designed such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer, or a wastewater reclamation system shall be installed.	☐ If a car wash area is not provided, describe any measures taken to discourage on-site car washing and explain how these will be enforced.	Describe operational measures to implement the following (if applicable): ☐ Washwater from vehicle and equipment washing operations shall not be discharged to the storm drain system. Refer to "Outdoor Cleaning Activities and Professional Mobile Service Providers" for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://rcflood.org/stormwater/ ☐Car dealerships and similar may rinse cars with water only.

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 **Potential Sources of Runoff Pollutants**	2 **Permanent Controls—Shown on WQMP Drawings**	3 **Permanent Controls—Listed in WQMP Table and Narrative**	4 **Operational BMPs—Included in WQMP Table and Narrative**
☐ **K.** Vehicle/Equipment Repair and Maintenance	☐ Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to prevent run-on and runoff of stormwater. ☐ Show secondary containment for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas. ☐ Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.	☐ State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area. ☐ State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements. ☐ State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.	In the Stormwater Control Plan, note that all of the following restrictions apply to use the site: ☐ No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinsewater from parts cleaning into storm drains. ☐ No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately. ☐ No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment. Refer to "Automotive Maintenance & Car Care Best Management Practices for Auto Body Shops, Auto Repair Shops, Car Dealerships, Gas Stations and Fleet Service Operations". Brochure can be found at http://rcflood.org/stormwater/ Refer to Outdoor Cleaning Activities and Professional Mobile Service Providers for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://rcflood.org/stormwater/

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 **Potential Sources of Runoff Pollutants**	2 **Permanent Controls—Shown on WQMP Drawings**	3 **Permanent Controls—Listed in WQMP Table and Narrative**	4 **Operational BMPs—Included in WQMP Table and Narrative**
☐ **L.** Fuel Dispensing Areas	☐ Fueling areas[6] shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are: a) graded at the minimum slope necessary to prevent ponding; and b) separated from the rest of the site by a grade break that prevents run-on of stormwater to the maximum extent practicable. ☐ Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area[1].] The canopy [or cover] shall not drain onto the fueling area.		☐ The property owner shall dry sweep the fueling area routinely. ☐ See the Fact Sheet SD-30 , "Fueling Areas" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

[6] The fueling area shall be defined as the area extending a minimum of 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus a minimum of one foot, whichever is greater.

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 **Potential Sources of Runoff Pollutants**	2 **Permanent Controls—Shown on WQMP Drawings**	3 **Permanent Controls—Listed in WQMP Table and Narrative**	4 **Operational BMPs—Included in WQMP Table and Narrative**
☐ **M.** Loading Docks	☐ Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct stormwater away from the loading area. Water from loading dock areas shall be drained to the sanitary sewer, or diverted and collected for ultimate discharge to the sanitary sewer. ☐ Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation. ☐ Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.		☐ Move loaded and unloaded items indoors as soon as possible. ☐ See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 **Potential Sources of Runoff Pollutants**	2 **Permanent Controls—Shown on WQMP Drawings**	3 **Permanent Controls—Listed in WQMP Table and Narrative**	4 **Operational BMPs—Included in WQMP Table and Narrative**
☐ **N.** Fire Sprinkler Test Water		☐ Provide a means to drain fire sprinkler test water to the sanitary sewer.	☐ See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
☐ **O.** Miscellaneous Drain or Wash Water or Other Sources ☐ Boiler drain lines ☐ Condensate drain lines ☐ Rooftop equipment ☐ Drainage sumps ☒ Roofing, gutters, and trim. ☐ Other sources		☐ Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system. ☐ Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system. ☒ Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment. ☐ Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water. ☐ Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff. ☐ Include controls for other sources as specified by local reviewer.	

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 **Potential Sources of Runoff Pollutants**	2 **Permanent Controls—Shown on WQMP Drawings**	3 **Permanent Controls—Listed in WQMP Table and Narrative**	4 **Operational BMPs—Included in WQMP Table and Narrative**
☒ **P.** Plazas, sidewalks, and parking lots.			☒ Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.

Appendix 9: O&M

Operation and Maintenance Plan and Documentation of Finance, Maintenance and Recording Mechanisms

To Be Included with Final WQMP

Appendix 10: Educational Materials

BMP Fact Sheets, Maintenance Guidelines and Other End-User BMP Information

1. "A citizen's guide to understanding Stormwater" from EPA 833-B-00-002.
2. Stormwater pollution what you should know for "Outdoor Cleaning Activities and Non-point Source Discharges" from CRFC
3. Guidelines for maintaining your swimming pool, Jacuzzi and garden fountain.
4. CASQA Handouts

SD-10 Site Design & Landscape Planning

SD-11 Roof Runoff Control

SD-12 Efficient Irrigation

SD-13 Storm Drain Signage

SC-10 Non-Stormwater Discharges

SC-44 Drainage System Maintenance

WHEN IT RAINS IT DRAINS

For more information contact:

ONLY RAIN IN THE STORM DRAIN
Riverside County Flood Control District
1995 Market Street, Riverside, CA 92501
Call Toll Free: 1-800-506-2555
E-mail: flood.fcnpdes@co.riverside.ca.us

or visit
www.epa.gov/npdes/stormwater
www.epa.gov/nps

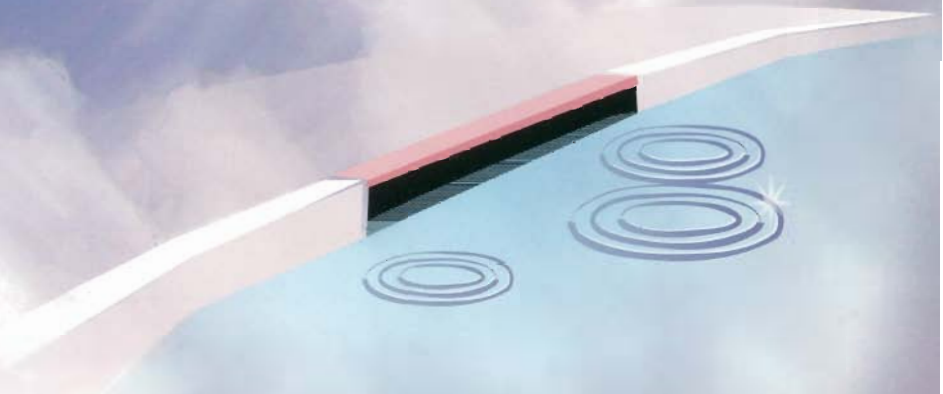
EPA United States Environmental Protection Agency

EPA 833-B-03-002

January 2003

THE YEAR OF CLEAN WATER
Celebration & Recommitment

After the Storm



A Citizen's Guide to Understanding Stormwater

WHEN IT RAINS IT DRAINS

What is stormwater runoff?

Stormwater runoff occurs when precipitation from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, and streets prevent stormwater from naturally soaking into the ground.

Why is stormwater runoff a problem?

Stormwater can pick up debris, chemicals, dirt, and other pollutants and flow into a storm sewer system or directly to a lake, stream, river, wetland, or coastal water. Anything that enters a storm sewer system is discharged untreated into the waterbodies we use for swimming, fishing, and providing drinking water.

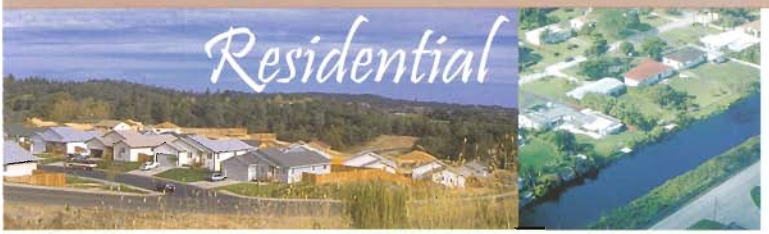
The effects of pollution

Polluted stormwater runoff can have many adverse effects on plants, fish, animals, and people.

- Sediment can cloud the water and make it difficult or impossible for aquatic plants to grow. Sediment also can destroy aquatic habitats.
- Excess nutrients can cause algae blooms. When algae die, they sink to the bottom and decompose in a process that removes oxygen from the water. Fish and other aquatic organisms can't exist in water with low dissolved oxygen levels.
- Bacteria and other pathogens can wash into swimming areas and create health hazards, often making beach closures necessary.

- Debris—plastic bags, six-pack rings, bottles, and cigarette butts—washed into waterbodies can choke, suffocate, or disable aquatic life like ducks, fish, turtles, and birds.
- Household hazardous wastes like insecticides, pesticides, paint, solvents, used motor oil, and other auto fluids can poison aquatic life. Land animals and people can become sick or die from eating diseased fish and shellfish or ingesting polluted water.
- Polluted stormwater often affects drinking water sources. This, in turn, can affect human health and increase drinking water treatment costs.

Stormwater Pollution Solutions



Residential

Recycle or properly dispose of household products that contain chemicals, such as insecticides, pesticides, paint, solvents, and used motor oil and other auto fluids. Don't pour them onto the ground or into storm drains.

Lawn care

Excess fertilizers and pesticides applied to lawns and gardens wash off and pollute streams. In addition, yard clippings and leaves can wash into storm drains and contribute nutrients and organic matter to streams.

- Don't overwater your lawn. Consider using a soaker hose instead of a sprinkler.
- Use pesticides and fertilizers sparingly. When use is necessary, use these chemicals in the recommended amounts. Use organic mulch or safer pest control methods whenever possible.
- Compost or mulch yard waste. Don't leave it in the street or sweep it into storm drains or streams.
- Cover piles of dirt or mulch being used in landscaping projects.

Auto care

Washing your car and degreasing auto parts at home can send detergents and other contaminants through the storm sewer system. Dumping automotive fluids into storm drains has the same result as dumping the materials directly into a waterbody.

- Use a commercial car wash that treats or recycles its wastewater, or wash your car on your yard so the water infiltrates into the ground.
- Repair leaks and dispose of used auto fluids and batteries at designated drop-off or recycling locations.

Septic systems

Leaking and poorly maintained septic systems release nutrients and pathogens (bacteria and viruses) that can be picked up by stormwater and discharged into nearby waterbodies. Pathogens can cause public health problems and environmental concerns.

- Inspect your system every 3 years and pump your tank as necessary (every 3 to 5 years).
- Don't dispose of household hazardous waste in sinks or toilets.

Pet waste

Pet waste can be a major source of bacteria and excess nutrients in local waters.

- When walking your pet, remember to pick up the waste and dispose of it properly. Flushing pet waste is the best disposal method. Leaving pet waste on the ground increases public health risks by allowing harmful bacteria and nutrients to wash into the storm drain and eventually into local waterbodies.

Education is essential to changing people's behavior. Signs and markers near storm drains warn residents that pollutants entering the drains will be carried untreated into a local waterbody.

Residential landscaping

Permeable Pavement—Traditional concrete and asphalt don't allow water to soak into the ground. Instead these surfaces rely on storm drains to divert unwanted water. Permeable pavement systems allow rain and snowmelt to soak through, decreasing stormwater runoff.

Rain Barrels—You can collect rainwater from rooftops in mosquito-proof containers. The water can be used later on lawn or garden areas.

Rain Gardens and Grassy Swales—Specially designed areas planted with native plants can provide natural places for rainwater to collect and soak into the ground. Rain from rooftop areas or paved areas can be diverted into these areas rather than into storm drains.

Vegetated Filter Strips—Filter strips are areas of native grass or plants created along roadways or streams. They trap the pollutants stormwater picks up as it flows across driveways and streets.

Commercial

Dirt, oil, and debris that collect in parking lots and paved areas can be washed into the storm sewer system and eventually enter local waterbodies.

- Sweep up litter and debris from sidewalks, driveways and parking lots, especially around storm drains.
- Cover grease storage and dumpsters and keep them clean to avoid leaks.
- Report any chemical spill to the local hazardous waste cleanup team. They'll know the best way to keep spills from harming the environment.

Erosion controls that aren't maintained can cause excessive amounts of sediment and debris to be carried into the stormwater system. Construction vehicles can leak fuel, oil, and other harmful fluids that can be picked up by stormwater and deposited into local waterbodies.

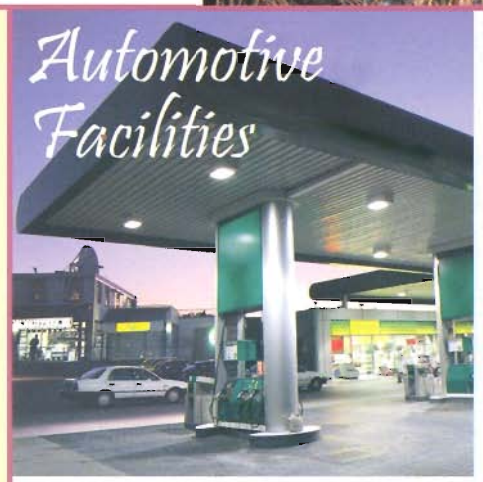
- Divert stormwater away from disturbed or exposed areas of the construction site.
- Install silt fences, vehicle mud removal areas, vegetative cover, and other sediment and erosion controls and properly maintain them, especially after rainstorms.
- Prevent soil erosion by minimizing disturbed areas during construction projects, and seed and mulch bare areas as soon as possible.

Construction

Agriculture

Lack of vegetation on streambanks can lead to erosion. Overgrazed pastures can also contribute excessive amounts of sediment to local waterbodies. Excess fertilizers and pesticides can poison aquatic animals and lead to destructive algae blooms. Livestock in streams can contaminate waterways with bacteria, making them unsafe for human contact.

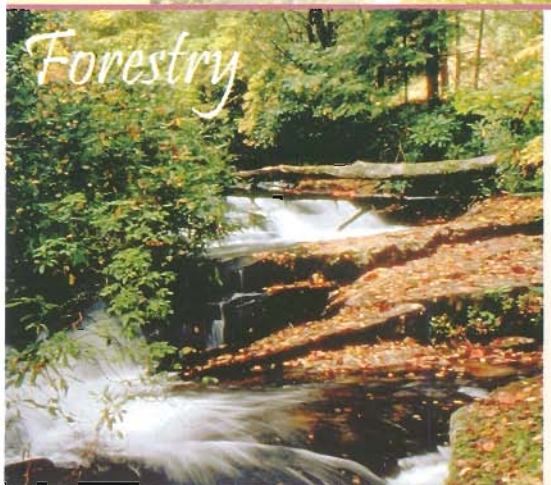
- Keep livestock away from streambanks and provide them a water source away from waterbodies.
- Store and apply manure away from waterbodies and in accordance with a nutrient management plan.
- Vegetate riparian areas along waterways.
- Rotate animal grazing to prevent soil erosion in fields.
- Apply fertilizers and pesticides according to label instructions to save money and minimize pollution.



Automotive Facilities

Uncovered fueling stations allow spills to be washed into storm drains. Cars waiting to be repaired can leak fuel, oil, and other harmful fluids that can be picked up by stormwater.

- Clean up spills immediately and properly dispose of cleanup materials.
- Provide cover over fueling stations and design or retrofit facilities for spill containment.
- Properly maintain fleet vehicles to prevent oil, gas, and other discharges from being washed into local waterbodies.
- Install and maintain oil/water separators.



Forestry

Improperly managed logging operations can result in erosion and sedimentation.

- Conduct preharvest planning to prevent erosion and lower costs.
- Use logging methods and equipment that minimize soil disturbance.
- Plan and design skid trails, yard areas, and truck access roads to minimize stream crossings and avoid disturbing the forest floor.
- Construct stream crossings so that they minimize erosion and physical changes to streams.
- Expedite revegetation of cleared areas.

Helpful telephone numbers and links:

WATER AGENCY LIST in Riverside County

City of Banning	(951) 922-3130
City of Beaumont	(951) 769-8520
City of Blythe	(760) 922-6161
City of Coachella	(760) 398-3502
Coachella Valley Water District	(760) 398-2651
City of Corona	(951) 736-2259
Desert Center, CSA #51	(760) 227-3203
Eastern Municipal Water District	(951) 928-3777
Elsinore Valley MWD	(951) 674-3146
Farm Mutual Water Company	(951) 244-4198
City of Hemet	(951) 765-3712
Idyllwild Water District	(951) 659-2143
Jurupa Community Services District	(951) 360-8795
Lake Hemet MWD	(951) 658-3241
Lee Lake Water District	(951) 277-1414
March Air Force Base	(951) 656-7000
Mission Springs Water District	(760) 329-6448
City of Palm Springs	(760) 323-8253
Rancho Caballero	(951) 780-9272
Rancho California Water District	(951) 296-6900
Ripley, CSA #62	(760) 922-4951
City of Riverside	(951) 351-6170
Rubidoux Community Services District	(951) 684-7580
Silent Valley Club, Inc	(951) 849-4501
Valley Sanitary District	(760) 347-2356
Western Municipal Water District	(951) 789-5000
Yucaipa Valley Water District	(909) 797-5117

To report illegal dumping into storm drains or clogged storm drains, please call:

1-800-506-2555

Online resources include:

Riverside County Flood Control District outreach materials page:
www.floodcontrol.co.riverside.ca.us

California Storm Water Quality Association
www.casqa.org or www.cabmphandbooks.com

State Water Resources Control Board, Water Quality
www.swrcb.ca.gov/stormwtr/index.html

U.S. Environmental Protection Agency
www.epa.gov/oppt/p2home/programs/busprac.htm

StormWater Pollution

What you should know for...

OUTDOOR CLEANING ACTIVITIES AND NON-POINT SOURCE DISCHARGES

For disposal of wash water from:

- Sidewalk, plaza or parking lot cleaning
- Vehicle washing or detailing
- Building exterior cleaning
- Waterproofing
- Equipment cleaning or degreasing

Do you know . . . where the water actually goes?

Storm Drains are not connected to sanitary sewer systems and treatment plants!

The primary purpose of storm drains is to carry rain water away from developed areas to prevent flooding. Pollutants discharged to storm drains are conveyed directly into rivers, lakes and streams. Soaps, degreasers, automotive fluids, litter and a host of other materials washed off buildings, sidewalks, plazas, parking areas, vehicles and equipment must be properly managed to prevent the pollution of rivers, lakes and streams.

Preventing pollution is the best way to protect the environment. In addition, it is much easier and less costly than cleaning up "after the fact."

The Cities and County of Riverside Regional Water Quality Control Board

A WATERSHED is an area of land that catches rain and snow, then drains or seeps into a marsh, stream, river, lake or groundwater. Watersheds come in all shapes and sizes, crossing county, state, and national boundaries, therefore many of our activities at home, work or play affect the quality of our watersheds.

In accordance with state and federal law to protect our watersheds, the CITIES AND COUNTY OF RIVERSIDE have adopted ordinances for stormwater management and discharge control to prohibit the discharge of wastes into the storm drain system or local surface waters. This INCLUDES discharge of wash water from outdoor cleaning activities which may contain pollutants such as oil, grease, detergent, degreasers, trash, pet waste or other materials.

PLEASE NOTE: Check with your Regional Water Quality Control Board, local municipal government and water agencies on what the restrictions are in your area.

Help Protect Our Waterways!

Use These Guidelines For Outdoor Cleaning Activities and Wash Water Disposal

DO NOT . . . dispose of water containing soap or any other type of cleaning agent into a storm drain or water body. This is a direct violation of state and/or local regulations. Because wash water from cleaning parking areas may contain metallic brake pad dust, oil and other automotive fluids, litter, food wastes and other materials, if should never be discharged to a street, gutter or storm drain.

DO . . . dispose of small amounts of wash water from cleaning building exteriors, sidewalks or plazas onto landscaped or unpaved surfaces, provided you have the owner's permission and the discharge will not cause nuisance problems or flow into a street or storm drain.

DO . . . check with your sanitary sewer agency's policies and requirements concerning wash water disposal. Wash water from outdoor cleaning activities may be acceptable for disposal to the sanitary sewer with specific permission. See the list on the back of this flyer for phone numbers of the sanitary sewer agencies in your area.

DO . . . Understand that mobile auto detailers should divert wash water to landscaped or dirt areas. Be aware that soapy wash water may damage landscaping. Residual wash water may remain on paved surfaces to evaporate. Residues should be swept up and disposed of.

DO NOT . . . Dispose of leftover cleaning agents into the gutter. storm drain or sanitary sewer.

DO . . . understand that wash water (without soap) used to remove dust from a clean vehicle may be discharged to a street or drain. Wash water from sidewalk, plaza, and building surface cleaning may go into a street or storm drain **IF ALL** of the following conditions are met:

1. The surface being washed is free of residual oil, debris and other materials by using dry cleanup methods (i.e., sweeping, and cleaning any oil or chemical spills with rags or other absorbent materials before using water).
2. Washing is done with water only, not with soap or other cleaning materials.
3. You have not used the water to remove paint from surfaces during cleaning.

CALL 1-800-506-2555
TO REPORT ILLEGAL POLLUTING OF STORM DRAINS

or visit
www.floodcontrol.co.riverside.ca.us

USING CLEANING AGENTS:

If you must use soap, use biodegradable/ phosphate-free cleaners. Although the use of nontoxic cleaning products is strongly encouraged, do understand that these products can degrade water quality. The discharge of these products into the street, gutters, storm drain system or waterways is prohibited by local ordinances and the State Water Code. Avoid use of petroleum-based cleaning products.

When cleaning surfaces with a high-pressure washer or steam cleaning methods, additional precautions should be taken to prevent the discharge of pollutants into the storm drain system. These two methods of surface cleaning, as compared to the use of a low-pressure hose, can remove additional materials that can contaminate local waterways.

OTHER TIPS TO HELP PROTECT OUR WATER . . .

SCREENING WASH WATER

A thorough dry cleanup before washing exterior surfaces such as building and decks without loose paint, sidewalks, or plaza areas, should be sufficient to protect receiving waters. HOWEVER, if any debris (solids) could enter storm drains or remain in the gutter or street after cleaning, wash water should first pass through a "20 mesh" or finer screen to catch the solid materials, the mesh should then be disposed of in the trash.

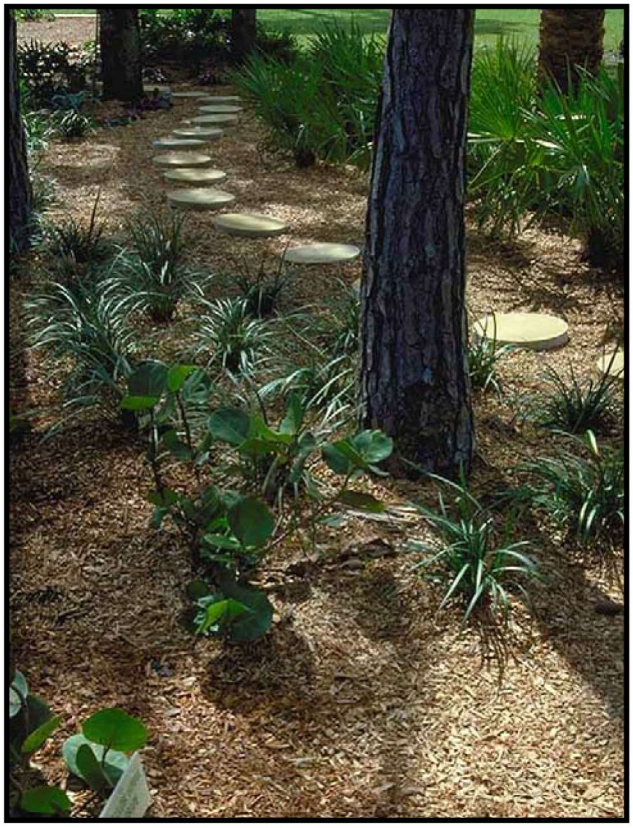
DRAIN INLET PROTECTION/CONTAINMENT & COLLECTION OF WASH WATER

- Sand bags can be used to create a barrier around storm drain inlets.
- Plugs or rubber mats can be used to temporarily seal storm drain openings.
- Containment pads, temporary berms or vacuum brooms can be used to contain and collect wash water.

EQUIPMENT AND SUPPLIES

Special materials such as absorbents, storm drain plugs and seals, small sump pumps, and vacuum booms are available from many vendors. For more information, check catalogs such as New Pig (800-468-4647, www.newpig.com), Lab Safety Supply (800-356-0783), C&H (800-558-9966), and W.W. Grainger (800-994-9174); or call the Cleaning Equipment Trade Association (800-441-0111) or the Power Washers of North America (800-393-PWNA).

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

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.

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.

Roof Runoff Controls SD-11

Rain Garden

Design Objectives

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

Description

Various roof runoff controls are available to address stormwater that drains off rooftops. The objective is to reduce the total volume and rate of runoff from individual lots, and retain the pollutants on site that may be picked up from roofing materials and atmospheric deposition. Roof runoff controls consist of directing the roof runoff away from paved areas and mitigating flow to the storm drain system through one of several general approaches: cisterns or rain barrels; dry wells or infiltration trenches; pop-up emitters, and foundation planting. The first three approaches require the roof runoff to be contained in a gutter and downspout system. Foundation planting provides a vegetated strip under the drip line of the roof.

Approach

Design of individual lots for single-family homes as well as lots for higher density residential and commercial structures should consider site design provisions for containing and infiltrating roof runoff or directing roof runoff to vegetative swales or buffer areas. Retained water can be reused for watering gardens, lawns, and trees. Benefits to the environment include reduced demand for potable water used for irrigation, improved stormwater quality, increased groundwater recharge, decreased runoff volume and peak flows, and decreased flooding potential.

Suitable Applications

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

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

One method of addressing roof runoff is to direct roof downspouts to cisterns or rain barrels. A cistern is an above ground storage vessel with either a manually operated valve or a permanently open outlet. Roof runoff is temporarily stored and then released for irrigation or infiltration between storms. The number of rain

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

barrels needed is a function of the rooftop area. Some low impact developers recommend that every house have at least 2 rain barrels, with a minimum storage capacity of 1000 liters. Roof barrels serve several purposes including mitigating the first flush from the roof which has a high volume, amount of contaminants, and thermal load. Several types of rain barrels are commercially available. Consideration must be given to selecting rain barrels that are vector proof and childproof. In addition, some barrels are designed with a bypass valve that filters out grit and other contaminants and routes overflow to a soak-away pit or rain garden.

If the cistern has an operable valve, the valve can be closed to store stormwater for irrigation or infiltration between storms. This system requires continual monitoring by the resident or grounds crews, but provides greater flexibility in water storage and metering. If a cistern is provided with an operable valve and water is stored inside for long periods, the cistern must be covered to prevent mosquitoes from breeding.

A cistern system with a permanently open outlet can also provide for metering stormwater runoff. If the cistern outlet is significantly smaller than the size of the downspout inlet (say ¼ to ½ inch diameter), runoff will build up inside the cistern during storms, and will empty out slowly after peak intensities subside. This is a feasible way to mitigate the peak flow increases caused by rooftop impervious land coverage, especially for the frequent, small storms.

Dry wells and Infiltration Trenches

Roof downspouts can be directed to dry wells or infiltration trenches. A dry well is constructed by excavating a hole in the ground and filling it with an open graded aggregate, and allowing the water to fill the dry well and infiltrate after the storm event. An underground connection from the downspout conveys water into the dry well, allowing it to be stored in the voids. To minimize sedimentation from lateral soil movement, the sides and top of the stone storage matrix can be wrapped in a permeable filter fabric, though the bottom may remain open. A perforated observation pipe can be inserted vertically into the dry well to allow for inspection and maintenance.

In practice, dry wells receiving runoff from single roof downspouts have been successful over long periods because they contain very little sediment. They must be sized according to the amount of rooftop runoff received, but are typically 4 to 5 feet square, and 2 to 3 feet deep, with a minimum of 1-foot soil cover over the top (maximum depth of 10 feet).

To protect the foundation, dry wells must be set away from the building at least 10 feet. They must be installed in solids that accommodate infiltration. In poorly drained soils, dry wells have very limited feasibility.

Infiltration trenches function in a similar manner and would be particularly effective for larger roof areas. An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. These are described under Treatment Controls.

Pop-up Drainage Emitter

Roof downspouts can be directed to an underground pipe that daylights some distance from the building foundation, releasing the roof runoff through a pop-up emitter. Similar to a pop-up irrigation head, the emitter only opens when there is flow from the roof. The emitter remains flush to the ground during dry periods, for ease of lawn or landscape maintenance.

Foundation Planting

Landscape planting can be provided around the base to allow increased opportunities for stormwater infiltration and protect the soil from erosion caused by concentrated sheet flow coming off the roof. Foundation plantings can reduce the physical impact of water on the soil and provide a subsurface matrix of roots that encourage infiltration. These plantings must be sturdy enough to tolerate the heavy runoff sheet flows, and periodic soil saturation.

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.

Supplemental Information

Examples

- City of Ottawa's Water Links Surface –Water Quality Protection Program
- City of Toronto Downspout Disconnection Program
- City of Boston, MA, Rain Barrel Demonstration Program

Other Resources

Hager, Marty Catherine, Stormwater, "Low-Impact Development", January/February 2003. www.stormh2o.com

Low Impact Urban Design Tools, Low Impact Development Design Center, Beltsville, MD. www.lid-stormwater.net

Start at the Source, Bay Area Stormwater Management Agencies Association, 1999 Edition

Efficient Irrigation SD-12

Design Objectives

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

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect
  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

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.

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.

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

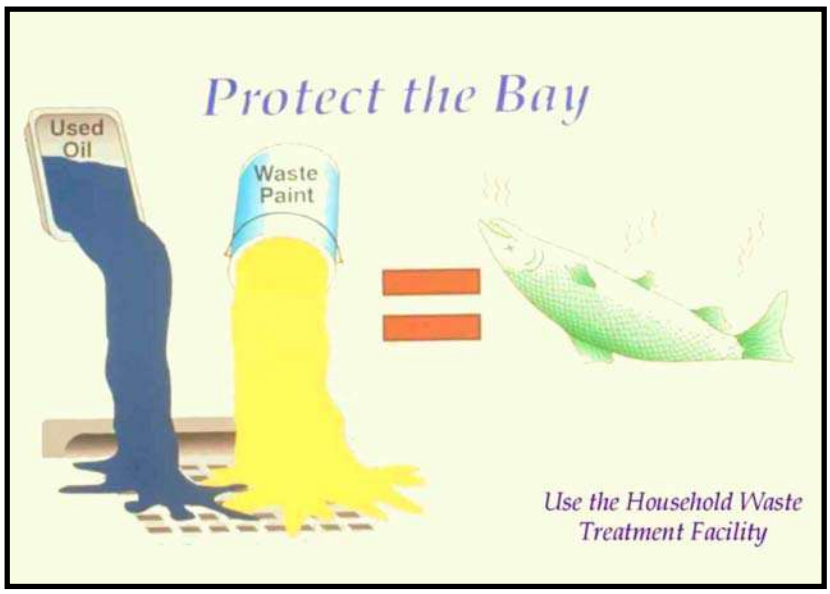
A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

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.

Non-Stormwater Discharges SC-10



Art Credit: Margie Winter

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

Description

Non-stormwater discharges are those flows that do not consist entirely of stormwater. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain. These include uncontaminated groundwater and natural springs. There are also some non-stormwater discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include car washing, air conditioner condensate, etc. However there are certain non-stormwater discharges that pose environmental concern. These discharges may originate from illegal dumping or from internal floor drains, appliances, industrial processes, sinks, and toilets that are connected to the nearby storm drainage system. These discharges (which may include: process waste waters, cooling waters, wash waters, and sanitary wastewater) can carry substances such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants into storm drains. They can generally be detected through a combination of detection and elimination. The ultimate goal is to effectively eliminate non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges of pollutants on streets and into the storm drain system and creeks.

Approach

Initially the industry must make an assessment of non-stormwater discharges to determine which types must be eliminated or addressed through BMPs. The focus of the following approach is in the elimination of non-stormwater discharges.

CASQA California Stormwater Quality Association

Pollution Prevention

- Ensure that used oil, used antifreeze, and hazardous chemical recycling programs are being implemented. Encourage litter control.

Suggested Protocols

Recommended Complaint Investigation Equipment

- Field Screening Analysis
  - pH paper or meter
  - Commercial stormwater pollutant screening kit that can detect for reactive phosphorus, nitrate nitrogen, ammonium nitrogen, specific conductance, and turbidity
  - Sample jars
  - Sample collection pole
  - A tool to remove access hole covers
- Laboratory Analysis
  - Sample cooler
  - Ice
  - Sample jars and labels
  - Chain of custody forms
- Documentation
  - Camera
  - Notebook
  - Pens
  - Notice of Violation forms
  - Educational materials

General

- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially those that are not classified as hazardous. These are often not responded to as effectively as they need to be.
- Stencil or demarcate 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 or demarcated next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.

- See SC44 Stormwater Drainage System Maintenance for additional information.

Illicit Connections

- Locate discharges from the industrial storm drainage system to the municipal storm drain system through review of "as-built" piping schematics.
- Isolate problem areas and plug illicit discharge points.
- Locate and evaluate all discharges to the industrial storm drain system.

Visual Inspection and Inventory

- Inventory and inspect each discharge point during dry weather.
- Keep in mind that drainage from a storm event can continue for a day or two following the end of a storm and groundwater may infiltrate the underground stormwater collection system. Also, non-stormwater discharges are often intermittent and may require periodic inspections.

Review Infield Piping

- A review of the "as-built" piping schematic is a way to determine if there are any connections to the stormwater collection system.
- Inspect the path of floor drains in older buildings.

Smoke Testing

- Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two systems.
- During dry weather the stormwater collection system is filled with smoke and then traced to sources. The appearance of smoke at the base of a toilet indicates that there may be a connection between the sanitary and the stormwater system.

Dye Testing

- A dye test can be performed by simply releasing a dye into either your sanitary or process wastewater system and examining the discharge points from the stormwater collection system for discoloration.

TV Inspection of Drainage System

- TV Cameras can be employed to visually identify illicit connections to the industrial storm drainage system.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.

- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Once a site has been cleaned:

- Post "No Dumping" signs with a phone number for reporting dumping and disposal.
- Landscaping and beautification efforts of hot spots may also discourage future dumping, as well as provide open space and increase property values.
- Lighting or barriers may also be needed to discourage future dumping.
- See fact sheet SC11 Spill Prevention, Control, and Cleanup.

Inspection

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Conduct field investigations of the industrial storm drain system for potential sources of non-stormwater discharges.
- Pro-actively conduct investigations of high priority areas. Based on historical data, prioritize specific geographic areas and/or incident type for pro-active investigations.

Reporting

- A database is useful for defining and tracking the magnitude and location of the problem.
- Report prohibited non-stormwater discharges observed during the course of normal daily activities so they can be investigated, contained, and cleaned up or eliminated.
- Document that non-stormwater discharges have been eliminated by recording tests performed, methods used, dates of testing, and any on-site drainage points observed.
- Document and report annually the results of the program.
- Maintain documentation of illicit connection and illegal dumping incidents, including significant conditionally exempt discharges that are not properly managed.

Training

- Training of technical staff in identifying and documenting illegal dumping incidents is required.
- Consider posting the quick reference table near storm drains to reinforce training.
- Train employees to identify non-stormwater discharges and report discharges to the appropriate departments.

- Educate employees about spill prevention and cleanup.
- Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Determine and implement appropriate outreach efforts to reduce non-permissible non-stormwater discharges.
- Conduct spill response drills annually (if no events occurred to evaluate your plan) in cooperation with other industries.
- When a responsible party is identified, educate the party on the impacts of his or her actions.

Spill Response and Prevention

- See SC11 Spill Prevention Control and Cleanup.

Other Considerations

- Many facilities do not have accurate, up-to-date schematic drawings.

Requirements

Costs (including capital and operation & maintenance)

- The primary cost is for staff time and depends on how aggressively a program is implemented.
- Cost for containment and disposal is borne by the discharger.
- Illicit connections can be difficult to locate especially if there is groundwater infiltration.
- Indoor floor drains may require re-plumbing if cross-connections to storm drains are detected.

Maintenance (including administrative and staffing)

- Illegal dumping and illicit connection violations requires technical staff to detect and investigate them.

Supplemental Information

Further Detail of the BMP

Illegal Dumping

- Substances illegally dumped on streets and into the storm drain systems and creeks include paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clippings, and pet wastes. All of these wastes cause stormwater and receiving water quality problems as well as clog the storm drain system itself.
- 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

One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people at the facility who are aware of the problem and who have the tools to at least identify the incident, if not correct it. Therefore, train field staff to recognize and report the incidents.

What constitutes a "non-stormwater" discharge?

- Non-stormwater discharges to the stormwater collection system may include any water used directly in the manufacturing process (process wastewater), air conditioning condensate and coolant, non-contact cooling water, cooling equipment condensate, outdoor secondary containment water, vehicle and equipment wash water, sink and drinking fountain wastewater, sanitary wastes, or other wastewaters.

Permit Requirements

- Facilities subject to stormwater permit requirements must include a certification that the stormwater collection system has been tested or evaluated for the presence of non-stormwater discharges. The State's General Industrial Stormwater Permit requires that non-stormwater discharges be eliminated prior to implementation of the facility's SWPPP.

Performance Evaluation

- Review annually internal investigation results; assess whether goals were met and what changes or improvements are necessary.
- Obtain feedback from personnel assigned to respond to, or inspect for, illicit connections and illegal dumping incidents.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Drainage System Maintenance SC-44

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff and stormwater that may contain certain pollutants. The protocols in this fact sheet are intended to reduce pollutants reaching receiving waters through proper conveyance system operation and maintenance.

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	
Bacteria	✓
Oil and Grease	
Organics	

Approach

Pollution Prevention

Maintain catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Suggested Protocols

Catch Basins/Inlet Structures

- Staff should regularly inspect facilities to ensure compliance with 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 SC34 Waste Handling and Disposal).

CASQA California Stormwater Quality Association

- Clean catch basins, storm drain inlets, and other conveyance structures before the wet season to remove sediments and debris accumulated during the summer.
- 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.
- 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 if necessary 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. Do not dewater near a storm drain or stream.

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 and pump flushed effluent to the sanitary sewer for treatment whenever possible.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge to reach the storm drain system when cleaning a storm drain pump station or other facility.
- Conduct routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.

Open Channel

- Modify storm channel characteristics to improve channel hydraulics, increase pollutant removals, and 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

- Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:
  - 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 upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
- Eliminate the discharge once the origin of flow is established.

- Stencil or demarcate 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

- Inspect and clean up hot spots and other storm drainage areas regularly 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.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.
- Allow only properly trained individuals to handle hazardous materials/wastes.
- Have staff involved in detection and removal of illicit connections trained in the following:
  - OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).

- OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and Federal OSHA 29 CFR 1910.146).

- Procedural training (field screening, sampling, smoke/dye testing, TV inspection).

Spill Response and Prevention

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.
- Clean up all spills and leaks using "dry" methods (with absorbent materials and/or rags) or dig up, remove, and properly dispose of contaminated soil.
- Refer to fact sheet SC-11 Spill Prevention, Control, and Cleanup.

Other Considerations (Limitations and Regulations)

- Clean-up 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 prohibition against disposal of flushed effluent to sanitary sewer in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget.
- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The primary cost is for staff time. Cost depends on how aggressively a program is implemented. Other cost considerations for an illegal dumping program include:

  - Purchase and installation of signs.

  - Rental of vehicle(s) to haul illegally-disposed items and material to landfills.

  - Rental of heavy equipment to remove larger items (e.g., car bodies) from channels.

  - Purchase of landfill space to dispose of illegally-dumped items and material.

- 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.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.
- Teams of at least two people plus administrative personnel are required to identify illicit discharges, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Technical staff are required to detect and investigate illegal dumping violations.

Supplemental Information

Further Detail of the BMP

Storm Drain Flushing

Flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in storm drainage systems. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as an open channel, another point where flushing will be initiated, or the sanitary sewer and the treatment facilities, thus preventing resuspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. 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, thereby releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce impacts of stormwater pollution, a second inflatable device placed well downstream may be used to recollect 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 recollect 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% for organics and 55-65% 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 sewer flushing.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

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

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net

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