Appendix H

Water Quality and Hydrology Reports

H-1 Water Quality Technical Memorandum

Prepared by: RRM Design Group

November 2016

H-2 Location Hydraulic Study

Prepared by: RRM Design Group

November 2016

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Water Quality Technical Memorandum

Las Positas Multi-Use Path

City of Santa Barbara

November 10, 2016

Prepared By:

rrm design group

William F. Strand, P.E.

1 INTRODUCTION

This technical memorandum describes a water quality assessment conducted for the City of Santa Barbara. The City propose to undertake the development of separated multiuse pathway (Class 1) along Modoc Road and Las Positas Road.

The proposed multiuse path terminuses are located on the north end at Modoc Road and Calle De Los Amigos. The south terminus of the multiuse path ties into the new Cliff Drive roundabout at the intersection of Las Positas Road and Cliff Drive (See Figure 1 – Vicinity Map).

The Las Positas Road Multiuse Path will consist of a paved Class I path approximately 8' wide with 2' wide shoulders on each side. The path will follow the south side right-of-way of Modoc Road starting at Calle De Los Amigos and traveling along Modoc Road to the Las Positas Road signalized intersection. The path along the south side of Modoc Road will include five (5) stop sign controlled residential street crossings and eight private driveway crossings. The multiuse path will be designed to tie into the existing Class II facility along both Modoc Road and Las Positas Road.

The Class I path will continue south along the west side right-of-way of Las Positas to the Cliff Drive intersection. The Las Positas Road reach consists of four (4) residential street crossings. The crossing at Veronica Springs road will include modification to an existing signalized crossing. The other three street crossings occur at stop sign controlled residential streets. One additional pedestrian signalized crossing will be added to Jerry Harwin Parkway to provide access across Las Positas Road to Elings Park. The Multiuse path continues along the west side of Las Positas Road to the new planned Cliff Drive Roundabout where it ties into the existing Class II facilities on Cliff Drive and hiking trails at Arroyo Burro Beach County Park. There are several segments of the trail segment along Las Positas that will require retaining walls and roadway barriers along the trail shoulder.

The Project is located in an area of the City long planned for alternative transportation improvements, creek restoration, and expanded public open space and recreation. Due to the size of the project it is classified as a Tier 3 project according to the City's Storm Water Management Program and is required to mitigate runoff using Best Management Practices.

2 PHYSICAL SETTING

The project is located in the Las Positas Creek drainage which discharges directly to the Pacific Ocean at Arroyo Burro Beach. The project elevations range from approximately 30 feet at Cliff Drive to 170 feet on Modoc Road. Annual rainfall in the region typically occurs during the winter month averaging approximately 18.4 inches/year per the Santa Barbara County Flood Control District records. Data from the National Oceanic and Atmospheric Administration (NOAA) for Santa Barbara County indicates summer monthly temperatures range from the low 60's to the low 80's while the winter months range from the upper 40's to upper 60's

3 FEDERAL AND STATE WATER QUALITY PERMITS

The Environmental Protection Agency (EPA) and the California State Water Resources Control Board (SWRCB), in accordance with the federal Clean Water Act (CWA) and its amendments, set statewide water quality standards. The SWRCB administers water rights, water pollution control, and water quality functions throughout the state, while the Regional Water Quality Control Boards (RWQCBs) conduct regional planning, permitting, and enforcement activities. The project area lies within the jurisdiction of the Central Coast RWQCB. The *Water Quality Control Plan for the Central Coast Basin* (Basin Plan) includes water quality standards to protect beneficial uses, including maintaining aquatic ecosystems and the resources those systems provide to society. This project drains to Arroyo Burro Creek, which is 303(d) listed for E. coli and Fecal Coliform (no TMDL has been developed).

The statewide National Pollutant Discharge Elimination System (NPDES) General Permit, Waste Discharge Requirements for Discharges of Storm Water Runoff Associated with Construction Activities (Order No. 2009-0009-DWQ) (Construction General Permit or CGP) requires measures to protect water quality during construction activities for construction sites of an acre or more.
Because the project will impact a limited amount of riparian vegetation along edge of the trail a Lake and Streambed Alteration Agreement (LSA) will be required from the California Department of Fish and Wildlife.

The project is located within the Coastal Zone and will require a Coastal Permit from the California Coastal Commission.

The project will require extension of several existing culverts which discharge into Las Positas Creek to allow placement of the proposed path likely requiring a U.S. Army Corps of Engineers 404 Permit and a RWQCB 401 Permit (Water Quality Certification).

Coordination with the respective agencies to obtain the necessary permits will occur when funds are secured for construction.

4 STORM WATER MANAGEMENT PROGRAM (SWMP)

The Federal Clean Water Act's National Pollutant Discharge Elimination System (NPDES) Phase II regulations govern storm water discharges from small municipalities that operate storm drain systems. The State Water Resources Control Board (Water Board), and the Regional Water Quality Control Boards (RWQCB), are responsible for implementation of NPDES regulations.

The City's Storm Water Management Program (SWMP) details how the City will protect water quality by listing a series of Best Management Practices (BMPs) and Measurable Goals that the City must meet each year. In February 2013, the Water Board adopted a new NPDES General Permit for municipal storm water discharges.

After careful review of the new PCRs, City staff decided to apply for an exemption from the Central Coast PCRs, and to continue implementing the existing City program. The City's exemption request was submitted to the RWQCB in October 2012, and the exemption was granted in early January 2013.

4.1 Storm Water BMP Guidance Manual

The project proposes more than 4,000 SF of new impervious area which puts it into the Tier 3 Classification according to the city's Storm Water Management Program. Tier 3 Projects have the following requirements: a peak runoff discharge requirement, a volume reduction requirement, and a water quality treatment requirement.

The peak runoff discharge requirement states that storm water runoff BMPs shall provide detention such that the post development peak storm water runoff discharge rate does not exceed the pre development discharge rate for the 2, 5, 10, and 25 year 24 hour storm events.

The volume reduction requirement states that the volume difference between the pre and post conditions generated from a one inch 24 hour storm event

The water quality treatment requirement for Tier 3 projects states that the storm water runoff BMPs shall be sized for the one inch 24-hr design storm from the entire project site.

According to the Stormwater Guidance Manual, both the Volume Reduction Requirement and the Water Quality Treatment Requirement can be satisfied simultaneously if the Volume Reduction quantity is larger than the Water Quality Treatment quantity.

4.1.1 Sit Assessment and BMP Selection

4.1.1.1 Existing Hydrology – The project area is located in the Arroyo Burro watershed and generally drains toward Las Positas and Arroyo Burro Creeks. Most of the project site is located out of the 100-year floodplain with portions inundated at road crossings with undersized culverts. Most of the project site is drained via surface flow with a small number of City inlets and storm drains.

4.1.1.2 Existing Topography – The project area generally drains to the south to the Pacific Ocean. Along Modoc Road there are several high and low points. Flow on the south side of Modoc (project area) generally surface flows along curbs to the south thru existing developments. Along Las Positas Road the project site slopes from north to south. The road is crowned with the west side (project area) sheet flowing to Las Positas and Arroyo Burro Creeks.

4.1.1.3 Existing Soils – Per Figure 1, Appendix B of the Storm Water BMP Manual the project area is located in Hydrologic Soil Group B.

4.1.1.4 Pollutants of Concern – Based on Table 2-2 of the Storm Water BMP Manual the pollutants of concern for Roads (Paths are not specifically identified) are:

- Trash

- Bacteria
- Sediment
- Pesticides and Herbicides

Per the SWRCB, Arroyo Burro Creek is 303(d) listed for E. coli and Fecal Coliform (Pollutant of Concern).

4.1.2 Site Design BMP's

Because the project is Tier 3, Site Design BMP's are required. The following Site Design BMP's have been considered and incorporated into the project design.

4.1.2.1 Conserve Natural Areas – The extent possible the proposed multi-use path has been located in existing disturbed areas within the City's Right-of-Way. The path alignment was selected to minimize encroachment into riparian areas, the floodway, and areas with steep slopes.

4.1.2.2 Maintain, Restore, and Utilize Natural Flow Paths – The path has been designed to minimize grading and maintain existing drainage paths.

4.1.2.3 Site BMP's on Infiltrative Soils – The project is wholly located on B soils. Site BMP's will be located within the B Soils.

4.1.2.4 Minimize Soil Disturbance and Compaction – The project has been designed to conform to existing grades minimizing cut and fill.

4.1.2.5 Minimize Impervious Surfaces – The path width has been kept to the minimum required by Caltrans for a Class 1 path (8 feet paved) with 2 foot permeable shoulders.

4.1.2.6 Disconnect Impervious Surfaces and Utilize Pervious Areas – The path has been designed to drain to a planter area between the path and the roadway. To provide adequate storage for the design volume an infiltration trench is located in the planter.

4.1.3 Storm Water Runoff BMP's

In order to meet the City's Tier 3 Storm Water Requirements Best Management Practices (BMP's) were evaluated for site suitability.

Volume Reduction – This requirement has been designed to capture the one-inch 24-hr storm. Volume: 2.8 Cf/Lf of trail

Water Quality Treatment – This requirement has been sized for the one-inch 24-hr storm. Volume: 0.6 Cf

For proposed new impervious improvements, the Volume Reduction Quantity is greater than the Water Quality Treatment Quantity so the designed BMP will be sized based on the Volume Reduction Quantity which will simultaneously satisfy the

Water Quality Treatment volume. BMPs will be sized for the Water Quality Treatment Volume for existing impervious surfaces which drain to the project.

In regards to the existing impervious surfaces which drain to the project,

BMP Selection Process – Tier 3 projects must compare the list of pollutants anticipated by the land use and any pollutants of concern in downstream locations.

Anticipated Pollutants –

- Trash
- Bacteria (Pollutant of Concern)
- Sediment
- Pesticides and Herbicides

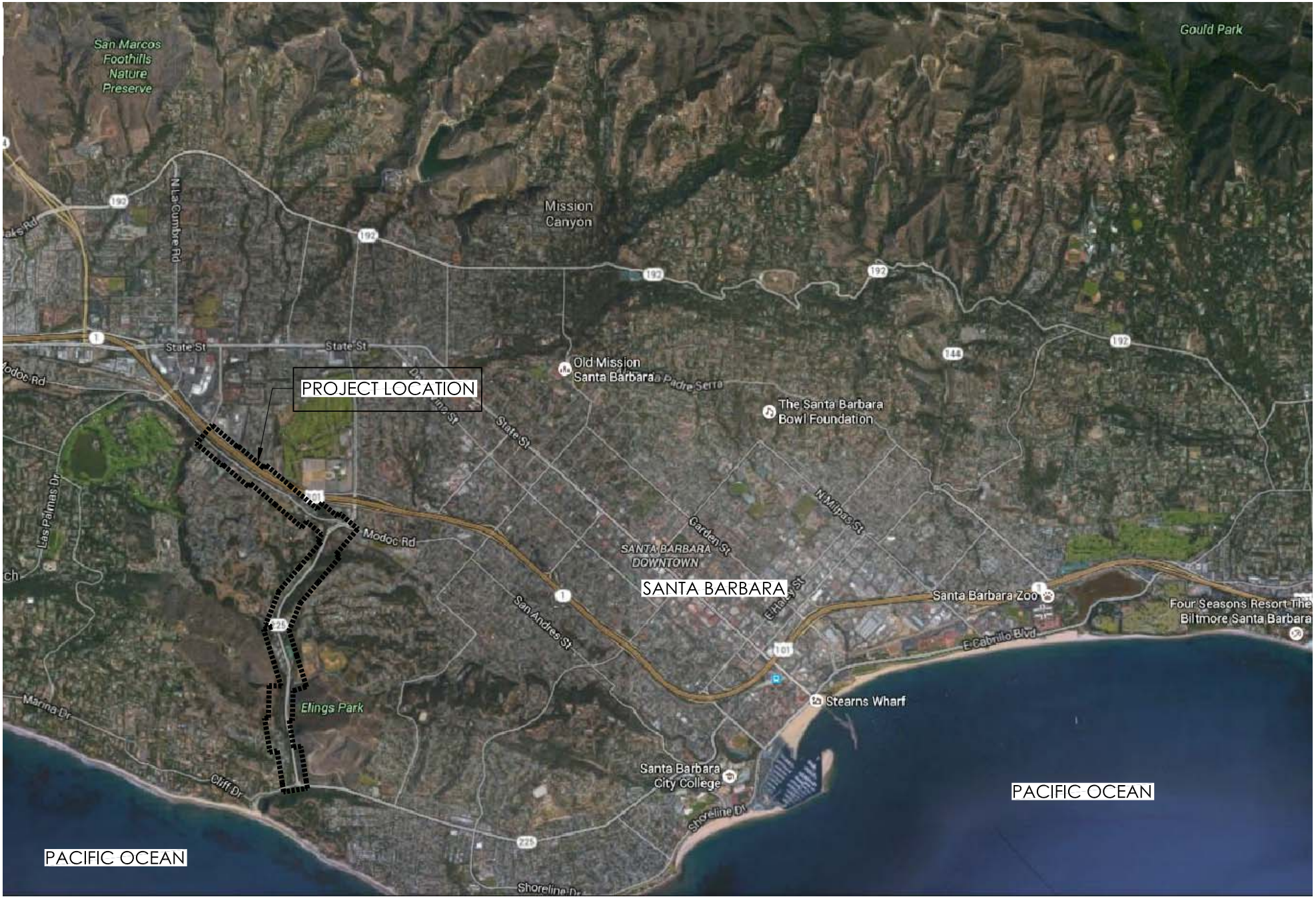
BMP Selection – Table 6-1 BMP Selection Matrix – Pollutants of Concern was reviewed for BMP's which have very high or high treatment effectiveness for Bacteria. The following BMP have high or very high effectiveness for bacteria removal:

- Bio retention
- San Filter
- Infiltration BMP's
- Permeable Pavement

Because of the linear nature of the project infiltration trenches were selected because they can be applied to a linear project and do not require irrigation for plantings (bio retention). Infiltration trenches also have High Effectiveness for Trash, Bacteria, and Sediment filtration.

In several areas where more space is available Bio-retention areas will be implemented. Bio-retention areas have a high effectiveness for the treatment of trash, bacteria, and sediment infiltration.

To comply with the City's Storm Water Management Program for Tier 3 projects, infiltration trenches and bio-retention areas will be incorporated into the trail design to capture and infiltrate the Volume Reduction/ Water Quality Treatment requirements (see attached trail cross section).

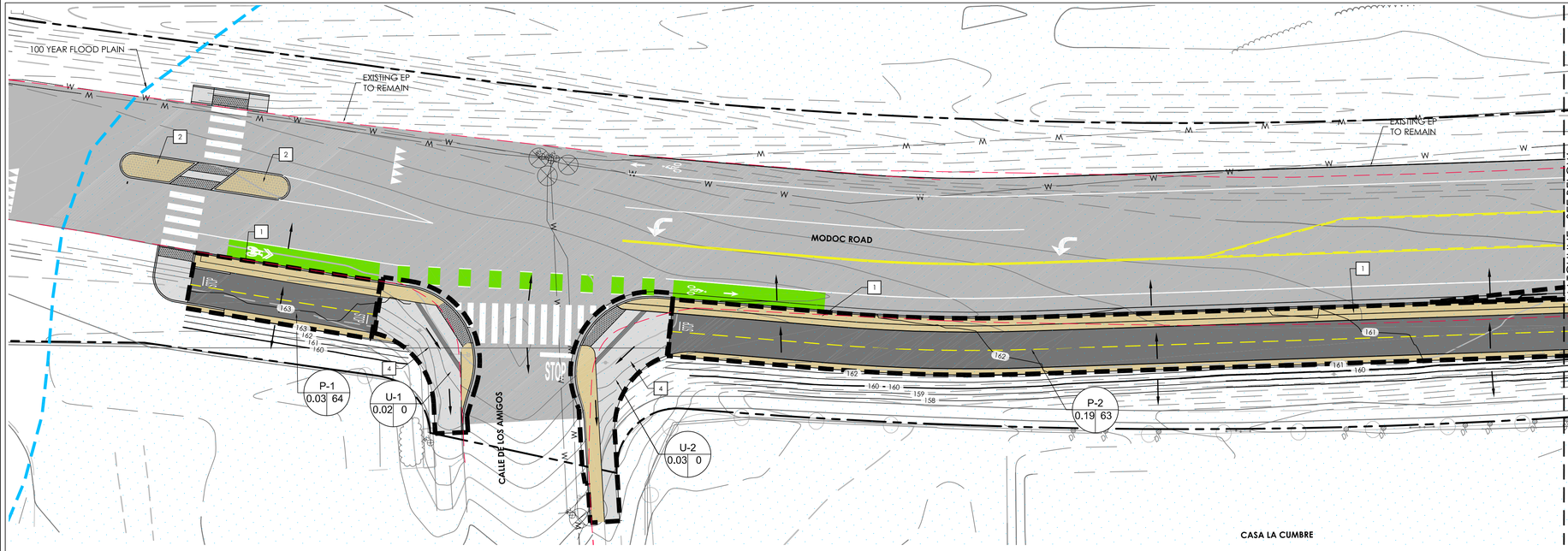


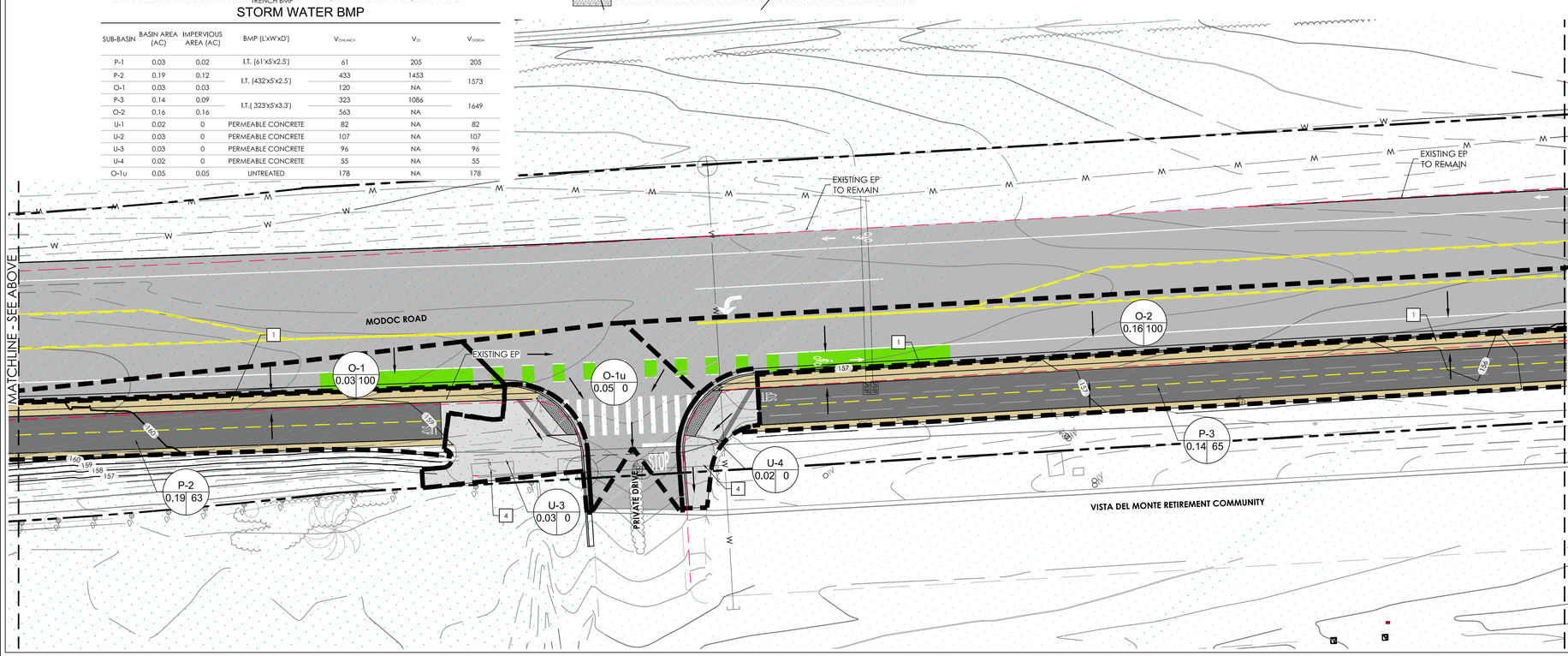
rrm design group

NORTH

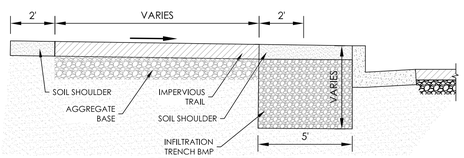
FIGURE 1: VICINITY MAP

November 2016



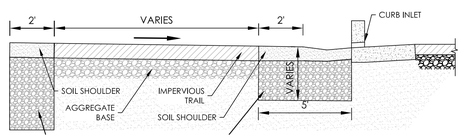


DETAIL A1: INFILTRATION TRENCH BMP

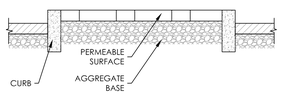


STORM WATER BMP

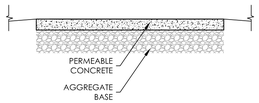
DETAIL A2: INFILTRATION TRENCH BMP



DETAIL B: PERMEABLE SURFACE



DETAIL C: PERMEABLE CONCRETE



SUB-BASIN	BASIN AREA (AC)	IMPERVIOUS AREA (AC)	BMP (LxW'xD')	$V_{ONE-INCH}$	V_{DI}	V_{DESIGN}
P-1	0.03	0.02	I.T. (61'x5'x2.5')	61	205	205
P-2	0.19	0.12	I.T. (432'x5'x2.5')	433	1453	1573
O-1	0.03	0.03		120	NA	
P-3	0.14	0.09	I.T.(323'x5'x3.3')	323	1086	1649
O-2	0.16	0.16		563	NA	
U-1	0.02	0	PERMEABLE CONCRETE	82	NA	82
U-2	0.03	0	PERMEABLE CONCRETE	107	NA	107
U-3	0.03	0	PERMEABLE CONCRETE	96	NA	96
U-4	0.02	0	PERMEABLE CONCRETE	55	NA	55
O-1u	0.05	0.05	UNTREATED	178	NA	178

LEGEND

- 900 PROPOSED MAJOR CONTOUR
- 901 PROPOSED MINOR CONTOUR
- 900 EXISTING MAJOR CONTOUR
- 901 EXISTING MINOR CONTOUR
- EXISTING AC PAVING
- PROPOSED SOIL SHOULDER
- PROPOSED AC PAVING
- PROPOSED PERMEABLE CONCRETE PAVING
- PROPOSED PERMEABLE SURFACE
- PROPOSED FLOW DIRECTION
- PROPOSED CURB RAMP
- PROPOSED BARRICADE
- PROPOSED RETAINING WALL
- EXISTING EDGE OF PAVEMENT
- EXISTING RIGHT OF WAY
- PROPOSED BASIN BOUNDARY
- 92.9 EXISTING GRADE
- I.T. INFILTRATION TRENCH

O-2 (Sub-Basin Name); 0.2 (Sub-Basin Area in Acres); 100 (% Impervious)

Sub-Basin Types
- O: Offsite Run-On
- P: Proposed Impervious Surface (Mitigated)
- U: Proposed Pervious Surface (Mitigated)

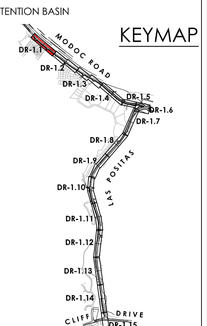
PROJECT TOTALS

NEW IMPERVIOUS AREA:	106,800 SF (2.45 AC)
EXISTING IMPERVIOUS AREA REPLACED WITH PERVIOUS AREA:	72,046 SF (1.65 AC)
TOTAL UNTREATED AREA:	14,288 SF (0.33 AC; 2.84% OF ALL SUB-BASINS)
TOTAL AREA OF OFF-SITE RUN ON:	261,484 SF (6.00 AC)

STORM WATER BMP KEYNOTES

1. INFILTRATION TRENCH PER DETAIL A, THIS SHEET
2. PERMEABLE SURFACE PER DETAIL B, THIS SHEET
3. EXISTING STORM DRAIN STRUCTURE
4. PERMEABLE CONCRETE PER DETAIL C, THIS SHEET
5. OPTIONAL PERMEABLE CONCRETE
6. PROPOSED BIO-RETENTION BASIN

KEYMAP



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Las Positas Multi-Use Pathway

Schematic Drainage Area Exhibit

NO.	REVISION	DATE

PROJECT MANAGER: BAH
DRAWN BY: SJP
CHECKED BY: WFS
DATE: NOVEMBER 10, 2016
CAD FILE: 0203-DR.dwg
JOB NUMBER: 0203-01-RC15
SHEET: DR-1.1

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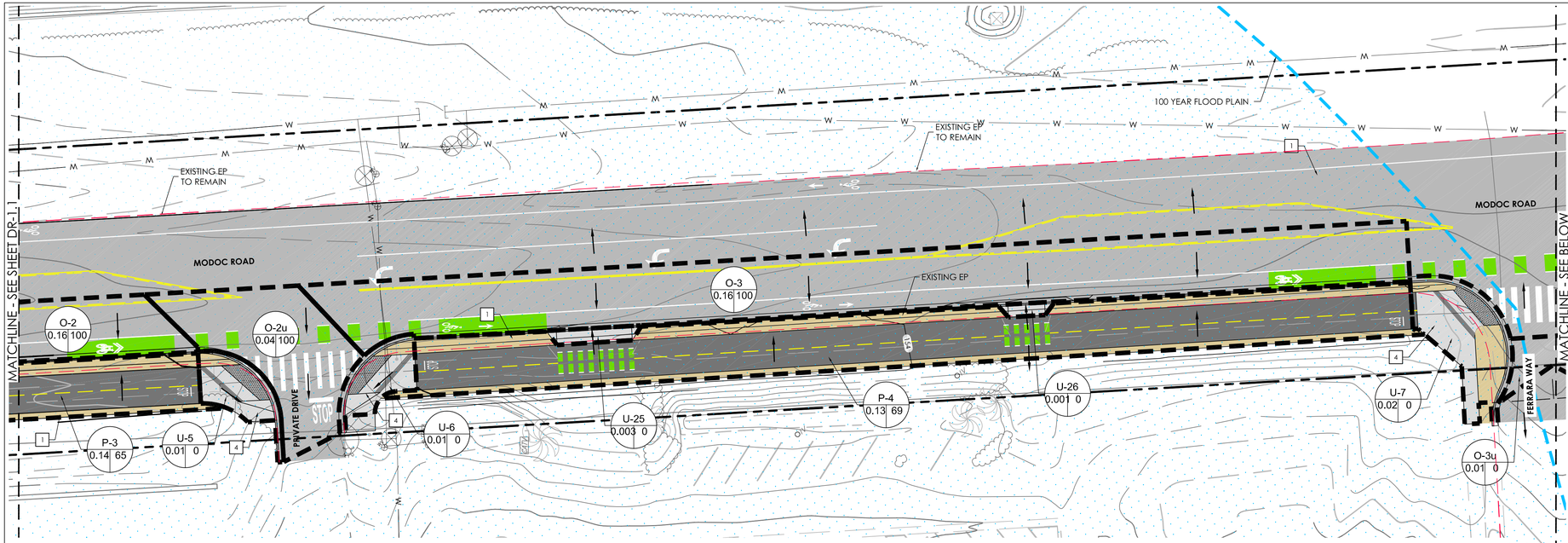

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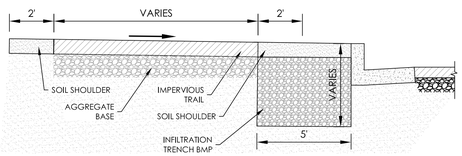
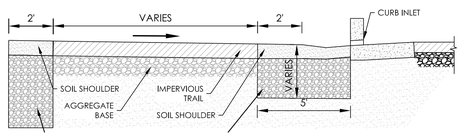
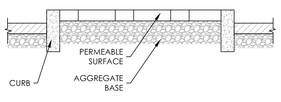


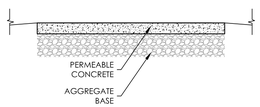
DETAIL A2: INFILTRATION TRENCH BMP



DETAIL B: PERMEABLE SURFACE

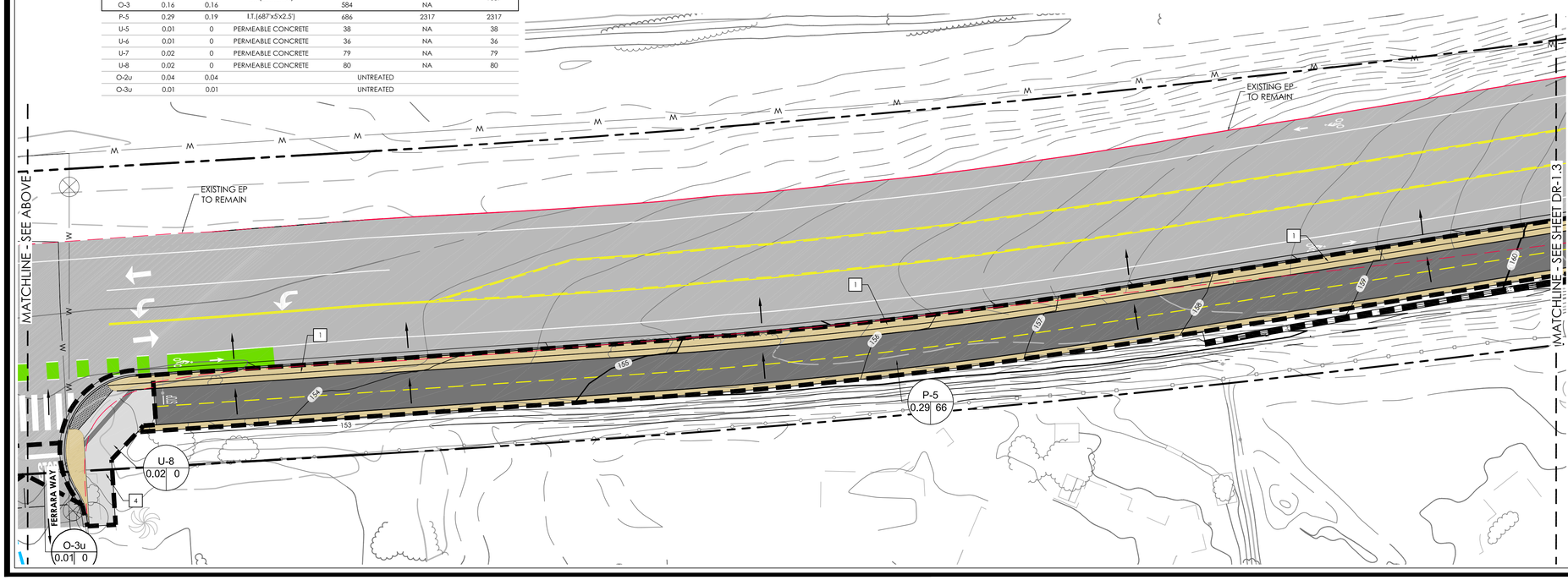


DETAIL C: PERMEABLE CONCRETE



STORM WATER BMP

SUB-BASIN	BASIN AREA (AC)	IMPERVIOUS AREA (AC)	BMP	V_{CHURCH}	V_{TS}	V_{DESIGN}
P-3	0.14	0.09	I.T. (323'x5'x3.3')	323	1086	1649
O-2	0.16	0.16		563	NA	
P-4	0.13	0.09	I.T. (288'x5'x4')	328	1103	1687
O-3	0.16	0.16		584	NA	
P-5	0.29	0.19	I.T.(687'x5'x2.5')	686	2317	2317
U-5	0.01	0	PERMEABLE CONCRETE	38	NA	38
U-6	0.01	0	PERMEABLE CONCRETE	36	NA	36
U-7	0.02	0	PERMEABLE CONCRETE	79	NA	79
U-8	0.02	0	PERMEABLE CONCRETE	80	NA	80
O-2u	0.04	0.04	UNTREATED			
O-3u	0.01	0.01	UNTREATED			



LEGEND

- PROPOSED MAJOR CONTOUR
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- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING AC PAVING
- PROPOSED SOIL SHOULDER
- PROPOSED AC PAVING
- PROPOSED PERMEABLE CONCRETE PAVING
- PROPOSED PERMEABLE SURFACE
- PROPOSED FLOW DIRECTION
- PROPOSED CURB RAMP
- PROPOSED BARRICADE
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- I.T. INFILTRATION TRENCH

O-2 (0.2 | 100): Sub-Basin Name; Sub-Basin Area in Acres; % Impervious

Sub-Basin Types
- O: Offsite Run-On
- P: Proposed Impervious Surface (Mitigated)
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PROJECT TOTALS

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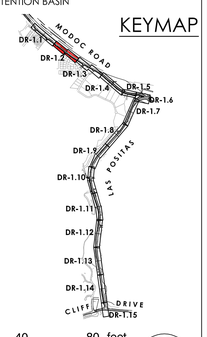
EXISTING IMPERVIOUS AREA REPLACED WITH PERVIOUS AREA:	72,046 SF (1.65 AC)
TOTAL UNTREATED AREA:	14,288 SF (0.33 AC; 2.84% OF ALL SUB-BASINS)
TOTAL AREA OF OFF-SITE RUN ON:	261,484 SF (6.00 AC)

STORM WATER BMP KEYNOTES

1. INFILTRATION TRENCH PER DETAIL A, THIS SHEET
2. PERMEABLE SURFACE PER DETAIL B, THIS SHEET
3. EXISTING STORM DRAIN STRUCTURE
4. PERMEABLE CONCRETE PER DETAIL C, THIS SHEET
5. OPTIONAL PERMEABLE CONCRETE
6. PROPOSED BIO-RETENTION BASIN

KEYMAP



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Las Positas Multi-Use Pathway

Schematic Drainage Area Exhibit

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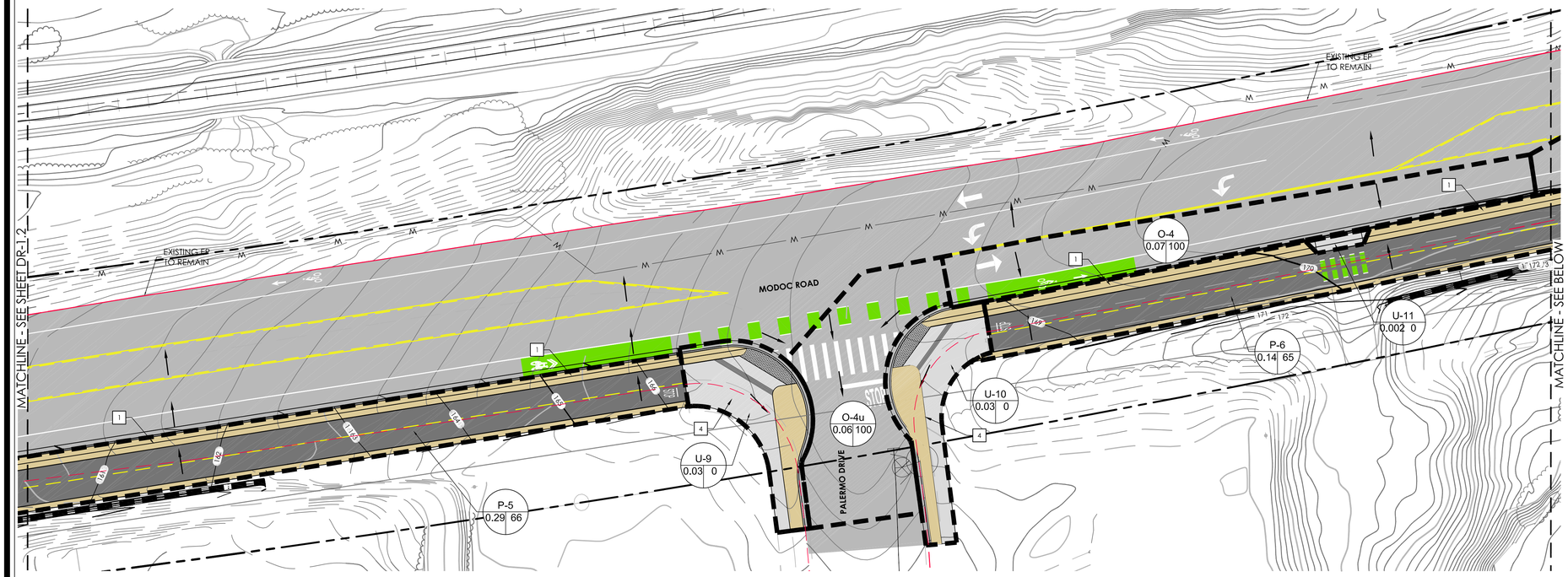

LEGEND

- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING AC PAVING
- PROPOSED SOIL SHOULDER
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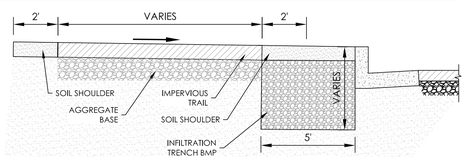
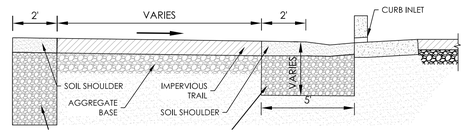
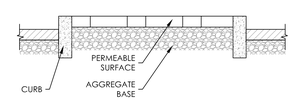
DETAIL A1: INFILTRATION TRENCH BMP



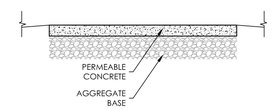
DETAIL A2: INFILTRATION TRENCH BMP



DETAIL B: PERMEABLE SURFACE



DETAIL C: PERMEABLE CONCRETE



Sub-Basin Name

O-2
0.2 100

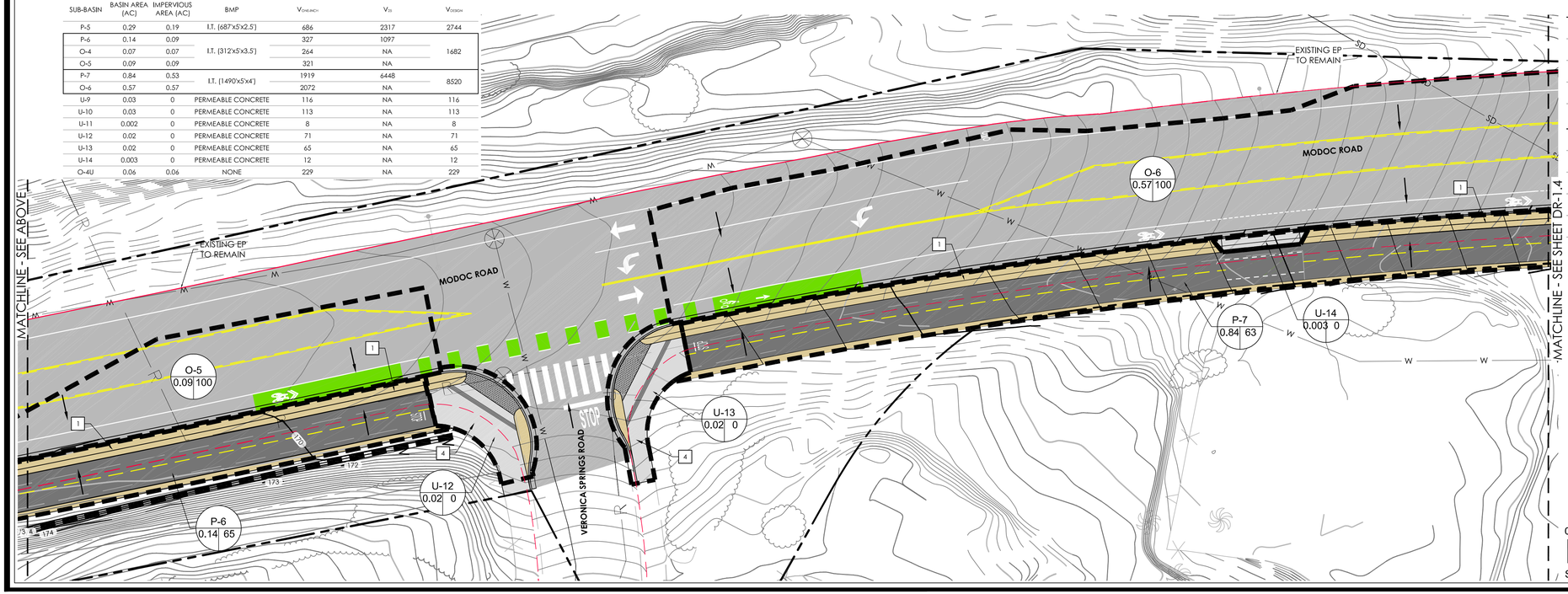
Sub-Basin Area in Acres

% Impervious

Sub-Basin Types
O: Offsite Run-On
P: Proposed Impervious Surface (Mitigated)
U: Proposed Pervious Surface (Mitigated)

STORM WATER BMP

SUB-BASIN	BASIN AREA (AC)	IMPERVIOUS AREA (AC)	BMP	$V_{CHELINCH}$	V_{DI}	V_{DESIGN}
P-5	0.29	0.19	I.T. (687'x5'x2.5')	686	2317	2744
P-6	0.14	0.09	I.T. (312'x5'x3.5')	327	1097	1682
O-4	0.07	0.07		264	NA	
O-5	0.09	0.09		321	NA	
P-7	0.84	0.53	I.T. (1490'x5'x4')	1919	6448	8520
O-6	0.57	0.57		2072	NA	
U-9	0.03	0	PERMEABLE CONCRETE	116	NA	116
U-10	0.03	0	PERMEABLE CONCRETE	113	NA	113
U-11	0.002	0	PERMEABLE CONCRETE	8	NA	8
U-12	0.02	0	PERMEABLE CONCRETE	71	NA	71
U-13	0.02	0	PERMEABLE CONCRETE	65	NA	65
U-14	0.003	0	PERMEABLE CONCRETE	12	NA	12
O-4U	0.06	0.06	NONE	229	NA	229



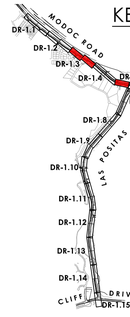
PROJECT TOTALS

NEW IMPERVIOUS AREA:	106,800 SF (2.45 AC)
EXISTING IMPERVIOUS AREA REPLACED WITH PERVIOUS AREA:	72,046 SF (1.65 AC)
TOTAL UNTREATED AREA:	14,288 SF (0.33 AC; 2.84% OF ALL SUB-BASINS)
TOTAL AREA OF OFF-SITE RUN ON:	261,484 SF (6.00 AC)

STORM WATER BMP KEYNOTES

1. INFILTRATION TRENCH PER DETAIL A, THIS SHEET
2. PERMEABLE SURFACE PER DETAIL B, THIS SHEET
3. EXISTING STORM DRAIN STRUCTURE
4. PERMEABLE CONCRETE PER DETAIL C, THIS SHEET
5. OPTIONAL PERMEABLE CONCRETE
6. PROPOSED BIO-RETENTION BASIN

KEYMAP



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REGISTERED PROFESSIONAL ENGINEER
WILLIAM FREDRICK GRANT
No. C 65712
exp. 9/30/17
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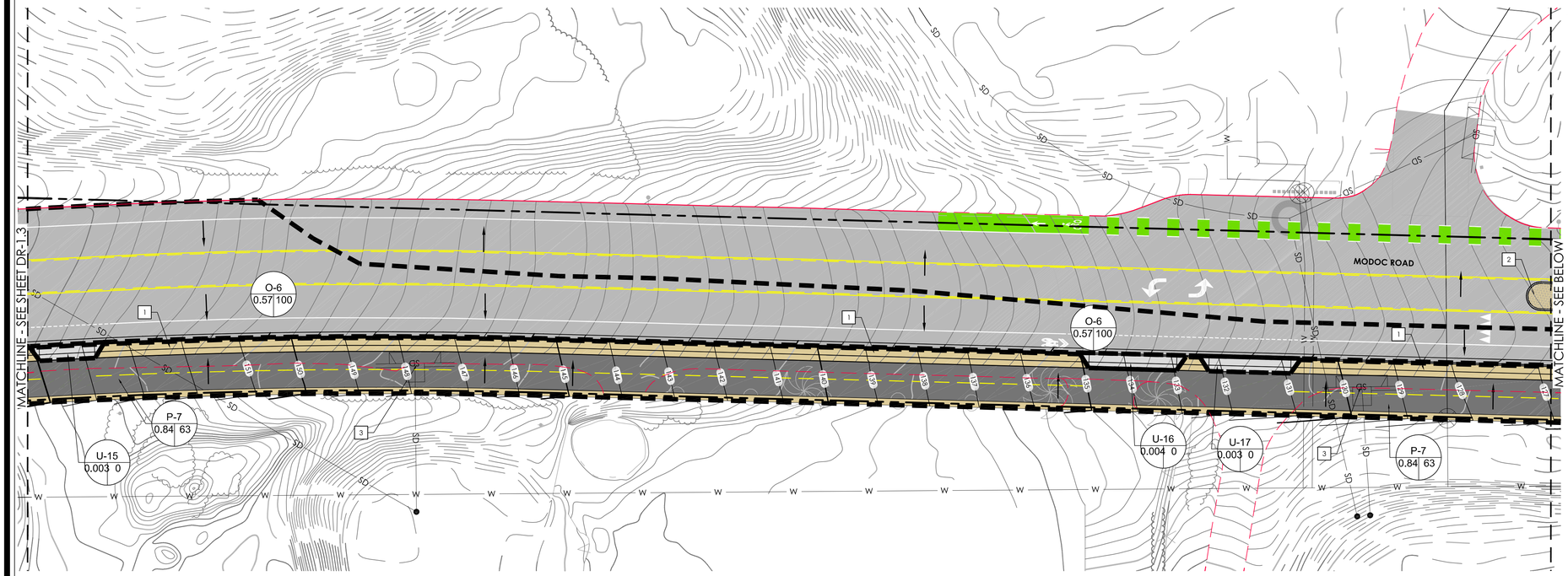
Las Positas Multi-Use Pathway

Schematic Drainage Area Exhibit

NO.	REVISION	DATE

PROJECT MANAGER: BAH
DRAWN BY: SJP
CHECKED BY: WFS
DATE: NOVEMBER 10, 2016
CAD FILE: 0203-DR.dwg
JOB NUMBER: 0203-01-RC15
SHEET: DR-1.3

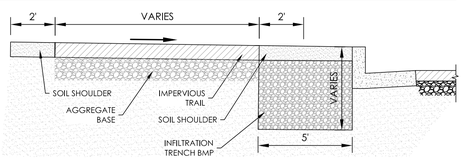
N:\0201\0203-01-RC15-Las Positas Multi-Use Pathway\Engineering\Cad Docs\Sheet Files\0203-DR.dwg, DR-1.3, Nov 14, 2016, 3:22pm, SJPfeifer



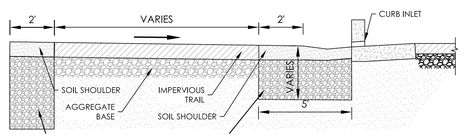
LEGEND

- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING AC PAVING
- PROPOSED SOIL SHOULDER
- PROPOSED AC PAVING
- PROPOSED PERMEABLE CONCRETE PAVING
- PROPOSED PERMEABLE SURFACE
- PROPOSED FLOW DIRECTION
- PROPOSED CURB RAMP
- PROPOSED BARRICADE
- PROPOSED RETAINING WALL
- EXISTING EDGE OF PAVEMENT
- EXISTING RIGHT OF WAY
- PROPOSED BASIN BOUNDARY
- 92.9 EXISTING GRADE
- I.T. INFILTRATION TRENCH

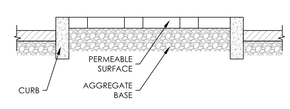
DETAIL A1: INFILTRATION TRENCH BMP



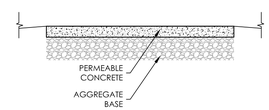
DETAIL A2: INFILTRATION TRENCH BMP



DETAIL B: PERMEABLE SURFACE



DETAIL C: PERMEABLE CONCRETE



Sub-Basin Name

O-2
0.2 100

Sub-Basin Area in Acres

% Impervious

Sub-Basin Types
O: Offsite Run-On
P: Proposed Impervious Surface (Mitigated)
U: Proposed Pervious Surface (Mitigated)

STORM WATER BMP

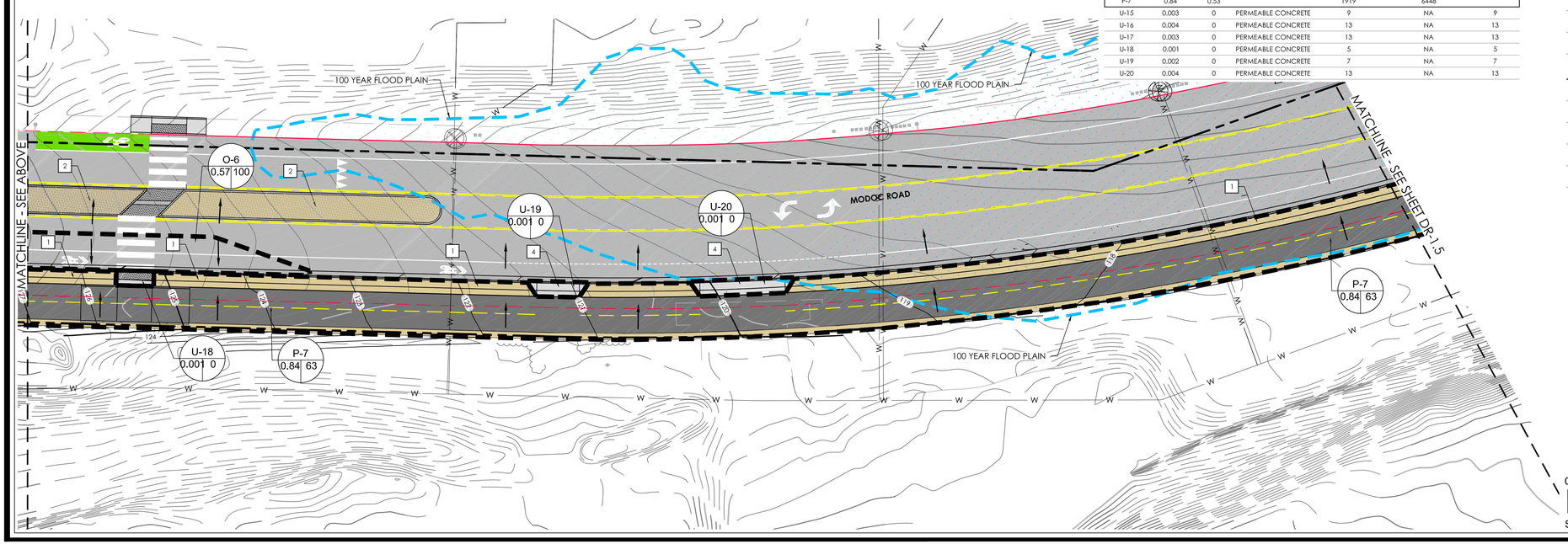
SUB-BASIN	BASIN AREA (AC)	IMPERVIOUS AREA (AC)	BMP	$V_{CHECK(C)}$	V_{T5}	V_{DESIGN}
O-6	0.57	0.57	I.T. (1490'x5'x4')	2072	NA	8520
P-7	0.84	0.53		1919	6448	
U-15	0.003	0	PERMEABLE CONCRETE	9	NA	9
U-16	0.004	0	PERMEABLE CONCRETE	13	NA	13
U-17	0.003	0	PERMEABLE CONCRETE	13	NA	13
U-18	0.001	0	PERMEABLE CONCRETE	5	NA	5
U-19	0.002	0	PERMEABLE CONCRETE	7	NA	7
U-20	0.004	0	PERMEABLE CONCRETE	13	NA	13

PROJECT TOTALS

NEW IMPERVIOUS AREA:	106,800 SF (2.45 AC)
EXISTING IMPERVIOUS AREA REPLACED WITH PERVIOUS AREA:	72,046 SF (1.65 AC)
TOTAL UNTREATED AREA:	14,288 SF (0.33 AC; 2.84% OF ALL SUB-BASINS)
TOTAL AREA OF OFF-SITE RUN ON:	261,484 SF (6.00 AC)

STORM WATER BMP KEYNOTES

1. INFILTRATION TRENCH PER DETAIL A, THIS SHEET
2. PERMEABLE SURFACE PER DETAIL B, THIS SHEET
3. EXISTING STORM DRAIN STRUCTURE
4. PERMEABLE CONCRETE PER DETAIL C, THIS SHEET
5. OPTIONAL PERMEABLE CONCRETE
6. PROPOSED BIO-RETENTION BASIN



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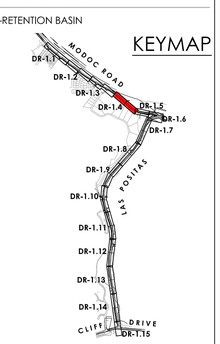

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SCALE 1" = 20'

NO PRELIMINARY REVIEW
REGISTERED PROFESSIONAL ENGINEER
WILLIAM FREDRICK WANG
No. C 65712
exp. 9/30/17
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Las Positas Multi-Use Pathway

Schematic Drainage Area Exhibit

NO.	REVISION	DATE

PROJECT MANAGER: BAH
DRAWN BY: SJP
CHECKED BY: WFS
DATE: NOVEMBER 10, 2016
CAD FILE: 0203-DR.dwg
JOB NUMBER: 0203-01-RC15
SHEET: DR-1.4

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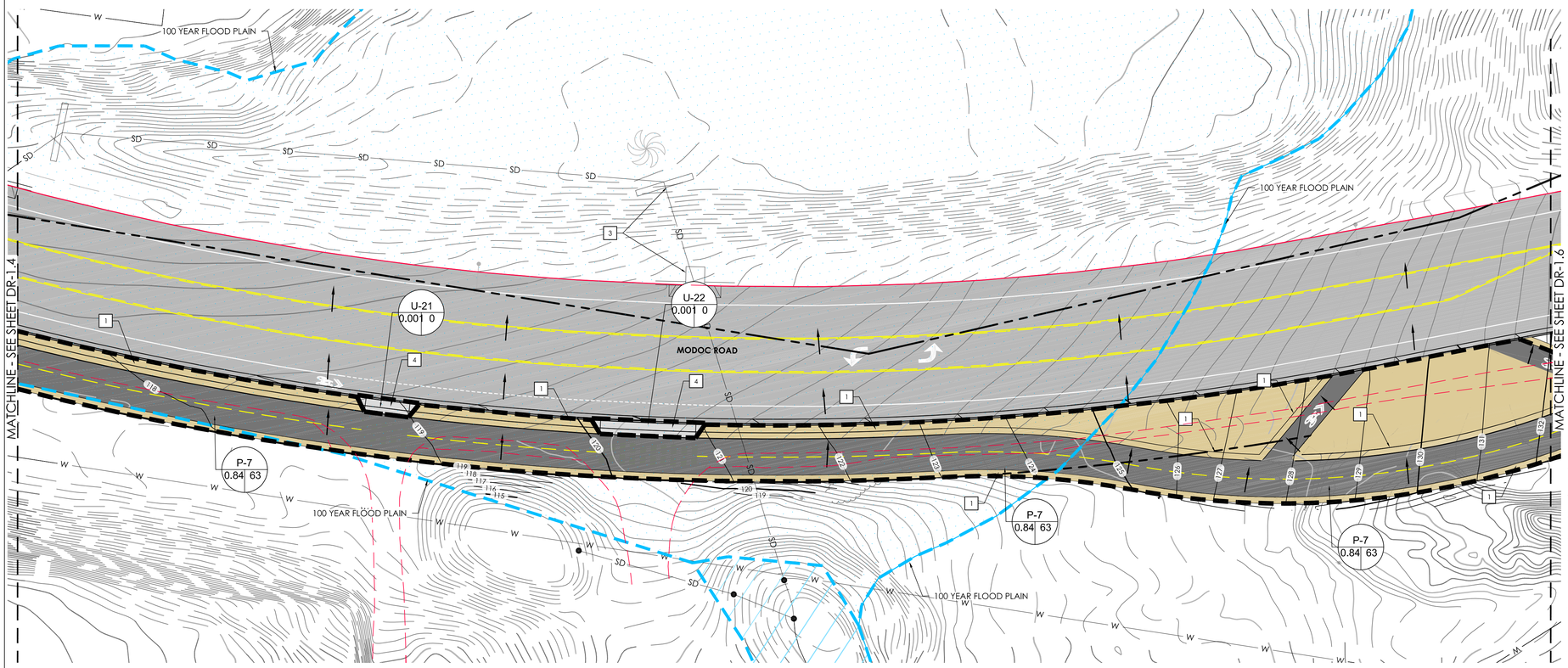

LEGEND

- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING AC PAVING
- PROPOSED SOIL SHOULDER
- PROPOSED AC PAVING
- PROPOSED PERMEABLE CONCRETE PAVING
- PROPOSED PERMEABLE SURFACE
- PROPOSED FLOW DIRECTION
- PROPOSED CURB RAMP
- PROPOSED BARRICADE
- PROPOSED RETAINING WALL
- EXISTING EDGE OF PAVEMENT
- EXISTING RIGHT OF WAY
- PROPOSED BASIN BOUNDARY
- 92.9 EXISTING GRADE
- I.T. INFILTRATION TRENCH

Sub-Basin Name
O-2
0.2 | 100
Sub-Basin Area in Acres
% Impervious

Sub-Basin Types
O: Offsite Run-On
P: Proposed Impervious Surface (Mitigated)
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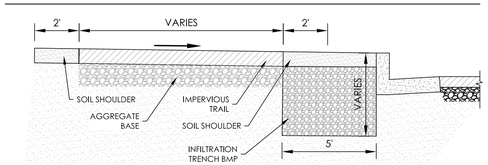
5. OPTIONAL PERMEABLE CONCRETE
6. PROPOSED BIO-RETENTION BASIN

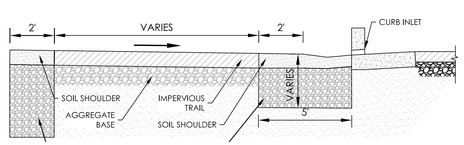
STORM WATER BMP

SUB-BASIN	BASIN AREA (AC)	IMPERVIOUS AREA (AC)	BMP	$V_{DMI-HCI}$	V_{TS}	V_{DESIGN}
U-21	0.001	0	PERMEABLE CONCRETE	8	NA	8
U-22	0.001	0	PERMEABLE CONCRETE	15	NA	15
P-7	0.84	0.53	I.T. (1490'x5'x4')	1919	6448	8520

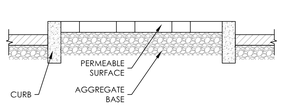
DETAIL A1: INFILTRATION TRENCH BMP



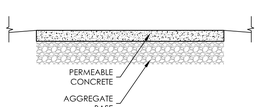
DETAIL A2: INFILTRATION TRENCH BMP



DETAIL B: PERMEABLE SURFACE



DETAIL C: PERMEABLE CONCRETE



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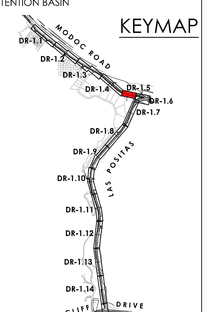

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SCALE 1" = 20'

N:\0201\0203-01-RC15-LasPositasMultiUsePathway\Engineering\CorrDocs\Sheet-Files\0203-DR.dwg DR-1.5 Nov 14, 2016 3:23pm S.JPfeifer

REGISTERED PROFESSIONAL ENGINEER
WILLIAM FREDRICK WANG
No. C 65712
exp. 9/30/17
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Las Positas Multi-Use Pathway

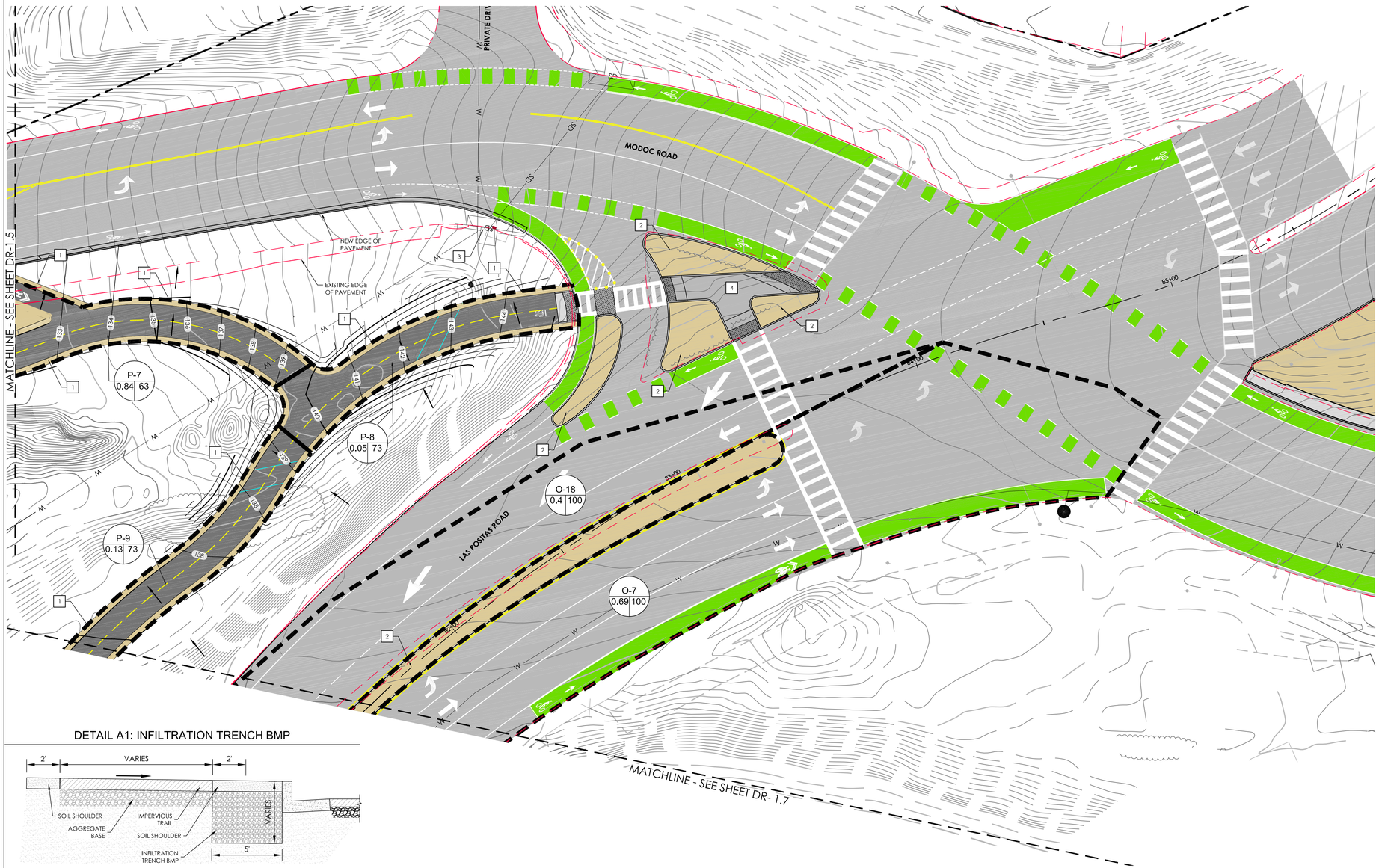
Schematic Drainage Area Exhibit

NO.	REVISION	DATE

PROJECT MANAGER: BAH
DRAWN BY: SJP
CHECKED BY: WFS
DATE: NOVEMBER 10, 2016
CAD FILE: 0203-DR.dwg
JOB NUMBER: 0203-01-RC15
SHEET: DR-1.5

STORM WATER BMP

SUB-BASIN	BASIN AREA (AC)	IMPERVIOUS AREA (AC)	BMP	$V_{DREAMCH}$	V_{TH}	V_{DESIGN}
P-7	0.84	0.53	I.T. (1414'x5'x4')	1919	6448	8520
P-8	0.05	0.03	I.T. (113'X2'X6')	127	426	426
P-9	0.13	0.09	I.T. (331'x2'x5.5')	332	1116	1116
O-7	0.69	0.69	SIDEWALK FILTRATION SYSTEM NORTH 687 L.F.	2497	N.A.	6312
O-18	0.40	0.40		1462	N.A.	



LEGEND

- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING AC PAVING
- PROPOSED SOIL SHOULDER
- PROPOSED AC PAVING
- PROPOSED PERMEABLE CONCRETE PAVING
- PROPOSED PERMEABLE SURFACE
- PROPOSED FLOW DIRECTION
- PROPOSED CURB RAMP
- PROPOSED BARRICADE
- PROPOSED RETAINING WALL
- EXISTING EDGE OF PAVEMENT
- EXISTING RIGHT OF WAY
- PROPOSED BASIN BOUNDARY
- 92.9 EXISTING GRADE
- I.T. INFILTRATION TRENCH

O-2 (Sub-Basin Name)
0.2 (Sub-Basin Area in Acres) | 100 (% Impervious)

Sub-Basin Types
O: Offsite Run-On
P: Proposed Impervious Surface (Mitigated)
U: Proposed Pervious Surface (Mitigated)

PROJECT TOTALS

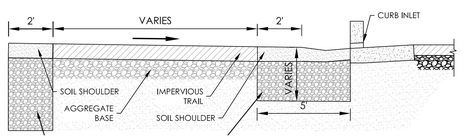
NEW IMPERVIOUS AREA:	106,800 SF (2.45 AC)
EXISTING IMPERVIOUS AREA REPLACED WITH PERVIOUS AREA:	72,046 SF (1.65 AC)
TOTAL UNTREATED AREA:	14,288 SF (0.33 AC; 2.84% OF ALL SUB-BASINS)
TOTAL AREA OF OFF-SITE RUN ON:	261,484 SF (6.00 AC)

STORM WATER BMP KEYNOTES

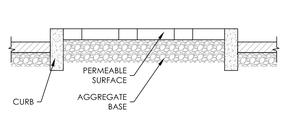
1. INFILTRATION TRENCH PER DETAIL A, THIS SHEET
2. PERMEABLE SURFACE PER DETAIL B, THIS SHEET
3. EXISTING STORM DRAIN STRUCTURE
4. PERMEABLE CONCRETE PER DETAIL C, THIS SHEET
5. OPTIONAL PERMEABLE CONCRETE
6. PROPOSED BIO-RETENTION BASIN
7. SIDEWALK FILTRATION SYSTEM PER DETAIL D, THIS SHEET

DETAIL A1: INFILTRATION TRENCH BMP

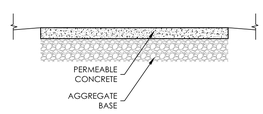
DETAIL A2: INFILTRATION TRENCH BMP



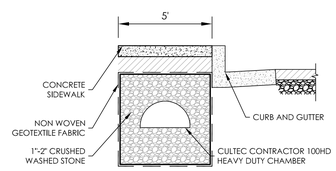
DETAIL B: PERMEABLE SURFACE



DETAIL C: PERMEABLE CONCRETE



DETAIL D: SIDEWALK INFILTRATION SYSTEM



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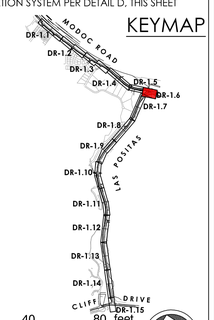

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REGISTERED PROFESSIONAL ENGINEER
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No. C 65712
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Las Positas Multi-Use Pathway

Schematic Drainage Area Exhibit

NO.	REVISION	DATE

PROJECT MANAGER: BAH
DRAWN BY: SJP
CHECKED BY: WFS
DATE: NOVEMBER 10, 2016
CAD FILE: 0203-DR.dwg
JOB NUMBER: 0203-01-RC15
SHEET: DR-1.6

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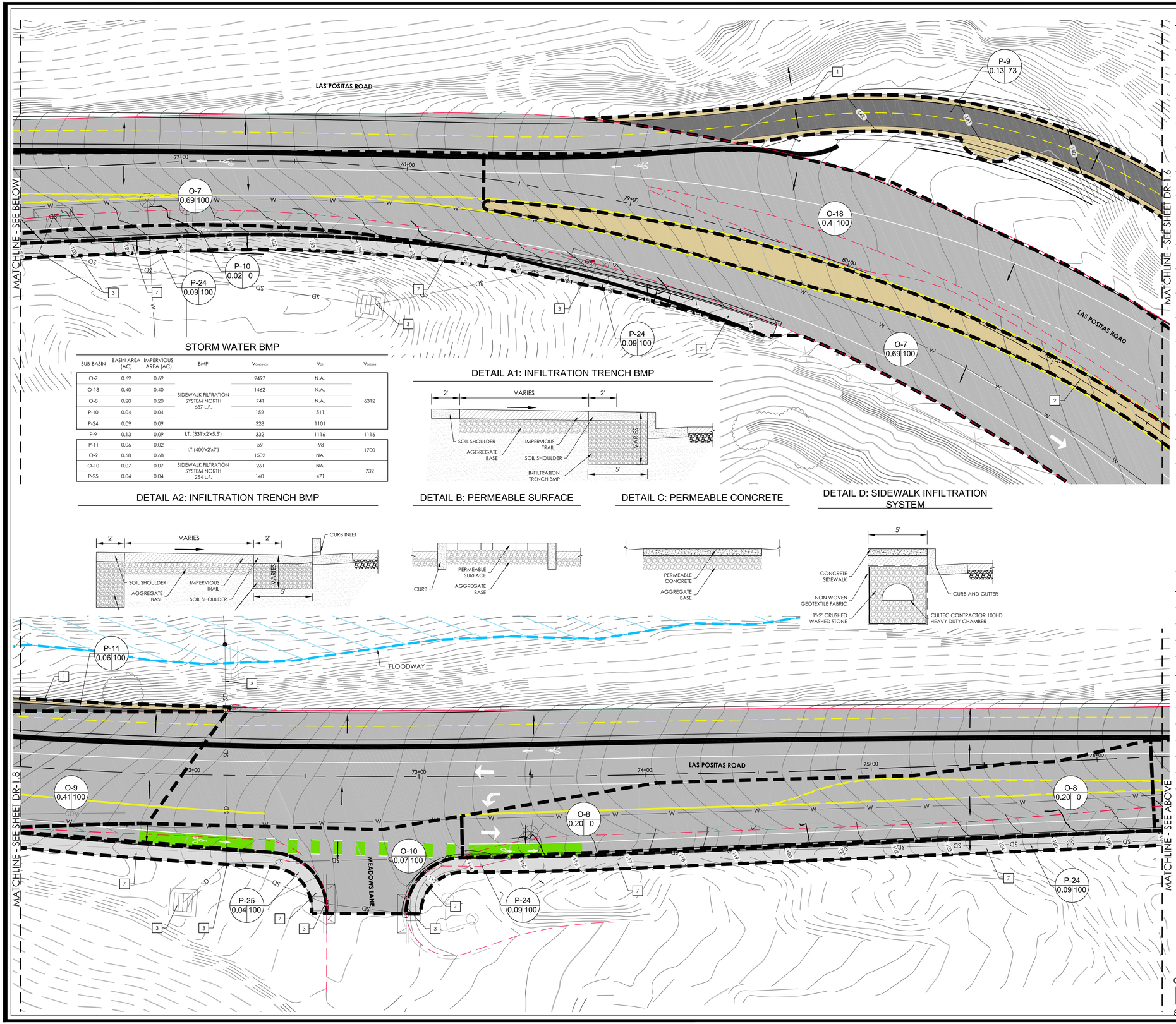


LEGEND

- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING AC PAVING
- PROPOSED SOIL SHOULDER
- PROPOSED AC PAVING
- PROPOSED PERMEABLE CONCRETE PAVING
- PROPOSED PERMEABLE SURFACE
- PROPOSED FLOW DIRECTION
- PROPOSED CURB RAMP
- PROPOSED BARRICADE
- PROPOSED RETAINING WALL
- EXISTING EDGE OF PAVEMENT
- EXISTING RIGHT OF WAY
- PROPOSED BASIN BOUNDARY
- 92.9 EXISTING GRADE
- I.T. INFILTRATION TRENCH

O-2 (Sub-Basin Name) 0.2 (Sub-Basin Area in Acres) 100 (% Impervious)

Sub-Basin Types
- O: Offsite Run-On
- P: Proposed Impervious Surface (Mitigated)
- U: Proposed Pervious Surface (Mitigated)

STORM WATER BMP

SUB-BASIN	BASIN AREA (AC)	IMPERVIOUS AREA (AC)	BMP	$V_{SOIL@1INCH}$	V_{SS}	V_{DESIGN}
O-7	0.69	0.69	SIDEWALK FILTRATION SYSTEM NORTH 687 L.F.	2497	N.A.	6312
O-18	0.40	0.40		1462	N.A.	
O-8	0.20	0.20		741	N.A.	
P-10	0.04	0.04		152	511	
P-24	0.09	0.09		328	1101	
P-9	0.13	0.09	I.T. (331'x2'x5.5')	332	1116	1116
P-11	0.06	0.02	I.T.(400'x2'x7')	59	198	1700
O-9	0.68	0.68		1502	NA	
O-10	0.07	0.07	SIDEWALK FILTRATION SYSTEM NORTH 254 L.F.	261	NA	732
P-25	0.04	0.04		140	471	

DETAIL A1: INFILTRATION TRENCH BMP

DETAIL A2: INFILTRATION TRENCH BMP

DETAIL B: PERMEABLE SURFACE

DETAIL C: PERMEABLE CONCRETE

DETAIL D: SIDEWALK INFILTRATION SYSTEM

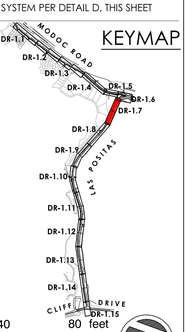
PROJECT TOTALS

NEW IMPERVIOUS AREA:	106,800 SF (2.45 AC)
EXISTING IMPERVIOUS AREA REPLACED WITH PERVIOUS AREA:	72,046 SF (1.65 AC)
TOTAL UNTREATED AREA:	14,288 SF (0.33 AC; 2.84% OF ALL SUB-BASINS)
TOTAL AREA OF OFF-SITE RUN ON:	261,484 SF (6.00 AC)

STORM WATER BMP KEYNOTES

1. INFILTRATION TRENCH PER DETAIL A, THIS SHEET
2. PERMEABLE SURFACE PER DETAIL B, THIS SHEET
3. EXISTING STORM DRAIN STRUCTURE
4. PERMEABLE CONCRETE PER DETAIL C, THIS SHEET
5. OPTIONAL PERMEABLE CONCRETE
6. PROPOSED BIO-RETENTION BASIN
7. SIDEWALK FILTRATION SYSTEM PER DETAIL D, THIS SHEET

KEYMAP



DIG ALERT
DIAL TOLL FREE
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AT LEAST 2 DAYS BEFORE YOU DIG

0 20 40 80 feet
SCALE 1" = 20'

NO PRELIMINARY OR CONSTRUCTION
REGISTERED PROFESSIONAL ENGINEER
WILLIAM FREDRICK WENZ
No. C 65712
EXP. 9/30/17
CIVIL
STATE OF CALIFORNIA

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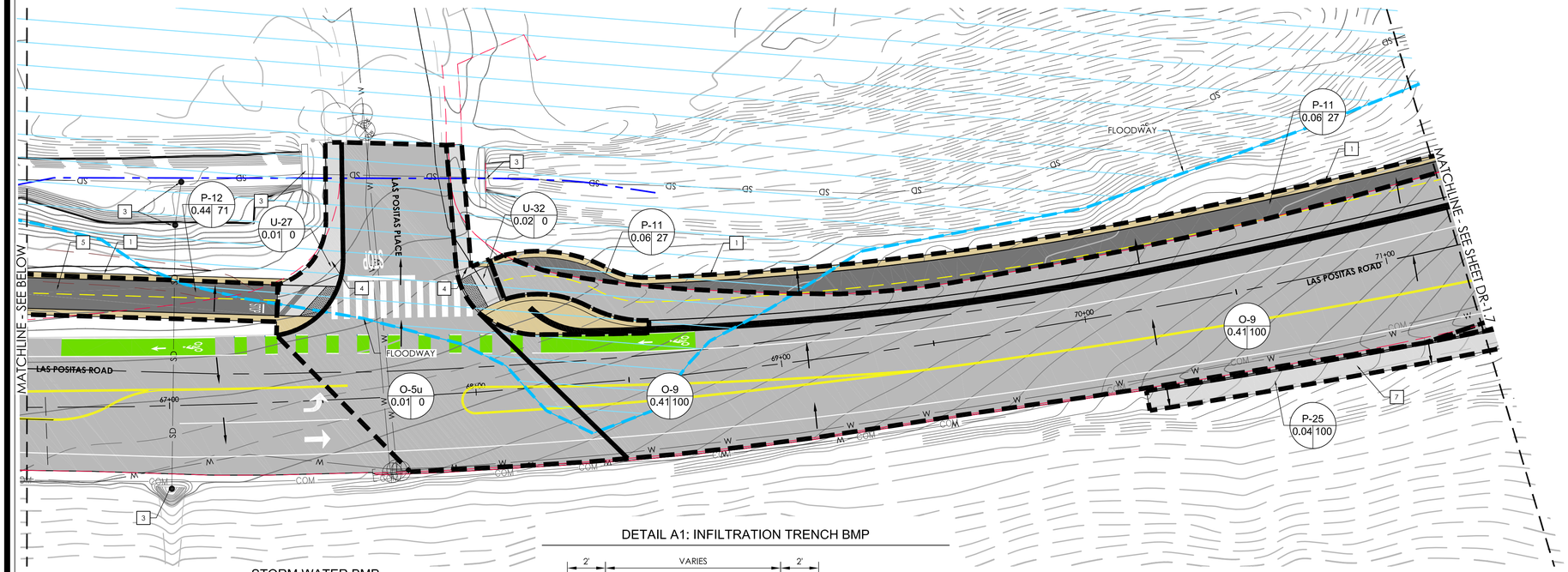
Las Positas Multi-Use Pathway

Schematic Drainage Area Exhibit

NO.	REVISION	DATE

PROJECT MANAGER: BAH
DRAWN BY: SJP
CHECKED BY: WFS
DATE: NOVEMBER 10, 2016
CAD FILE: 0203-DR.dwg
JOB NUMBER: 0203-01-RC15
SHEET: DR-1.7

N:\0203\0203-01-RC15-Las Positas-Multi-Use Pathway\Engineering\CorrDocs\Sheet-Files\0203-DR.dwg, DR-1.7, Nov 14, 2016, 3:24pm, SJPfeifer



LEGEND

- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING AC PAVING
- PROPOSED SOIL SHOULDER
- PROPOSED AC PAVING
- PROPOSED PERMEABLE CONCRETE PAVING
- PROPOSED PERMEABLE SURFACE
- PROPOSED FLOW DIRECTION
- PROPOSED CURB RAMP
- PROPOSED BARRICADE
- PROPOSED RETAINING WALL
- EXISTING EDGE OF PAVEMENT
- EXISTING RIGHT OF WAY
- PROPOSED BASIN BOUNDARY
- 92.9 EXISTING GRADE
- I.T. INFILTRATION TRENCH

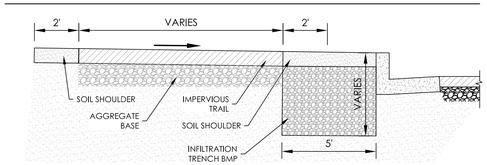
Sub-Basin Name
O-2 | 0.2 | 100
Sub-Basin Area in Acres
% Impervious

Sub-Basin Types
O: Offsite Run-On
P: Proposed Impervious Surface (Mitigated)
U: Proposed Pervious Surface (Mitigated)

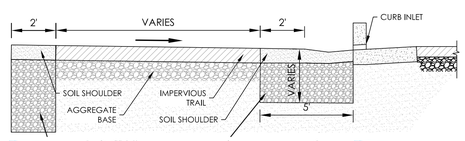
STORM WATER BMP

SUB-BASIN	BASIN AREA (AC)	IMPERVIOUS AREA (AC)	BMP	$V_{DMEANCH}$	V_{T5}	V_{DESIGN}
P-11	0.06	0.02	I.T.(400'x2'x7')	59	198	1700
O-9	0.68	0.68		1502	NA	
P-12	0.44	0.31	I.T. (1369'x2'x4.5')	1122	3770	3770
O-10	0.07	0.07	SIDEWALK FILTRATION SYSTEM NORTH 254 L.F.	261	NA	732
P-25	0.04	0.04		140	471	

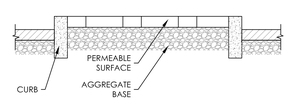
DETAIL A1: INFILTRATION TRENCH BMP



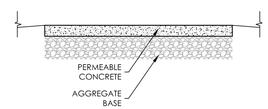
DETAIL A2: INFILTRATION TRENCH BMP



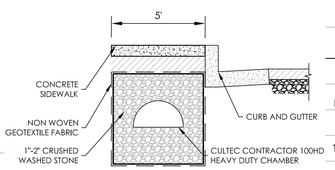
DETAIL B: PERMEABLE SURFACE



DETAIL C: PERMEABLE CONCRETE



DETAIL D: SIDEWALK INFILTRATION SYSTEM



PROJECT TOTALS

NEW IMPERVIOUS AREA:	106,800 SF (2.45 AC)
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STORM WATER BMP KEYNOTES

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2. PERMEABLE SURFACE PER DETAIL B, THIS SHEET
3. EXISTING STORM DRAIN STRUCTURE
4. PERMEABLE CONCRETE PER DETAIL C, THIS SHEET
5. OPTIONAL PERMEABLE CONCRETE
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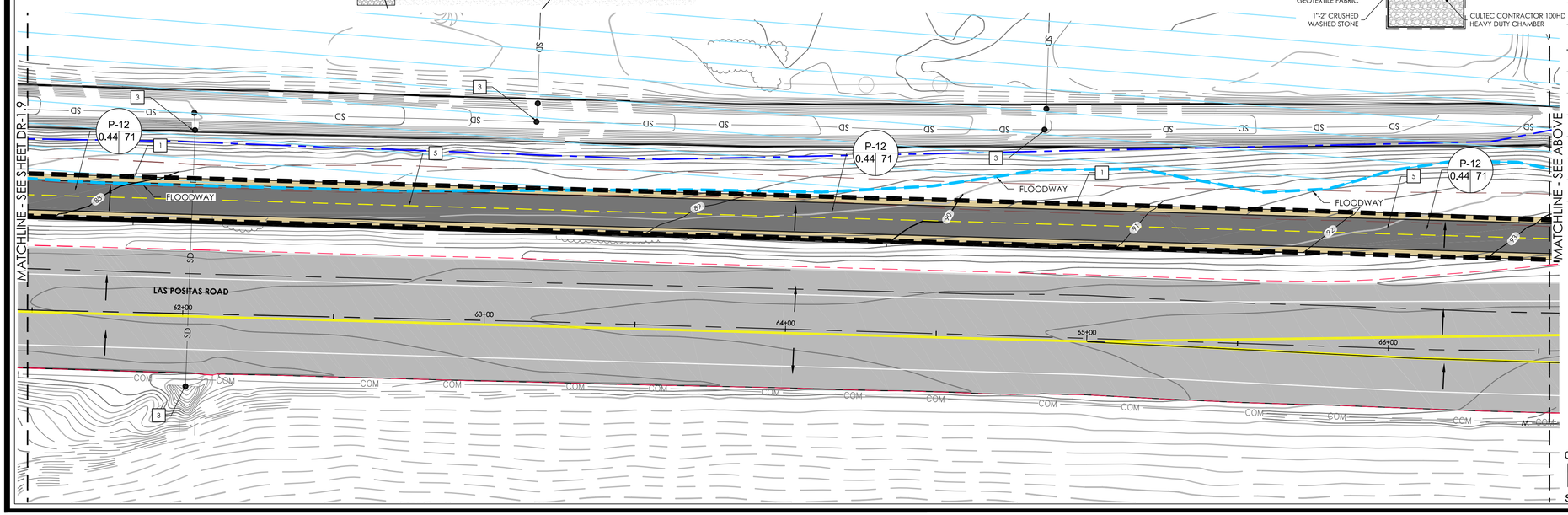
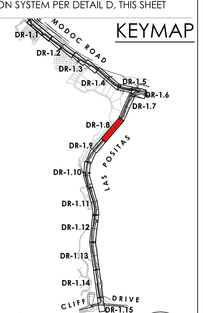
7. SIDEWALK FILTRATION SYSTEM PER DETAIL D, THIS SHEET



KEYMAP



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NO PRELIMINARY REVIEW FOR CONSTRUCTION
REGISTERED PROFESSIONAL ENGINEER
WILLIAM FREDRICK WANG
No. C 65712
EXP. 9/30/17
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Las Positas Multi-Use Pathway

Schematic Drainage Area Exhibit

NO.	REVISION	DATE

PROJECT MANAGER: BAH
DRAWN BY: SJP
CHECKED BY: WFS
DATE: NOVEMBER 10, 2016
CAD FILE: 0203-DR.dwg
JOB NUMBER: 0203-01-RC15
SHEET: DR-1.8

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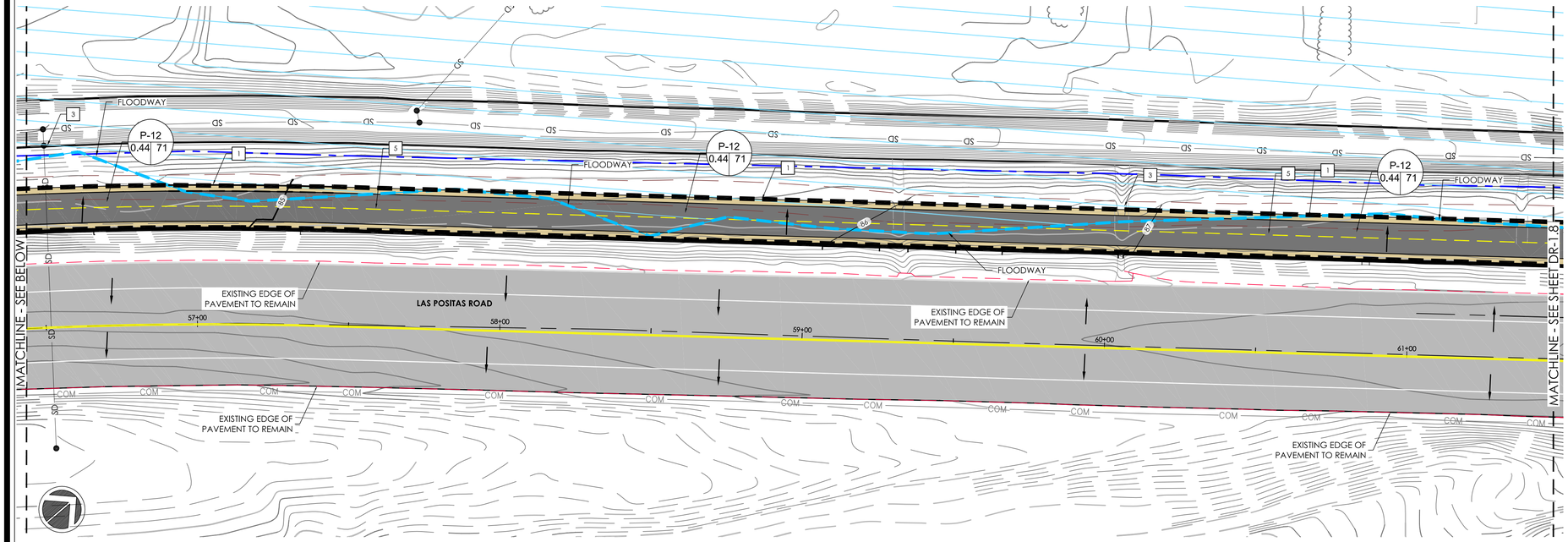
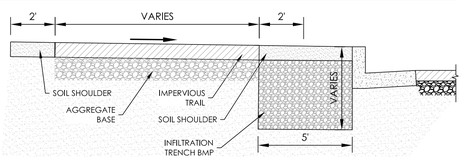


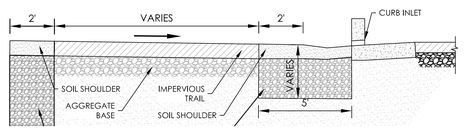
STORM WATER BMP

SUB-BASIN	BASIN AREA (AC)	IMPERVIOUS AREA (AC)	BMP	$V_{DMA-MOD}$	V_{35}	V_{DESIGN}
P-12	0.44	0.31	I.T. (1369'x2'x4.5')	1122	3770	3770
P-13	0.09	0.07	I.T. (279'x2'x4.5')	236	794	794

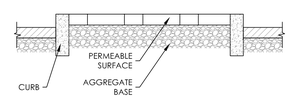
DETAIL A1: INFILTRATION TRENCH BMP



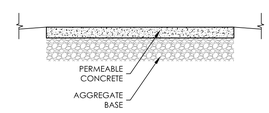
DETAIL A2: INFILTRATION TRENCH BMP

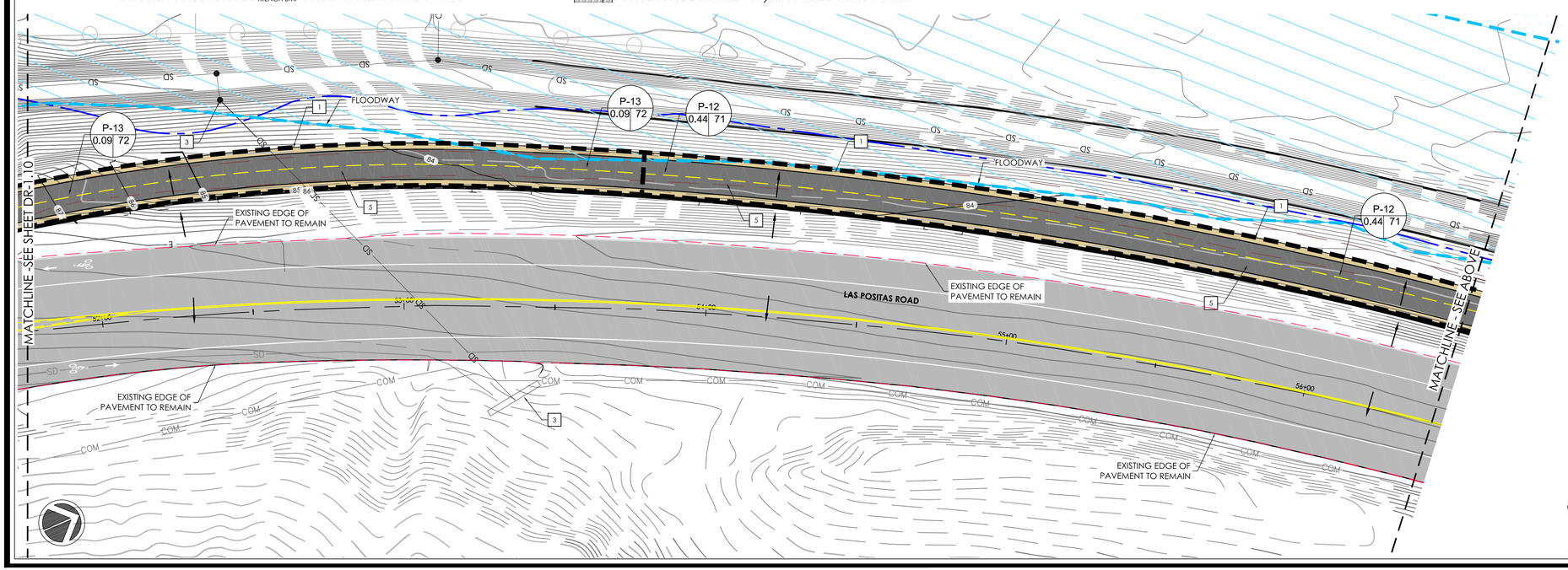


DETAIL B: PERMEABLE SURFACE



DETAIL C: PERMEABLE CONCRETE





LEGEND

- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING AC PAVING
- PROPOSED SOIL SHOULDER
- PROPOSED AC PAVING
- PROPOSED PERMEABLE CONCRETE PAVING
- PROPOSED PERMEABLE SURFACE
- PROPOSED FLOW DIRECTION
- PROPOSED CURB RAMP
- PROPOSED BARRICADE
- PROPOSED RETAINING WALL
- EXISTING EDGE OF PAVEMENT
- EXISTING RIGHT OF WAY
- PROPOSED BASIN BOUNDARY
- 92.9 EXISTING GRADE
- I.T. INFILTRATION TRENCH

Sub-Basin Name
O-2
0.2 | 100
Sub-Basin Area in Acres
% Impervious

Sub-Basin Types
O: Offsite Run-On
P: Proposed Impervious Surface (Mitigated)
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STORM WATER BMP KEYNOTES

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6. PROPOSED BIO-RETENTION BASIN

KEYMAP

DIG ALERT
DIAL TOLL FREE
811
AT LEAST 2 DAYS BEFORE YOU DIG

0 20 40 80 feet
SCALE 1" = 20'

N:\0201\0203-01-RC15-Las Positas Multi-Use Pathway\Engineering\Con Docs\Sheet Files\0203-DR.dwg, DR-1.9, Nov 14, 2016, 3:26pm, SJPfeifer

REGISTERED PROFESSIONAL ENGINEER
JEREMY PREDRICK GRANT
No. C 65712
exp. 9/30/17
CIVIL
STATE OF CALIFORNIA
NOT FOR CONSTRUCTION
PRELIMINARY

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Las Positas Multi-Use Pathway

Schematic Drainage Area Exhibit

NO.	REVISION	DATE

PROJECT MANAGER: BAH
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CHECKED BY: WFS
DATE: NOVEMBER 10, 2016
CAD FILE: 0203-DR.dwg
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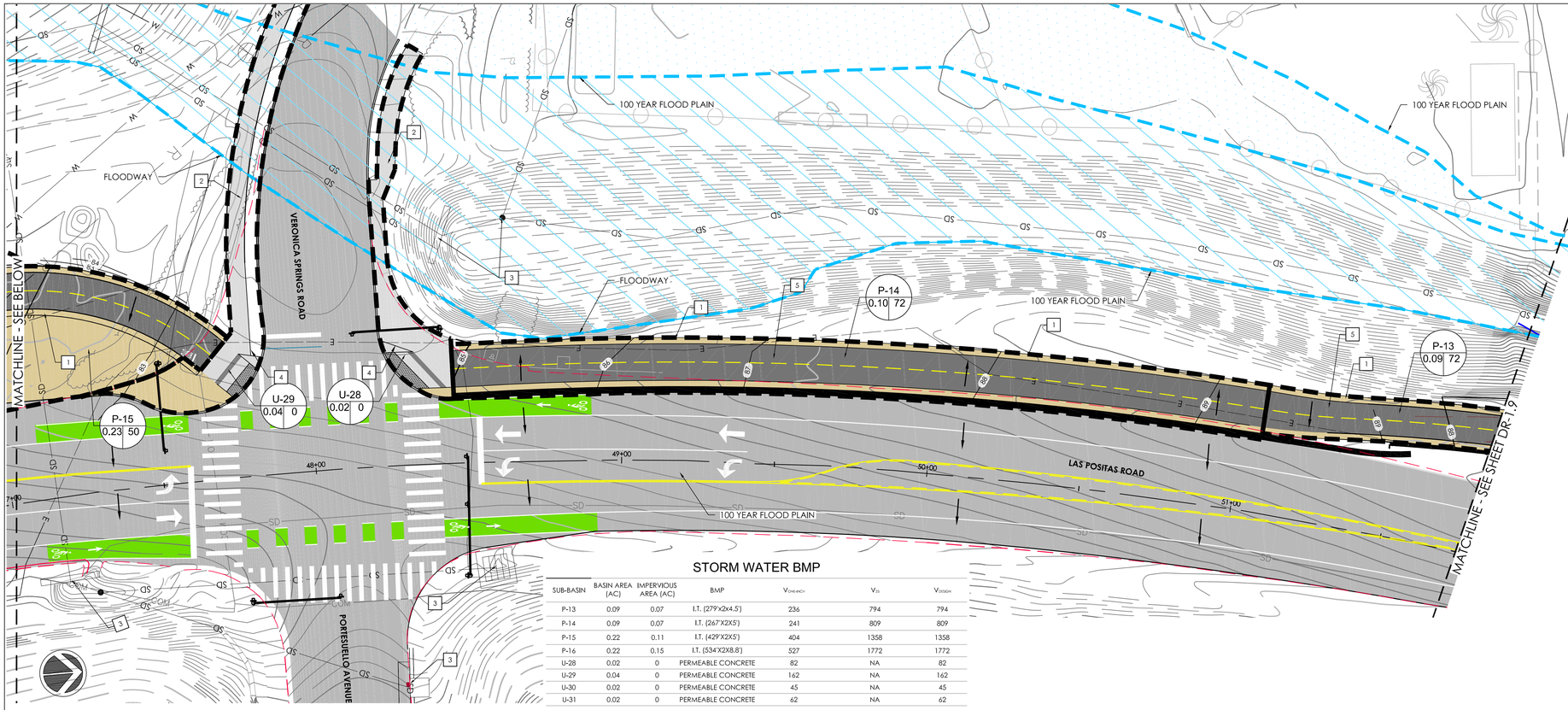

STORM WATER BMP

SUB-BASIN	BASIN AREA (AC)	IMPERVIOUS AREA (AC)	BMP	$V_{DCIA(AC)}$	V_{TS}	V_{DESIGN}
P-13	0.09	0.07	I.T. (279'x2x4.5')	236	794	794
P-14	0.09	0.07	I.T. (267'X2X5')	241	809	809
P-15	0.22	0.11	I.T. (429'X2X5')	404	1358	1358
P-16	0.22	0.15	I.T. (534'X2X8.8')	527	1772	1772
U-28	0.02	0	PERMEABLE CONCRETE	82	NA	82
U-29	0.04	0	PERMEABLE CONCRETE	162	NA	162
U-30	0.02	0	PERMEABLE CONCRETE	45	NA	45
U-31	0.02	0	PERMEABLE CONCRETE	62	NA	62

LEGEND

- 900 PROPOSED MAJOR CONTOUR
- 901 PROPOSED MINOR CONTOUR
- 900 EXISTING MAJOR CONTOUR
- 901 EXISTING MINOR CONTOUR
- EXISTING AC PAVING
- PROPOSED SOIL SHOULDER
- PROPOSED AC PAVING
- PROPOSED PERMEABLE CONCRETE PAVING
- PROPOSED PERMEABLE SURFACE
- PROPOSED FLOW DIRECTION
- PROPOSED CURB RAMP
- PROPOSED BARRICADE
- PROPOSED RETAINING WALL
- EXISTING EDGE OF PAVEMENT
- EXISTING RIGHT OF WAY
- PROPOSED BASIN BOUNDARY
- 92.9 EXISTING GRADE
- I.T. INFILTRATION TRENCH

Sub-Basin Name
O-2
0.2 | 100
Sub-Basin Area in Acres
% Impervious

Sub-Basin Types
O: Offsite Run-On
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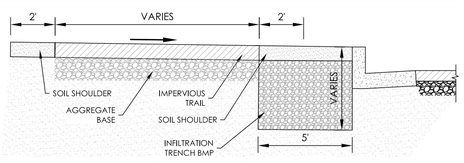
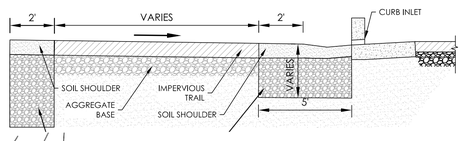
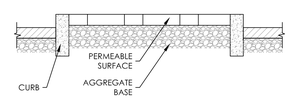
DETAIL A1: INFILTRATION TRENCH BMP



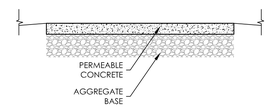
DETAIL A2: INFILTRATION TRENCH BMP

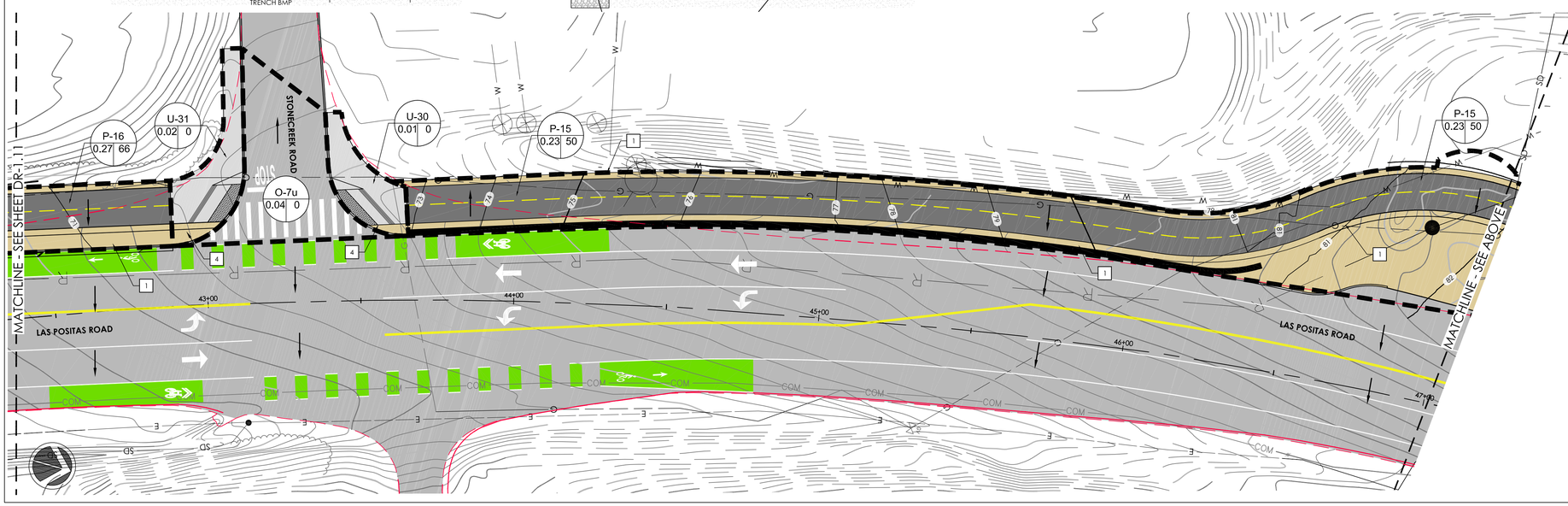


DETAIL B: PERMEABLE SURFACE

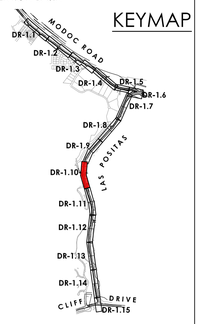


DETAIL C: PERMEABLE CONCRETE





KEYMAP



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Las Positas Multi-Use Pathway

Schematic Drainage Area Exhibit

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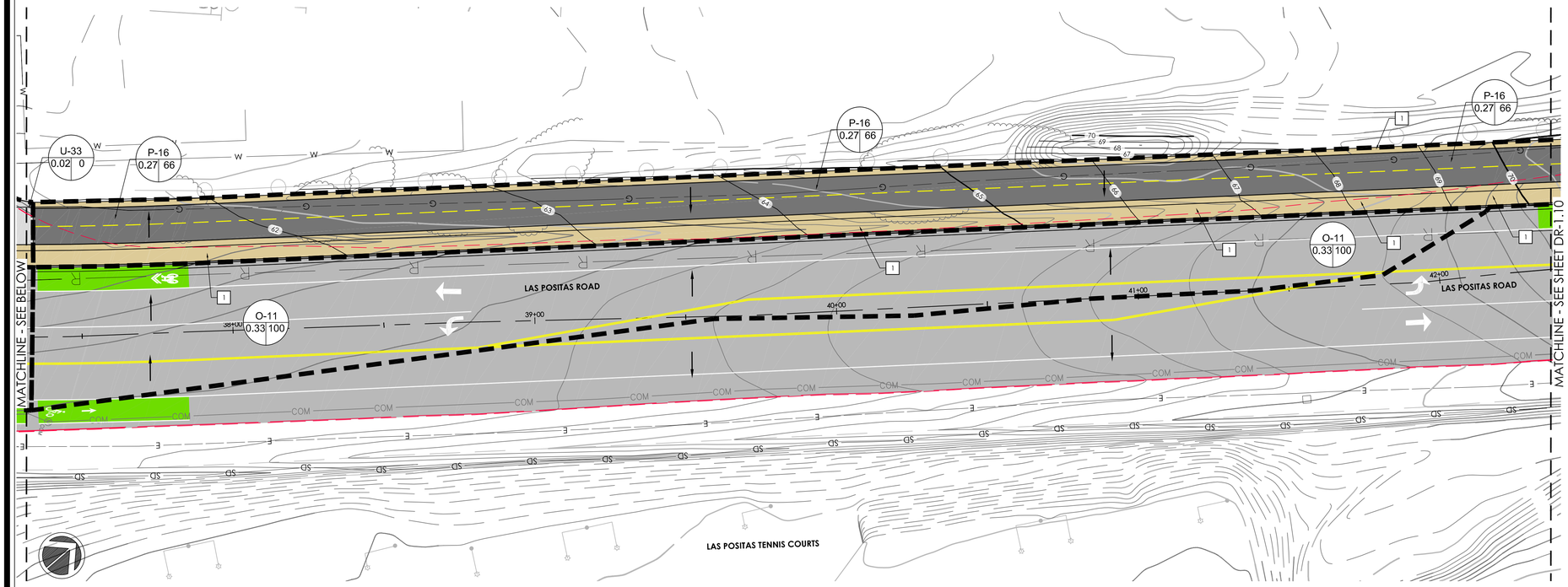

LEGEND

- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING AC PAVING
- PROPOSED SOIL SHOULDER
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Sub-Basin Name
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0.2 100
Sub-Basin Area in Acres
% Impervious

Sub-Basin Types
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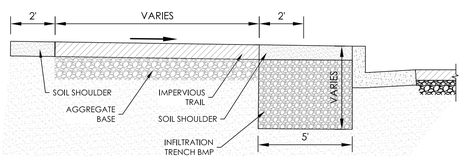
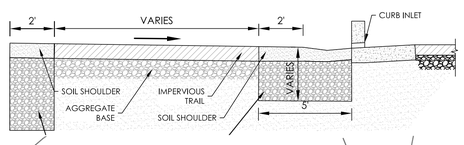
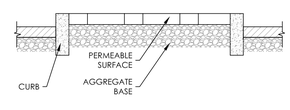
DETAIL A1: INFILTRATION TRENCH BMP



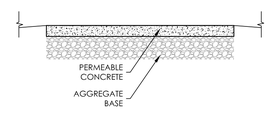
DETAIL A2: INFILTRATION TRENCH BMP

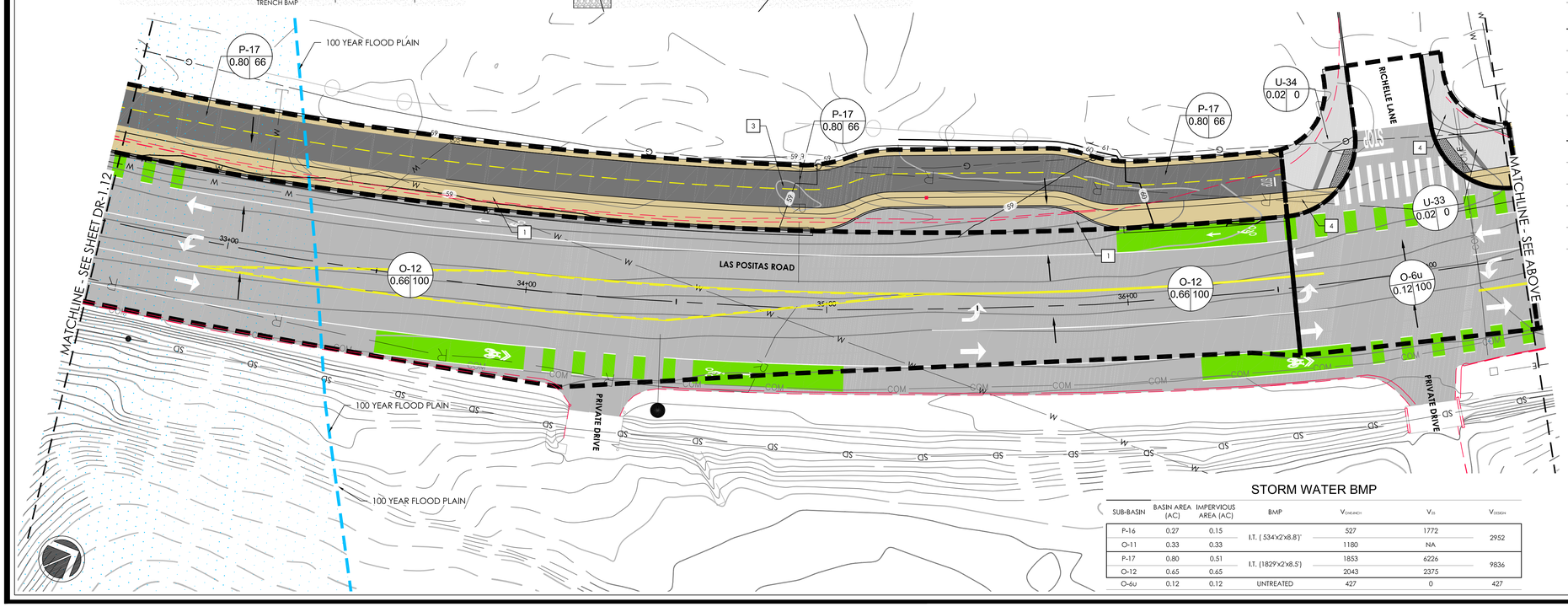


DETAIL B: PERMEABLE SURFACE



DETAIL C: PERMEABLE CONCRETE





STORM WATER BMP

SUB-BASIN	BASIN AREA (AC)	IMPERVIOUS AREA (AC)	BMP	$V_{ONEINCH}$	V_{25}	V_{DESIGN}
P-16	0.27	0.15	I.T. (534'x2'x8.8')'	527	1772	2952
O-11	0.33	0.33		1180	NA	
P-17	0.80	0.51	I.T. (1829'x2'x8.5')	1853	6226	9836
O-12	0.65	0.65		2043	2375	
O-6u	0.12	0.12	UNTREATED	427	0	427

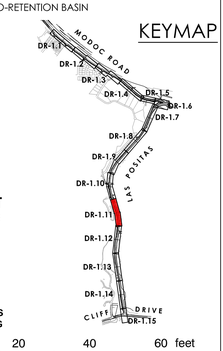
PROJECT TOTALS

NEW IMPERVIOUS AREA:	106,800 SF (2.45 AC)
EXISTING IMPERVIOUS AREA REPLACED WITH PERVIOUS AREA:	72,046 SF (1.65 AC)
TOTAL UNTREATED AREA:	14,288 SF (0.33 AC; 2.84% OF ALL SUB-BASINS)
TOTAL AREA OF OFF-SITE RUN ON:	261,484 SF (6.00 AC)

STORM WATER BMP KEYNOTES

1. INFILTRATION TRENCH PER DETAIL A, THIS SHEET
2. PERMEABLE SURFACE PER DETAIL B, THIS SHEET
3. EXISTING STORM DRAIN STRUCTURE
4. PERMEABLE CONCRETE PER DETAIL C, THIS SHEET
5. OPTIONAL PERMEABLE CONCRETE
6. PROPOSED BIO-RETENTION BASIN

KEYMAP



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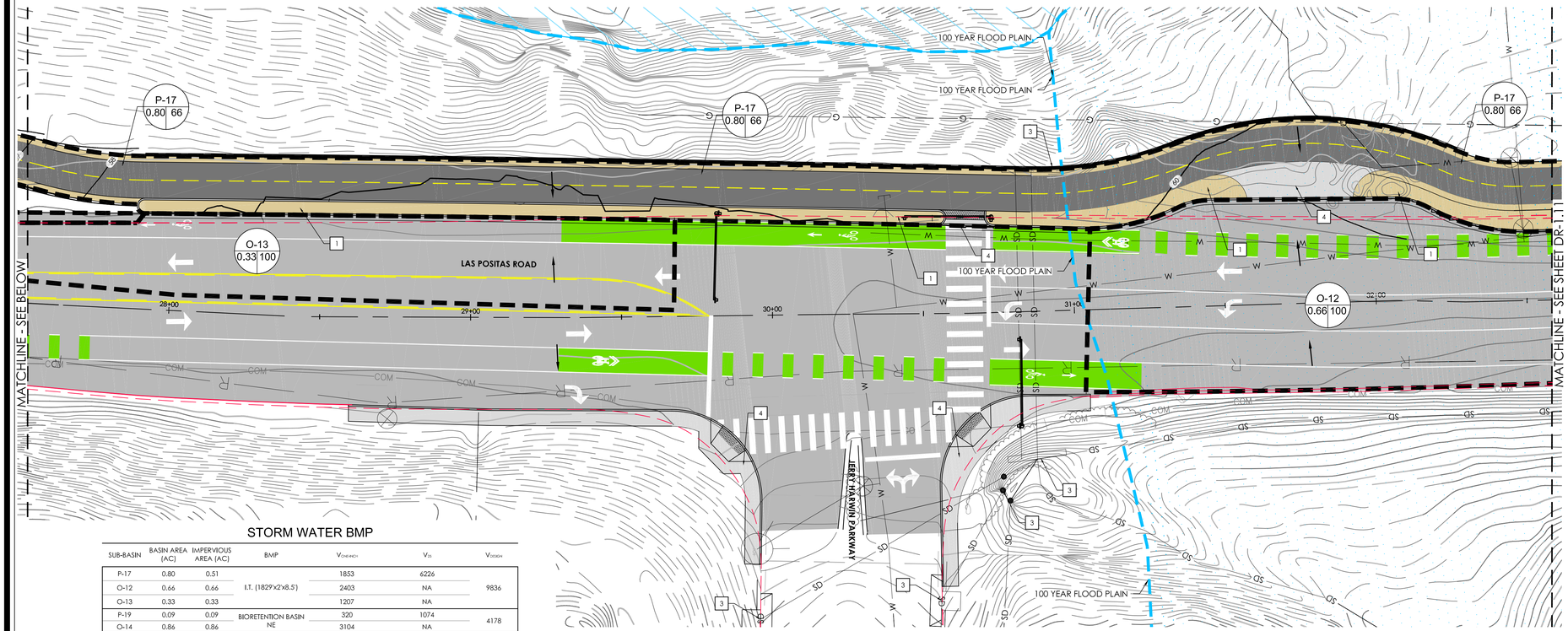
Las Positas Multi-Use Pathway
Schematic Drainage Area Exhibit

NO.	REVISION	DATE

PROJECT MANAGER: BAH
DRAWN BY: SJP
CHECKED BY: WFS
DATE: NOVEMBER 10, 2016
CAD FILE: 0203-DR.dwg
JOB NUMBER: 0203-01-RC15
SHEET: DR-1.11

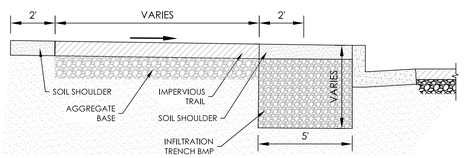
N:\0201\0203-01-RC15-Las Positas-Multi-Use-Pathway\Engineering\Con Docs\Sheets-Plans\0203-DR.dwg, DR-1.11, Nov 14, 2016 3:27pm, SJPfeifer



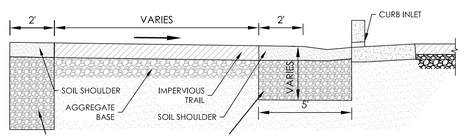
STORM WATER BMP

SUB-BASIN	BASIN AREA (AC)	IMPERVIOUS AREA (AC)	BMP	$V_{CHE-HACH}$	V_{T5}	V_{DESIGN}
P-17	0.80	0.51	I.T. (1829'x2'x8.5')	1853	6226	9836
O-12	0.66	0.66		2403	NA	
O-13	0.33	0.33		1207	NA	
P-19	0.09	0.09	BIORETENTION BASIN NE	320	1074	4178
O-14	0.86	0.86		3104	NA	
P-23	0.02	0.02	BIORETENTION BASIN W	78	263	263

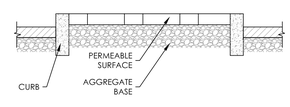
DETAIL A1: INFILTRATION TRENCH BMP



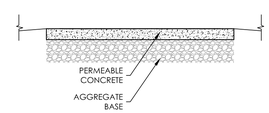
DETAIL A2: INFILTRATION TRENCH BMP

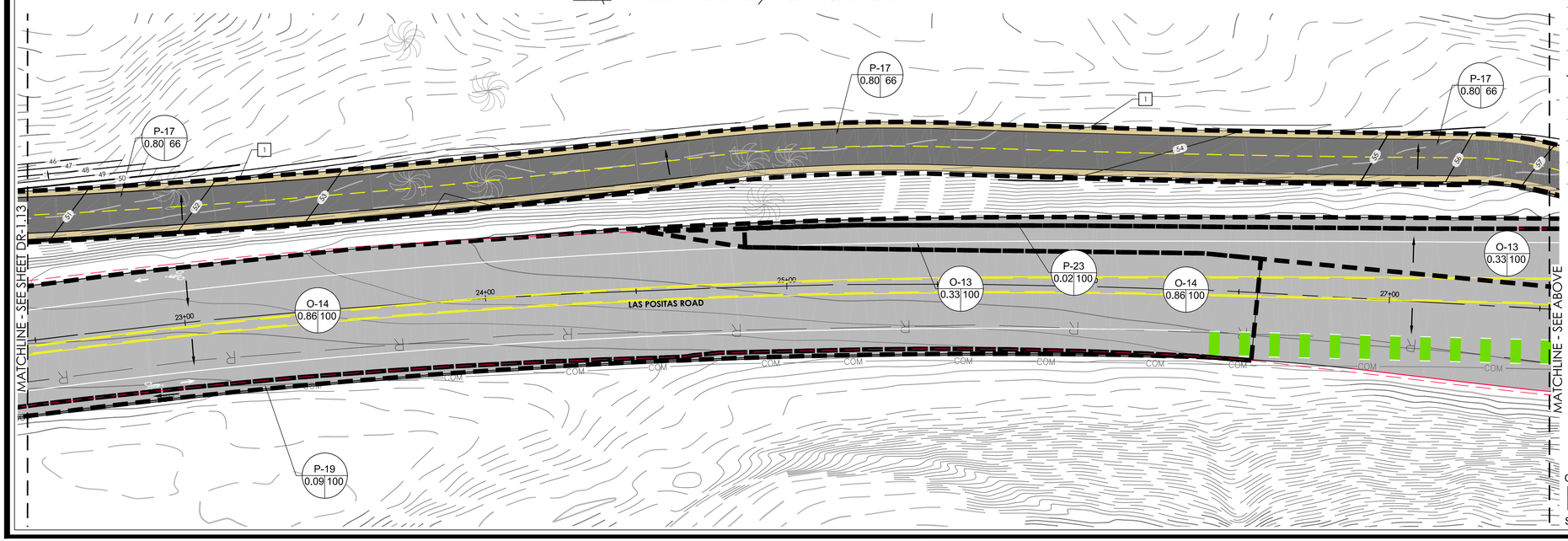


DETAIL B: PERMEABLE SURFACE



DETAIL C: PERMEABLE CONCRETE





LEGEND

- 900 PROPOSED MAJOR CONTOUR
- 901 PROPOSED MINOR CONTOUR
- 900 EXISTING MAJOR CONTOUR
- 901 EXISTING MINOR CONTOUR
- EXISTING AC PAVING
- PROPOSED SOIL SHOULDER
- PROPOSED AC PAVING
- PROPOSED PERMEABLE CONCRETE PAVING
- PROPOSED PERMEABLE SURFACE
- PROPOSED FLOW DIRECTION
- PROPOSED CURB RAMP
- PROPOSED BARRICADE
- PROPOSED RETAINING WALL
- EXISTING EDGE OF PAVEMENT
- EXISTING RIGHT OF WAY
- PROPOSED BASIN BOUNDARY
- 92.9 EXISTING GRADE
- I.T. INFILTRATION TRENCH

O-2 (0.2 | 100): Sub-Basin Name; Sub-Basin Area in Acres; % Impervious

Sub-Basin Types
- O: Offsite Run-On
- P: Proposed Impervious Surface (Mitigated)
- U: Proposed Pervious Surface (Mitigated)

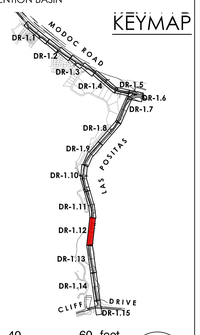
PROJECT TOTALS

NEW IMPERVIOUS AREA:	106,800 SF (2.45 AC)
EXISTING IMPERVIOUS AREA REPLACED WITH PERVIOUS AREA:	72,046 SF (1.65 AC)
TOTAL UNTREATED AREA:	14,288 SF (0.33 AC; 2.84% OF ALL SUB-BASINS)
TOTAL AREA OF OFF-SITE RUN ON:	261,484 SF (6.00 AC)

STORM WATER BMP KEYNOTES

1. INFILTRATION TRENCH PER DETAIL A, THIS SHEET
2. PERMEABLE SURFACE PER DETAIL B, THIS SHEET
3. EXISTING STORM DRAIN STRUCTURE
4. PERMEABLE CONCRETE PER DETAIL C, THIS SHEET
5. OPTIONAL PERMEABLE CONCRETE
6. PROPOSED BIO-RETENTION BASIN

KEYMAP



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WILLIAM FREDRICK FRANDSEN
No. C 65712
exp. 9/30/17
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Las Positas Multi-Use Pathway

Schematic Drainage Area Exhibit

NO.	REVISION	DATE

PROJECT MANAGER: BAH
DRAWN BY: SJP
CHECKED BY: WFS
DATE: NOVEMBER 10, 2016
CAD FILE: 0203-DR.dwg
JOB NUMBER: 0203-01-RC15
SHEET: DR-1.12

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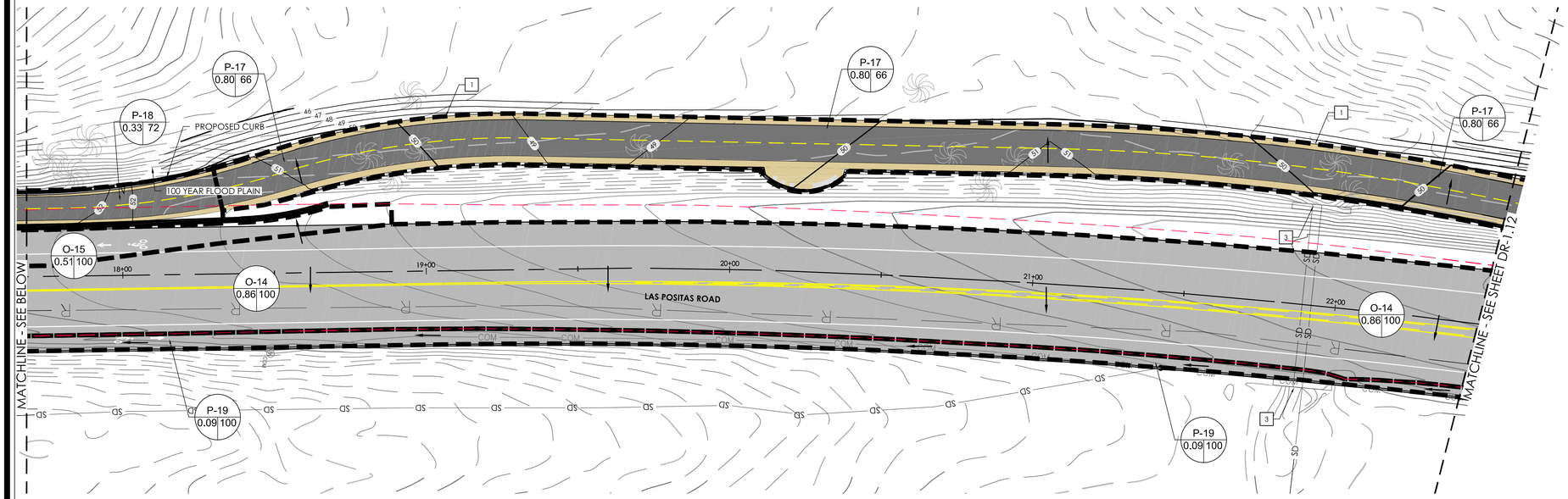
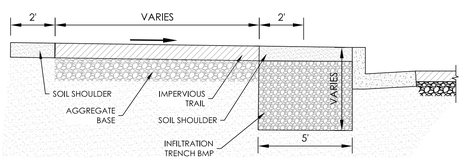


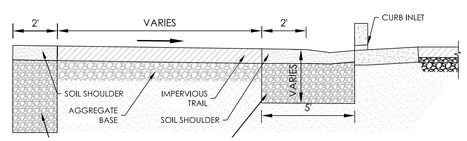
STORM WATER BMP

SUB-BASIN	BASIN AREA (AC)	IMPERVIOUS AREA (AC)	BMP	$V_{CHELINCH}$	V_{DI}	V_{DESIGN}
O-15	0.51	0.51	BIORETENTION BASIN W	1834	NA	5591
P-18	0.33	0.13	BIORETENTION BASIN W	483	1623	
O-16	0.25	0.25	BIORETENTION BASIN SE	912	NA	912
P-17	0.80	0.51	I.T.(1829'x2'x6.7')	1853	6226	9836
O-14	0.86	0.86	BIORETENTION BASIN NE	3104	NA	4178
P-19	0.09	0.09	BIORETENTION BASIN NE	320	1074	
P-20	0.07	0.07	BIORETENTION BASIN E	240	807	

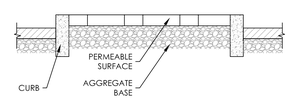
DETAIL A1: INFILTRATION TRENCH BMP



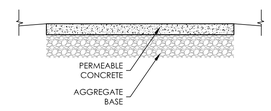
DETAIL A2: INFILTRATION TRENCH BMP

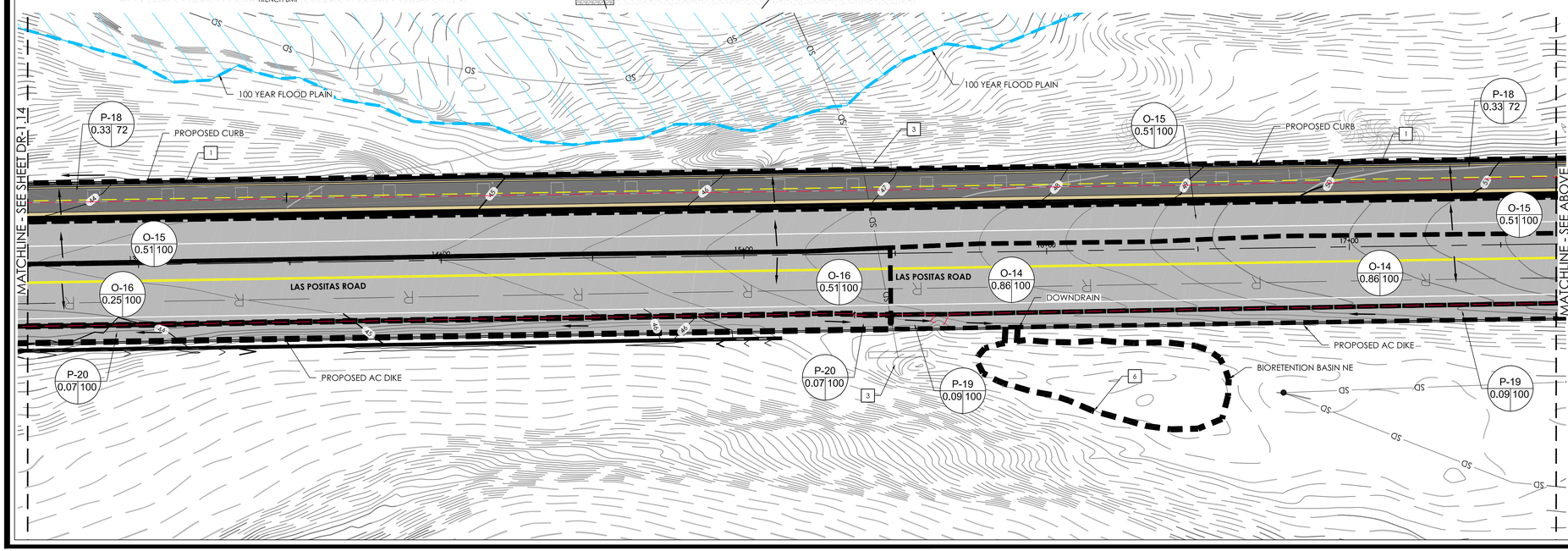


DETAIL B: PERMEABLE SURFACE



DETAIL C: PERMEABLE CONCRETE





LEGEND

- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING AC PAVING
- PROPOSED SOIL SHOULDER
- PROPOSED AC PAVING
- PROPOSED PERMEABLE CONCRETE PAVING
- PROPOSED PERMEABLE SURFACE
- PROPOSED FLOW DIRECTION
- PROPOSED CURB RAMP
- PROPOSED BARRICADE
- PROPOSED RETAINING WALL
- EXISTING EDGE OF PAVEMENT
- EXISTING RIGHT OF WAY
- PROPOSED BASIN BOUNDARY
- 92.9 EXISTING GRADE
- I.T. INFILTRATION TRENCH

Sub-Basin Name
O-2
0.2 100
Sub-Basin Area in Acres
% Impervious

Sub-Basin Types
O: Offsite Run-On
P: Proposed Impervious Surface (Mitigated)
U: Proposed Pervious Surface (Mitigated)

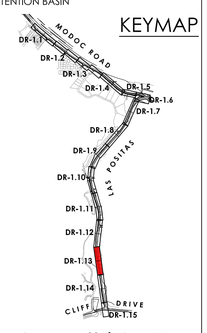
PROJECT TOTALS

NEW IMPERVIOUS AREA:	106,800 SF (2.45 AC)
EXISTING IMPERVIOUS AREA REPLACED WITH PERVIOUS AREA:	72,046 SF (1.65 AC)
TOTAL UNTREATED AREA:	14,288 SF (0.33 AC; 2.84% OF ALL SUB-BASINS)
TOTAL AREA OF OFF-SITE RUN ON:	261,484 SF (6.00 AC)

STORM WATER BMP KEYNOTES

1. INFILTRATION TRENCH PER DETAIL A, THIS SHEET
2. PERMEABLE SURFACE PER DETAIL B, THIS SHEET
3. EXISTING STORM DRAIN STRUCTURE
4. PERMEABLE CONCRETE PER DETAIL C, THIS SHEET
5. OPTIONAL PERMEABLE CONCRETE
6. PROPOSED BIO-RETENTION BASIN

KEYMAP



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Las Positas Multi-Use Pathway

Schematic Drainage Area Exhibit

NO.	REVISION	DATE

PROJECT MANAGER: BAH
DRAWN BY: SJP
CHECKED BY: WFS
DATE: NOVEMBER 10, 2016
CAD FILE: 0203-DR.dwg
JOB NUMBER: 0203-01-RC15
SHEET: DR-1.13

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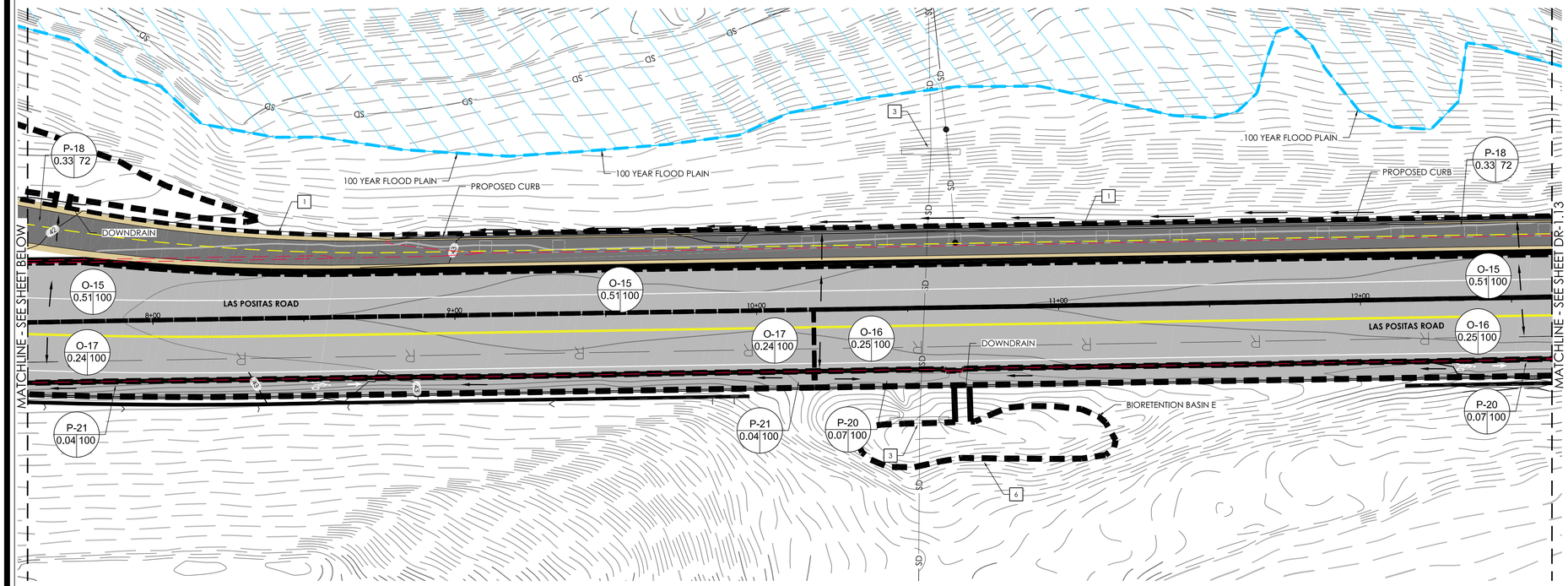


LEGEND

- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING AC PAVING
- PROPOSED SOIL SHOULDER
- PROPOSED AC PAVING
- PROPOSED PERMEABLE CONCRETE PAVING
- PROPOSED PERMEABLE SURFACE
- PROPOSED FLOW DIRECTION
- PROPOSED CURB RAMP
- PROPOSED BARRICADE
- PROPOSED RETAINING WALL
- EXISTING EDGE OF PAVEMENT
- EXISTING RIGHT OF WAY
- PROPOSED BASIN BOUNDARY
- 92.9 EXISTING GRADE
- I.T. INFILTRATION TRENCH

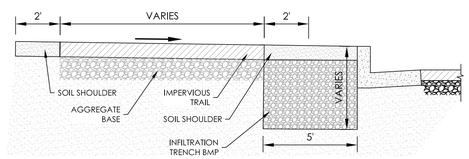
Sub-Basin Name

O-2 | 0.2 | 100

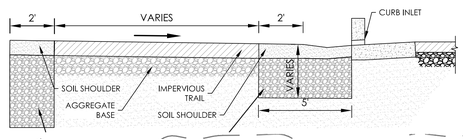
Sub-Basin Area in Acres — % Impervious

Sub-Basin Types
O: Offsite Run-On
P: Proposed Impervious Surface (Mitigated)
U: Proposed Pervious Surface (Mitigated)

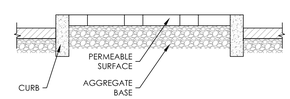
DETAIL A1: INFILTRATION TRENCH BMP



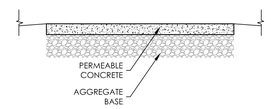
DETAIL A2: INFILTRATION TRENCH BMP

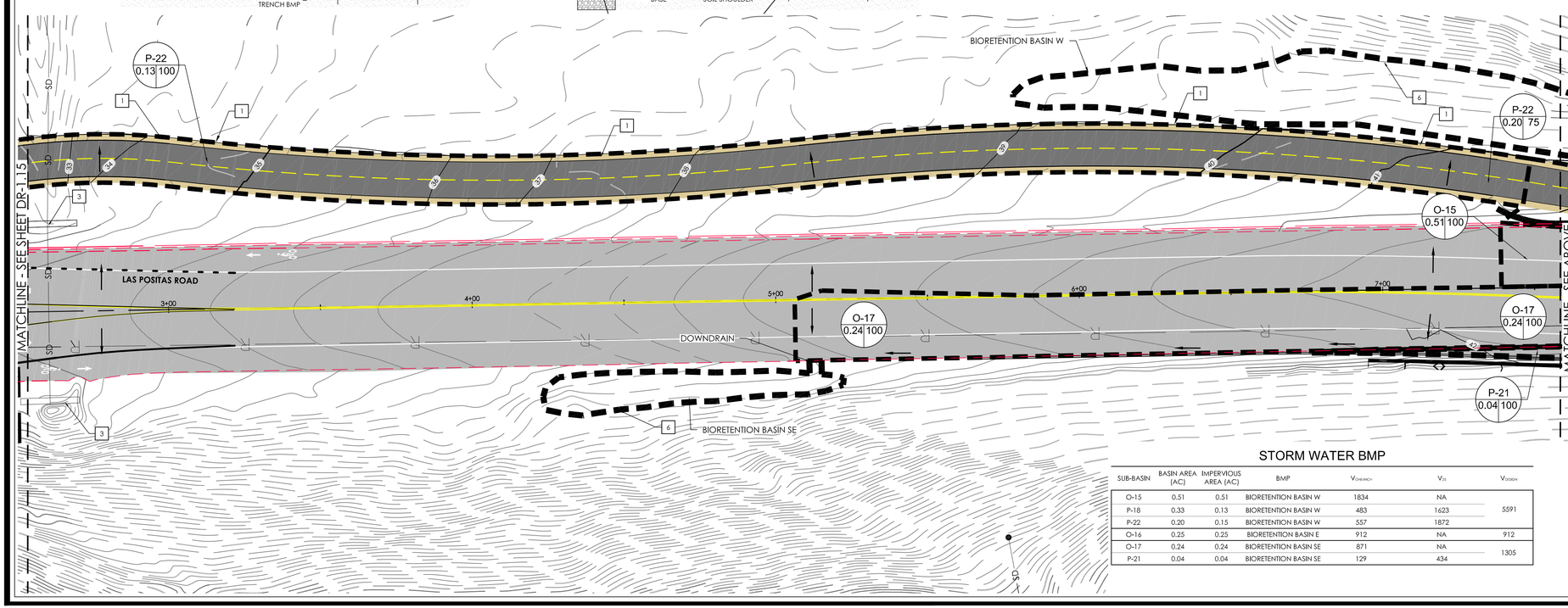


DETAIL B: PERMEABLE SURFACE



DETAIL C: PERMEABLE CONCRETE





PROJECT TOTALS

NEW IMPERVIOUS AREA:	106,800 SF (2.45 AC)
EXISTING IMPERVIOUS AREA REPLACED WITH PERVIOUS AREA:	72,046 SF (1.65 AC)
TOTAL UNTREATED AREA:	14,288 SF (0.33 AC; 2.84% OF ALL SUB-BASINS)
TOTAL AREA OF OFF-SITE RUN ON:	261,484 SF (6.00 AC)

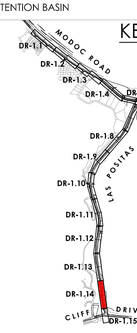
STORM WATER BMP KEYNOTES

1. INFILTRATION TRENCH PER DETAIL A, THIS SHEET
2. PERMEABLE SURFACE PER DETAIL B, THIS SHEET
3. EXISTING STORM DRAIN STRUCTURE
4. PERMEABLE CONCRETE PER DETAIL C, THIS SHEET
5. OPTIONAL PERMEABLE CONCRETE
6. PROPOSED BIO-RETENTION BASIN

STORM WATER BMP

SUB-BASIN	BASIN AREA (AC)	IMPERVIOUS AREA (AC)	BMP	$V_{OTHERWCH}$	V_{25}	V_{DESIGN}
O-15	0.51	0.51	BIORETENTION BASIN W	1834	NA	5591
P-18	0.33	0.13	BIORETENTION BASIN W	483	1623	
P-22	0.20	0.15	BIORETENTION BASIN W	557	1872	
O-16	0.25	0.25	BIORETENTION BASIN E	912	NA	912
O-17	0.24	0.24	BIORETENTION BASIN SE	871	NA	1305
P-21	0.04	0.04	BIORETENTION BASIN SE	129	434	

KEYMAP



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REGISTERED PROFESSIONAL ENGINEER
WILLIAM FREDRICK WANG
No. C 65712
exp. 9/30/17
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Las Positas Multi-Use Pathway

Schematic Drainage Area Exhibit

NO.	REVISION	DATE

PROJECT MANAGER: BAH
DRAWN BY: SJP
CHECKED BY: WFS
DATE: NOVEMBER 10, 2016
CAD FILE: 0203-DR.dwg
JOB NUMBER: 0203-01-RC15
SHEET: DR-1.14

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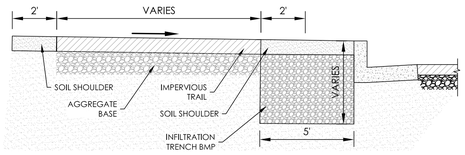
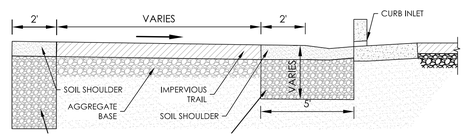
STORM WATER BMP

SUB-BASIN	BASIN AREA (AC)	IMPERVIOUS AREA (AC)	BMP	$V_{CHERNICH}$	V_{T5}	V_{DESIGN}
P-22	0.20	0.15	BIORETENTION BASIN W	557	1872	5591

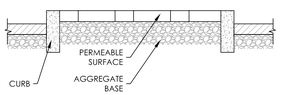
DETAIL A1: INFILTRATION TRENCH BMP



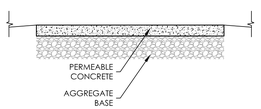
DETAIL A2: INFILTRATION TRENCH BMP

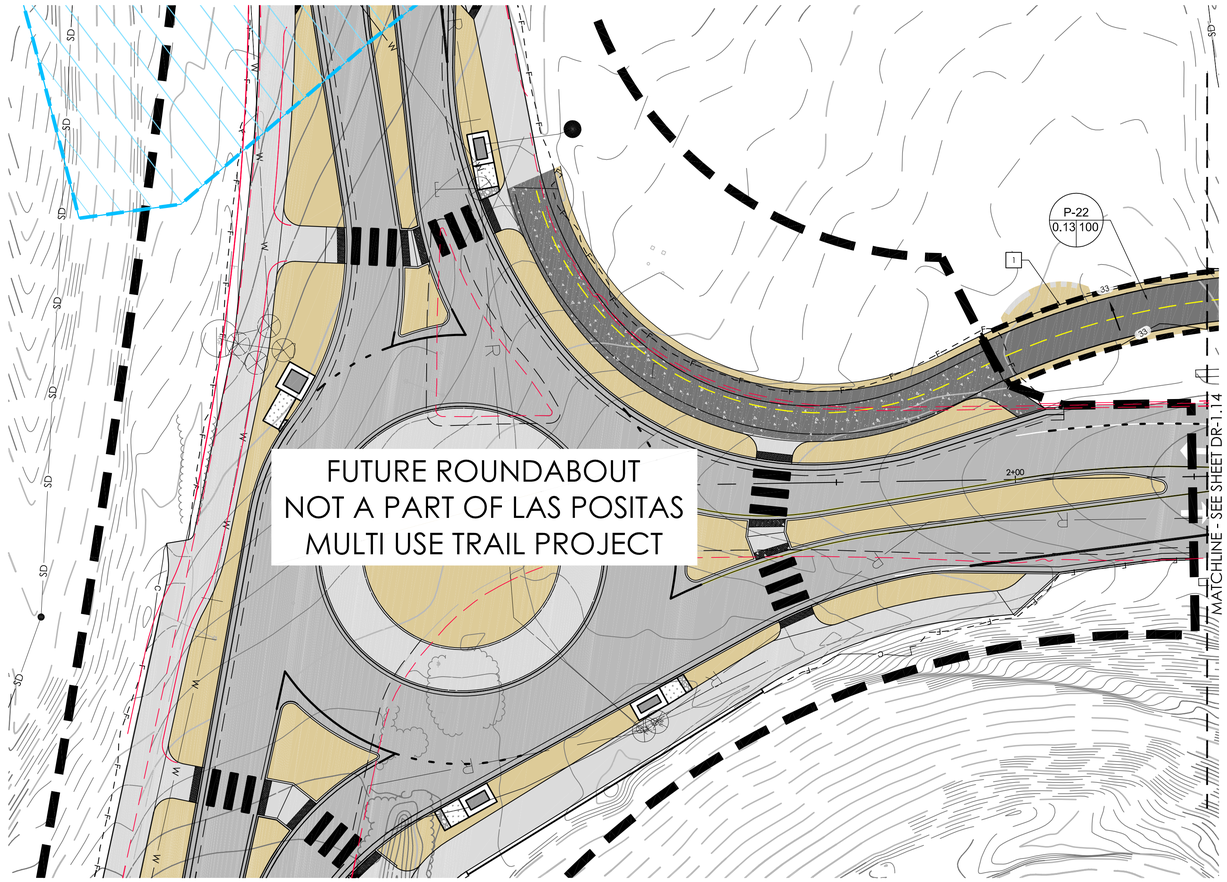


DETAIL B: PERMEABLE SURFACE



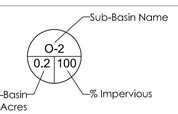
DETAIL C: PERMEABLE CONCRETE





LEGEND

- 900 — PROPOSED MAJOR CONTOUR
- 901 — PROPOSED MINOR CONTOUR
- 900 — EXISTING MAJOR CONTOUR
- 901 — EXISTING MINOR CONTOUR
- EXISTING AC PAVING
- PROPOSED SOIL SHOULDER
- PROPOSED AC PAVING
- PROPOSED PERMEABLE CONCRETE PAVING
- PROPOSED PERMEABLE SURFACE
- PROPOSED FLOW DIRECTION
- PROPOSED CURB RAMP
- PROPOSED BARRICADE
- PROPOSED RETAINING WALL
- EXISTING EDGE OF PAVEMENT
- EXISTING RIGHT OF WAY
- PROPOSED BASIN BOUNDARY
- 92.9 EXISTING GRADE
- I.T. INFILTRATION TRENCH



Sub-Basin Types
O: Offsite Run-On
P: Proposed Impervious Surface (Mitigated)
U: Proposed Pervious Surface (Mitigated)

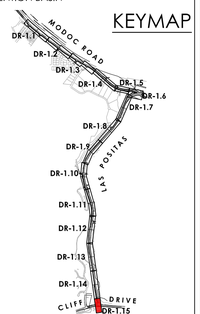
PROJECT TOTALS

NEW IMPERVIOUS AREA:	106,800 SF (2.45 AC)
EXISTING IMPERVIOUS AREA REPLACED WITH PERVIOUS AREA:	72,046 SF (1.65 AC)
TOTAL UNTREATED AREA:	14,288 SF (0.33 AC; 2.84% OF ALL SUB-BASINS)
TOTAL AREA OF OFF-SITE RUN ON:	261,484 SF (6.00 AC)

STORM WATER BMP KEYNOTES

1. INFILTRATION TRENCH PER DETAIL A, THIS SHEET
2. PERMEABLE SURFACE PER DETAIL B, THIS SHEET
3. EXISTING STORM DRAIN STRUCTURE
4. PERMEABLE CONCRETE PER DETAIL C, THIS SHEET
5. OPTIONAL PERMEABLE CONCRETE
6. PROPOSED BIO-RETENTION BASIN

KEYMAP



DIG ALERT
DIAL TOLL FREE
811
AT LEAST 2 DAYS BEFORE YOU DIG

0 20 40 80 feet
SCALE 1" = 20'

NO PRELIMINARY OR CONSTRUCTION
REGISTERED PROFESSIONAL ENGINEER
WILLIAM FREDRICK WENTZ
No. C 65712
EXP. 9/30/17
CIVIL
STATE OF CALIFORNIA

SEAL OF THE CITY OF SANTA BARBARA CALIFORNIA

rrm design group
a California corporation • Jenny Grant, Architect C26975 • Jerry McNoah, PE 56005, LS 6219 • Jeff Wilson, LA 5844
3765 S. Higuera St., Ste. 102 • San Luis Obispo, CA 93401
p: (805) 543-1794 • f: (805) 543-4609
www.rrmdesign.com

Las Positas Multi-Use Pathway

Schematic Drainage Area Exhibit

NO.	REVISION	DATE

PROJECT MANAGER: BAH
DRAWN BY: SJP
CHECKED BY: WFS
DATE: NOVEMBER 10, 2016
CAD FILE: 0203-DR.dwg
JOB NUMBER: 0203-01-RC15
SHEET: DR-1.15

N:\0201\0203-01-RC15-Las Positas Multi-Use Pathway\Engineering\Cont Docs\Sheet Files\0203-DR.dwg, DR-1.15, Nov 14, 2016, 3:30pm, SJPfeifer

Bioretention Worksheet

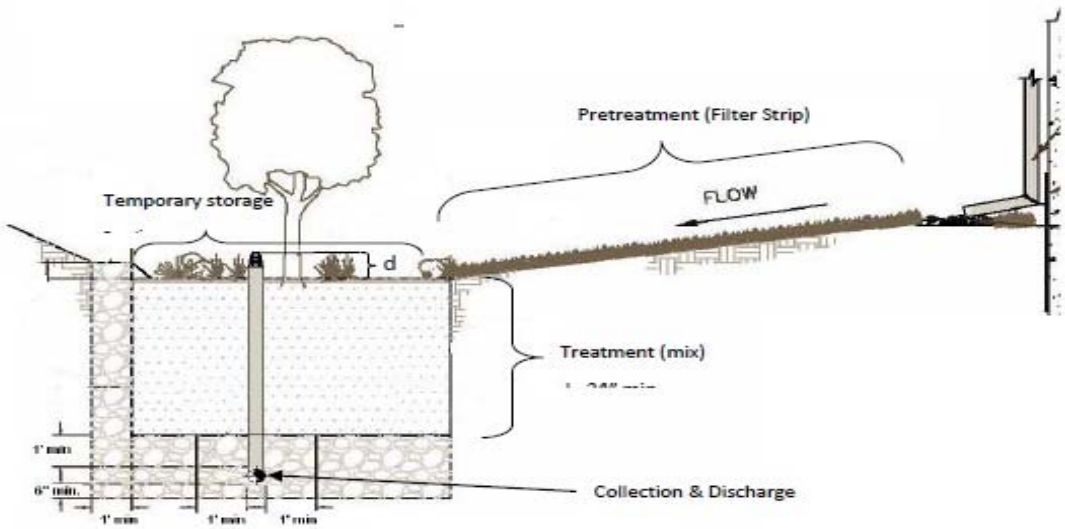


Figure D-1: Bioretention Area Cross-Section

Refer to Figure D-1 and Figure 6-2 for the description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$

1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	807	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$=	1152	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site *Volume reduction calculated using sub-basin runoff values that run into this bioretention BMP.	$V_{reduction}$=	1719	*ft^3

Step 2: Determine storm water quality design volume, V_{wq}

2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	1152	ft^3

Step 3: Determine design volume, V_{design} (for sizing)

3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}=	1719	ft^3

Step 4: Pretreatment

4-1. If pretreatment is required please go to the vegetated filter stirp worksheet, Appendix C

Step 5: Calculate bioretention area			
5-1. Enter thickness of planting mix (min 24"), I	I=	24	in
5-2. Enter storage depth (12" max.) above the filter, d	d=	12	in
5-3. Enter infiltratoin rate, k_{design} (Note: infiltration rate of planting soil. If no underdrain, infiltration rate of native subsoil or fill.) If no underdrains, see Step 4 of the Infiltration BMP Worksheet, Appendix D to calculate k_{design}	k_{design}=	1.5	in/hr
5-4. Enter drawdown time, t	t=	72	hrs
5-5. Calculate bioretention area, $A_{sf} = (V_{design} \times I)/[t \times k_{design}/12) \times (I+d)]$	A_{sf}=	127	sf
Step 6: Calculate Underdrain System Flowrate			
None			
Step 7: Provide Conveyance Capacity for Flows Higher Than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the surface area becomes clogged.			

Bioretention Worksheet

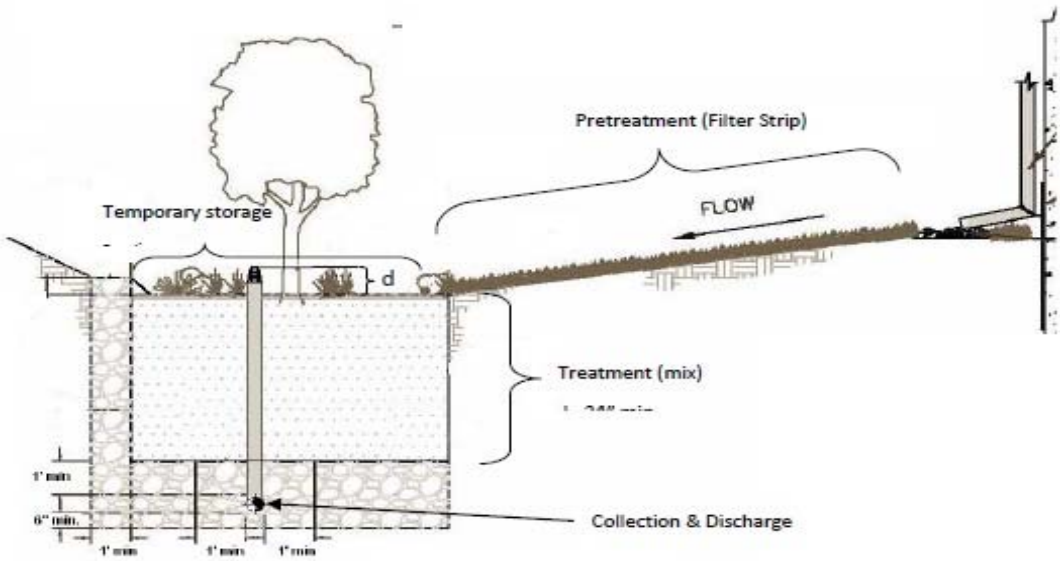


Figure D-1: Bioretention Area Cross-Section

Refer to Figure D-1 and Figure 6-2 for the description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	1074	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$=	3424	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site *Volume reduction calculated using sub-basin runoff values that run into this bioretention BMP.	$V_{reduction}$=	1719	*ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	3424	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}=	3424	ft^3
Step 4: Pretreatment			
4-1. If pretreatment is required please go to the vegetated filter stirp worksheet, Appendix C			

Step 5: Calculate bioretention area			
5-1. Enter thickness of planting mix (min 24"), I	I=	24	in
5-2. Enter storage depth (12" max.) above the filter, d	d=	12	in
5-3. Enter infiltratoin rate, k_{design} (Note: infiltration rate of planting soil. If no underdrain, infiltration rate of native subsoil or fill.) If no underdrains, see Step 4 of the Infiltration BMP Worksheet, Appendix D to calculate k_{design}	k_{design}=	1.5	in/hr
5-4. Enter drawdown time, t	t=	72	hrs
5-5. Calculate bioretention area, $A_{sf} = (V_{design} \times I)/[t \times k_{design}/12) \times (I+d)]$	A_{sf}=	254	sf
Step 6: Calculate Underdrain System Flowrate			
None			
Step 7: Provide Conveyance Capacity for Flows Higher Than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the surface area becomes clogged.			

Bioretention Worksheet

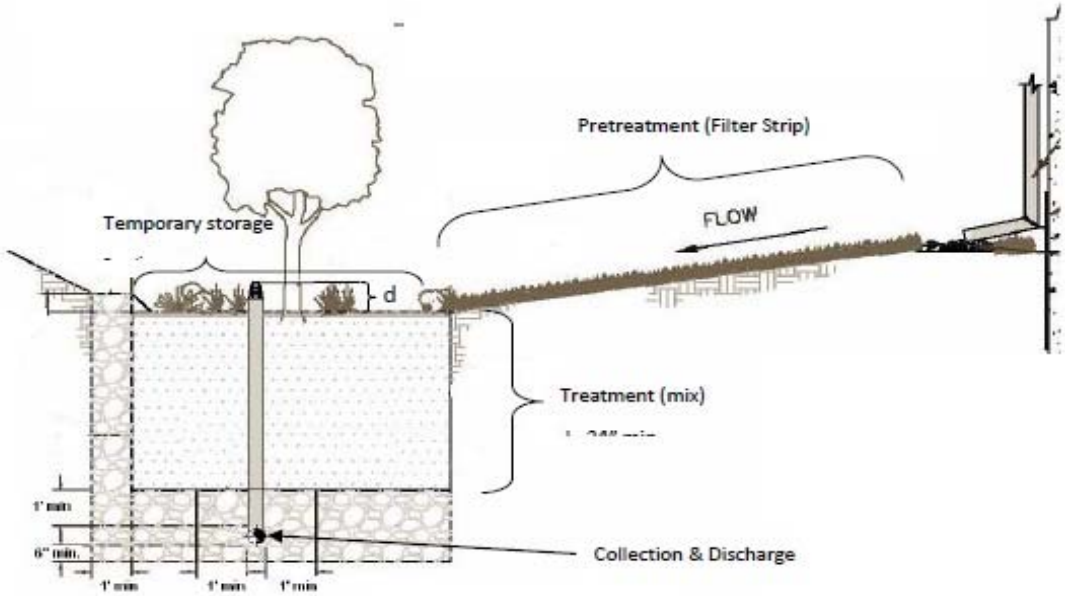


Figure D-1: Bioretention Area Cross-Section

Refer to Figure D-1 and Figure 6-2 for the description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$

1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	434	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$=	1000	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site *Volume reduction calculated using sub-basin runoff values that run into this bioretention BMP.	$V_{reduction}$=	1305	*ft^3

Step 2: Determine storm water quality design volume, V_{wq}

2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	1000	ft^3

Step 3: Determine design volume, V_{design} (for sizing)

3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}=	1305	ft^3

Step 4: Pretreatment

4-1. If pretreatment is required please go to the vegetated filter stirp worksheet, Appendix C

Step 5: Calculate bioretention area			
5-1. Enter thickness of planting mix (min 24"), I	I=	24	in
5-2. Enter storage depth (12" max.) above the filter, d	d=	12	in
5-3. Enter infiltratoin rate, k_{design} (Note: infiltration rate of planting soil. If no underdrain, infiltration rate of native subsoil or fill.) If no underdrains, see Step 4 of the Infiltration BMP Worksheet, Appendix D to calculate k_{design}	k_{design}=	1.5	in/hr
5-4. Enter drawdown time, t	t=	72	hrs
5-5. Calculate bioretention area, $A_{sf} = (V_{design} \times I)/[t \times k_{design}/12) \times (I+d)]$	A_{sf}=	97	sf
Step 6: Calculate Underdrain System Flowrate			
None			
Step 7: Provide Conveyance Capacity for Flows Higher Than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the surface area becomes clogged.			

Bioretention Worksheet

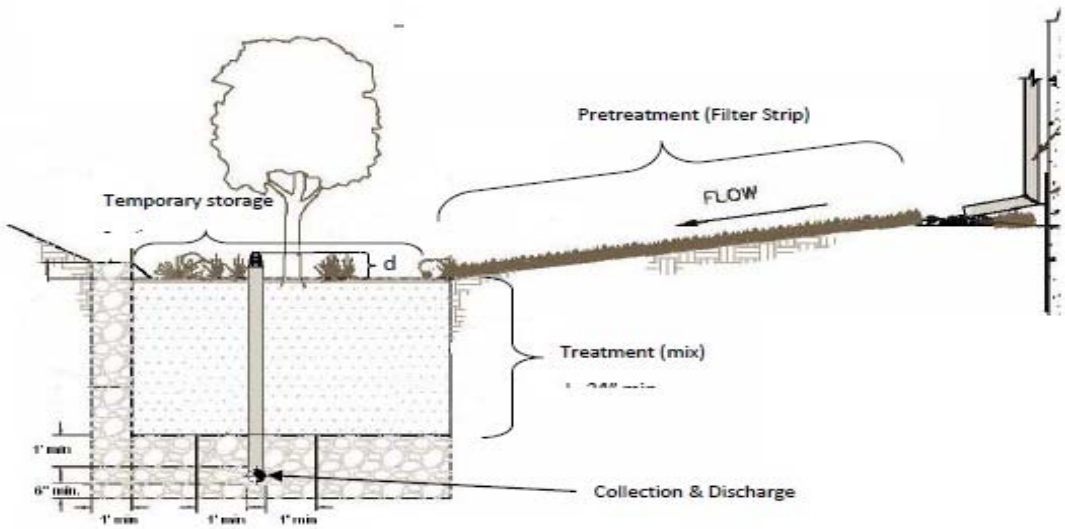


Figure D-1: Bioretention Area Cross-Section

Refer to Figure D-1 and Figure 6-2 for the description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$

1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	3758	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$=	2952	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$=	5591	*ft^3

*Volume reduction calculated using sub-basin runoff values that run into this bioretention BMP.

Step 2: Determine storm water quality design volume, V_{wq}

2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	2952	ft^3

Step 3: Determine design volume, V_{design} (for sizing)

3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}=	5591	ft^3

Step 4: Pretreatment

4-1. If pretreatment is required please go to the vegetated filter stirp worksheet, Appendix C

Step 5: Calculate bioretention area			
5-1. Enter thickness of planting mix (min 24"), I	I=	24	in
5-2. Enter storage depth (12" max.) above the filter, d	d=	12	in
5-3. Enter infiltratoin rate, k_{design} (Note: infiltration rate of planting soil. If no underdrain, infiltration rate of native subsoil or fill.) If no underdrains, see Step 4 of the Infiltration BMP Worksheet, Appendix D to calculate k_{design}	k_{design}=	1.5	in/hr
5-4. Enter drawdown time, t	t=	72	hrs
5-5. Calculate bioretention area, $A_{sf} = (V_{design} \times I)/[t \times k_{design}/12) \times (I+d)]$	A_{sf}=	414	sf
Step 6: Calculate Underdrain System Flowrate			
None			
Step 7: Provide Conveyance Capacity for Flows Higher Than Q_{wq}			
7-1. An emergency overflow must be provided if the bioretention area is placed online or in the event the surface area becomes clogged.			

Infiltration BMP Worksheet

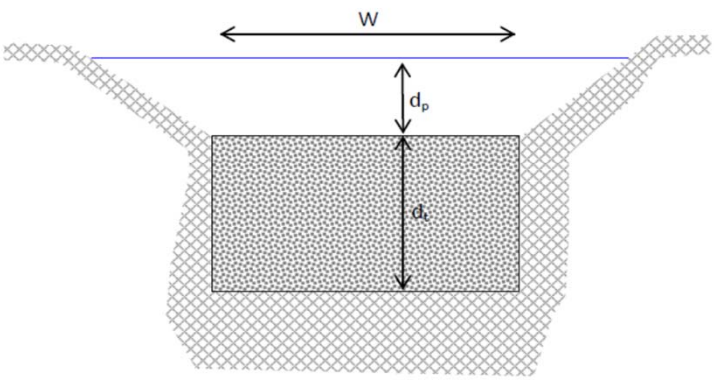


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$

1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	1103	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$=	328	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$=	1687	*ft^3

*Volume reduction calculated using sub-basin runoff values that run into this infiltration trench BMP.

Step 2: Determine storm water quality design volume, V_{wq}

2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	328	ft^3

Step 3: Determine design volume, V_{design} (for sizing)

3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}=	1687	ft^3

Step 4 Calculate design infiltration rate

4-1. Enter soil infiltration rate (0.05 in/ hr min.), $k_{measured}$	$k_{measured}$ =	0.05	in/hr
4-2. Enter correction factor for testing (0.3 small scale, 0.5 large scale), F_t	F_t=	0.3	ft
4-3. Enter correction factor for plugging, (0.7 loams-sandy loams, 0.8 fine-loamy sands, 0.9 medium sands, 1.0 coarse sands-cobbles, F_p	F_p=	0.7	ft

4-4. Enter the depth from the bottom of the facility to the maximum wet-season water table or nearest impervious layer, whichever is less. D	D=	5	ft
4-5. Enter the estimated width of the facility	W=	5	ft
4-6. Calculate the correction factor of geometry (0.25 min, 1.0 max), F_g = 4•D/W +0.05	F_g=	1	
4-7. Calculate the design infiltration rate, $k_{design}=k_{measured}F_tF_pF_g$	K_{design}=	0.0105	in/hr
Step 5: Determine facility size			
5-1. Enter drawdown time (72 hrs max.), t_d	t_d=	72	hrs
5-2. Calculate max. depth of runoff that can be infiltrated within the t, $d_{max}=k_{design}t/12$	d_{max}=	0.063	ft
5-3. Enter trench fill aggregate porosity, n_t	n_t=	0.32	
5-4. Enter depth of trench fill, d_t	d_t=	48.00	in
5-5. Enter max ponding depth, or max. $d_p=d_{max}-n_td_t$	d_p=	0	ft
Step 6:Determine Infiltrating surface area (filter bottom area)			
6-1. Enter the time to fill infiltration basin or trench with water (use 2 hours for most designs), T	T=	2	hrs
6-2. Calculate infiltrating surface area for infiltration basin: $A_b=V_{design}/((Tk_{design}/12)+d_p)$	A_b=	Not Applicable	
6-3. Calculate infiltrating surface area for infiltration trenches: $A_t=V_{design}/((Tk_{design}/12)+n_td_t+d_p)$	A_t=	1316.2	ft^2
6-4. Calculate infiltrating surface area for dry wells: $A_{dw}=V_{design}/(Tk_{design}/12)+n_td_t))$	A_{dw}=	Not Applicable	
Step 7: Determine Provided Retention Capacity			
4-1. Enter provided infiltrating surface area, A_p	A_p=	1,438	ft^2
4-2. Calculate provided retention capacity, $V_p=(Tk_{design}/12)+n*d_t/12+d_p)*A_p$	V_p=	1,843	ft^3
4-3. Check $V_p \geq V_{design}$		OK	

Infiltration BMP Worksheet

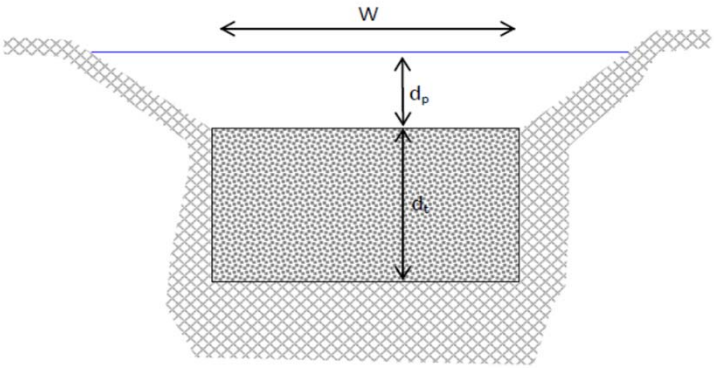


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$

1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C — V_{25}= 6448 ft^3

1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C — $V_{one\text{-}inch}$= 1919 ft^3

1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site — $V_{reduction}$= 8520 *ft^3

*Volume reduction calculated using sub-basin runoff values that run into this infiltration trench BMP.

Step 2: Determine storm water quality design volume, V_{wq}

2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$) — V_{wq}= 1919 ft^3

Step 3: Determine design volume, V_{design} (for sizing)

3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq} — V_{design}= 8520 ft^3

Step 4 Calculate design infiltration rate

4-1. Enter soil infiltration rate (0.05 in/ hr min.), $k_{measured}$ — $k_{measured}$ = 0.05 in/hr

4-2. Enter correction factor for testing (0.3 small scale, 0.5 large scale), F_t — F_t= 0.3 ft

4-3. Enter correction factor for plugging, (0.7 loams-sandy loams, 0.8 fine-loamy sands, 0.9 medium sands, 1.0 coarse sands-cobbles, F_p — F_p= 0.7 ft

4-4. Enter the depth from the bottom of the facility to the maximum wet-season water table or nearest impervious layer, whichever is less. D	D=	5	ft
4-5. Enter the estimated width of the facility	W=	5	ft
4-6. Calculate the correction factor of geometry (0.25 min, 1.0 max), F_g = 4•D/W +0.05	F_g=	4.05	
4-7. Calculate the design infiltration rate, $k_{design}=k_{measured}F_tF_pF_g$	K_{design}=	0.042525	in/hr
Step 5: Determine facility size			
5-1. Enter drawdown time (72 hrs max.), t_d	t_d=	72	hrs
5-2. Calculate max. depth of runoff that can be infiltrated within the t, $d_{max}=k_{design}t/12$	d_{max}=	0.25515	ft
5-3. Enter trench fill aggregate porosity, n_t	n_t=	0.32	
5-4. Enter depth of trench fill, d_t	d_t=	48.00	in
5-5. Enter max ponding depth, or max. $d_p=d_{max}-n_td_t$	d_p=	0	ft
Step 6:Determine Infiltrating surface area (filter bottom area)			
6-1. Enter the time to fill infiltration basin or trench with water (use 2 hours for most designs), T	T=	2	hrs
6-2. Calculate infiltrating surface area for infiltration basin: $A_b=V_{design}/((Tk_{design}/12)+d_p)$	A_b=	Not Applicable	
6-3. Calculate infiltrating surface area for infiltration trenches: $A_t=V_{design}/((Tk_{design}/12)+n_td_t+d_p)$	A_t=	6619.7	ft^2
6-4. Calculate infiltrating surface area for dry wells: $A_{dw}=V_{design}/(Tk_{design}/12)+n_td_t))$	A_{dw}=	Not Applicable	
Step 7: Determine Provided Retention Capacity			
4-1. Enter provided infiltrating surface area, A_p	A_p=	7,450	ft^2
4-2. Calculate provided retention capacity, $V_p=(Tk_{design}/12)+n*d_t/12+d_p)*A_p$	V_p=	9,589	ft^3
4-3. Check $V_p \geq V_{design}$		OK	

Infiltration BMP Worksheet

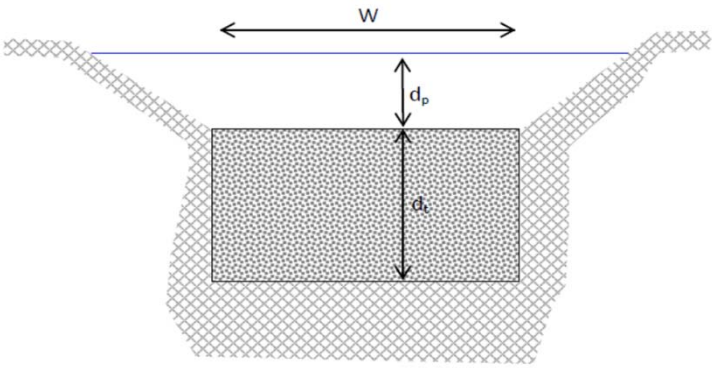


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$

1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C — V_{25}= 198 ft^3

1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C — $V_{one\text{-}inch}$= 59 ft^3

1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site — $V_{reduction}$= 1700 *ft^3

*Volume reduction calculated using sub-basin runoff values that run into this infiltration trench BMP.

Step 2: Determine storm water quality design volume, V_{wq}

2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$) — V_{wq}= 59 ft^3

Step 3: Determine design volume, V_{design} (for sizing)

3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq} — V_{design}= 1700 ft^3

Step 4 Calculate design infiltration rate

4-1. Enter soil infiltration rate (0.05 in/ hr min.), $k_{measured}$ — $k_{measured}$ = 0.05 in/hr

4-2. Enter correction factor for testing (0.3 small scale, 0.5 large scale), F_t — F_t= 0.3 ft

4-3. Enter correction factor for plugging, (0.7 loams-sandy loams, 0.8 fine-loamy sands, 0.9 medium sands, 1.0 coarse sands-cobbles, F_p — F_p= 0.7 ft

4-4. Enter the depth from the bottom of the facility to the maximum wet-season water table or nearest impervious layer, whichever is less. D	D=	5	ft
4-5. Enter the estimated width of the facility	W=	2	ft
4-6. Calculate the correction factor of geometry (0.25 min, 1.0 max), F_g = 4•D/W +0.05	F_g=	10.05	
4-7. Calculate the design infiltration rate, $k_{design}=k_{measured}F_tF_pF_g$	K_{design}=	0.105525	in/hr
Step 5: Determine facility size			
5-1. Enter drawdown time (72 hrs max.), t_d	t_d=	72	hrs
5-2. Calculate max. depth of runoff that can be infiltrated within the t, $d_{max}=k_{design}t/12$	d_{max}=	0.63315	ft
5-3. Enter trench fill aggregate porosity, n_t	n_t=	0.32	
5-4. Enter depth of trench fill, d_t	d_t=	84.00	in
5-5. Enter max ponding depth, or max. $d_p=d_{max}-n_td_t$	d_p=	0	ft
Step 6:Determine Infiltrating surface area (filter bottom area)			
6-1. Enter the time to fill infiltration basin or trench with water (use 2 hours for most designs), T	T=	2	hrs
6-2. Calculate infiltrating surface area for infiltration basin: $A_b=V_{design}/((Tk_{design}/12)+d_p)$	A_b=	Not Applicable	
6-3. Calculate infiltrating surface area for infiltration trenches: $A_t=V_{design}/((Tk_{design}/12)+n_td_t+d_p)$	A_t=	752.8	ft^2
6-4. Calculate infiltrating surface area for dry wells: $A_{dw}=V_{design}/(Tk_{design}/12)+n_td_t))$	A_{dw}=	Not Applicable	
Step 7: Determine Provided Retention Capacity			
4-1. Enter provided infiltrating surface area, A_p	A_p=	800	ft^2
4-2. Calculate provided retention capacity, $V_p=(Tk_{design}/12)+n*d_t/12+d_p)*A_p$	V_p=	1,806	ft^3
4-3. Check $V_p \geq V_{design}$		OK	

Infiltration BMP Worksheet

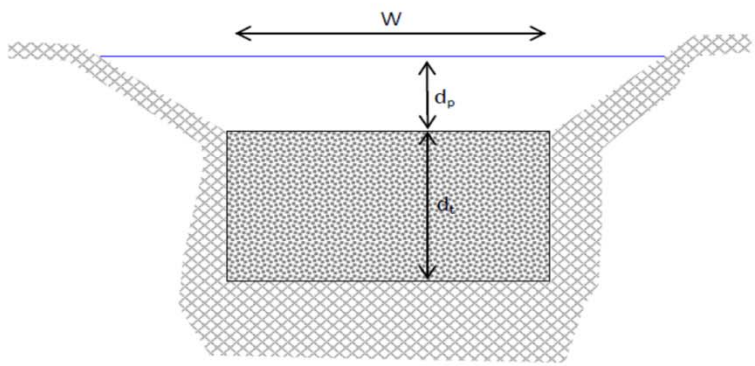


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$

1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C — V_{25}= 1772 ft^3

1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C — $V_{one\text{-}inch}$= 527 ft^3

1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site — $V_{reduction}$= 2952 *ft^3

*Volume reduction calculated using sub-basin runoff values that run into this infiltration trench BMP.

Step 2: Determine storm water quality design volume, V_{wq}

2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$) — V_{wq}= 527 ft^3

Step 3: Determine design volume, V_{design} (for sizing)

3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq} — V_{design}= 2952 ft^3

Step 4 Calculate design infiltration rate

4-1. Enter soil infiltration rate (0.05 in/ hr min.), $k_{measured}$ — $k_{measured}$ = 0.05 in/hr

4-2. Enter correction factor for testing (0.3 small scale, 0.5 large scale), F_t — F_t= 0.3 ft

4-3. Enter correction factor for plugging, (0.7 loams-sandy loams, 0.8 fine-loamy sands, 0.9 medium sands, 1.0 coarse sands-cobbles, F_p — F_p= 0.7 ft

4-4. Enter the depth from the bottom of the facility to the maximum wet-season water table or nearest impervious layer, whichever is less. D	D=	5	ft
4-5. Enter the estimated width of the facility	W=	2	ft
4-6. Calculate the correction factor of geometry (0.25 min, 1.0 max), F_g = 4•D/W +0.05	F_g=	10.05	
4-7. Calculate the design infiltration rate, $k_{design}=k_{measured}F_tF_pF_g$	K_{design}=	0.105525	in/hr
Step 5: Determine facility size			
5-1. Enter drawdown time (72 hrs max.), t_d	t_d=	72	hrs
5-2. Calculate max. depth of runoff that can be infiltrated within the t, $d_{max}=k_{design}t/12$	d_{max}=	0.63315	ft
5-3. Enter trench fill aggregate porosity, n_t	n_t=	0.32	
5-4. Enter depth of trench fill, d_t	d_t=	105.00	in
5-5. Enter max ponding depth, or max. $d_p=d_{max}-n_td_t$	d_p=	0	ft
Step 6:Determine Infiltrating surface area (filter bottom area)			
6-1. Enter the time to fill infiltration basin or trench with water (use 2 hours for most designs), T	T=	2	hrs
6-2. Calculate infiltrating surface area for infiltration basin: $A_b=V_{design}/((Tk_{design}/12)+d_p)$	A_b=	Not Applicable	
6-3. Calculate infiltrating surface area for infiltration trenches: $A_t=V_{design}/((Tk_{design}/12)+n_td_t+d_p)$	A_t=	1047.6	ft^2
6-4. Calculate infiltrating surface area for dry wells: $A_{dw}=V_{design}/(Tk_{design}/12)+n_td_t))$	A_{dw}=	Not Applicable	
Step 7: Determine Provided Retention Capacity			
4-1. Enter provided infiltrating surface area, A_p	A_p=	1,066	ft^2
4-2. Calculate provided retention capacity, $V_p=(Tk_{design}/12)+n*d_t/12+d_p)*A_p$	V_p=	3,004	ft^3
4-3. Check $V_p \geq V_{design}$		OK	

Infiltration BMP Worksheet

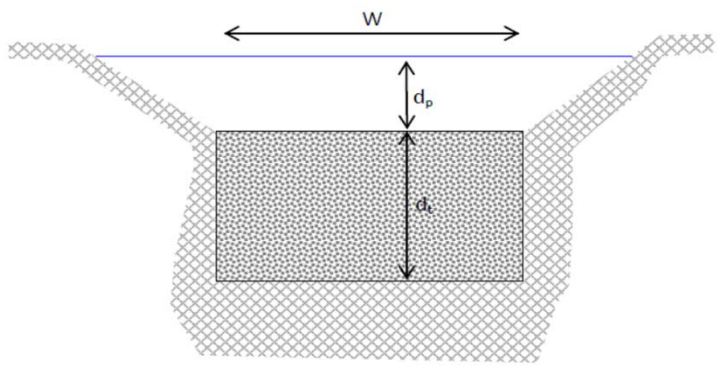


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$

1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C — V_{25}= 6226 ft^3

1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C — $V_{one\text{-}inch}$= 1853 ft^3

1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site — $V_{reduction}$= 9836 *ft^3

*Volume reduction calculated using sub-basin runoff values that run into this infiltration trench BMP.

Step 2: Determine storm water quality design volume, V_{wq}

2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$) — V_{wq}= 1853 ft^3

Step 3: Determine design volume, V_{design} (for sizing)

3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq} — V_{design}= 9836 ft^3

Step 4 Calculate design infiltration rate

4-1. Enter soil infiltration rate (0.05 in/ hr min.), $k_{measured}$ — $k_{measured}$ = 0.05 in/hr

4-2. Enter correction factor for testing (0.3 small scale, 0.5 large scale), F_t — F_t= 0.3 ft

4-3. Enter correction factor for plugging, (0.7 loams-sandy loams, 0.8 fine-loamy sands, 0.9 medium sands, 1.0 coarse sands-cobbles, F_p — F_p= 0.7 ft

4-4. Enter the depth from the bottom of the facility to the maximum wet-season water table or nearest impervious layer, whichever is less. D	D=	5	ft
4-5. Enter the estimated width of the facility	W=	2	ft
4-6. Calculate the correction factor of geometry (0.25 min, 1.0 max), F_g = 4•D/W +0.05	F_g=	10.05	
4-7. Calculate the design infiltration rate, $k_{design}=k_{measured}F_tF_pF_g$	K_{design}=	0.105525	in/hr
Step 5: Determine facility size			
5-1. Enter drawdown time (72 hrs max.), t_d	t_d=	72	hrs
5-2. Calculate max. depth of runoff that can be infiltrated within the t, $d_{max}=k_{design}t/12$	d_{max}=	0.63315	ft
5-3. Enter trench fill aggregate porosity, n_t	n_t=	0.32	
5-4. Enter depth of trench fill, d_t	d_t=	102.00	in
5-5. Enter max ponding depth, or max. $d_p=d_{max}-n_td_t$	d_p=	0	ft
Step 6:Determine Infiltrating surface area (filter bottom area)			
6-1. Enter the time to fill infiltration basin or trench with water (use 2 hours for most designs), T	T=	2	hrs
6-2. Calculate infiltrating surface area for infiltration basin: $A_b=V_{design}/((Tk_{design}/12)+d_p)$	A_b=	Not Applicable	
6-3. Calculate infiltrating surface area for infiltration trenches: $A_t=V_{design}/((Tk_{design}/12)+n_td_t+d_p)$	A_t=	3592.8	ft^2
6-4. Calculate infiltrating surface area for dry wells: $A_{dw}=V_{design}/(Tk_{design}/12)+n_td_t))$	A_{dw}=	Not Applicable	
Step 7: Determine Provided Retention Capacity			
4-1. Enter provided infiltrating surface area, A_p	A_p=	3,656	ft^2
4-2. Calculate provided retention capacity, $V_p=(Tk_{design}/12)+n*d_t/12+d_p)*A_p$	V_p=	10,009	ft^3
4-3. Check $V_p \geq V_{design}$		OK	

Infiltration BMP Worksheet

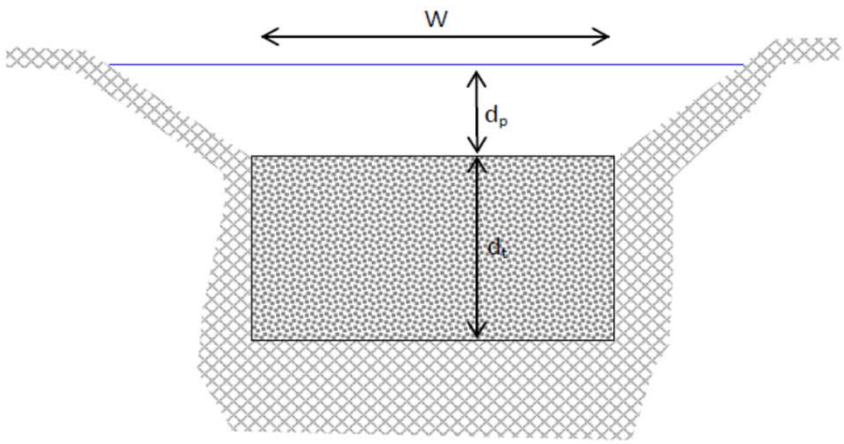


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 120	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 120	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 120	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 120	ft^3

Infiltration BMP Worksheet

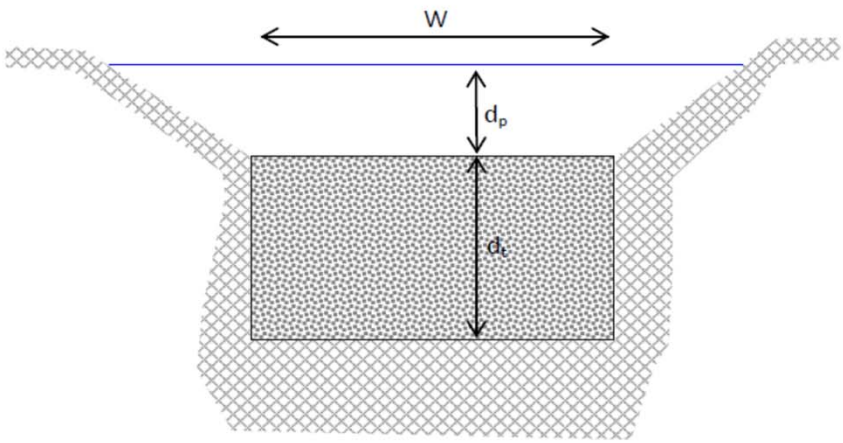


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 563	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 563	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 563	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 563	ft^3

Infiltration BMP Worksheet

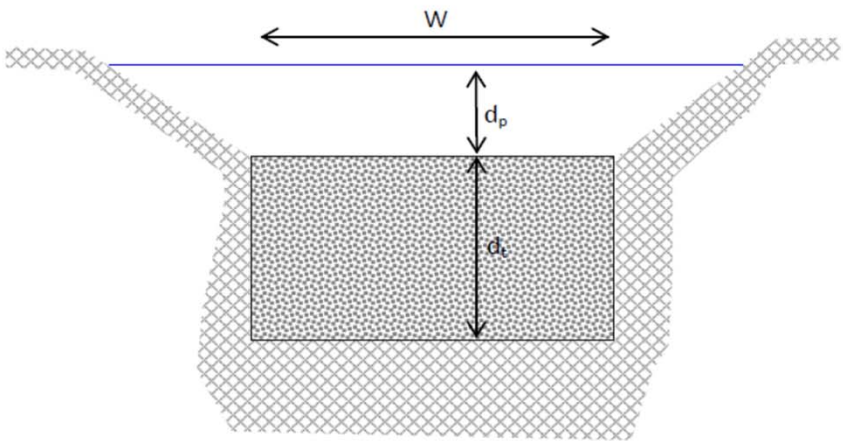


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 584	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 584	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 584	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 584	ft^3

Infiltration BMP Worksheet

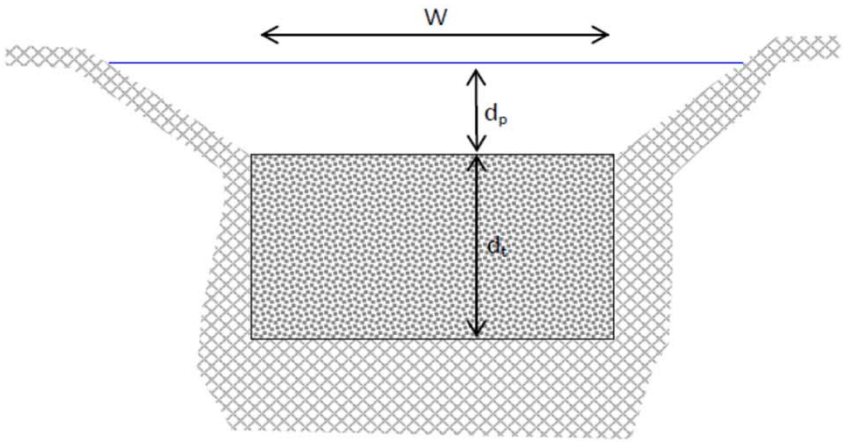


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 264	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 264	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 264	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 264	ft^3

Infiltration BMP Worksheet

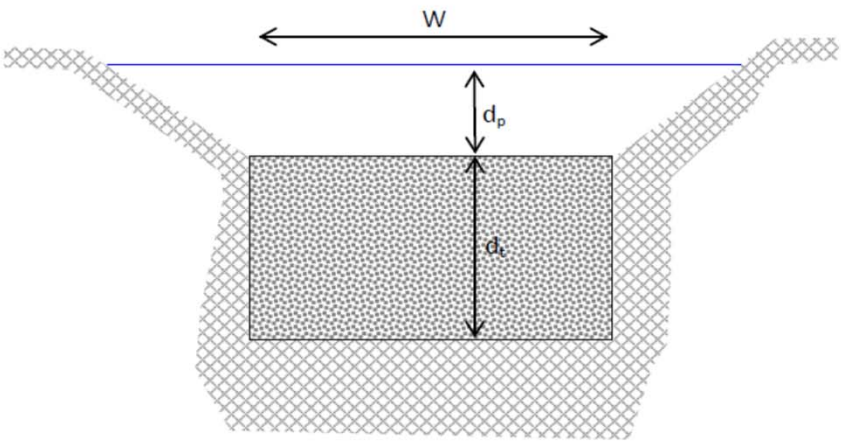


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 321	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 321	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 321	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 321	ft^3

Infiltration BMP Worksheet

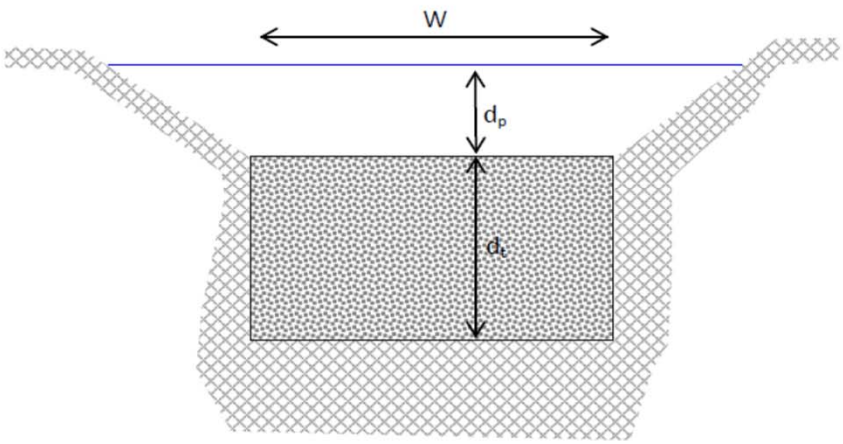


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 2072	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 2072	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 2072	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 2072	ft^3

Infiltration BMP Worksheet

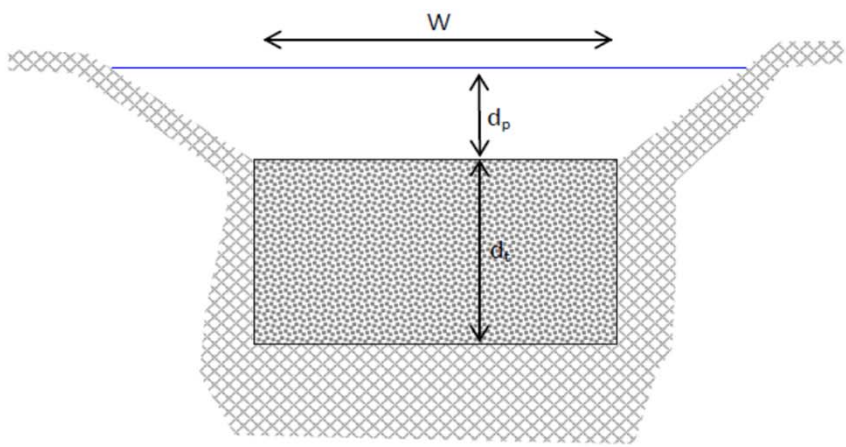


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 2497	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 2497	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 2497	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 2497	ft^3

Infiltration BMP Worksheet

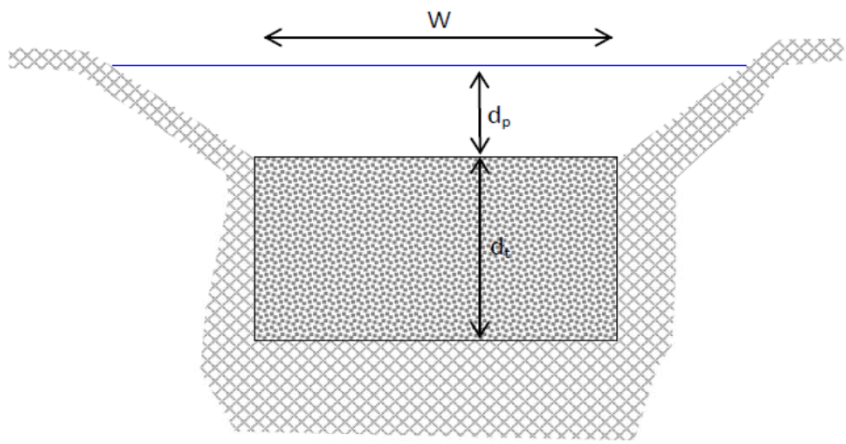


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 741	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 741	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 741	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 741	ft^3

Infiltration BMP Worksheet

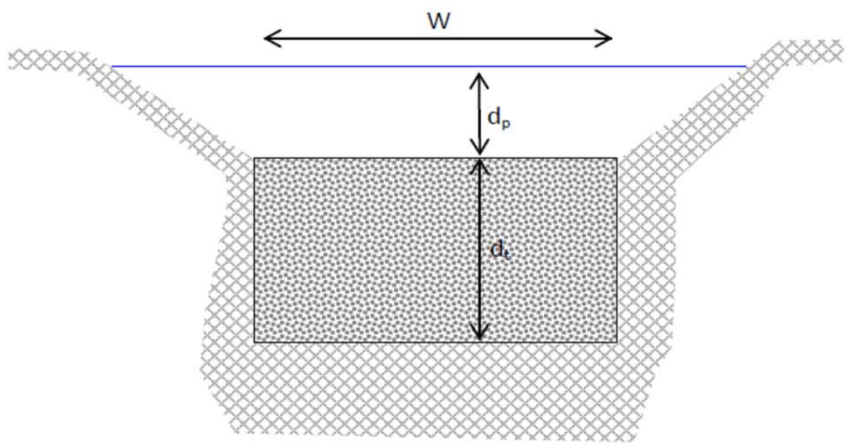


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 1502	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 1502	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 1502	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 1502	ft^3

Infiltration BMP Worksheet

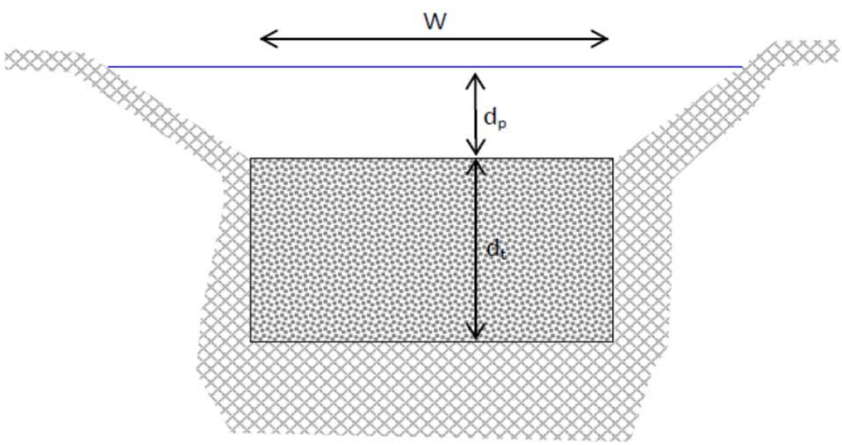


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 261	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 261	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 261	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 261	ft^3

Infiltration BMP Worksheet

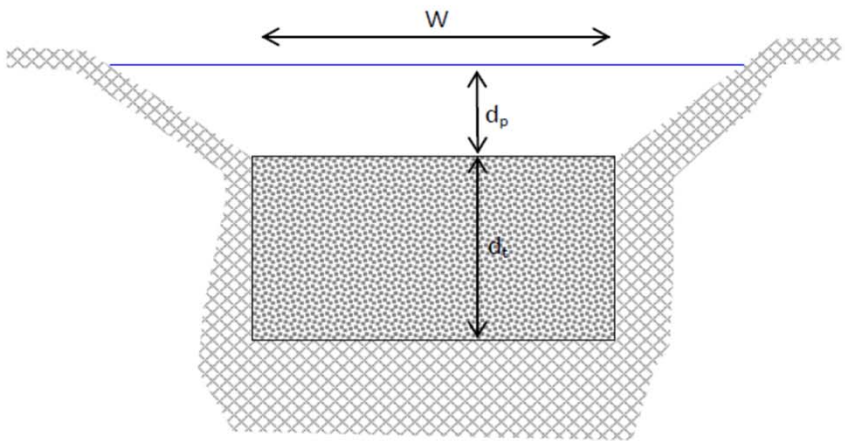


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 1180	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 1180	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 1180	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 1180	ft^3

Infiltration BMP Worksheet

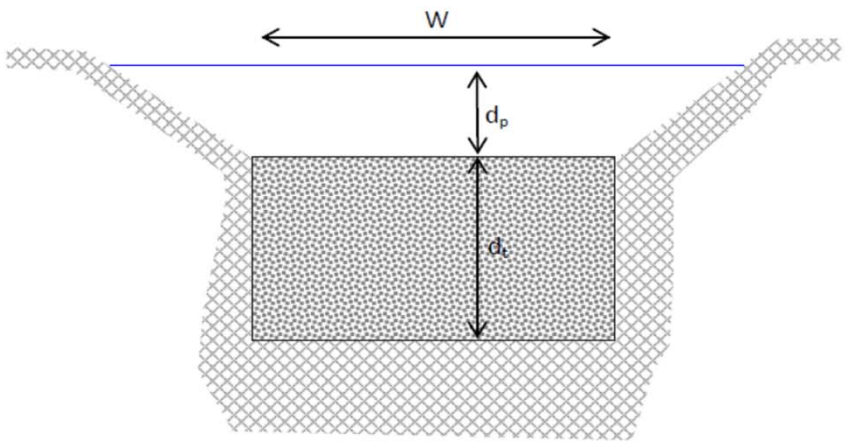


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 2403	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 2403	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 2403	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 2403	ft^3

Infiltration BMP Worksheet

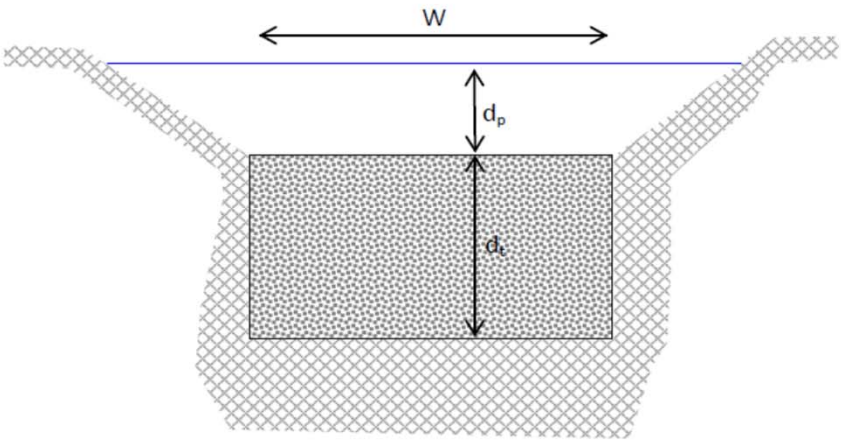


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 1207	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 1207	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 1207	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 1207	ft^3

Bioretention Design Example

Bioretention areas have several components that allow the pretreatment, spreading, filtration, collection and discharge of the incoming flows.

Step 1: Determine design volume reduction, $V_{reduction}$

1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$=	3104	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$=	3104	ft^3

Step 2: Determine storm water quality design volume, V_{wq}

2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	3104	ft^3

Step 3: Determine design volume, V_{design} (for sizing)

3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}=	3104	ft^3

Bioretention Design Example

Bioretention areas have several components that allow the pretreatment, spreading, filtration, collection and discharge of the incoming flows.

Step 1: Determine design volume reduction, $V_{reduction}$

1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$=	1834	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$=	1834	ft^3

Step 2: Determine storm water quality design volume, V_{wq}

2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	1834	ft^3

Step 3: Determine design volume, V_{design} (for sizing)

3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}=	1834	ft^3

Bioretention Design Example

Bioretention areas have several components that allow the pretreatment, spreading, filtration, collection and discharge of the incoming flows.

Step 1: Determine design volume reduction, $V_{reduction}$

1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$=	912	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$=	912	ft^3

Step 2: Determine storm water quality design volume, V_{wq}

2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	912	ft^3

Step 3: Determine design volume, V_{design} (for sizing)

3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}=	912	ft^3

Infiltration BMP Worksheet

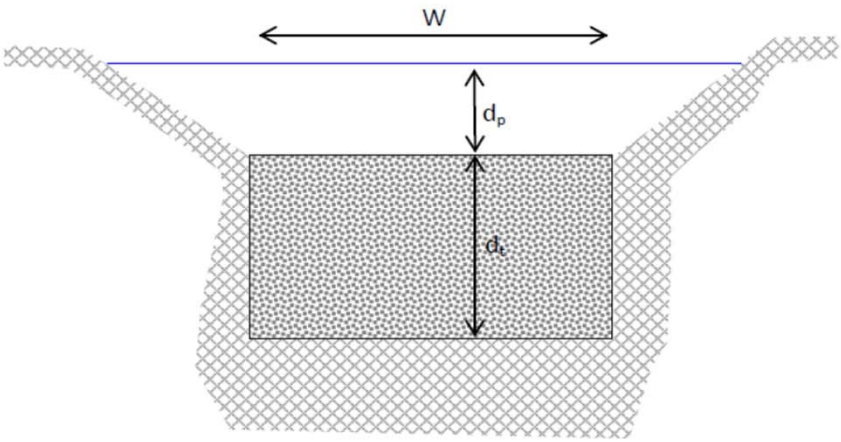


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 1462	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 1462	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 1462	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 1462	ft^3

Infiltration BMP Worksheet

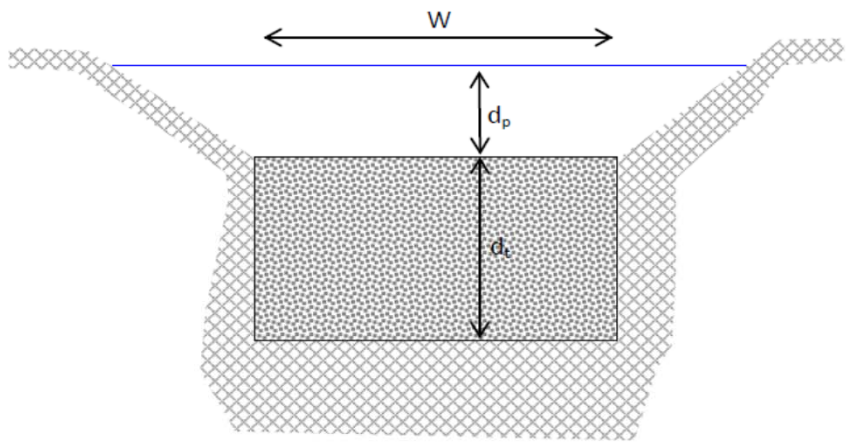


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 205	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 61	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 205	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 61	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 205	ft^3

Infiltration BMP Worksheet

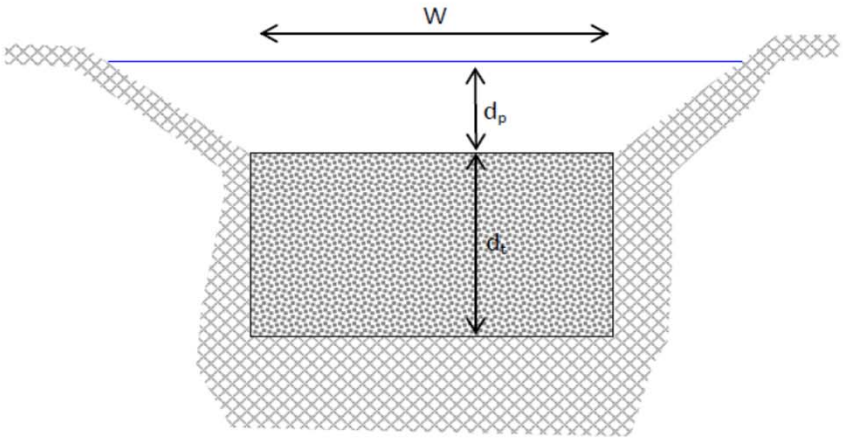


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$	
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 1453 ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 433 ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 1453 ft^3
Step 2: Determine storm water quality design volume, V_{wq}	
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 433 ft^3
Step 3: Determine design volume, V_{design} (for sizing)	
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 1453 ft^3

Infiltration BMP Worksheet

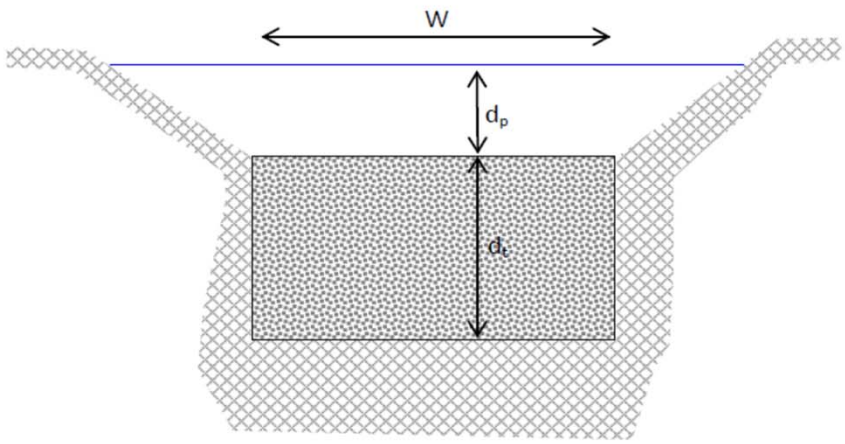


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 1086	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 323	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 1086	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 323	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 1086	ft^3

Infiltration BMP Worksheet

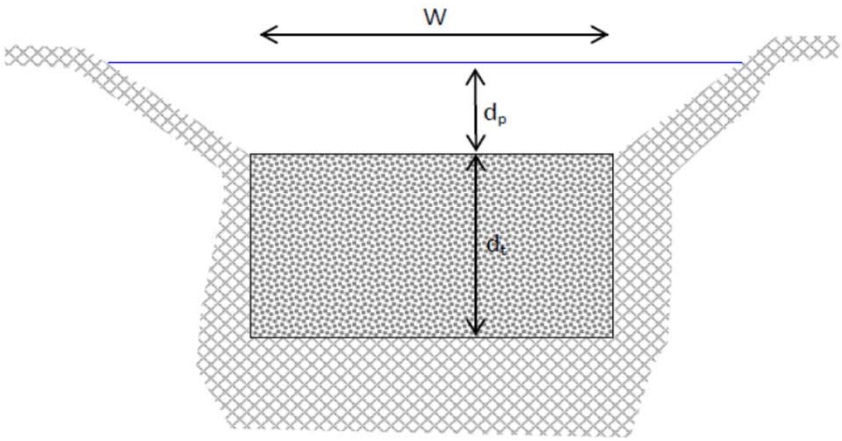


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$	
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 2317 ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 689 ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 2317 ft^3
Step 2: Determine storm water quality design volume, V_{wq}	
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 689 ft^3
Step 3: Determine design volume, V_{design} (for sizing)	
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 2317 ft^3

Infiltration BMP Worksheet

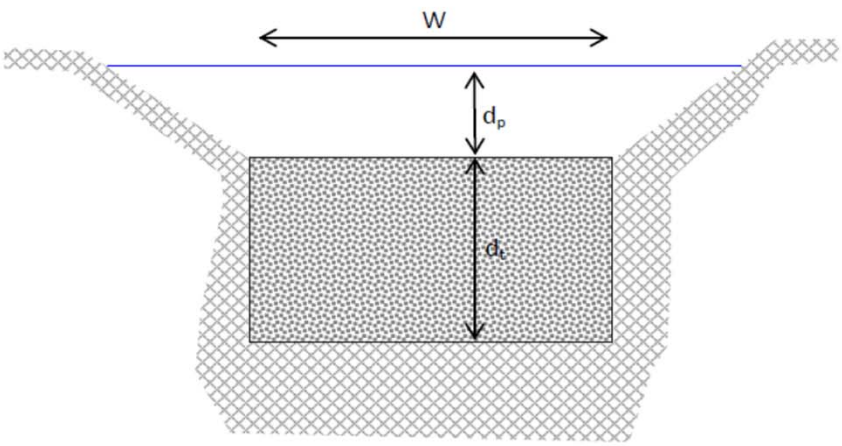


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 1097	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 327	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 1097	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 327	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 1097	ft^3

Infiltration BMP Worksheet

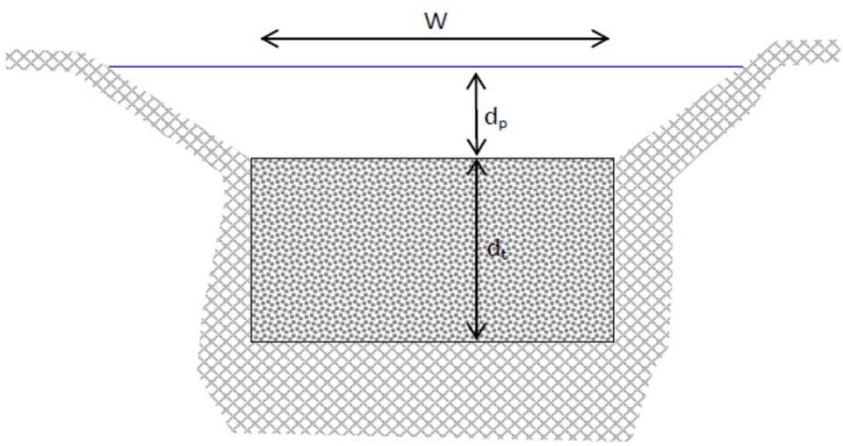


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 426	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 127	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 426	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 127	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 426	ft^3

Infiltration BMP Worksheet

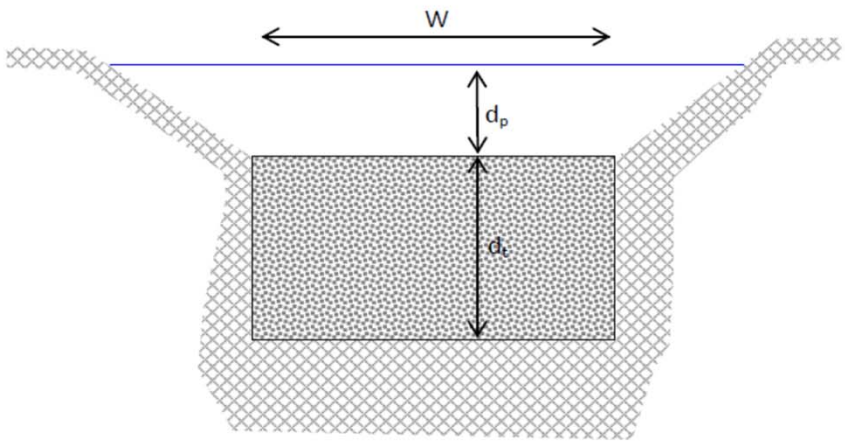


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 1116	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 332	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 1116	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 332	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 1116	ft^3

Infiltration BMP Worksheet

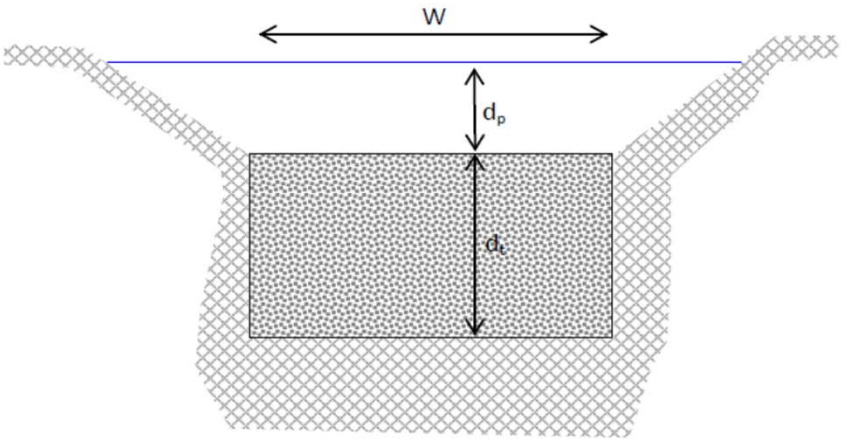


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 511	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 152	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 511	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 152	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 511	ft^3

Infiltration BMP Worksheet

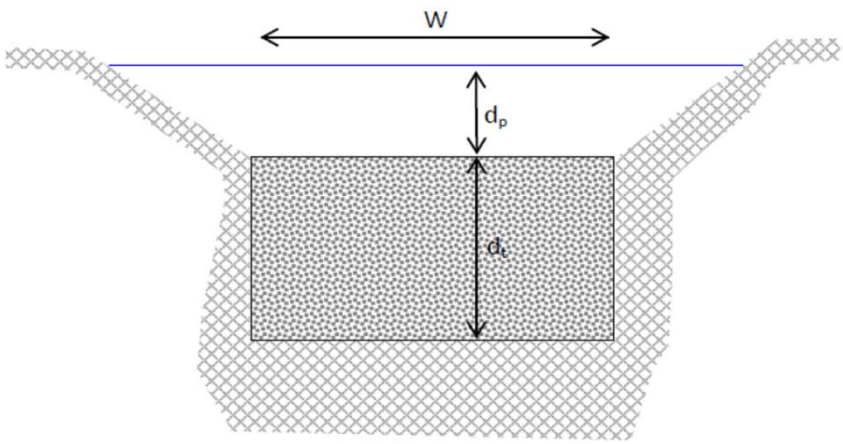


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$	
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 3770 ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 1122 ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 3770 ft^3
Step 2: Determine storm water quality design volume, V_{wq}	
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 1122 ft^3
Step 3: Determine design volume, V_{design} (for sizing)	
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 3770 ft^3

Infiltration BMP Worksheet

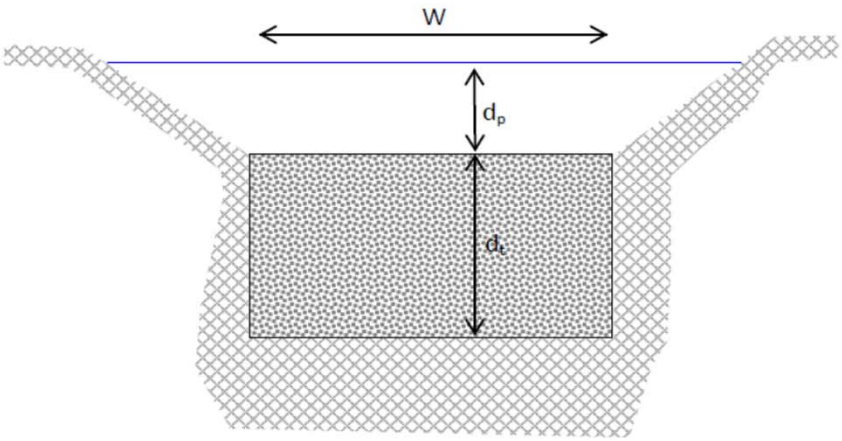


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 794	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 236	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 794	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 236	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 794	ft^3

Infiltration BMP Worksheet

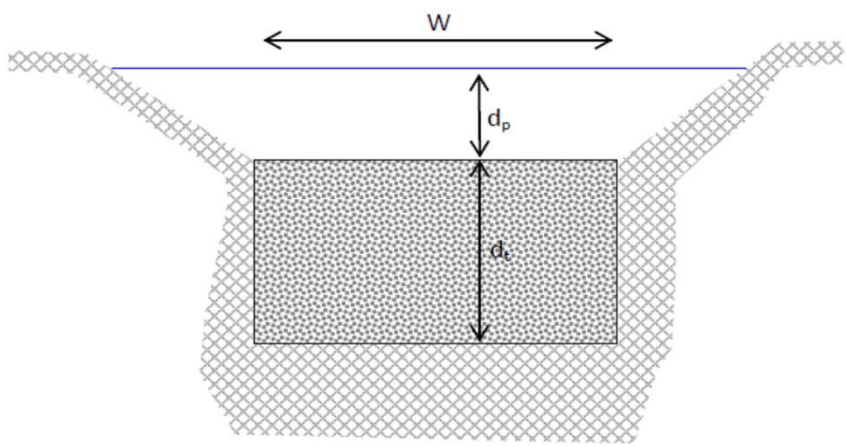


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 809	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 241	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 809	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 241	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 809	ft^3

Infiltration BMP Worksheet

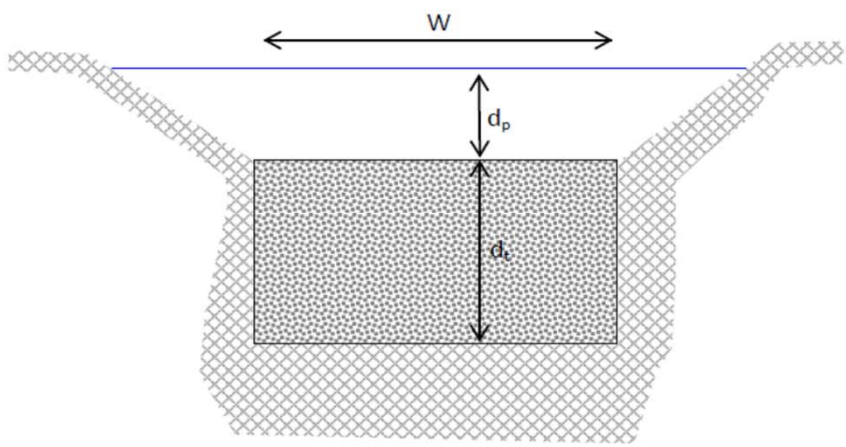


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 1358	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 404	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 1358	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 404	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 1358	ft^3

Bioretention Design Example

Bioretention areas have several components that allow the pretreatment, spreading, filtration, collection and discharge of the incoming flows.

Step 1: Determine design volume reduction, $V_{reduction}$

1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	1623	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$=	483	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$=	1623	ft^3

Step 2: Determine storm water quality design volume, V_{wq}

2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	483	ft^3

Step 3: Determine design volume, V_{design} (for sizing)

3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}=	1623	ft^3

Bioretention Design Example

Bioretention areas have several components that allow the pretreatment, spreading, filtration, collection and discharge of the incoming flows.

Step 1: Determine design volume reduction, $V_{reduction}$			
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	1872	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$=	557	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$=	1872	ft^3
Step 2: Determine storm water quality design volume, V_{wq}			
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	557	ft^3
Step 3: Determine design volume, V_{design} (for sizing)			
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}=	1872	ft^3

Bioretention Design Example

Bioretention areas have several components that allow the pretreatment, spreading, filtration, collection and discharge of the incoming flows.

Step 1: Determine design volume reduction, $V_{reduction}$

1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	434	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$=	129	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$=	434	ft^3

Step 2: Determine storm water quality design volume, V_{wq}

2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	129	ft^3

Step 3: Determine design volume, V_{design} (for sizing)

3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}=	434	ft^3

Bioretention Design Example

Bioretention areas have several components that allow the pretreatment, spreading, filtration, collection and discharge of the incoming flows.

Step 1: Determine design volume reduction, $V_{reduction}$

1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}=	1872	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$=	557	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$=	1872	ft^3

Step 2: Determine storm water quality design volume, V_{wq}

2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}=	557	ft^3

Step 3: Determine design volume, V_{design} (for sizing)

3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}=	1872	ft^3

Infiltration BMP Worksheet

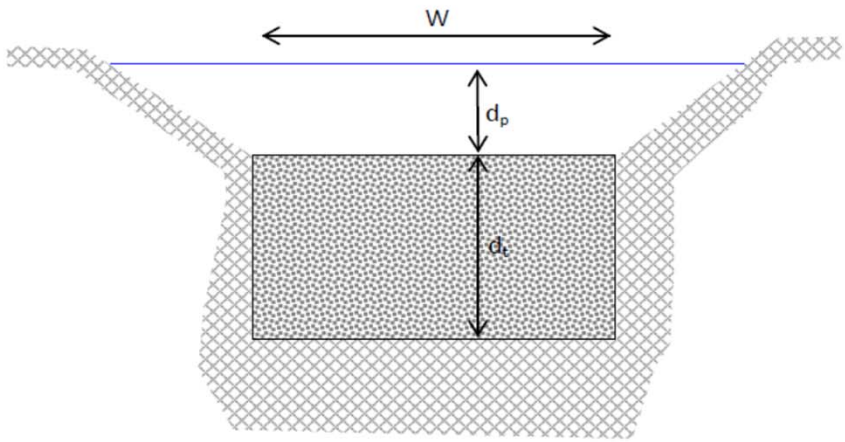


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$	
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 1101 ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 328 ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 1101 ft^3
Step 2: Determine storm water quality design volume, V_{wq}	
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 328 ft^3
Step 3: Determine design volume, V_{design} (for sizing)	
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 1101 ft^3

Infiltration BMP Worksheet

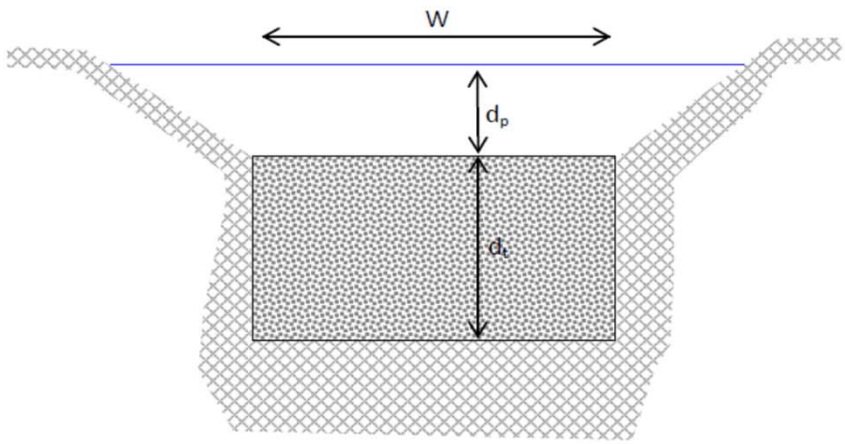


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 471	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 140	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 471	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 140	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 471	ft^3

Infiltration BMP Worksheet

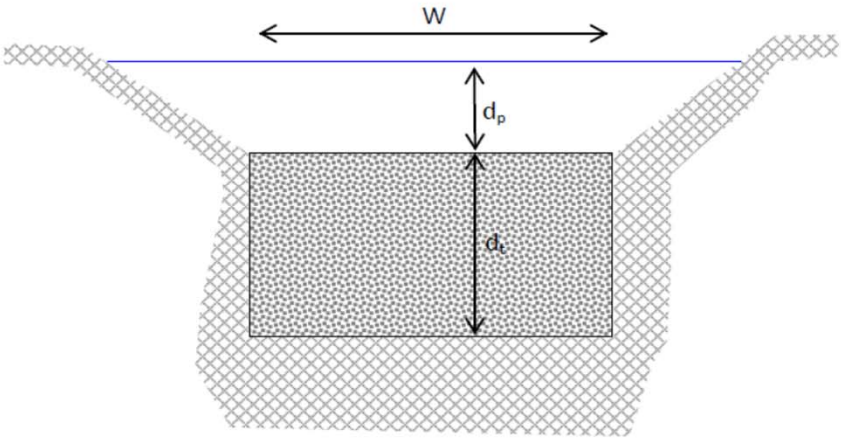


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 82	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 82	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 82	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 82	ft^3

Infiltration BMP Worksheet

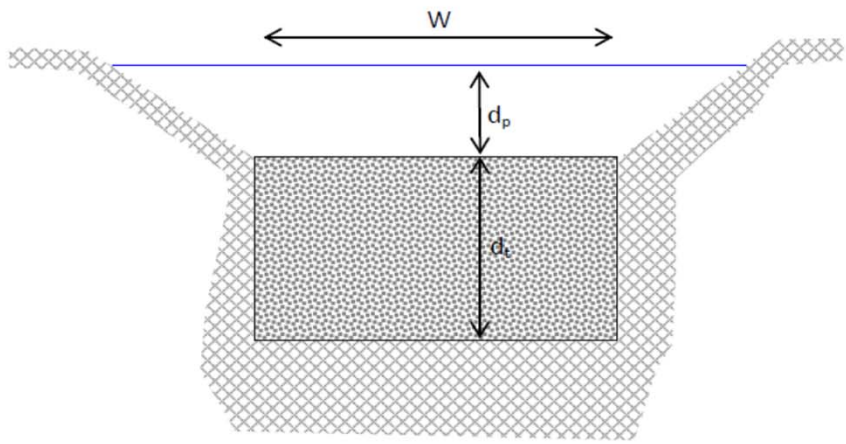


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 107	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 107	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 107	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 107	ft^3

Infiltration BMP Worksheet

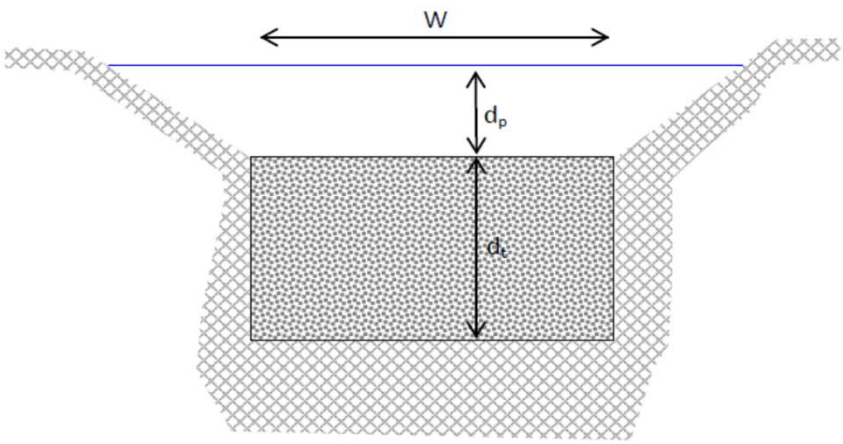


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 96	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 96	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 96	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 96	ft^3

Infiltration BMP Worksheet

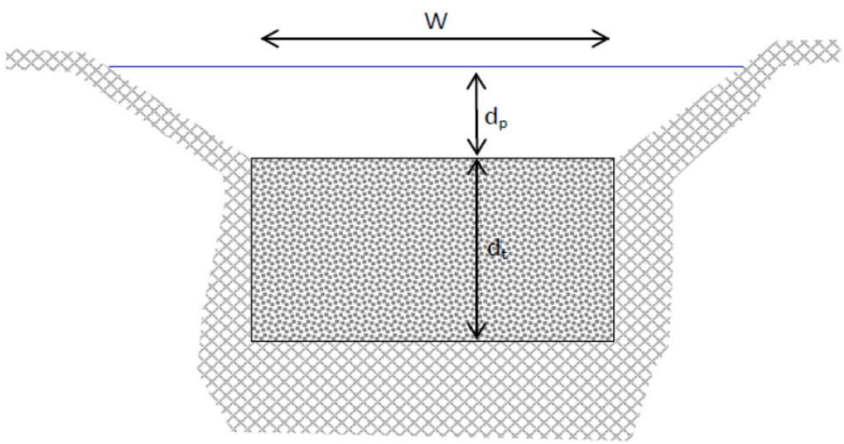


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 55	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 55	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 55	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 55	ft^3

Infiltration BMP Worksheet

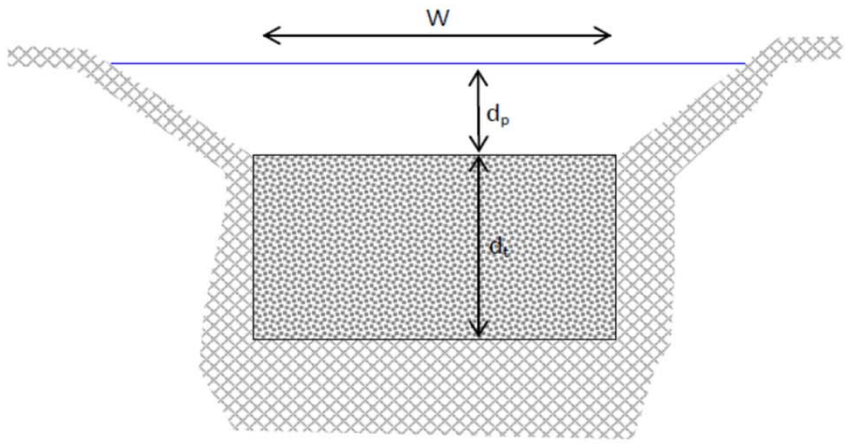


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 38	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 38	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 38	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 38	ft^3

Infiltration BMP Worksheet

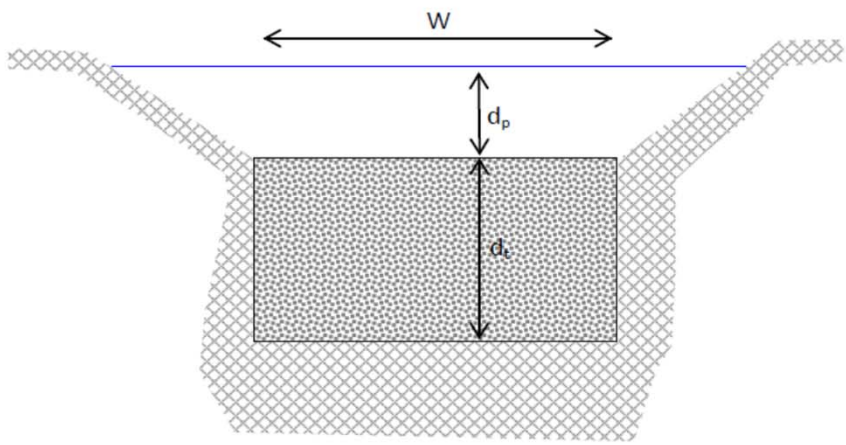


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 36	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 36	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 36	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 36	ft^3

Infiltration BMP Worksheet

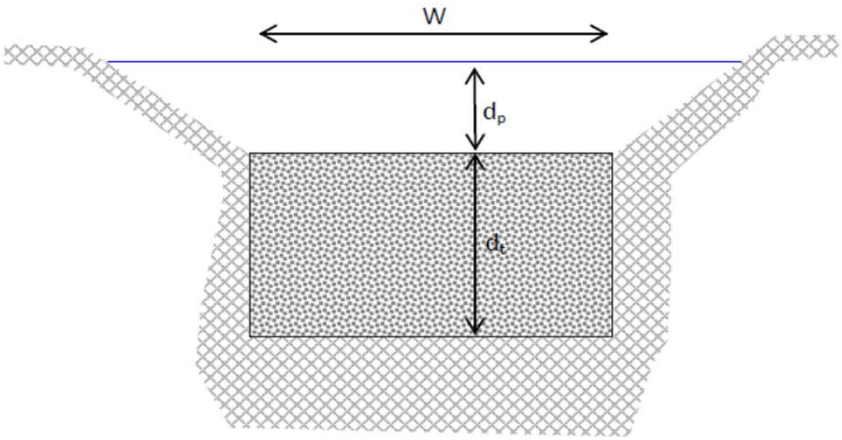


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 79	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 79	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 79	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 79	ft^3

Infiltration BMP Worksheet

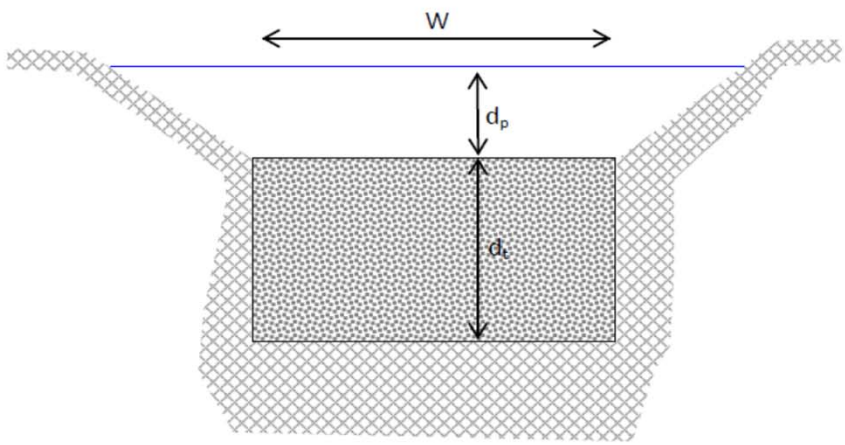


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 80	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 80	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 80	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 80	ft^3

Infiltration BMP Worksheet

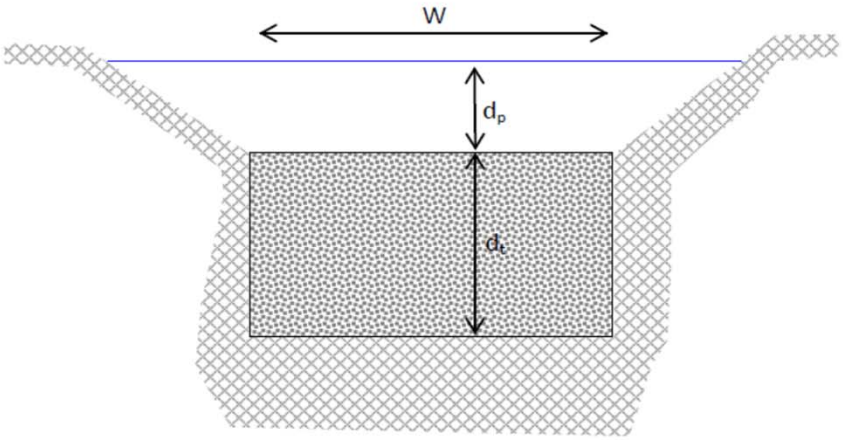


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 116	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 116	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 116	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 116	ft^3

Infiltration BMP Worksheet

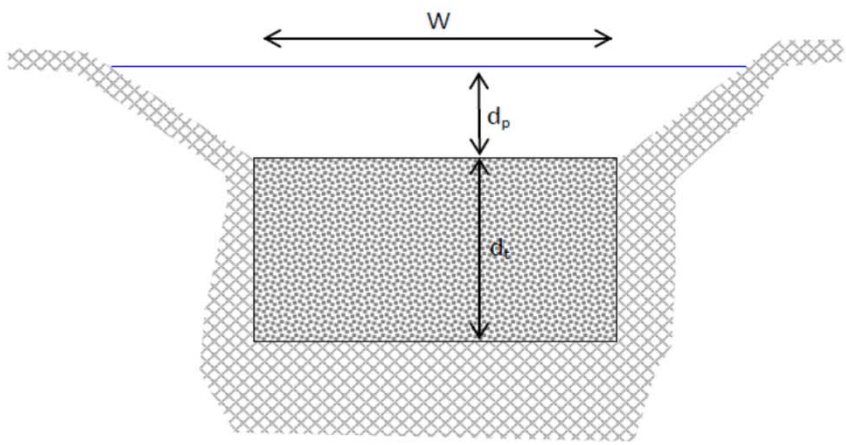


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 113	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 113	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 113	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 113	ft^3

Infiltration BMP Worksheet

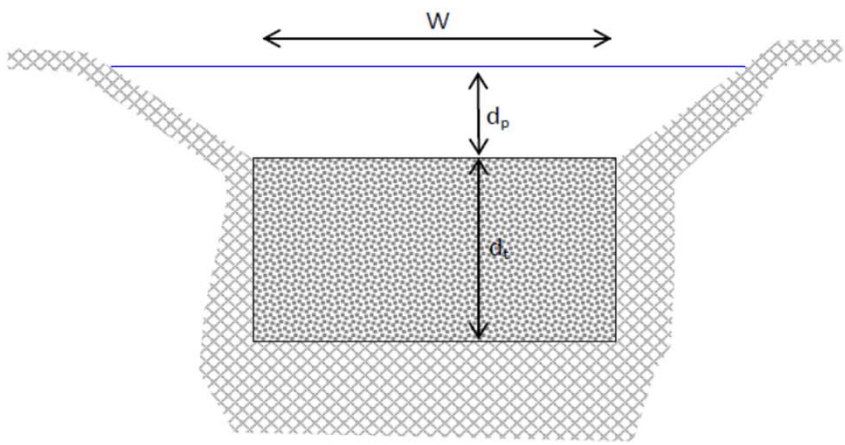


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 8	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 8	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 8	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 8	ft^3

Infiltration BMP Worksheet

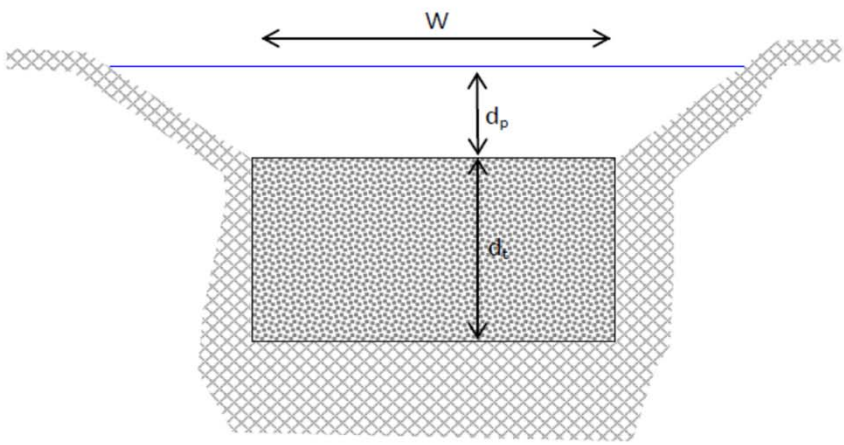


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 71	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 71	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 71	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 71	ft^3

Infiltration BMP Worksheet

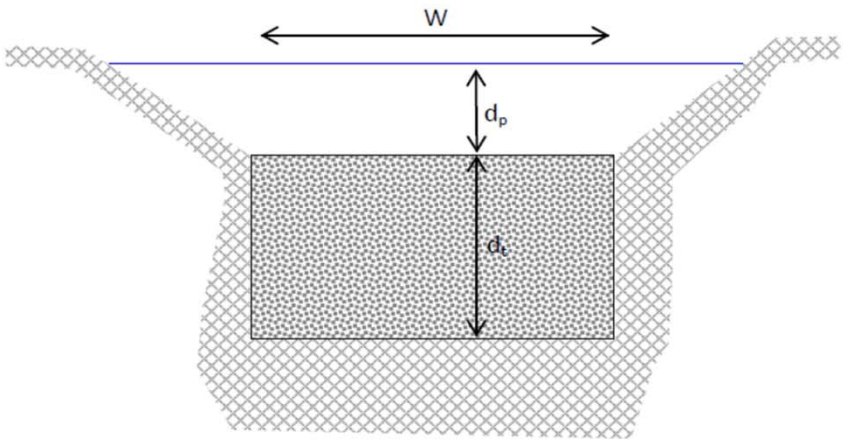


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 65	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 65	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 65	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 65	ft^3

Infiltration BMP Worksheet

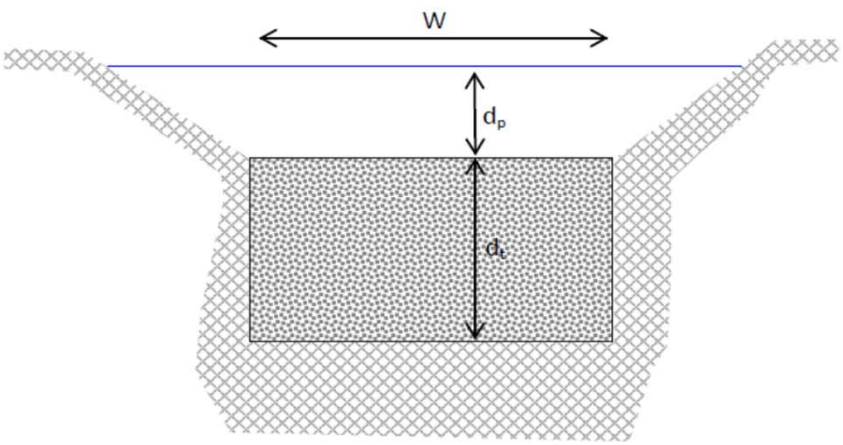


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 12	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 12	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 12	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 12	ft^3

Infiltration BMP Worksheet

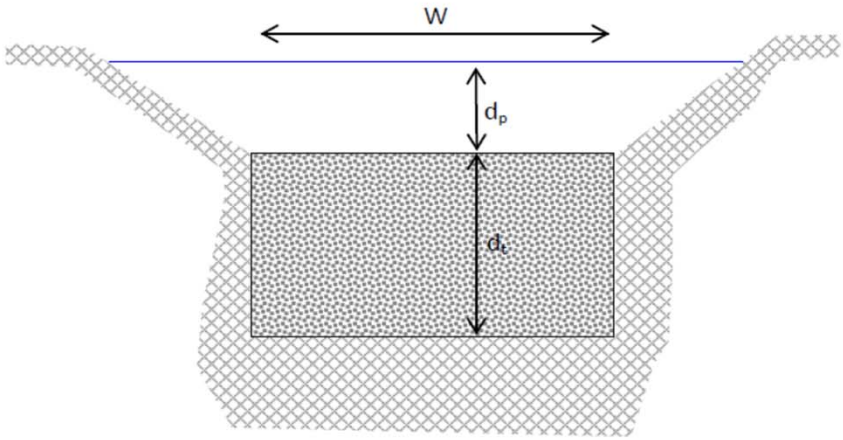


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$	
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0 ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 9 ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 9 ft^3
Step 2: Determine storm water quality design volume, V_{wq}	
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 9 ft^3
Step 3: Determine design volume, V_{design} (for sizing)	
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 9 ft^3

Infiltration BMP Worksheet

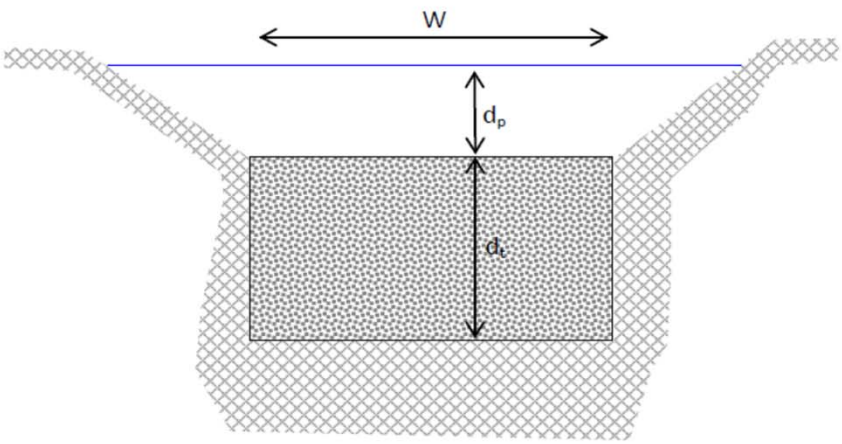


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 13	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 13	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 13	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 13	ft^3

Infiltration BMP Worksheet

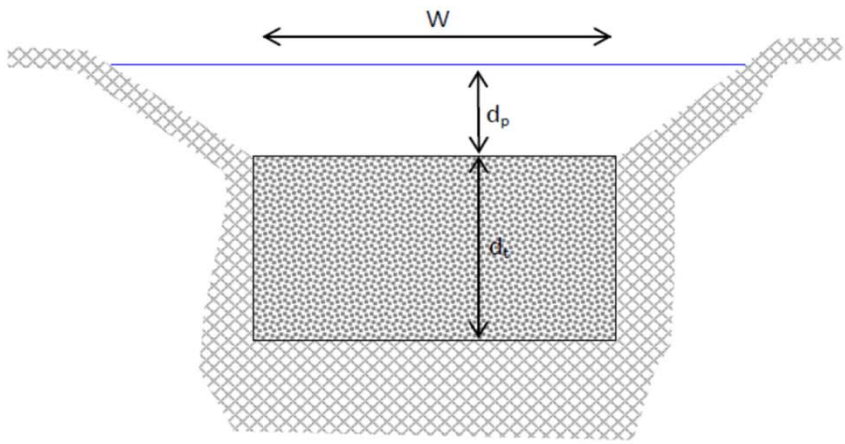


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 13	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 13	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 13	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 13	ft^3

Infiltration BMP Worksheet

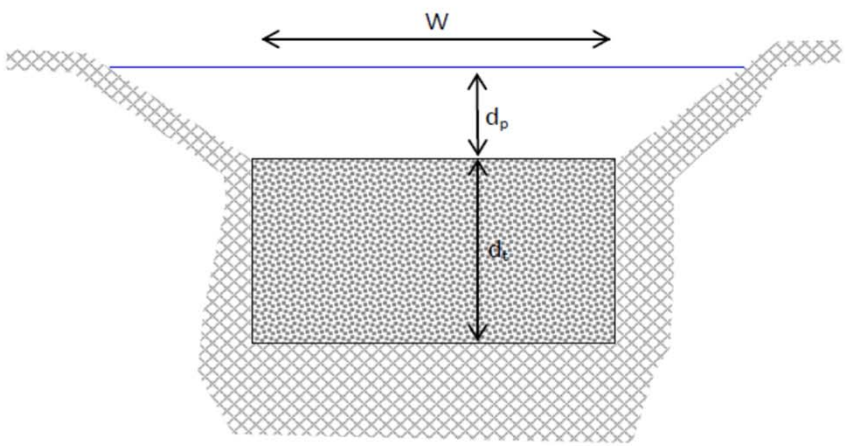


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 5	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 5	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 5	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 5	ft^3

Infiltration BMP Worksheet

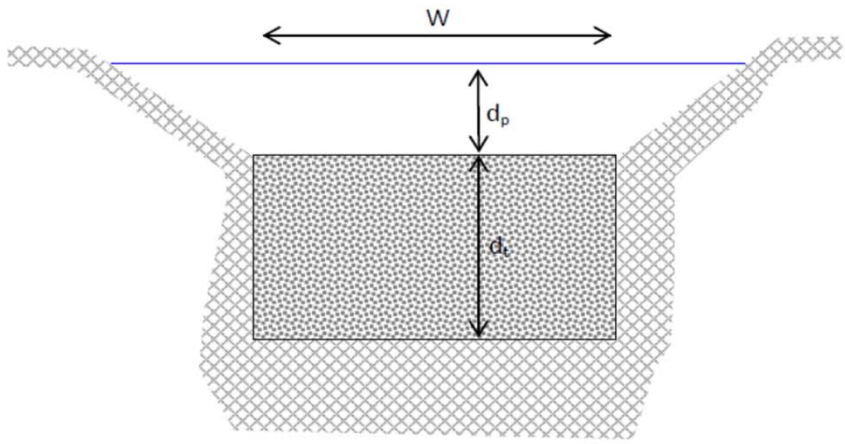


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$	
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0 ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 7 ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 7 ft^3
Step 2: Determine storm water quality design volume, V_{wq}	
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 7 ft^3
Step 3: Determine design volume, V_{design} (for sizing)	
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 7 ft^3

Infiltration BMP Worksheet

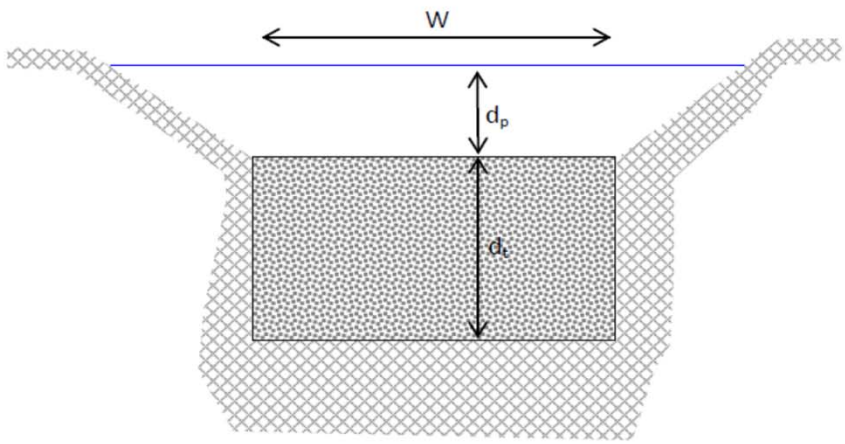


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 13	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 13	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 13	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 13	ft^3

Infiltration BMP Worksheet

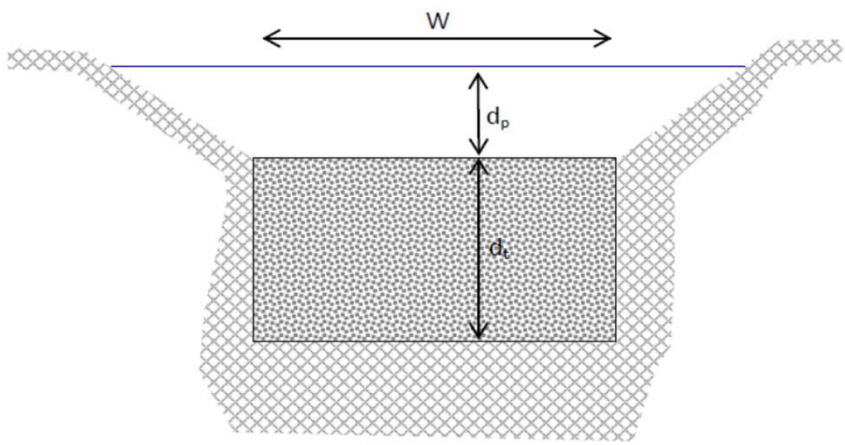


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 8	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 8	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 8	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 8	ft^3

Infiltration BMP Worksheet

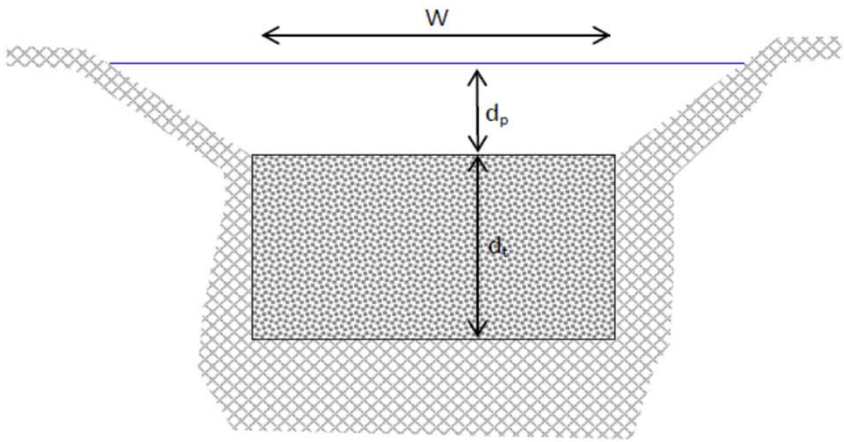


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 15	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 15	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 15	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 15	ft^3

Infiltration BMP Worksheet

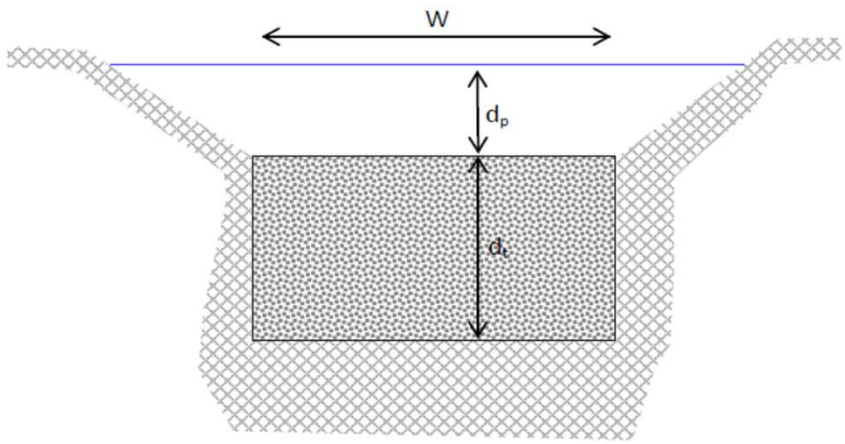


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 11	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 11	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 11	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 11	ft^3

Infiltration BMP Worksheet

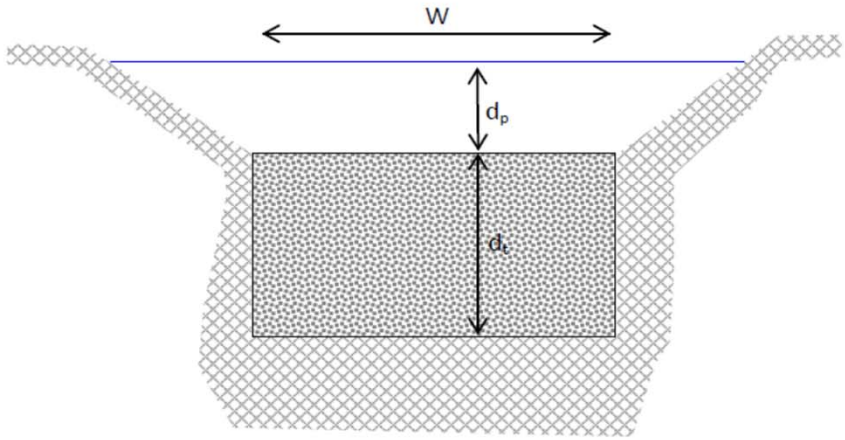


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 5	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 5	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 5	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 5	ft^3

Infiltration BMP Worksheet

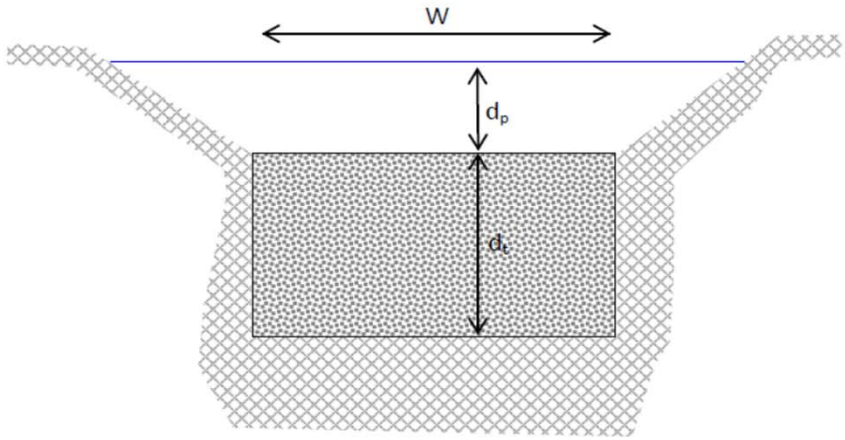


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 47	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 47	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 47	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 47	ft^3

Infiltration BMP Worksheet

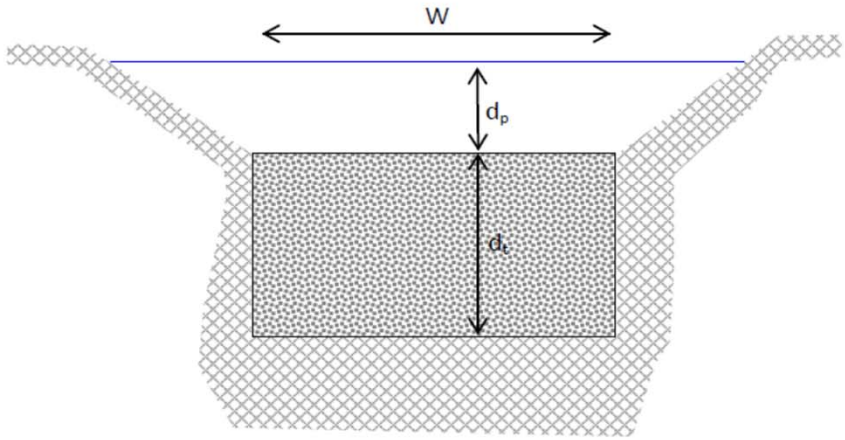


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 82	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 82	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 82	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 82	ft^3

Infiltration BMP Worksheet

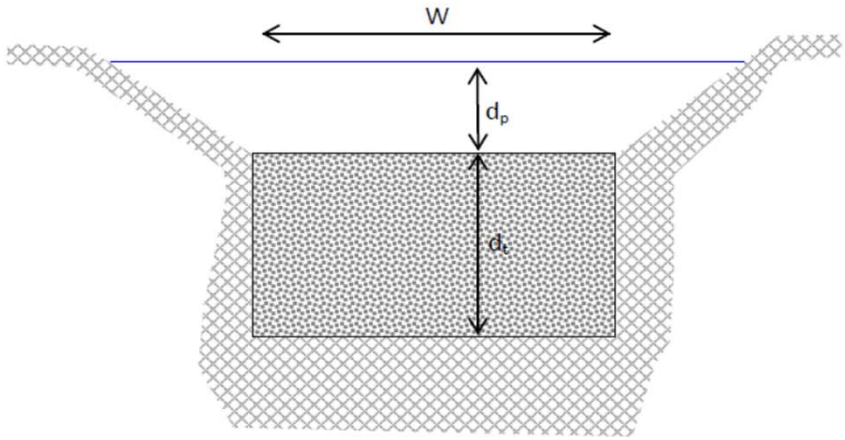


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 162	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 162	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 162	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 162	ft^3

Infiltration BMP Worksheet

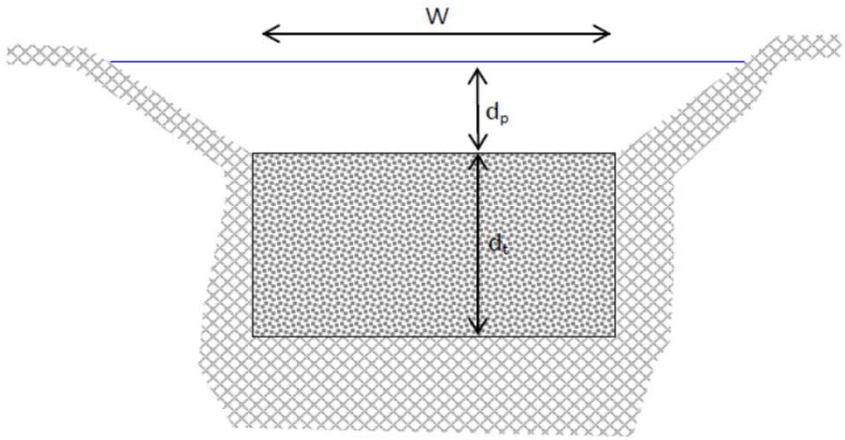


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 45	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 45	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 45	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 45	ft^3

Infiltration BMP Worksheet

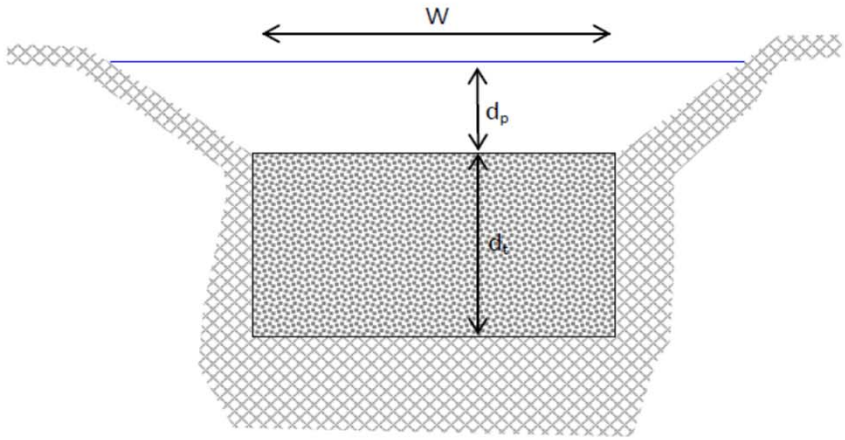


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 62	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 62	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 62	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 62	ft^3

Infiltration BMP Worksheet

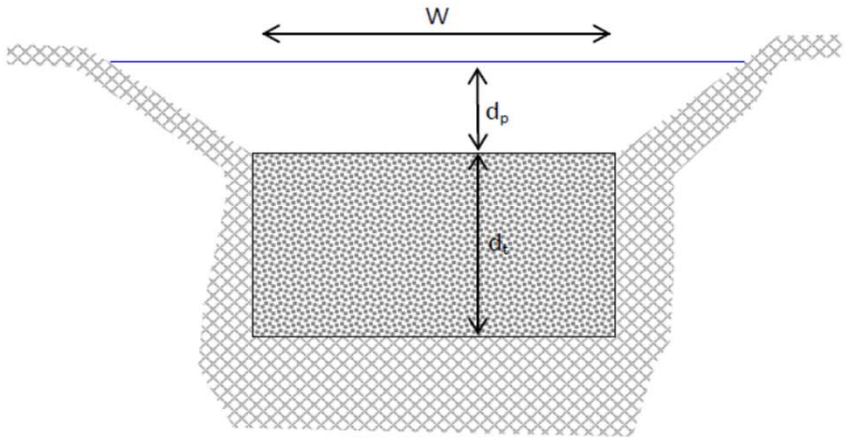


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 70	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 70	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 70	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 70	ft^3

Infiltration BMP Worksheet

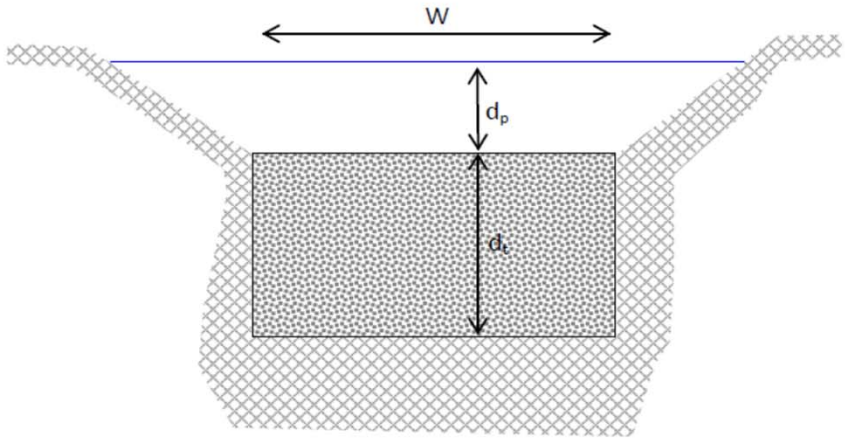


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 56	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 56	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 56	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 56	ft^3

Infiltration BMP Worksheet

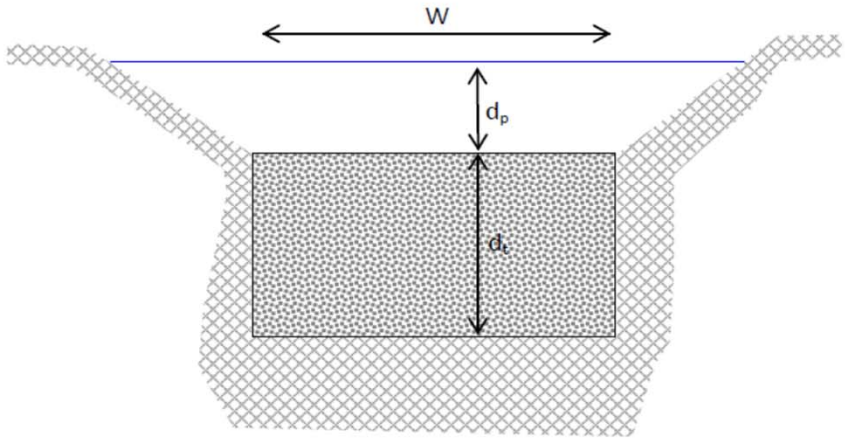


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 59	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 59	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 59	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 59	ft^3

Infiltration BMP Worksheet

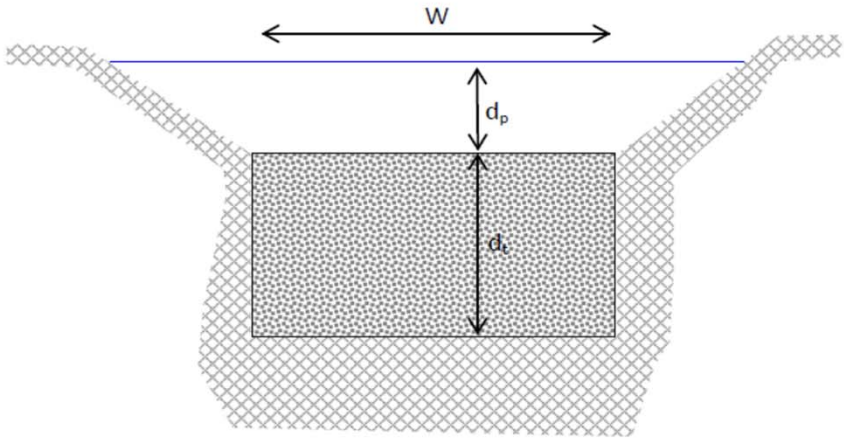


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 178	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 178	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 178	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 178	ft^3

Infiltration BMP Worksheet

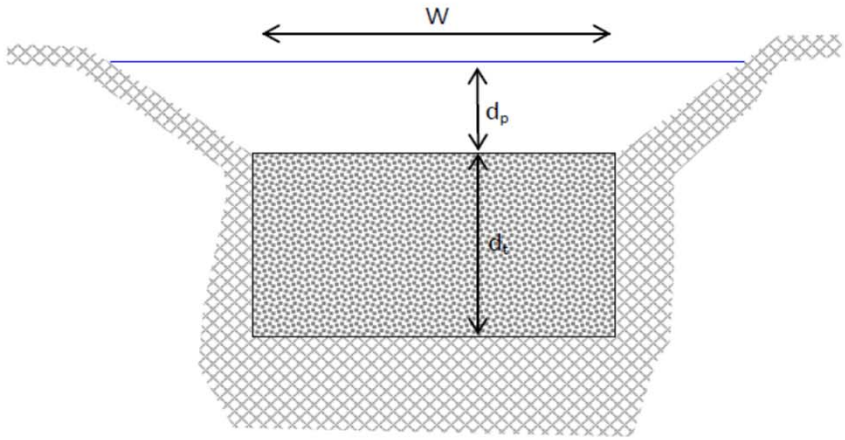


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 153	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 153	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 153	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 153	ft^3

Infiltration BMP Worksheet

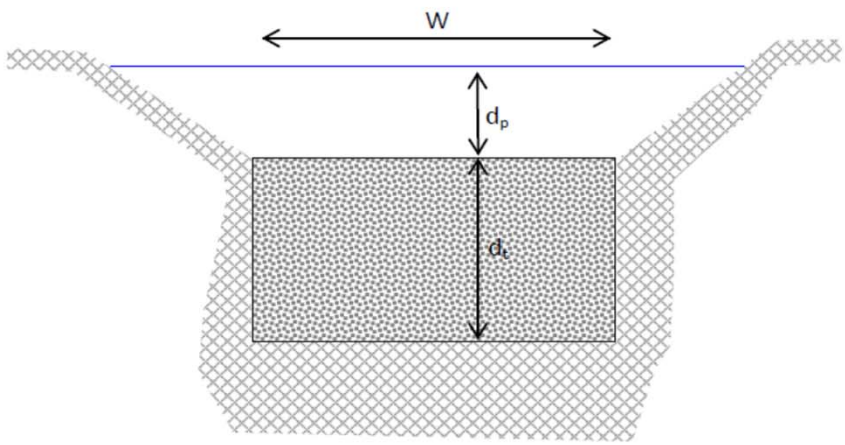


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 31	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 31	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 31	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 31	ft^3

Infiltration BMP Worksheet

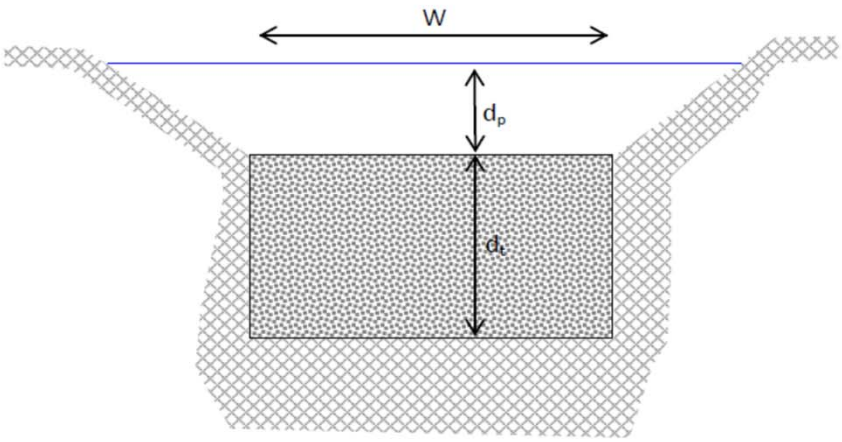


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 229	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 229	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 229	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 229	ft^3

Infiltration BMP Worksheet

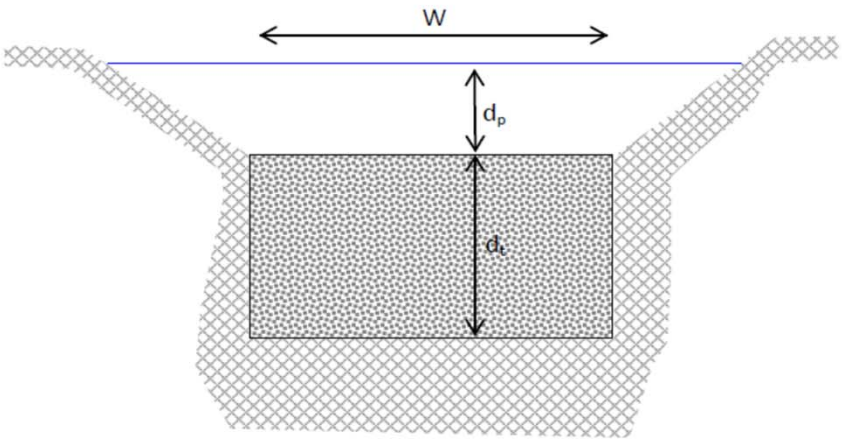


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 31	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 31	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 31	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 31	ft^3

Infiltration BMP Worksheet

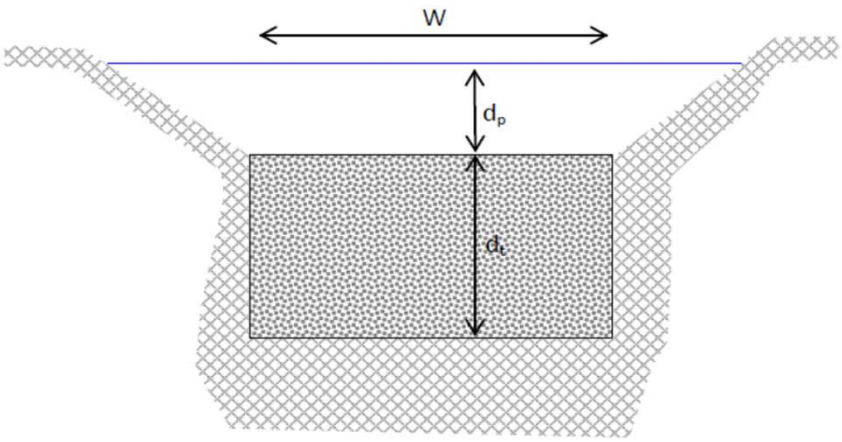


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 427	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 427	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 427	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 427	ft^3

Infiltration BMP Worksheet

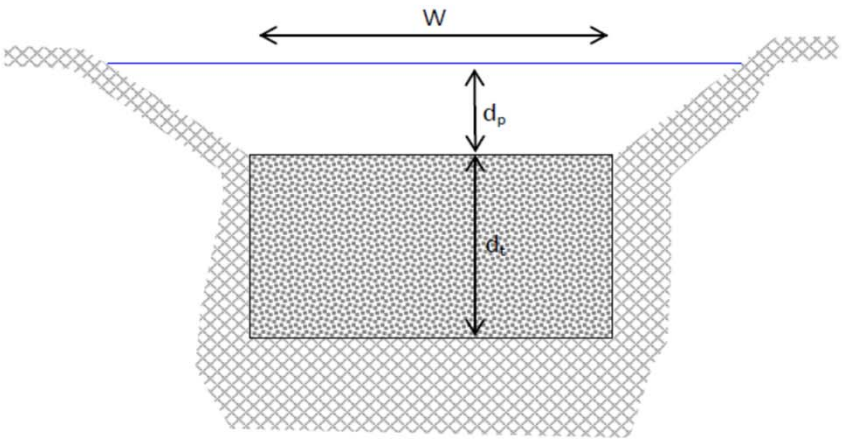


Figure D-5: Infiltration BMP cross-section

Refer to Figures D-5, 6-12, 6-13 and 6-14 for a diagrammatic description of the geometric variables.

Step 1: Determine design volume reduction, $V_{reduction}$		
1-1. Enter the volume difference between the pre- and post-development conditions for the 25-yr, 24-hr design storm, V_{25}, calculated using SBUH method, Appendix C	V_{25}= 0	ft^3
1-2. Enter the volume generated from a one-inch, 24-hr storm event, $V_{one\text{-}inch}$, calculated using SBUH method, Appendix C	$V_{one\text{-}inch}$= 142	ft^3
1-3. Determine design volume reduction which is the larger of V_{25} and $V_{one\text{-}inch}$ and is the volume to be retained on-site	$V_{reduction}$= 142	ft^3
Step 2: Determine storm water quality design volume, V_{wq}		
2-1. Determine the water quality design volume, V_{wq}, using SBUH method, Appendix C (Note: V_{wq} is always equal to $V_{one\text{-}inch}$)	V_{wq}= 142	ft^3
Step 3: Determine design volume, V_{design} (for sizing)		
3-1. V_{design} = the larger of $V_{reduction}$ and V_{wq}	V_{design}= 142	ft^3

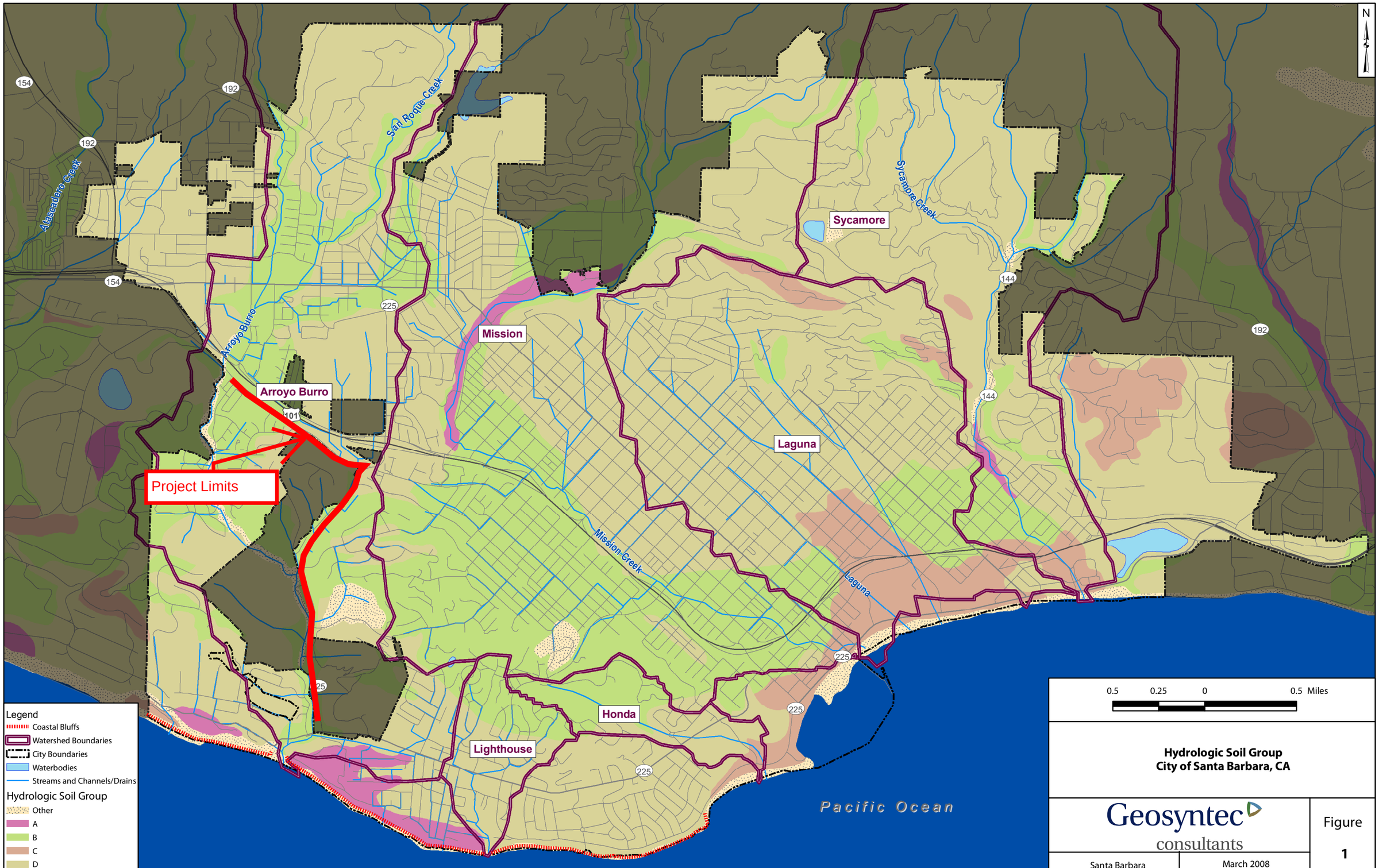


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Table 6-1: BMP Selection Matrix - Pollutants of Concern

Important Note to Users: Treatment effectiveness for pollutants of concern can vary widely for individual BMPs. This table should be used to provide general BMP comparisons only and should not replace the evaluation performed by a water quality professional. For greater accuracy, only compare treatment effectiveness within each of the Stormwater Runoff BMP Categories. BMPs shall be selected that have high or very high treatment effectiveness for the primary pollutants of concern as defined in Section 6.3.

Manual Section	Stormwater Runoff BMP Category	Stormwater Runoff BMP	Volume Mitigation (% of inflow)	Treatment Effectiveness for Pollutants of Concern[1]					
				Trash	Nutrients	Bacteria	Metals (particulate and dissolved fractions)	Sediment	Organics (hydrocarbons, oil, and grease)
6.6	**Biofiltration and Filtration BMPs**	Bioretention	◒	●	◒	◒	◒	●	◒
		Vegetated Swale Filter	◉	◉	◒	○	◉	◉	◉
		Vegetated Filter Strip	◉	◉	◒	○	◉	◒	◉
		Sand Filter	○	●	◉	◒	◒	●	◒
6.7	**Infiltration BMPs**	Includes infiltration trenches, infiltration basins, and dry wells	●	●	●	●	●	●	●
6.8	**Permeable Pavement BMPs**	Includes pervious concrete, porous asphalt, permeable pavers, grass-pave, and gravel-pave	◒	○	◉	◒	◒	●	◒
6.9	**Building BMPs**	Cistern/Rain Barrel	◒	Building BMPs are generally intended for achieving volume reduction of roof drainage. Treatment effectiveness of building BMPs are not comparable to other BMPs in this table that treat runoff from a wide range of impervious surfaces that generally have higher pollutant concentrations.					
		Planter Box	◉						
		Green Roof	◉						
6.10	**Retention and Detention BMPs**	Constructed Treatment Wetland	◒	●	◒	◉	◒	●	◒
		Wet Retention Basin	◒	●	◒	◉	◒	●	◒
		Dry Extended Detention Basin	◉	◒	◒	◒	◉	◉	◒
6.11	**Proprietary Devices**	Includes hydrodyamic devices, catch basins, media filters, and biotreatment devices	*The treatment effectiveness of specific proprietary devices must be provided by the manufacturer and should be verified by independent third-party sources and data or assessed by a professional consultant.*						

Very High	High	Moderate	Low	Very Low
●	◒	◉	◒	○

[1] Effectiveness may change based on design variations; standard BMP designs have been assumed.

Location Hydraulic Study

Las Positas Multi-Use Path

City of Santa Barbara

November 10 , 2016

rrm design group

1 LOCATION

Modoc Road (Calle De Los Amigos to Las Positas Road)

Las Positas Road (Modoc Road to Cliff Drive)

(See Figure 1: Vicinity Map)

2 NAME OF STREAMS

Las Positas Creek and Arroyo Burro Creek

3 GEOGRAPHICAL REFERENCE

The Proposed Project is located in the city of Santa Barbara south of the 101 Highway on Modoc Road and Las Positas Road. The path begins at the intersection of Calle De Los Amigos and Modoc Road, continues through the Modoc Road and Las Positas Road intersection, and concludes at the intersection of Las Positas Road and Cliff Drive.

4 DESCRIPTION OF PROJECT

The Project proposes an approximately three (3) mile separated multi-use path (Class I Bike Path) that connects the local and regional community to the area's recreational resources and transportation network. The 3 mile path will run alongside Modoc Road from Calle De Los Amigos to Las Positas Road and continues on Las Positas Road from Modoc Road to Cliff Drive. Various trail alignment alternatives are shown on EX-1.01 to EX-1.15. The proposed project consists of the following improvements:

Modoc Road

- The path will run along the south side of Modoc Road. The improvements will include a 6" curb, 5' planted parkway, and 10'-16' wide trail. Between Calle De Los Amigos and Ferrara Way, the path will encroach into the 100 year floodplain. This area overtops the road and the floodwaters flow into the neighborhood south of Modoc Road due to insufficient capacity in the storm drains upstream. The proposed improvements will match existing topography and slope to the south to maintain existing drainage patters and ensure no rise in the floodplain.

- Between Veronica Springs Road and Las Positas Road, the improvements will again, encroach the 100 year flood plain and cross over Las Positas Creek. Currently there is a 66" RCP culvert that conveys Las Positas Creek under Modoc Road. The culvert is undersized and the 100-year storm flows overtop the road. The culvert will remain in place and the proposed trail will be graded at or below the existing grades to maintain predevelopment drainage patterns and ensure no rise in the floodplain.

Las Positas Road

- As the proposed path continues on Las Positas Road, the improvements have been designed to stay out of the creek corridor as much as possible and also out of the floodplain. There are currently two undersized culverts under existing roads which cause flows to leave the channel (Las Positas Place and Veronica Springs Road). At these two crossings encroachment into the floodplain is unavoidable. The proposed path will be graded to match existing topography (No Fill). From Las Positas Place to Veronica Springs Road, the City's Creek Division has a proposed Creek Restoration Project. In this location, the proposed trail will be located approximately 1' above the 100 year flood level and will be graded to match existing topography (No Fill). The trail meanders closer to Veronica Springs Road to avoid trees.

5 HYDRAULIC DATA

Hydraulic Data is based on the Flood Insurance Study of Santa Barbara County dated December 4, 2012.

Las Positas Creek

- The Las Positas Creek watershed encompasses approximately 490 acres within the City of Santa Barbara in combination with parts of unincorporated Santa Barbara County.

- Along Modoc Road, approximately 700' west of Las Positas Road there is a 66" RCP Culvert. During the 100 year storm event, flows overtop Modoc Road due to insufficient capacity of the culvert.

- Along Las Positas Creek the 8' x 3.5' box culvert at Las Positas Place backs up flows during the 100 Year storm event due to insufficient capacity. Floodwaters overtop Las Positas Place and Veronica Springs.

- At Veronica Springs Road, during the 100 year storm event flows back up onto Veronica Springs Road due to low right bank elevations and insufficient capacity in the double 66" culvert that crosses under Veronica Springs Road. Flows overtop Veronica Springs Road and spill onto Las Positas Road.

Las Positas Creek at the Arroyo Burro Confluence

- The 100 year flow rate of Las Positas Creek, at the confluence with Arroyo Burro Creek, just south of Veronica Springs Road, is approximately 1,580 cfs.

Arroyo Burro Creek

- The Arroyo Burro Creek watershed consists of approximately 6,217 acres and extends from the Pacific Ocean to the ridge of the Santa Ynez Mountains.

- Arroyo Burro Creek just downstream of the U.S. 101 Highway has a 100 year flow rate of 1,300 cfs.

Arroyo Burro Creek upstream of Cliff Drive

- The 100 year flow rate in Arroyo Burro Creek just upstream of Cliff Drive is approximately 5,950 cfs. Arroyo Burro Creek has an overflow path with a defined floodplain (Zone AE) south of the US 101 from Calle de Los Amigos to Ferrara Way which is within the project limits along Modoc Road.

6 FLOODPLAIN MAP

1. Flood Insurance Rate Map; Santa Barbara County California and Incorporated Areas Panel No. 1386 of 1835, Map Number 06083C1386H, November 4, 2015.

   See Figures 2 to 4

7 Q100 BACKWATER POTENTIAL IMPACTS

Backwater Damages To:

1. Residence No

   There are several residences currently located in the Arroyo Burro and Las Positas Creek Floodplains. The proposed project will match existing grades where floodplain encroachments occur and not cause backwater damages.

2. Other Building No

   There are other buildings currently located in the Arroyo Burro and Las Positas Creek Floodplains. The proposed project will match existing grades where floodplain encroachments occur and not cause backwater damages.

3. Crops No

   There are no crops located in the project area.

Traffic Impacts

The Project will not raise base flood elevations so there are no increased impacts to traffic.

1. Emergency Traffic Volume None
2. Emergency Supply or Evacuation Route None
3. Emergency Vehicle Access None
4. Practicable Detour Available None
5. School Bus or Mail Route None

Approximate Duration of Traffic Interruption for Base Flood

None

8 Project Evaluation

8.1 The Risk Associated with Implementation of the Action

The project does not have significant encroachments into the floodplain and therefore the risk associated with implementation of the project is minimal.

8.2 The Measures to Minimize Floodplain Impacts Associated with the Action

The impacts to the floodplain associated with the project are very minimal. The project's proposed grading will match into the existing topography and slope similarly to the existing conditions. For example, on the south edge of Modoc Road, the northern edge of the trail will be constructed to the same grades as the existing AC Dike and the trail will slope in the southern direction as does the existing topography.

8.3 The Measures to Restore and Preserve the Natural and Beneficial Floodplain Values Impacted by This Action

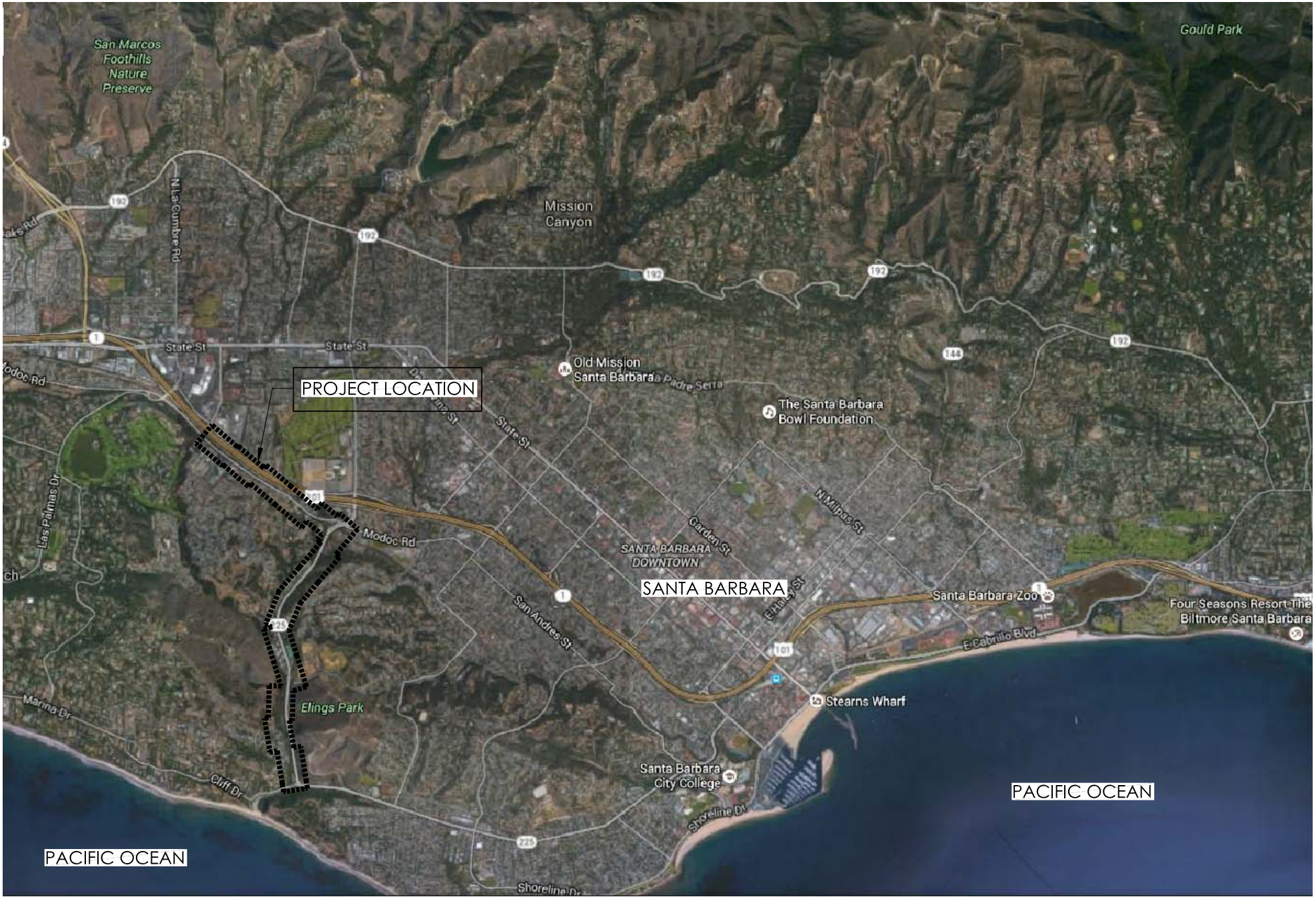
There are no identified significant impacts to the natural and beneficial floodplain values. No non-routine measures are required. All environmental impacts will be a result of construction activities and can be mitigated with standard measures such as revegetation and best management practices.

8.4 The Practicability of Alternatives to Any Significant Encroachments

Alternative alignments were considered and are shown on Figures 4 to 19. Comparing the proposed trail alignment to the alternatives, it is shown that the proposed alignment is strategically located outside of the floodplain to avoid encroachment or disturbance of the existing conditions. The alternatives were not selected mainly because they encroached into the floodplain and riparian zones.

9 Summary

The Multiuse Las Positas Trail Project will improve the area's connection to recreational resources and transportation network on a local and regional scale. The project does not intend to have a significant impact on Las Positas Creek nor Arroyo Burro Creek. Water surface elevations are not expected to change with the proposed improvements of the multiuse trail. The project proposes that the improvements that do encroach into the floodplain be graded to match existing topography as well as drainage patterns. This will in turn preserve the existing conditions in regards to drainage within the floodplain.

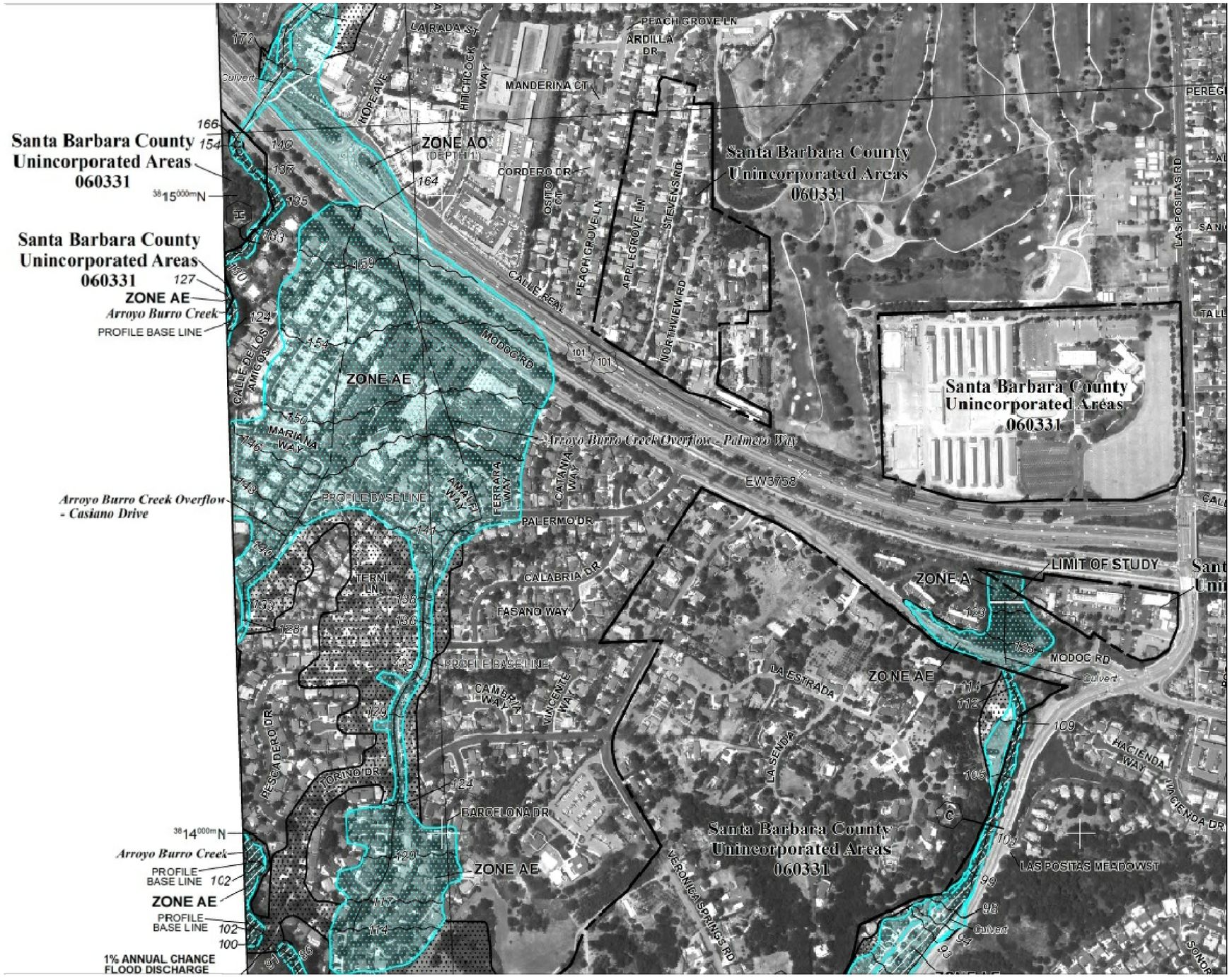


rrm design group

NORTH

FIGURE 1: VICINITY MAP

November 2016



NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1386H

FIRM

FLOOD INSURANCE RATE MAP

SANTA BARBARA COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL 1386 OF 1835

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SANTA BARBARA COUNTY UNINCORPORATED AREAS	060031	1386	H
SANTA BARBARA, CITY OF	060035	1386	H

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06083C1386H

MAP REVISED
NOVEMBER 4, 2015

Federal Emergency Management Agency

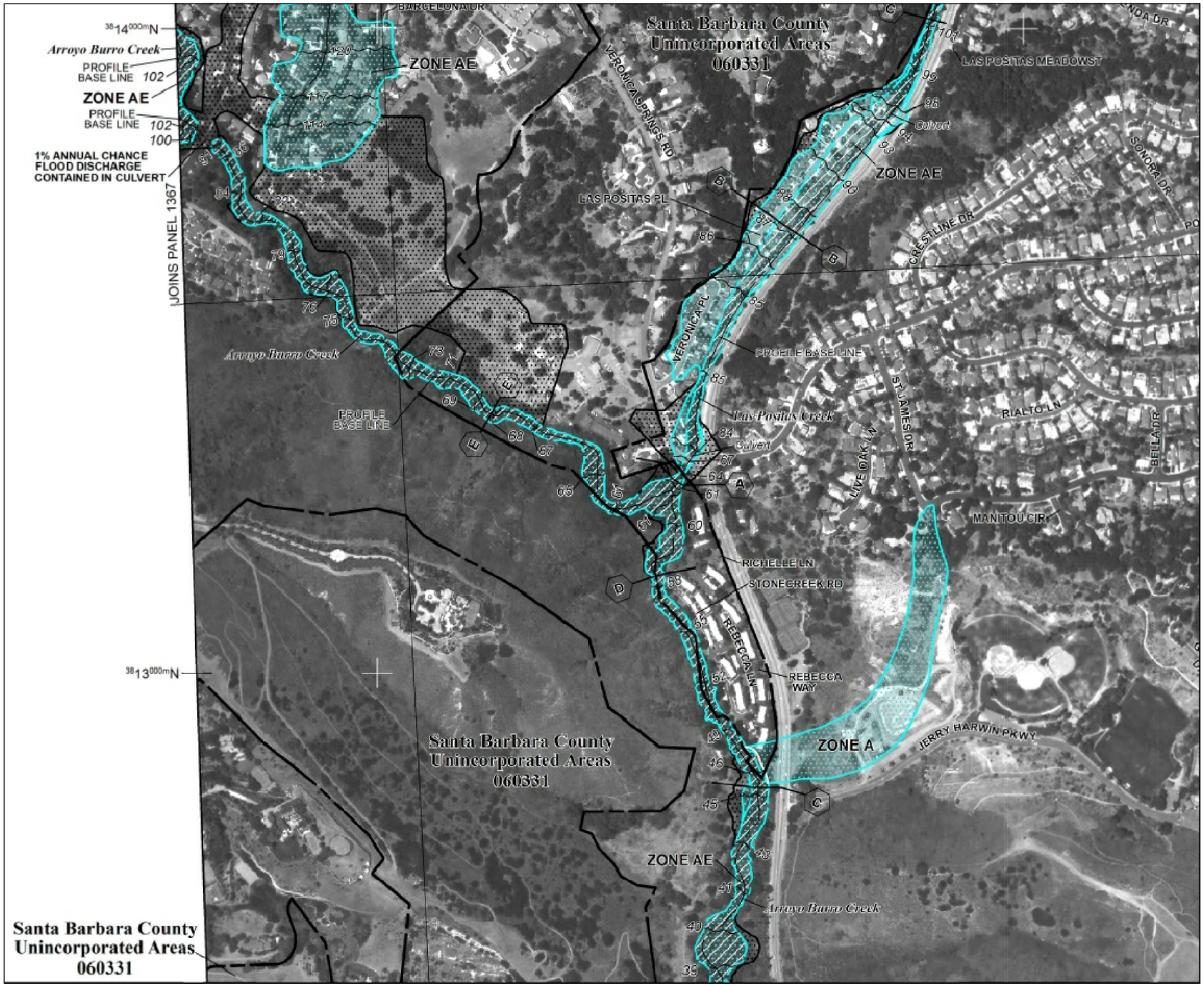
rrm design group

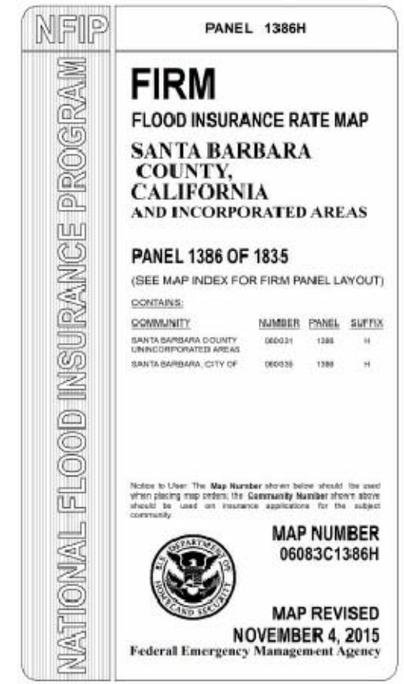
0 250 500 750 1,000 FEET

SCALE

NORTH

FIGURE 2: FIRM MAP





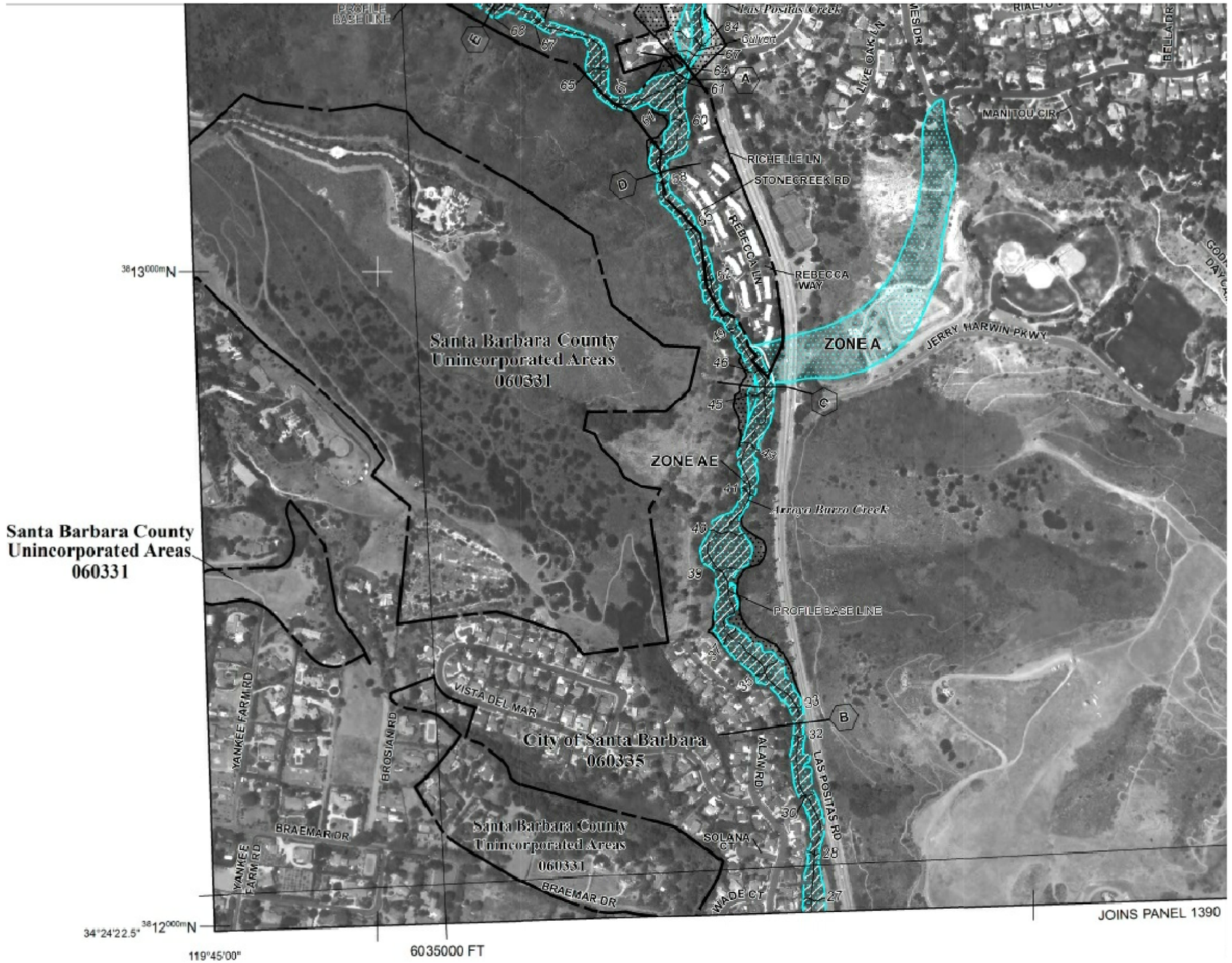
rrm design group

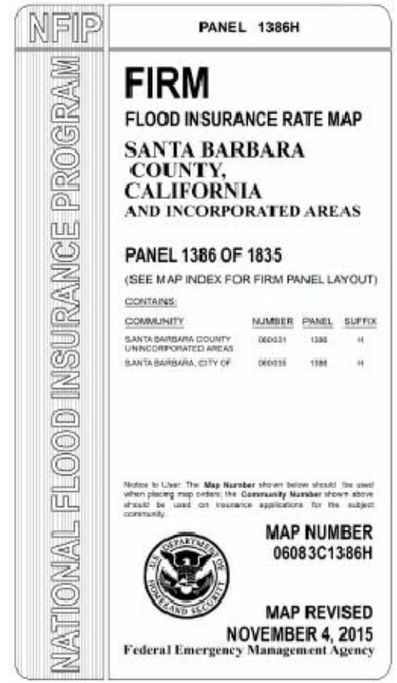
0 250 500 750 1,000 FEET

SCALE

NORTH

FIGURE 3: FIRM MAP





rrm design group

0 250 500 750 1,000 FEET

SCALE

NORTH

FIGURE 4: FIRM MAP

100-YEAR FLOODPLAIN

ARROYO BURRO CREEK OVERFLOW

FEMA FLOOD ZONE AE

PROJECT FLOODPLAIN ENCROACHMENT

PROJECT FLOODPLAIN ENCROACHMENT

MODOC ROAD

MODOC ROAD

CALLE DE LOS AMIGOS

PROPOSED TRAIL GRADING TO MATCH EXISTING TOPOGRAPHY (NO FILL)

CASA LA CUMBRE

PRIVATE DRIVE

VISTA DEL MONTE RETIREMENT COMMUNITY

PROPOSED TRAIL GRADING TO MATCH EXISTING TOPOGRAPHY (NO FILL)

MATCHLINE, SEE SHEET EX-1.02

LA CUMBRE CIRCLE

100-YEAR FLOODPLAIN

rrm design group

60 0 30 60 120

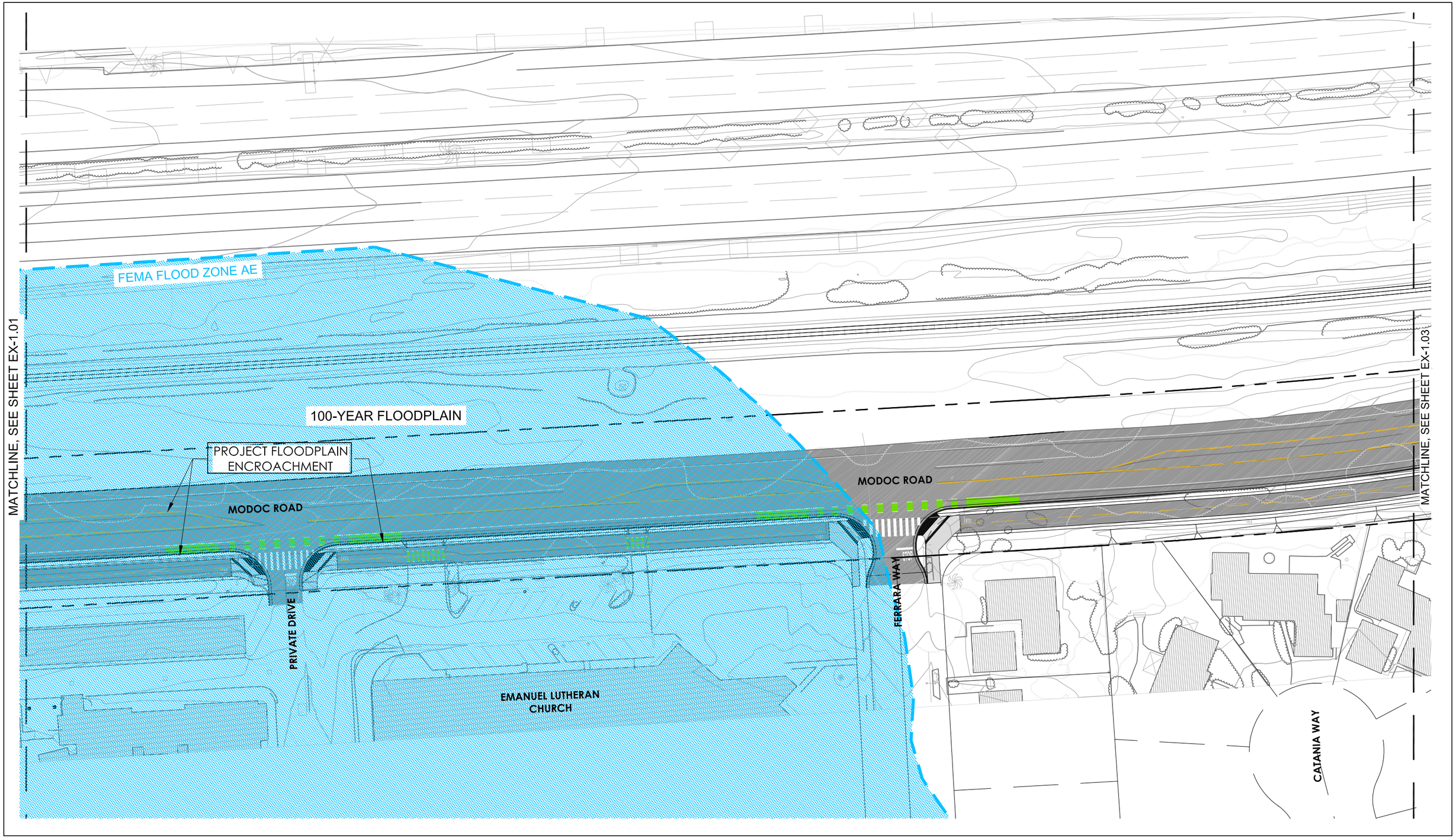
(IN FEET)

1 INCH = 60 FT.

NORTH

Location Hydraulic Study

EX-1.01



rrm design group

60 0 30 60 120

(IN FEET)

1 INCH = 60 FT.

NORTH

Location Hydraulic Study

EX-1.02

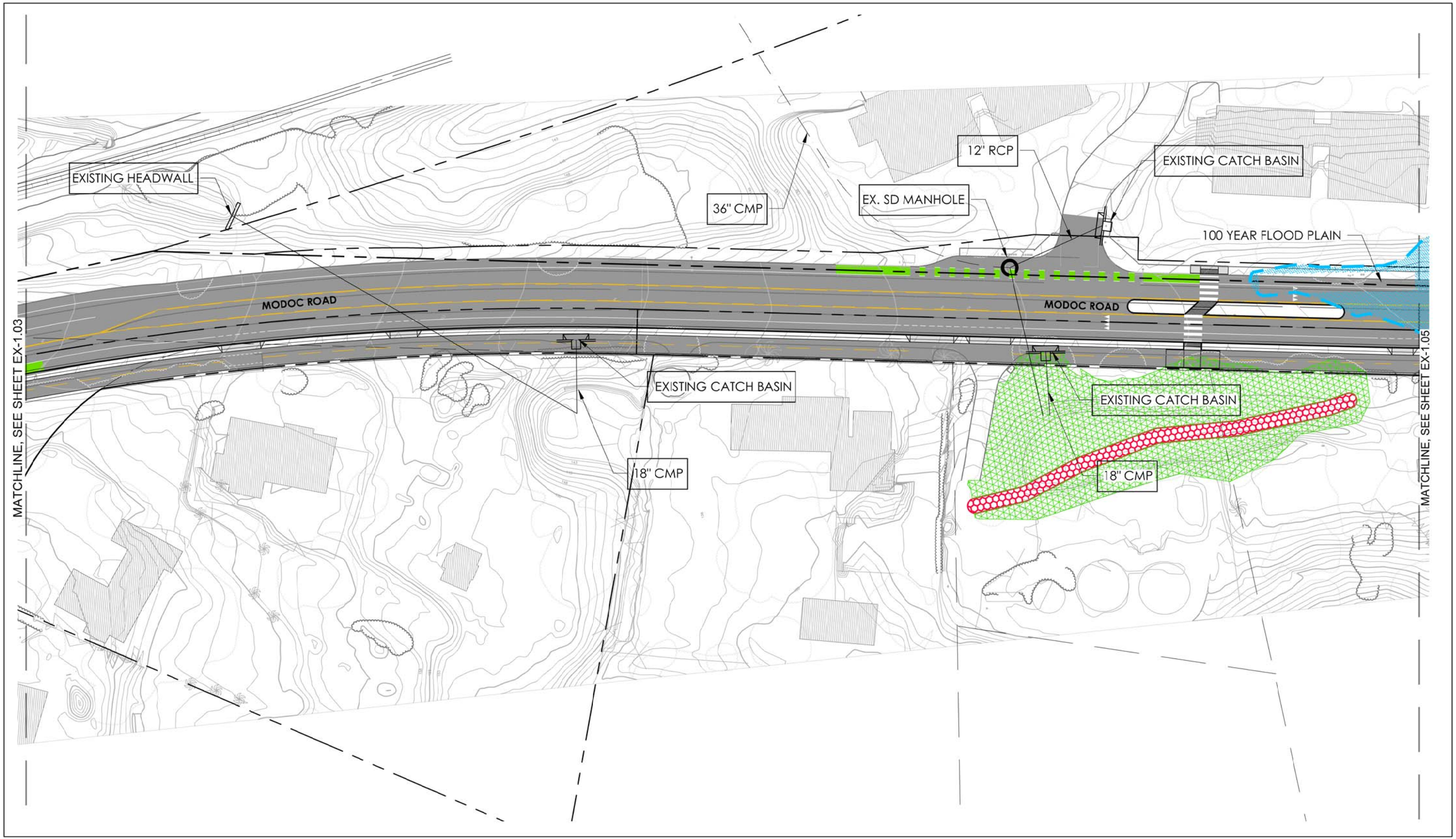
rrm design group

60 0 30 60 120

(IN FEET)
1 INCH = 60FT.

NORTH

Location Hydraulic Study EX-1.03



rrm design group

60 0 30 60 120

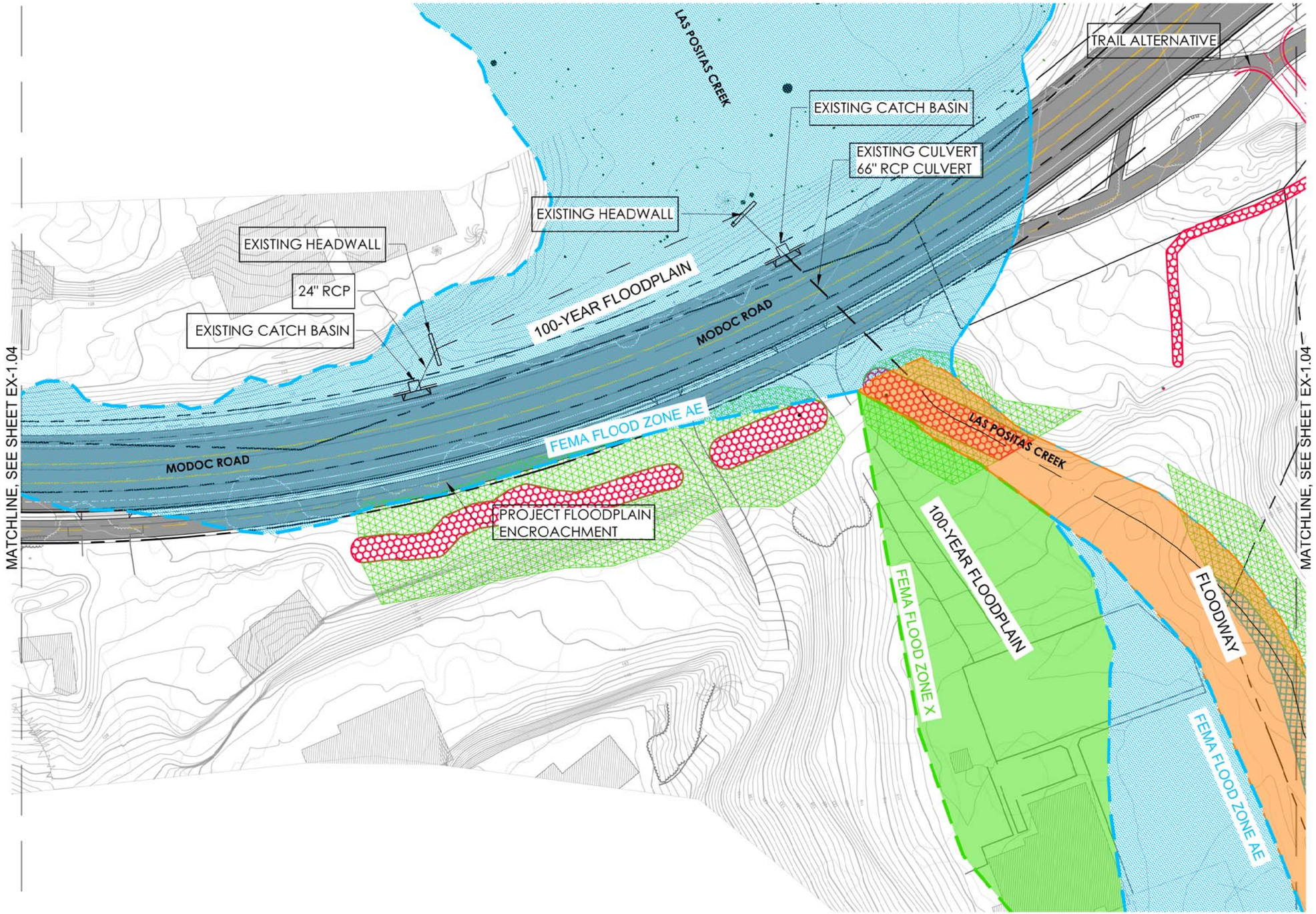
(IN FEET)

1 INCH = 60FT.

NORTH

Location Hydraulic Study

EX-1.04



rrm design group

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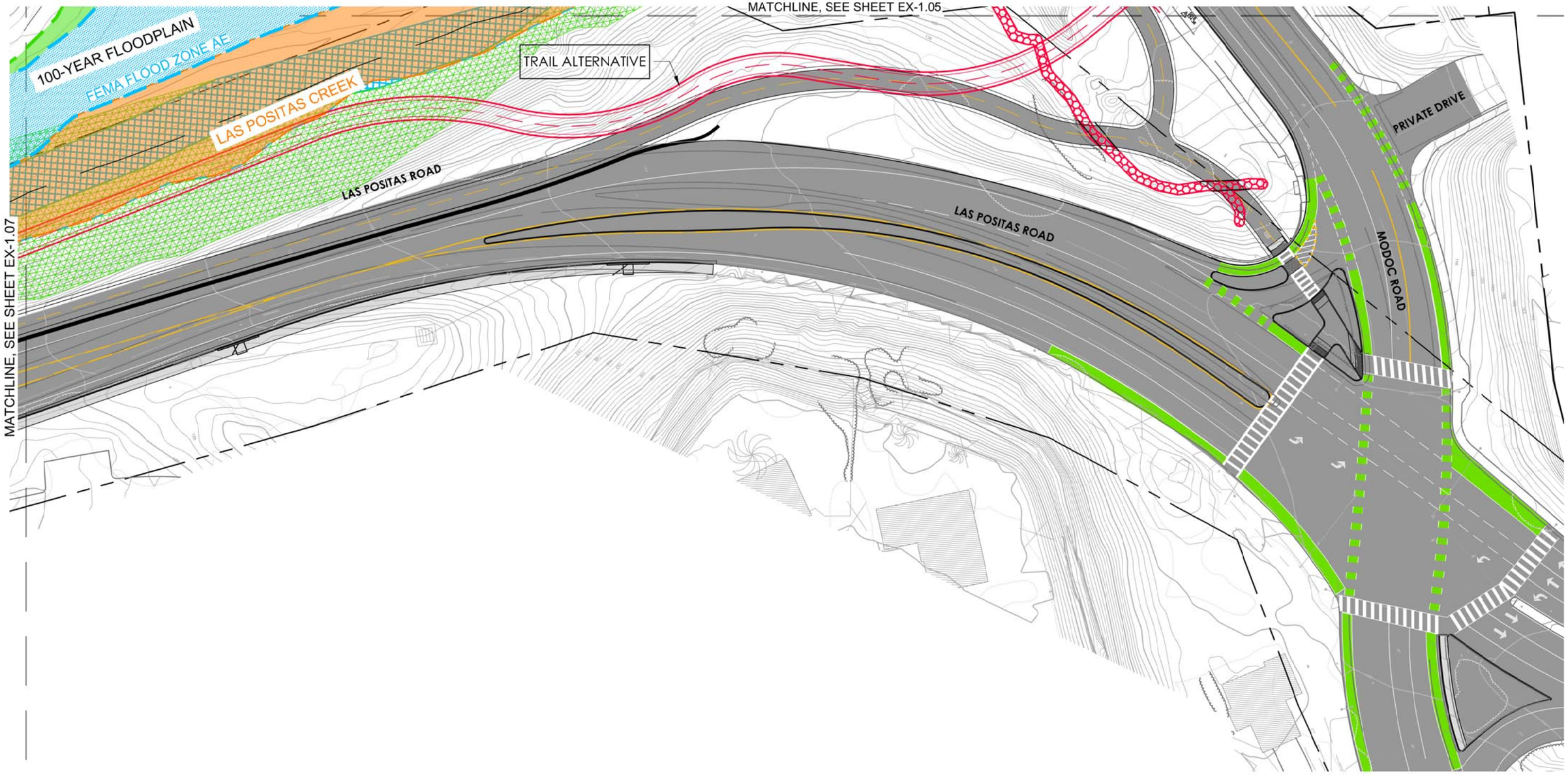
(IN FEET)
1 INCH = 60FT.

NORTH

Location Hydraulic Study

EX-1.05



rrm design group

60 0 30 60 120

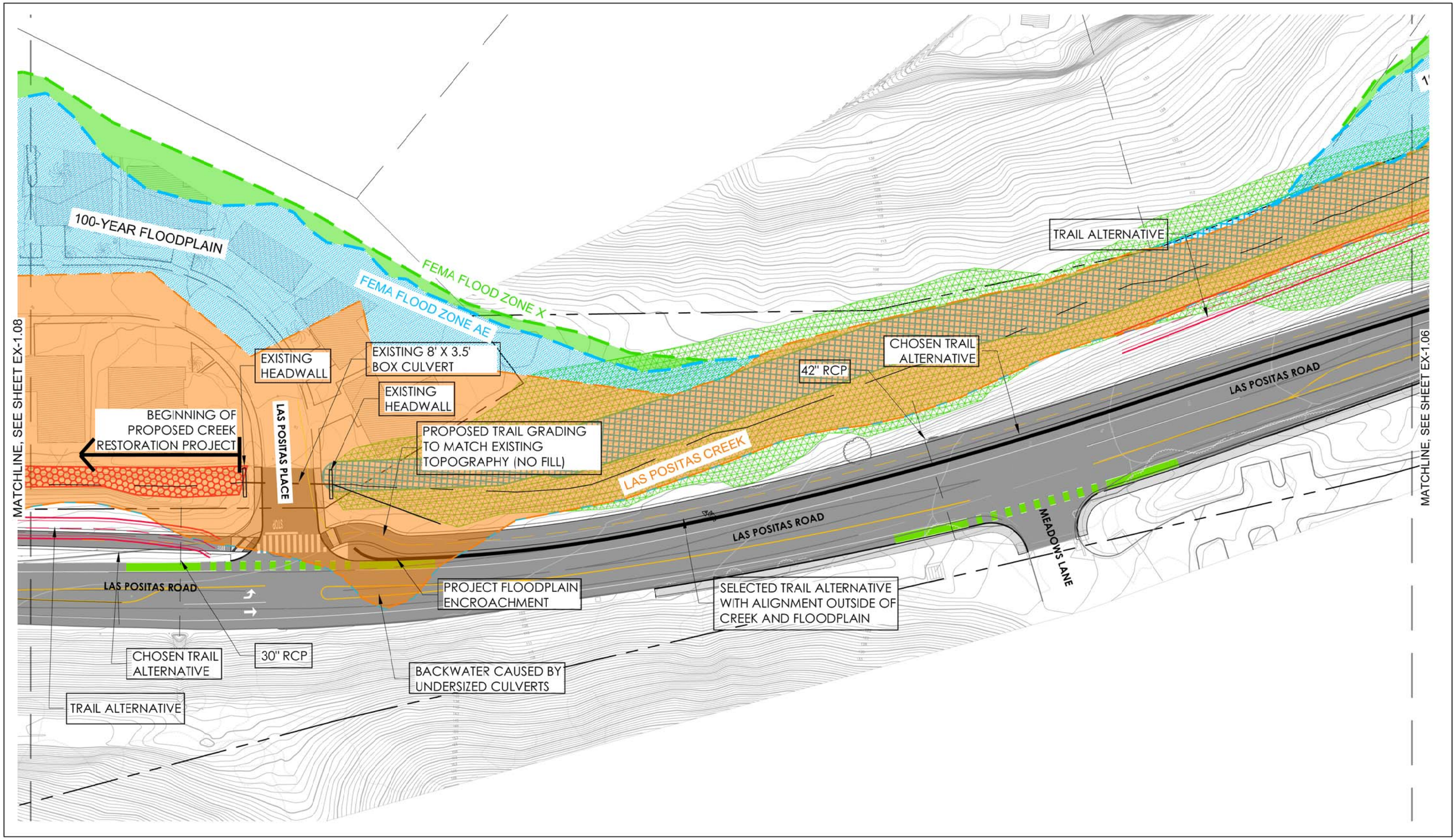
(IN FEET)

1 INCH = 60FT.

NORTH

Location Hydraulic Study

EX-1.06



rrm design group

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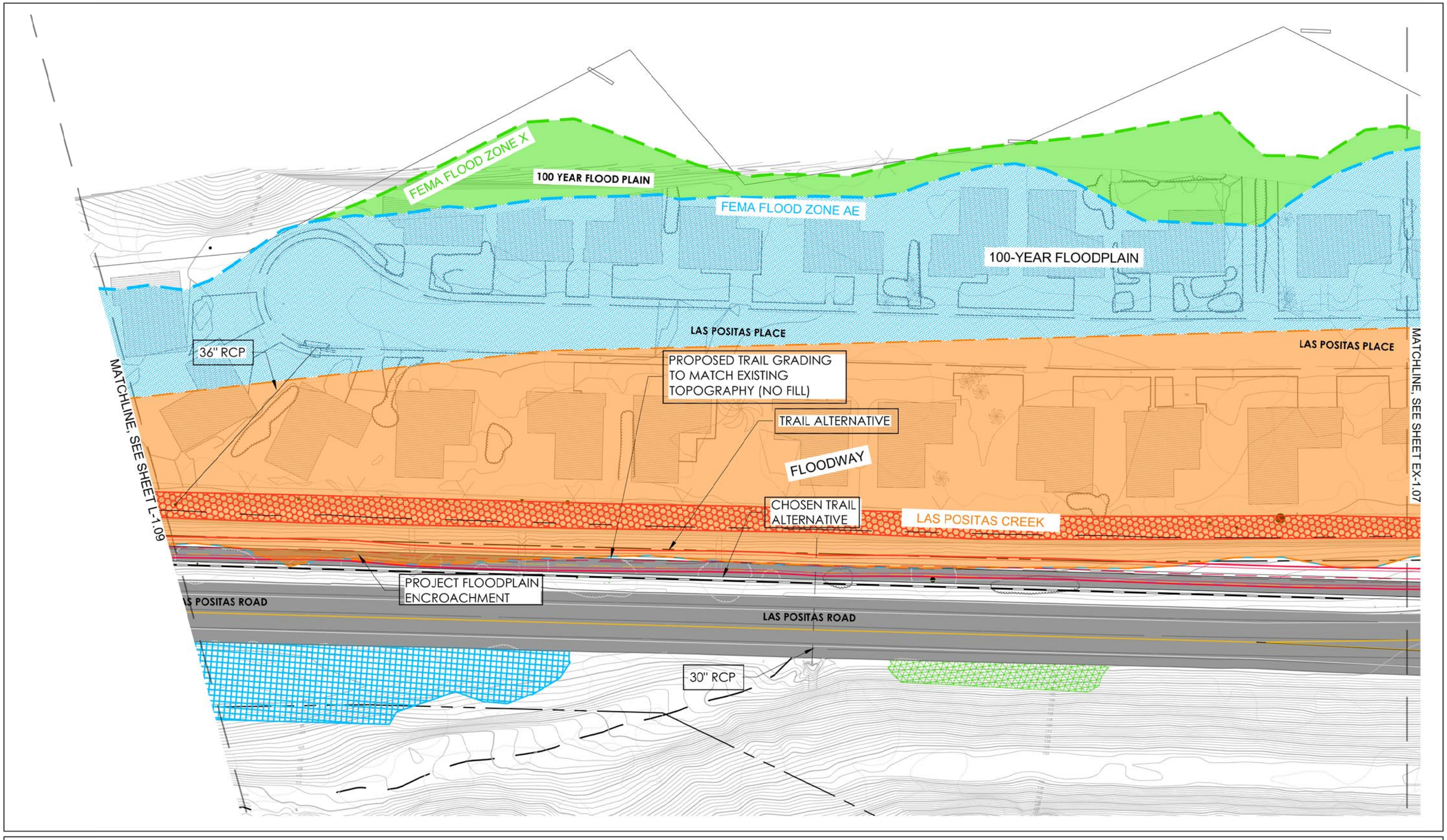
(IN FEET)

1 INCH = 60FT.

NORTH

Location Hydraulic Study EX-1.07



rrm design group

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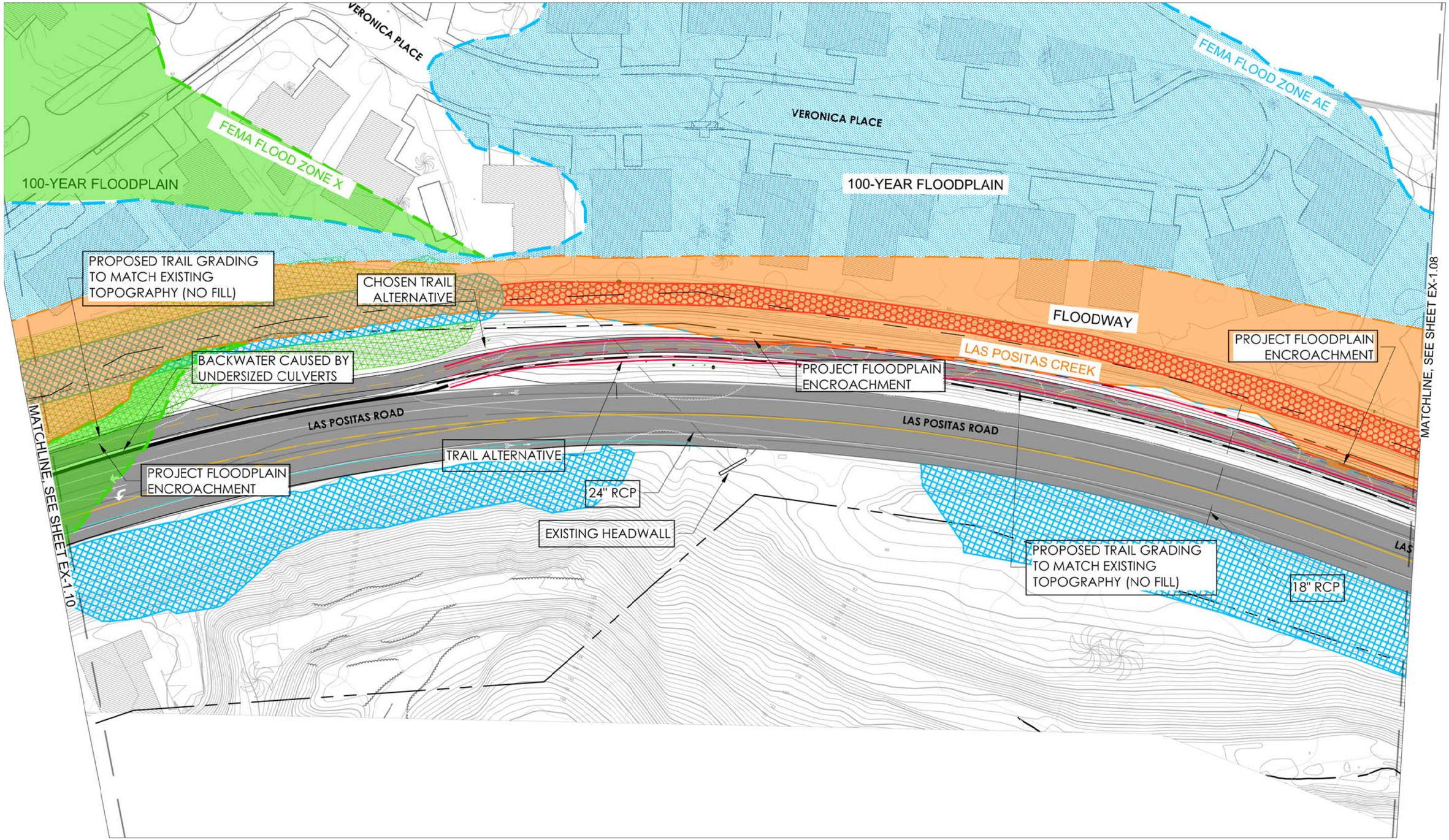
(IN FEET)
1 INCH = 60FT.

NORTH

Location Hydraulic Study EX-1.08



rrm design group

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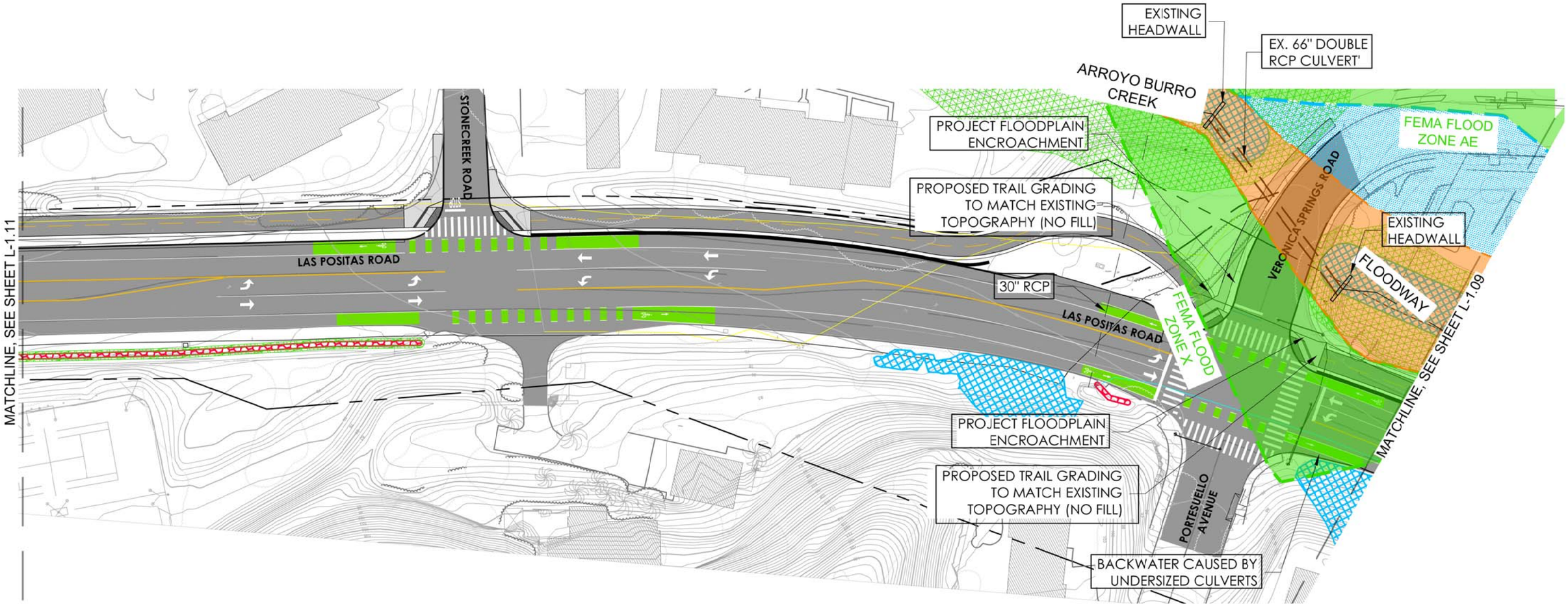
(IN FEET)
1 INCH = 60FT.

NORTH

Location Hydraulic Study EX-1.09



rrm design group

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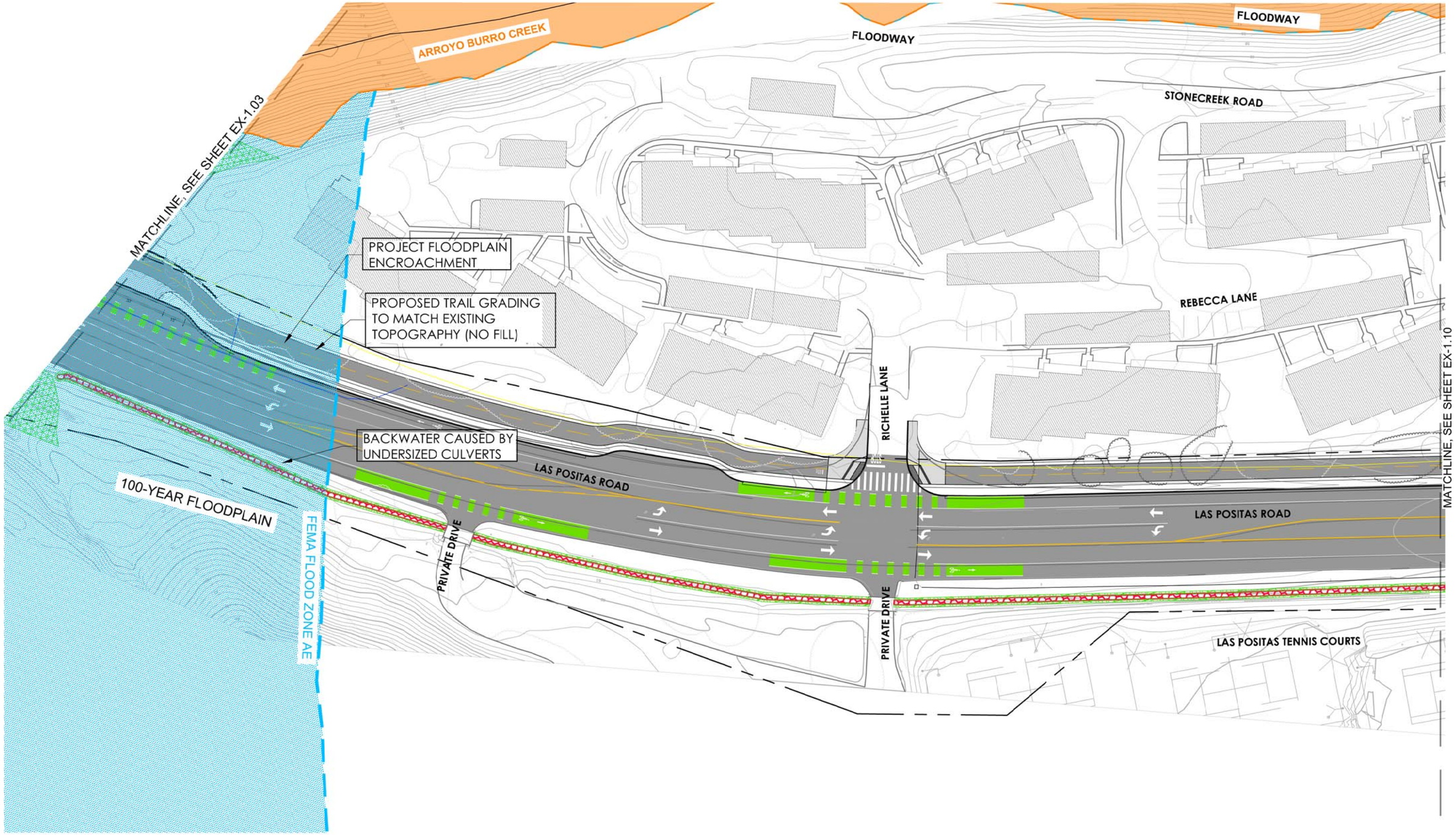
(IN FEET)
1 INCH = 60FT.

NORTH

Location Hydraulic Study EX-1.10



rrm design group

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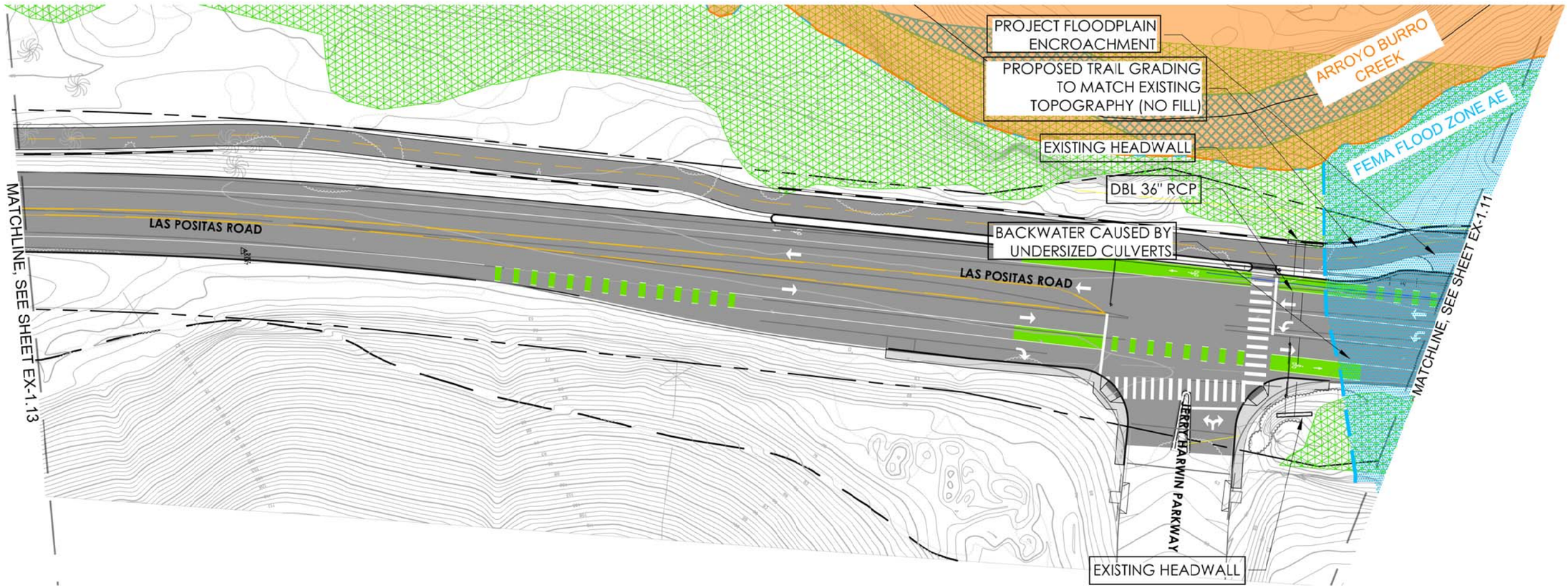
(IN FEET)

1 INCH = 60FT.

NORTH

Location Hydraulic Study EX-1.11



rrm design group

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(IN FEET)

1 INCH = 60FT.

NORTH

Location Hydraulic Study EX-1.12

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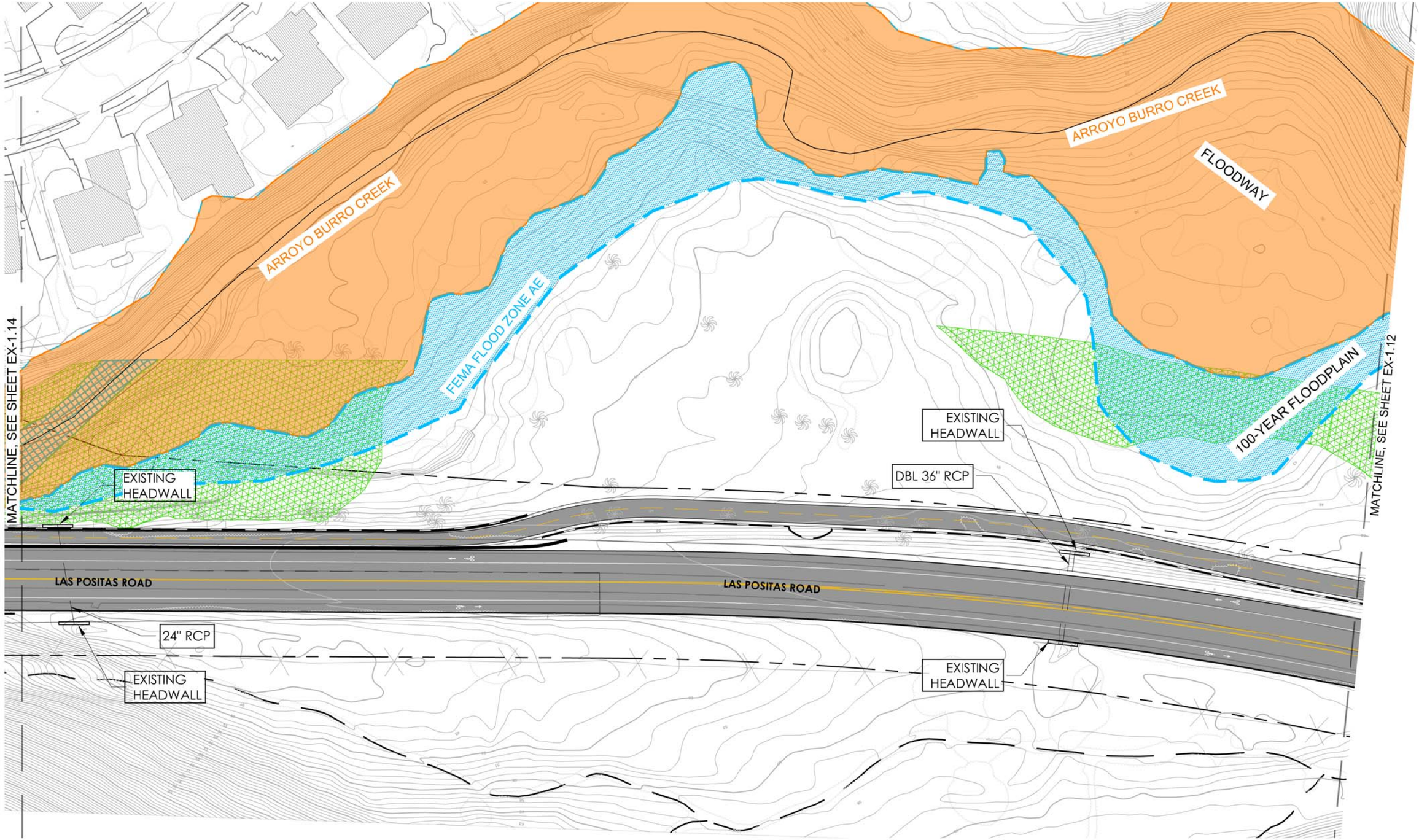

rrm design group

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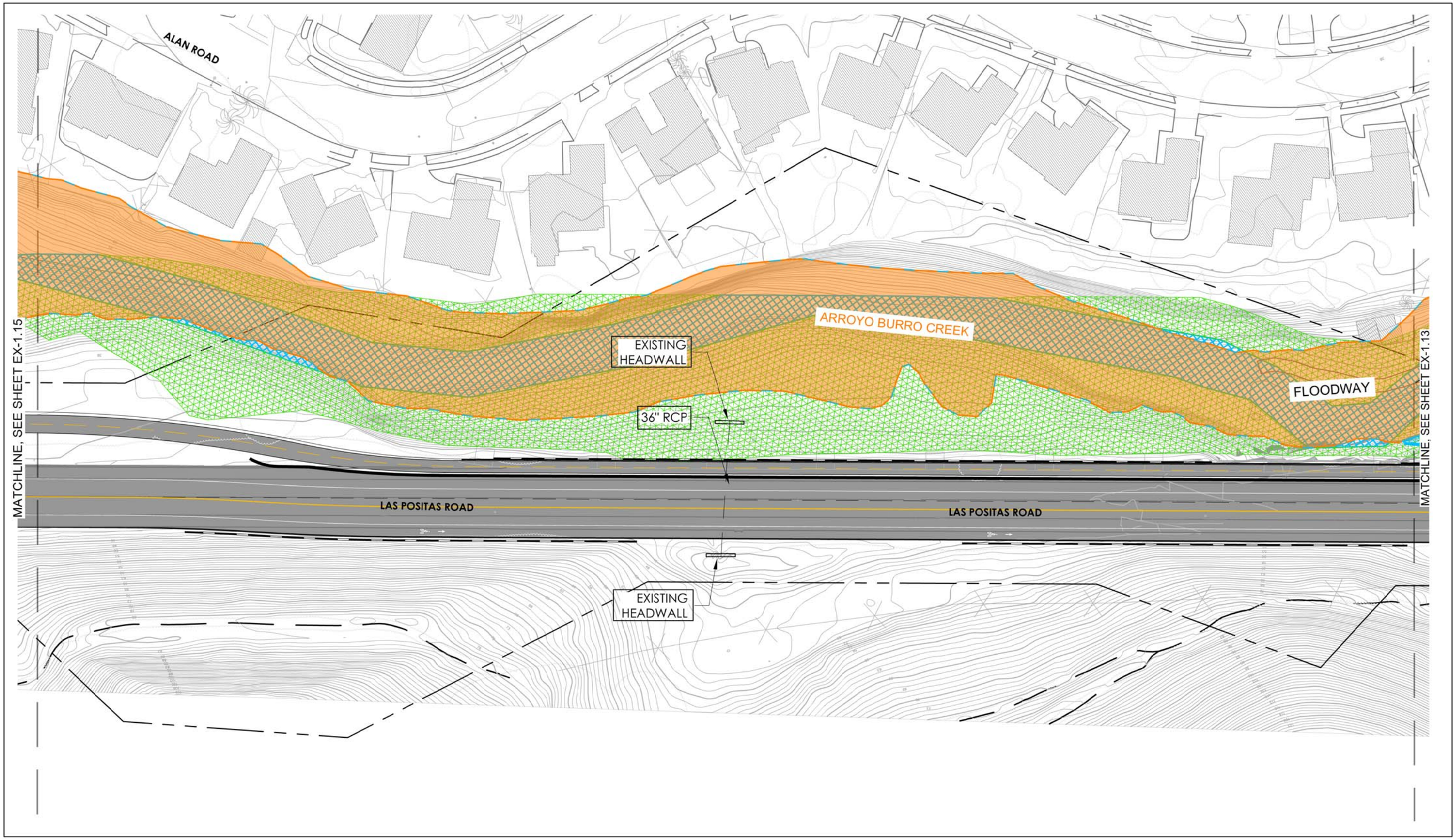
(IN FEET)
1 INCH = 60FT.

NORTH

Location Hydraulic Study EX-1.13



rrm design group

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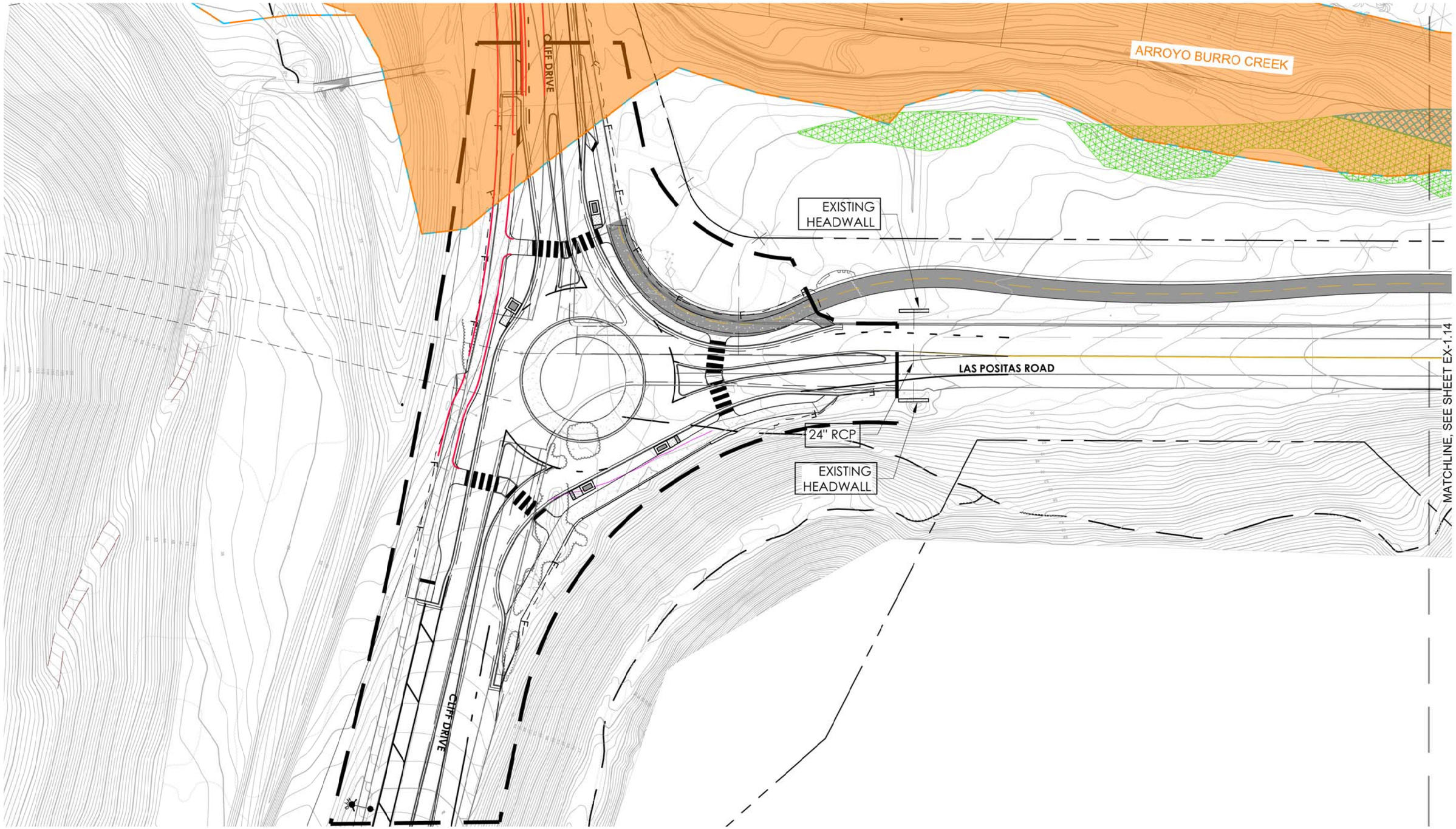
(IN FEET)

1 INCH = 60FT.

NORTH

Location Hydraulic Study EX-1.14



rrm design group

60 0 30 60 120

(IN FEET)
1 INCH = 60FT.

NORTH

Location Hydraulic Study EX-1.15