

SCVURPPP C.3 Workshop
April 29, 2025

GSI Handbook and Detail Updates

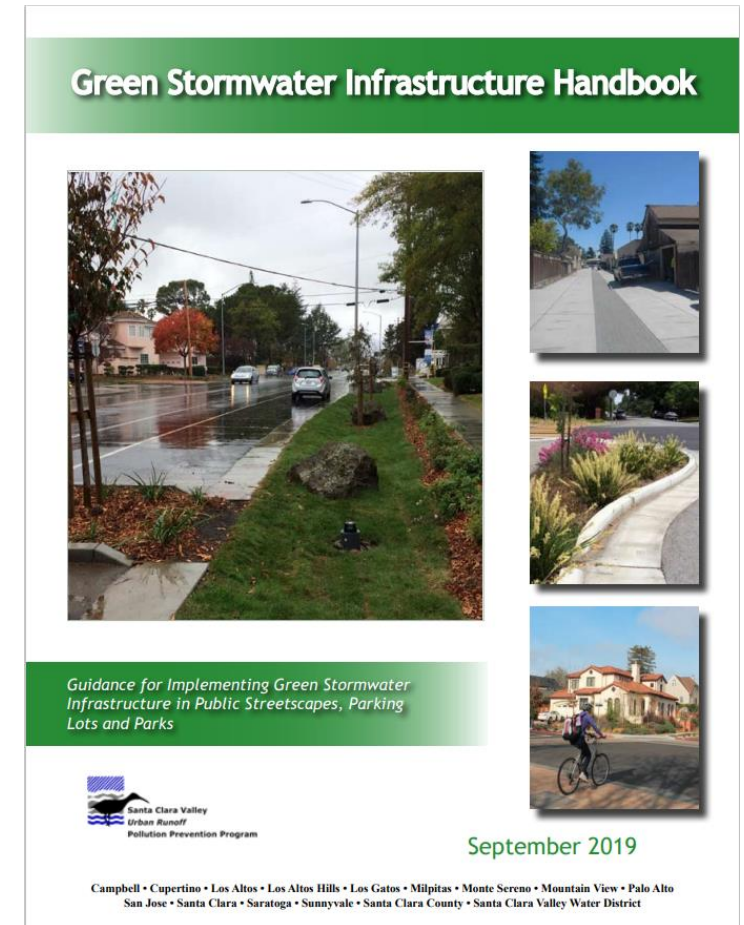
Jill Bicknell, P.E., and Renee Crawford, P.E.
Santa Clara Valley Urban Runoff Pollution Prevention Program

Presentation Overview

- Summary of GSI Handbook
- Part 1 – Guidelines Updates
- Part 2 – GSI Typical Details
- Overview of GSI Detail Updates
- Discussion of Selected GSI Details

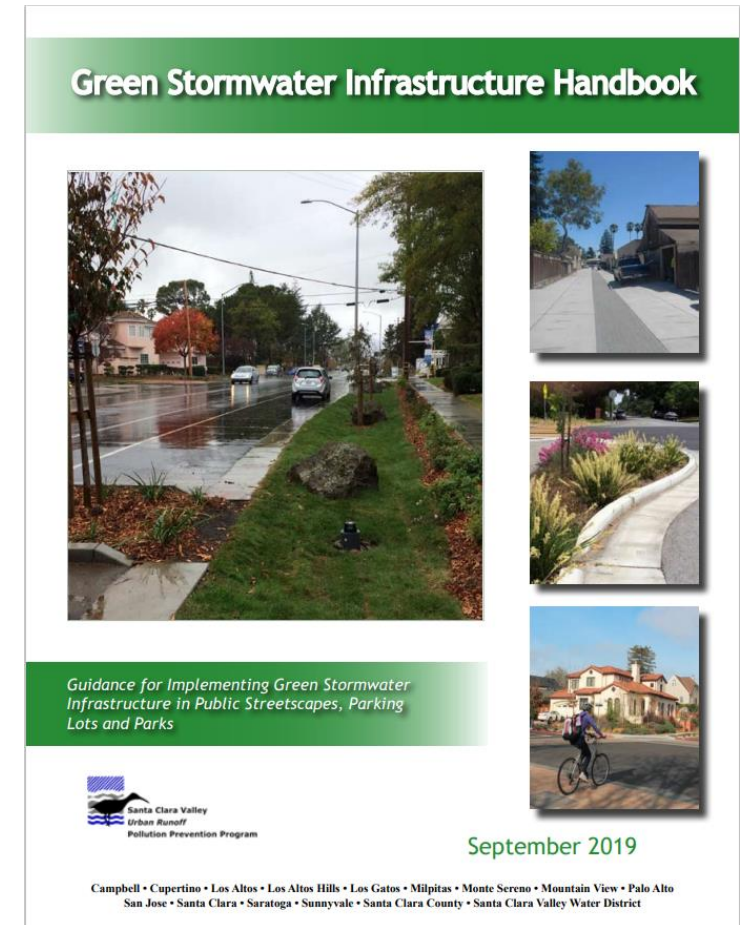
Summary of GSI Handbook

- MRP required GSI Plans to include general design guidelines, details, and specifications
- SCVURPPP members requested county-wide guidance document
- Covers integration of GSI with public streets, parking lots, and parks
- Companion to C.3 Stormwater Handbook (guidance for Regulated Projects)



Summary of GSI Handbook

- Parts of the GSI Handbook
 - Part 1 – General Guidelines
 - Part 2 – Typical Details & Design Specifications



Part 1: Guidelines Updates

- Information on the new and changed regulated project thresholds and requirements in MRP 3.0
- New guidance on mulch, including links to and discussion of the new regional Biotreatment Wood Mulch specification
- New guidance on integrating complete streets and green streets
- New photos and graphics
- Updated hyperlinks and references



Photo credits: EOA

GSI Typical vs. Standard Details

- Typical Details
 - Comprehensive examples
 - Offer good indications of elements to include
 - May not be directly applicable to Agency requirements
 - Are provided as guidance and must be modified prior to use for construction purposes to reflect specific project conditions and local requirements
 - Do not incorporate ADA, AASHTO, Agency design standards, etc.
- Standard Details
 - Intended to be used in their issued form

Green Stormwater Infrastructure Handbook Part 2

Guidance for Integrating Green Stormwater Infrastructure in Public Streetscapes,
Parking Lots and Parks

SEPTEMBER 2019

Prepared for the
Santa Clara Valley Urban Runoff
Pollution Prevention Program
by EOA, Inc.

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Courtney Siu, P.E.
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SCVURPPP GSI Detail Updates

- Original details adapted from SFPUC GI details
- Focused on Pervious Pavement and Bioretention
- Updates based on:
 - Co-Permittee comments received in 2020
 - SFPUC Detail updates in 2023
- Affected 76 Details
- Removed two (2) Details
 - End of Block Monitoring

Update Types

- Incorporated additional Designer responsibilities
- Removed SFPUC-specific conditions/references and added SCVURPPP-specific vocabulary and references
- Added reference to Interlocking Concrete Paver Institute (ICPI) Design Manual
- Provided facility component clarifications and uses
- Modified Edge Treatments
- Updated Specification references
- Clarified Stormwater Curb Extension types and dimensions
- Updated Underdrain and Observation Port details (in progress)

Selected Updated Details

Clarifications and References

PURPOSE:

PERVIOUS PAVEMENT (PAVEMENT) CONTROLS PEAK FLOWS AND VOLUMES OF STORMWATER RUNOFF VIA INFILTRATION THROUGH THE PAVEMENT SURFACE, STORAGE IN THE PAVEMENT SECTION, INFILTRATION INTO NATIVE SOIL, AND OVERFLOW THROUGH OPTIONAL SUBSURFACE OUTLETS (WHERE REQUIRED). RUNOFF IS TREATED AS IT INFILTRATES INTO UNDERLYING NATIVE SOIL. PER MS4 PERMIT, **OUTFLOW FROM PERMEABLE PAVEMENT IS CONSIDERED UNTREATED.**

DESIGNER NOTES & GUIDELINES:

- THE DESIGNER MUST ADAPT PLAN, SECTION DRAWINGS, AND CALCULATE DEPTH TO ADDRESS SITE-SPECIFIC CONDITIONS.
- ALL PAVEMENT SYSTEMS MUST BE DESIGNED BY A LICENSED ENGINEER IN ACCORDANCE WITH AASHTO, **INTERLOCKING CONCRETE PAVEMENT INSTITUTE DESIGN MANUAL**, OR CALTRANS DESIGN MANUAL BASED ON SITE-SPECIFIC CONDITIONS INCLUDING TRAFFIC LOADS AND SUBGRADE CONDITIONS. PAVEMENT SECTIONS SET FORTH IN THESE TYPICAL DETAILS ARE PROVIDED TO REPRESENT THE ANTICIPATED RANGE OF DESIGN REQUIREMENTS, BASED ON "GOOD" AND "POOR" SOIL CHARACTERIZATIONS NORMALLY ENCOUNTERED IN MUNICIPALITY. **ACTUAL SECTION DEPTHS MUST BE DETERMINED AS DESCRIBED IN GUIDELINE #3, BELOW.** SEE TABLES BELOW FOR TRAFFIC LOADING AND EFFECTIVE ROADBED SOIL RESILIENT MODULUS ASSUMPTIONS USED IN DEVELOPING THESE TYPICAL SECTIONS.

TRAFFIC LOADING ASSUMPTIONS:

DESIGN ASSUMPTION	MODERATE VEHICULAR	LIGHT VEHICULAR	PEDESTRIAN
EQUIVALENT SINGLE AXLE LOADS*	2,000,000	40,000	800
TRAFFIC INDEX (TI)**	10	6.5	4
* SEE AASHTO GUIDE FOR DESIGN OF PAVEMENT STRUCTURES FOR DEFINITIONS			
** SEE CALTRANS HIGHWAY DESIGN MANUAL FOR DEFINITIONS			

SUBGRADE ASSUMPTIONS:

DESIGN ASSUMPTION	GOOD SOILS	POOR SOILS
EFFECTIVE ROADBED SOIL RESILIENT MODULUS, M (PSI)*	6,800	3,700
CALIFORNIA R-VALUE, R **	33.3	15.6
DRAINAGE COEFFICIENT, m *	1.15	0.75
LAYER COEFFICIENT, a * FOR OPEN GRADED AGGREGATE BASE	0.08	
* SEE AASHTO GUIDE FOR DESIGN OF PAVEMENT STRUCTURES FOR DEFINITIONS		
** SEE CALTRANS HIGHWAY DESIGN MANUAL FOR DEFINITIONS		

- GEOTECHNICAL EVALUATION OF SUBGRADE SOILS TO VERIFY THEIR STRUCTURAL SUITABILITY FOR PERVIOUS PAVEMENT INSTALLATIONS IS REQUIRED.
- GEOTECHNICAL EVALUATION OF SEASONAL HIGH GROUND. WATER LEVEL IS REQUIRED TO VERIFY MINIMUM 5 FT. SEPARATION BETWEEN BASE OR RESERVOIR COURSE AND GROUNDWATER.
- THE PERVIOUS PAVEMENT FACILITY MUST BE DESIGNED TO PROVIDE SUFFICIENT SUBSURFACE STORAGE IN THE PAVEMENT SECTION TO MEET PROJECT HYDROLOGIC PERFORMANCE GOALS. THE SECTION THICKNESS WILL BE A FUNCTION OF THE SUBGRADE INFILTRATION RATE (DRAINAGE COEFFICIENT), SUBGRADE SLOPE, AND THE HEIGHT AND SPACING OF SUBSURFACE CHECK DAMS. SEE **PC 2.1** AND **PC 2.2**.
- ENTIRE PAVEMENT BASE SECTION MAY BE USED TO MEET SUBSURFACE STORAGE REQUIREMENTS.
- SUBSURFACE STORAGE DRAWDOWN TIME (I.E. TIME FOR MAXIMUM SUBSURFACE STORAGE VOLUME TO INFILTRATE INTO SUBGRADE AFTER THE END OF A STORM) SHOULD NOT EXCEED 48 HOURS. DRAWDOWN TIME IS CALCULATED AS THE MAXIMUM SUBSURFACE PONDING DEPTH DIVIDED BY THE NATIVE SOIL INFILTRATION RATE.
- THE DESIGNER MUST ENSURE THAT THE PAVEMENT EDGES ARE RESTRAINED AND THAT WATER IS CONTAINED IN THE PAVEMENT SECTION AS NEEDED TO PROTECT ADJACENT PAVEMENT SECTIONS OR STRUCTURES. SEE EDGE TREATMENTS (**PC 1.1** THROUGH **PC 1.6**) FOR GUIDANCE ON DESIGN OF THESE COMPONENTS.
- THE DESIGNER MUST EVALUATE UTILITY SURVEYS FOR POTENTIAL UTILITY CROSSINGS OR CONFLICTS. REFER TO **GC 2.1 - GC 2.12** FOR UTILITY CROSSING DETAILS AND **GC 1.4 - GC 4.4** FOR UTILITY CROSSING CONFLICT DETAILS OR OTHER MUNICIPAL DETAILS.
- ALL PERVIOUS PAVEMENT DESIGN MUST COMPLY WITH MUNICIPAL STANDARDS ACCESSIBILITY/ADA REQUIREMENTS.

RELATED COMPONENTS


EDGE TREATMENTS:	<table border="1"><tr><td>PC 1.1</td><td>PC 1.6</td></tr></table>	PC 1.1	PC 1.6
PC 1.1	PC 1.6		
CHECK DAMS:	<table border="1"><tr><td>PC 2.1</td><td>PC 2.2</td></tr></table>	PC 2.1	PC 2.2
PC 2.1	PC 2.2		
OVERFLOWS:	<table border="1"><tr><td>PC 3.1</td><td>PC 3.3</td></tr></table>	PC 3.1	PC 3.3
PC 3.1	PC 3.3		
LINERS:	<table border="1"><tr><td>GC 1.1</td><td>GC 1.2</td></tr></table>	GC 1.1	GC 1.2
GC 1.1	GC 1.2		
UTILITY CROSSINGS:	<table border="1"><tr><td>GC 2.1</td><td>GC 2.12</td></tr></table>	GC 2.1	GC 2.12
GC 2.1	GC 2.12		
UTILITY CONFLICTS:	<table border="1"><tr><td>GC 3.1</td><td>GC 3.4</td></tr></table>	GC 3.1	GC 3.4
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OBSERVATION PORTS:	<table border="1"><tr><td>GC 4.1</td><td>GC 4.3</td></tr></table>	GC 4.1	GC 4.3
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CLEANOUTS:	<table border="1"><tr><td>GC 5.1</td></tr></table>	GC 5.1	
GC 5.1			

RELATED SPECIFICATIONS

RELATED SPECIFICATIONS	SFPUC CSI NO.*
PERMEABLE/POROUS UNIT PAVERS: - PERMEABLE /POROUS UNIT PAVERS - JOINT FILLER AGGREGATE - PAVEMENT BASE - EDGE RESTRAINTS - GEOTEXTILE FOR SOIL SEPARATION	32 14 43
PERVIOUS CONCRETE PAVEMENT: - PERVIOUS CONCRETE - PAVEMENT BASE - GEOTEXTILE FOR SOIL SEPARATION	32 13 43
POROUS ASPHALT PAVEMENT: - POROUS ASPHALT - PAVEMENT BASE - GEOTEXTILE FOR SOIL SEPARATION	32 12 43

*REFER TO SCVURPPP GSI HANDBOOK PART 2 FOR SFPUC SPECIFICATIONS

NOTES		KEY MAP	SECTIONS		
PP 1.1	PP 1.2	PP 1.3	PP 2.1	PP 3.1	PP 4.1

	GREEN INFRASTRUCTURE TYPICAL DETAILS	DATE OCTOBER 2024	PERVIOUS PAVEMENT DESIGNER NOTES (1 OF 2)	SPC NO. PP 1.1
	DETAIL ADAPTED FROM SAN FRANCISCO PUBLIC UTILITIES COMMISSION PP 1.1	VERSION 2.0		
		REVISION		

Clarifications and References

RELATED SPECIFICATIONS	SFPUC CSI NO.*
PERMEABLE/POROUS UNIT PAVERS: <ul style="list-style-type: none"> - PERMEABLE /POROUS UNIT PAVERS - JOINT FILLER AGGREGATE - PAVEMENT BASE - EDGE RESTRAINTS - GEOTEXTILE FOR SOIL SEPARATION 	32 14 43
PERVIOUS CONCRETE PAVEMENT: <ul style="list-style-type: none"> - PERVIOUS CONCRETE - PAVEMENT BASE - GEOTEXTILE FOR SOIL SEPARATION 	32 13 43
POROUS ASPHALT PAVEMENT: <ul style="list-style-type: none"> - POROUS ASPHALT - PAVEMENT BASE - GEOTEXTILE FOR SOIL SEPARATION 	32 12 43

***REFER TO SCVURPPP GSI HANDBOOK PART 2 FOR SFPUC SPECIFICATIONS**

Clarifications and References

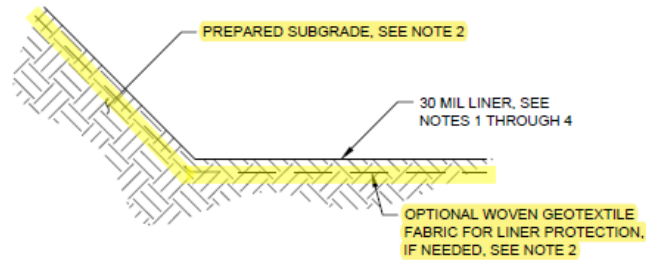
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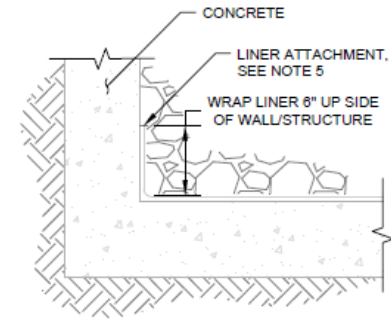
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SCVURPPP- Specific Typical Details



IMPERMEABLE LINER

1

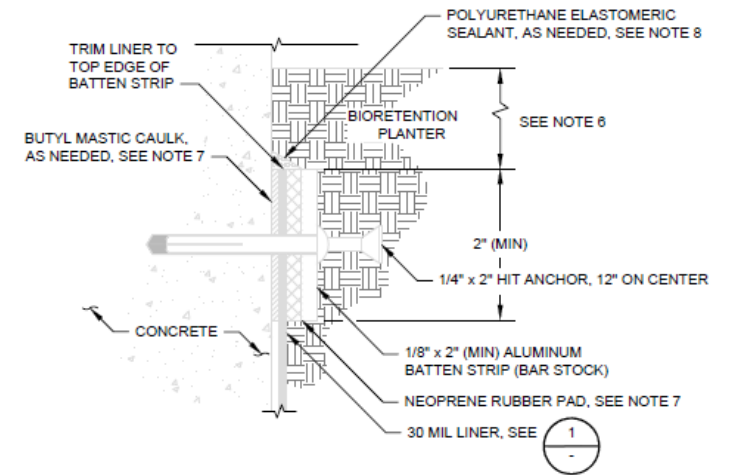


SOIL TIGHT LINER ATTACHMENT AT WALL/STRUCTURE

2

CONSTRUCTION NOTES:

1. WATERPROOFING AND/OR LINER SYSTEM TO BE DESIGNED AND INSTALLED BY WATERPROOFING PROFESSIONAL. POTENTIAL LINER MATERIALS TO BE CONSIDERED INCLUDE: HDPE (HIGH DENSITY POLYETHYLENE), CPSE (CHLOROSULFONATED POLYETHYLENE), OR LLDPE (LINEAR LOW DENSITY POLYETHYLENE).
2. LINER SHALL LAY FLUSH WITH GROUND WITH NO AIR VOIDS BELOW THE LINER PRIOR TO BACKFILLING MATERIAL ABOVE THE LINER AND REMOVE ALL SHARP ROCKS AND DEBRIS. IF SUBGRADE SOIL CONTAINS ANGULAR ROCKS/DEBRIS, INSTALL WOVEN GEOTEXTILE FABRIC OVER SUBGRADE TO PROTECT LINER FROM PUNCTURE. CONTOUR THE SUBGRADE AS NEEDED TO ENSURE LINER LAYS FLUSH WITH GROUND.
3. OVERLAP LINER PER MANUFACTURER'S RECOMMENDATIONS.
4. ALL SEAMS SHALL BE WELDED PER MANUFACTURER'S RECOMMENDATIONS UNLESS OTHERWISE SPECIFIED.
5. SECURE LINER CONTINUOUSLY WITH DOUBLE-SIDED TAPE ALONG LINER EDGE AND SINGLE SIDED TAPE ALONG THE TOP EDGE OF LINER TO HOLD LINER IN PLACE DURING BACKFILLING.
6. TOP OF LINER TO BE AT LEAST 3 INCHES BELOW FINISHED GRADE OF BIOTREATMENT SOIL MIX EXCEPT WHEN ADJACENT TO BUILDING WALL. WHEN ADJACENT TO BUILDING WALL, LINER OR EQUAL WATER PROOFING SHALL EXTEND TO TOP OF FREEBOARD ELEVATION.
7. APPLY BATTEN STRIP, AND NEOPRENE RUBBER PAD CONTINUOUSLY ALONG TOP EDGE OF LINER. FOR WATER-TIGHT APPLICATIONS, ALSO APPLY BUTYL MASTIC CAULK.
8. FOR WATER-TIGHT APPLICATIONS, APPLY BEAD OF POLYURETHANE ELASTOMERIC SEALANT CONTINUOUSLY ALONG TOP EDGE OF BATTEN STRIP ASSEMBLY.



WATER TIGHT LINER ATTACHMENT AT WALL/STRUCTURE

3

NOTES COMPONENTS

GC	GC
1.1	1.2

DWG NO.

GC
1.2



GREEN INFRASTRUCTURE TYPICAL DETAILS

DETAIL ADAPTED FROM SAN FRANCISCO PUBLIC
UTILITIES COMMISSION GC 1.2

DATE	OCTOBER 2024
VERSION	1.0
REVISION	

GENERAL COMPONENTS LINERS LINERS AND ATTACHMENTS

DATE

SCVURPPP-Specific Typical Details

6. TOP OF LINER TO BE AT LEAST 3 INCHES BELOW FINISHED GRADE OF BIOTREATMENT SOIL MIX EXCEPT WHEN ADJACENT TO BUILDING WALL. WHEN ADJACENT TO BUILDING WALL, LINER OR EQUAL WATER PROOFING SHALL EXTEND TO TOP OF FREEBOARD ELEVATION.
7. APPLY BATTEN STRIP, AND NEOPRENE RUBBER PAD CONTINUOUSLY ALONG TOP EDGE OF LINER. FOR WATER-TIGHT APPLICATIONS, ALSO APPLY BUTYL MASTIC CAULK.
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Santa Clara Valley
Urban Runoff
Pollution Prevention Program

GREEN INFRASTRUCTURE TYPICAL DETAILS

DETAIL ADAPTED FROM SAN FRANCISCO PUBLIC
UTILITIES COMMISSION GC 1.2



Santa Clara Valley
Urban Runoff
Pollution Prevention Program



Designer Responsibility (Designer Notes)

PURPOSE:

BIORETENTION BASINS CAPTURE AND TREAT STORMWATER RUNOFF VIA SURFACE AND SUBSURFACE STORAGE, FILTRATION THROUGH BIOTREATMENT SOIL, AND INFILTRATION INTO NATIVE SOIL WHERE FEASIBLE. BIORETENTION BASINS MAY HAVE UNDERDRAINS AND IMPERMEABLE LINERS ON THE SIDES AND/OR BOTTOM OF FACILITY IF NEEDED, BASED ON SOIL CONDITIONS AND GEOTECHNICAL CONSIDERATIONS.

DESIGNER NOTES & GUIDELINES:

- THE DESIGNER MUST ADAPT PLAN AND SECTION DRAWINGS TO ADDRESS SITE-SPECIFIC CONDITIONS.
- FACILITY SURFACE AREA AND PONDING DEPTH MUST BE SIZED TO MEET MRP PROVISION C.3.d SIZING REQUIREMENTS. CALCULATE VELOCITY OF RUNOFF TO DETERMINE SIZES AND NUMBERS OF INLET STRUCTURES.
- FACILITY DRAWDOWN TIME (I.E., TIME FOR SURFACE PONDING TO DRAIN THROUGH THE ENTIRE SECTION INCLUDING AGGREGATE STORAGE AFTER THE END OF A STORM) REQUIREMENTS:
 - 48 HOUR (PREFERRED) TO 72 HOUR MAXIMUM FACILITY DRAWDOWN.
 - AN AGGREGATE COURSE IS REQUIRED UNDER THE BIOTREATMENT SOIL. AGGREGATE SHALL BE CALTRANS CLASS 2 PERMEABLE MATERIAL.
- THE EDGE TREATMENT SLOPE IS TYPICALLY DESIGNED TO MATCH THE SLOPE OF THE ADJACENT ROADWAY/SIDEWALK. CHECK DAMS MAY BE USED TO TERRACE FACILITIES TO PROVIDE SUFFICIENT PONDING FOR HIGHER-SLOPED INSTALLATIONS. DESIGNER MUST SPECIFY CHECK DAM HEIGHT AND SPACING. REFER TO BC 6.1 AND BC 6.2 FOR GUIDANCE ON CHECK DAM DESIGN.
- THE FOLLOWING GUIDELINES APPLY TO RIGHT-OF-WAY APPLICATIONS:
 - BULBOUT CURB TRANSITIONS SHALL CONFORM TO MUNICIPAL STANDARDS.
 - WHEN FACILITY CONSTRUCTION IMPACTS EXISTING SIDEWALK, ALL SAW CUTS MUST ADHERE TO MUNICIPAL REQUIREMENTS. SAW CUTS SHOULD BE ALONG SCORE LINES AND ANY DISTURBED SIDEWALK FLAGS SHOULD BE REPLACED IN THEIR ENTIRETY.
 - DESIGNER TO SPECIFY TRANSITION OF BIORETENTION AREA TO TOP OF CURB ELEVATION BETWEEN CURB CUTS OR CONTINUOUS 6 INCH REVEAL AT CURB EDGE.
- UP TO TWO BIORETENTION AREAS MAY BE CONNECTED IN SERIES, IN LIEU OF MULTIPLE INLETS, PROVIDED THE CONNECTION IS A TRENCH DRAIN OR EQUAL SURFACE CONVEYANCE AND IS ADEQUATELY SIZED TO CONVEY FLOWS
- MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT MUNICIPAL ASSET PROTECTION STANDARDS. IN THE ABSENCE OF THESE STANDARDS, THE DESIGNER SHALL REFER TO SCVURPPP GSI HANDBOOK UTILITY COORDINATION SECTION. SEE UTILITY CROSSINGS (GC 2.1 - GC 2.12) AND UTILITY CONFLICTS (GC 3.1 - GC 3.3).
- FREEBOARD REQUIREMENTS SHOWN SHOULD BE USED AS GUIDELINES BUT THE DESIGNER SHALL CHECK WITH MUNICIPALITY FOR LOCAL REQUIREMENTS.
- BIORETENTION AREA VEGETATION MUST BE SPECIFIED BY DESIGN PROFESSIONAL PER MUNICIPAL VEGETATION PALLET OR SCVURPPP C.3 HANDBOOK APPENDIX D PLANT LIST.
- CONVEYANCE CONNECTIONS MAY BE CONFIGURED TO ACCEPT RUNOFF VIA OVERHEAD CONVEYANCE (DOWNSPOUTS, OVERHEAD RUNNELS), SURFACE FLOW (CHANNELS) OR SUBSURFACE CONVEYANCE (PIPES, TRENCH DRAINS).
- CONVEYANCE CONNECTIONS SHALL BE SIZED AND HAVE ADEQUATE FREEBOARD TO ACCOMMODATE DRAINAGE FROM ROOF AREAS AND PREVENT OVERFLOWING.

DESIGNER CHECKLIST

(MUST SPECIFY, AS APPLICABLE):

- FACILITY WIDTH, LENGTH, SLOPES (INCLUDING SIDE, CROSS, AND LONGITUDINAL), AND SHAPE
- DEPTH OF PONDING
- DEPTH OF FREEBOARD
- DEPTH OF BIOTREATMENT SOIL
- DEPTH AND TYPE OF GRAVEL STORAGE, IF ANY
- BIORETENTION AREA SURFACE ELEVATION (TOP OF BIOTREATMENT SOIL) AT UPSLOPE AND DOWNSLOPE ENDS OF FACILITY (I.E., PROVIDE SPOT ELEVATIONS OR CONTOURS AS NEEDED)
- CONTROL POINTS AT EVERY CORNER OF FACILITY AND POINT OF TANGENCY
- HORIZONTAL CONTROL: DIMENSIONS TO OR CONTROL POINTS AT EVERY INLET, OUTLET, CHECK DAM, SIDEWALK NOTCH, ETC.
- VERTICAL CONTROL: ELEVATIONS OF EVERY INLET, OUTLET, STRUCTURE RIM AND INVERT, CHECK DAM, AND SIDEWALK NOTCH
- TYPE AND DESIGN OF FACILITY COMPONENTS (E.G., EDGE TREATMENTS, INLETS/GUTTER MODIFICATIONS, UTILITY CROSSINGS, LINER, AND PLANTING DETAILS)

LAYOUT REQUIREMENTS:

- FOR RIGHT-OF-WAY APPLICATIONS, REFER TO THE MUNICIPAL STANDARD ACCESSIBILITY REQUIREMENTS DRAWINGS AND SPECIFICATIONS FOR CONSTRUCTION FOR STEP OUT ZONE, PEDESTRIAN ZONE, PARKING SPACE AND ACCESSIBLE PATH REQUIREMENTS.
- LOCATE CURB CUTS AND GUTTER MODIFICATIONS TO AVOID CONFLICTS WITH ACCESSIBILITY REQUIREMENTS (E.G., LOCATE OUTSIDE OF CROSSWALKS).

RELATED COMPONENTS		
EDGE TREATMENTS:	BC 1.1	BC 1.7
INLETS:	BC 2.1	BC 2.4
OUTLETS:	BC 3.1	BC 3.4
UNDERDRAINS:	BC 5.1	BC 5.2
CHECK DAMS:	BC 6.1	BC 6.2
LINERS:	GC 1.1	GC 1.2
UTILITY CROSSINGS:	GC 2.1	GC 2.12
UTILITY CONFLICTS:	GC 3.1	GC 3.4
OBSERVATION PORTS:	GC 4.1	GC 4.3
CLEANOUTS:		GC 5.1

NOTES	SECTION
BB 1.1	BB 2.1



GREEN INFRASTRUCTURE TYPICAL DETAILS

DETAIL ADAPTED FROM SAN FRANCISCO PUBLIC UTILITIES COMMISSION BB 1.1

DATE	OCTOBER 2024
VERSION	2.0
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BIORETENTION AREA DESIGNER NOTES

DRG NO.	BB 1.1
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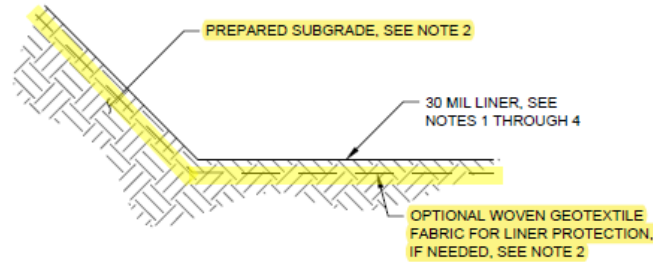
Designer Responsibility (Designer Checklist)

DESIGNER CHECKLIST

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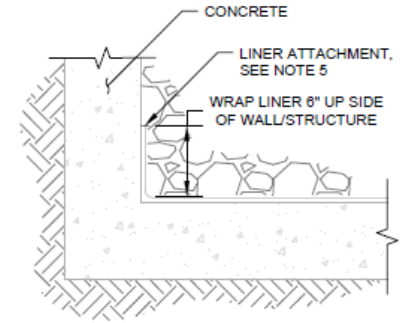
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Designer Responsibility



IMPERMEABLE LINER

1

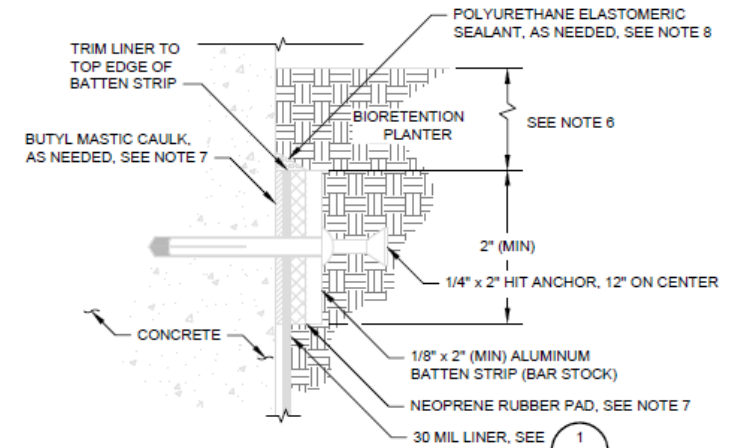


SOIL TIGHT LINER ATTACHMENT AT WALL/STRUCTURE

2

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WATER TIGHT LINER ATTACHMENT AT WALL/STRUCTURE

3

NOTES	COMPONENTS
GC 1.1	GC 1.2



GREEN INFRASTRUCTURE TYPICAL DETAILS

DETAIL ADAPTED FROM SAN FRANCISCO PUBLIC UTILITIES COMMISSION GC 1.2

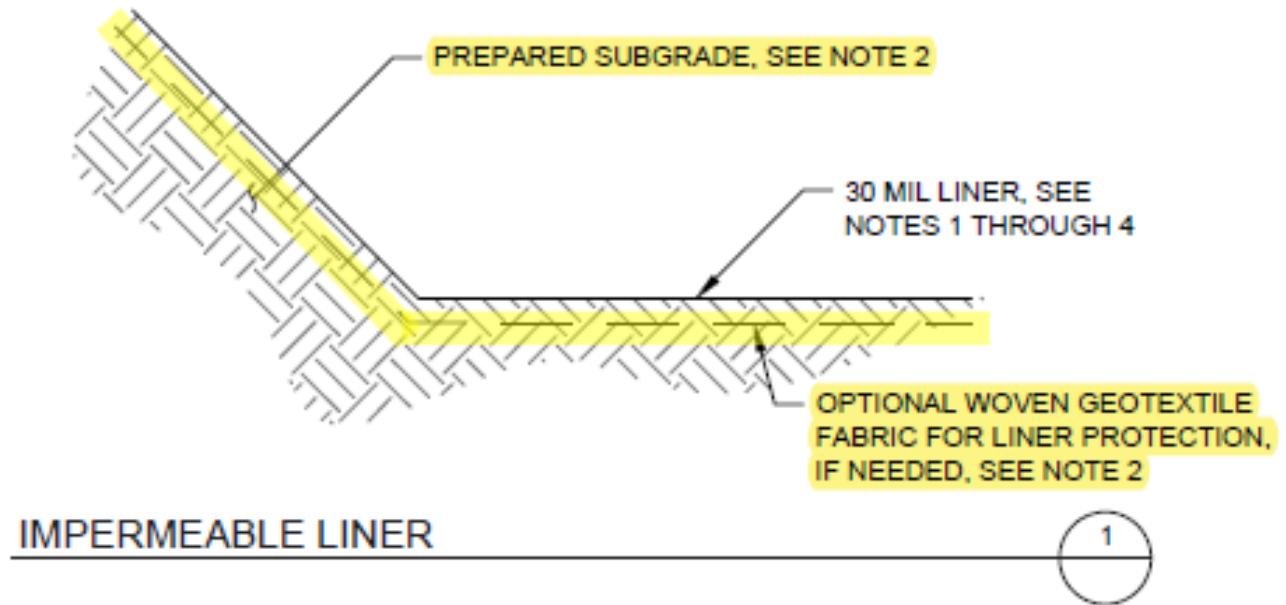
DATE	OCTOBER 2024
VERSION	1.0
REVISED	

GENERAL COMPONENTS LINERS LINERS AND ATTACHMENTS

COMP. NO.	GC 1.2
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NOT FOR CONSTRUCTION - REFER TO USER GUIDE

Designer Responsibility



CONSTRUCTION NOTES:

1. WATERPROOFING AND/OR LINER SYSTEM TO BE DESIGNED AND INSTALLED BY WATERPROOFING PROFESSIONAL. POTENTIAL LINER MATERIALS TO BE CONSIDERED INCLUDE: HDPE (HIGH DENSITY POLYETHYLENE), CPSE (CHLOROSULFONATED POLYETHYLENE), OR LLDPE (LINEAR LOW DENSITY POLYETHYLENE).
2. LINER SHALL LAY FLUSH WITH GROUND WITH NO AIR VOIDS BELOW THE LINER PRIOR TO BACKFILLING MATERIAL ABOVE THE LINER AND REMOVE ALL SHARP ROCKS AND DEBRIS. IF SUBGRADE SOIL CONTAINS ANGULAR ROCKS/DEBRIS, INSTALL WOVEN GEOTEXTILE FABRIC OVER SUBGRADE TO PROTECT LINER FROM PUNCTURE. CONTOUR THE SUBGRADE AS NEEDED TO ENSURE LINER LAYS FLUSH WITH GROUND.

Component Clarification

PURPOSE:

BIORETENTION OUTLET STRUCTURES CONVEY SURFACE AND/OR SUBSURFACE OUTFLOWS FROM A BIORETENTION FACILITY TO AN APPROVED DISCHARGE LOCATION.


DESIGNER NOTES & GUIDELINES:

1. THE DESIGNER MUST ADAPT DRAWINGS TO ADDRESS SITE-SPECIFIC CONDITIONS.
2. THE DESIGNER MUST SIZE CURB CUT, GRATE, AND OTHER OVERFLOW STRUCTURE FEATURES TO SATISFY MUNICIPAL HYDRAULIC REQUIREMENTS. **THE SIZING AND DESIGN OF ALL OVERFLOW STRUCTURES MUST ALSO CONSIDER MAINTENANCE ACCESS, COMPATIBLE GRATE SIZES, LOCATION, AND GENERAL AESTHETICS.**
3. AN OUTLET STRUCTURE OR CLEANOUT(S) THAT ALLOWS MAINTENANCE ACCESS TO ALL PIPES IS REQUIRED FOR FACILITIES WITH UNDERDRAINS.
4. IF SITE CONSTRAINTS NECESSITATE STORM DRAIN PIPE IN AN AREA SUBJECT TO VEHICULAR TRAFFIC OR OTHER LOADING, APPROPRIATE COVER DEPTH AND PIPE MATERIAL MUST BE SPECIFIED.
5. OUTLET PIPES MUST BE EQUIPPED WITH CLEANOUTS, SEE CLEANOUT DETAILS (GC 5.2).
6. DESIGNER SHALL EVALUATE BUOYANCY OF STRUCTURES FOR SITE SPECIFIC APPLICATION AND SPECIFY THICKENED OR EXTENDED BASE / ANTI-FLOTATION COLLAR, AS NECESSARY.
7. DESIGNER MAY SPECIFY CURB CUT INLET/OUTLET WITH METAL PLAT TOP WHEN ADJACENT TO VEHICLE PARKING AND LOADING AREAS WITH MUNICIPAL APPROVAL.
8. OPTIONAL EROSION CONTROL AT OUTLET STRUCTURES SPECIFIED BY DESIGNER. EXAMPLES INCLUDE ROCK MULCH, STREAMBED COBBLE OR EQUIVALENT. MINIMUM DIAMETER OF ROCK MULCH OR STREAMBED COBBLE SHALL BE LARGER THAN MAXIMUM GRATE OPENING WHEN USED AT OVERFLOW STRUCTURE.

DESIGNER CHECKLIST (MUST SPECIFY, AS APPLICABLE):

- OUTLET STRUCTURE TYPE/MATERIAL, DIAMETER, AND DEPTH
- ATRIUM GRATE MANUFACTURER, MODEL NO., AND SIZE
- FRAME AND GRATE TYPE, MODEL NO., AND SIZE
- CONTROL ELEVATIONS FOR OUTLET STRUCTURE RIMS
- MATERIAL AND DIAMETER FOR ALL PIPES
- WATER TIGHT CONNECTOR TYPE FOR ALL WALL PENETRATIONS (E.G., GROUTED, COMPRESSION, BOOT), SEE GC 2.9 AND GC 2.10
- CURB CUT WITH OR WITHOUT METAL PLATE TOP MODIFICATION

EDGE TREATMENTS							INLETS				OUTLETS				UNDERDRAINS		CHECK DAM	
NOTES	COMPONENTS						NOTES	COMPONENTS			NOTES	COMPONENTS			NOTES	COMPONENTS	NOTES	COMPONENTS
BC 1.1	BC 1.2	BC 1.3	BC 1.4	BC 1.5	BC 1.6	BC 1.7	BC 2.1	BC 2.2	BC 2.3	BC 2.4	BC 3.1	BC 3.2	BC 3.3	BC 3.4	BC 5.1	BC 5.2	BC 6.1	BC 6.2

	GREEN INFRASTRUCTURE TYPICAL DETAILS	DATE OCTOBER 2024	BIORETENTION COMPONENTS OUTLETS DESIGNER NOTES	DWG. NO. BC 3.1
	DETAIL ADAPTED FROM SAN FRANCISCO PUBLIC UTILITIES COMMISSION BC 3.1	VERSION 2.0		
		DRAWN		

Component Clarification

DESIGNER NOTES & GUIDELINES:

1. THE DESIGNER MUST ADAPT DRAWINGS TO ADDRESS SITE-SPECIFIC CONDITIONS.
2. THE DESIGNER MUST SIZE CURB CUT, GRATE, AND OTHER OVERFLOW STRUCTURE FEATURES TO SATISFY MUNICIPAL HYDRAULIC REQUIREMENTS. THE SIZING AND DESIGN OF ALL OVERFLOW STRUCTURES MUST ALSO CONSIDER MAINTENANCE ACCESS, COMPATIBLE GRATE SIZES, LOCATION, AND GENERAL AESTHETICS.

Component Clarification

LAYOUT REQUIREMENTS:

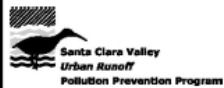
1. ALL PERVIOUS PAVEMENT DESIGN MUST COMPLY WITH MUNICIPAL STANDARD ACCESSIBILITY/ADA REQUIREMENTS.
2. THE ALLOWABLE CATCHMENT AREA CONTRIBUTING RUN-ON TO A PERVIOUS PAVEMENT FACILITY IS A MAXIMUM OF 2:1 RATIO OF AREA CONTRIBUTING RUN-ON TO PERVIOUS PAVEMENT AREA.
3. WHEN DESIGNED TO ACCEPT RUN-ON FROM OTHER CATCHMENT AREAS, PERVIOUS PAVEMENT AREAS MUST BE PROTECTED FROM SEDIMENTATION WHICH CAN CAUSE CLOGGING AND DIMINISHED FACILITY PERFORMANCE. THE FOLLOWING REQUIREMENTS APPLY FOR RUN-ON CONTRIBUTIONS:
 - RUN-ON FROM LAWN, LANDSCAPE OR OTHER ERODIBLE SURFACES IS DISCOURAGED. IF MINOR RUN-ON FROM LAWN OR LANDSCAPE AREAS IS UNAVOIDABLE, THOSE ERODIBLE AREAS MUST BE FULLY STABILIZED.
 - CONCENTRATED RUN-ON SHOULD BE DISPERSED PRIOR TO DISCHARGE TO A PERVIOUS PAVEMENT FACILITY.
 - IF SUBSURFACE DELIVERY IS USED (I.E., ACTS AS AN INFILTRATION DEVICE) PRETREATMENT AND FLOW DISTRIBUTION ARE REQUIRED.
4. WEARING COURSE FOR PAVERS SHALL BE SET ½ INCH HIGHER THAN FINAL ELEVATION TO ALLOW FOR SETTLING AFTER CONSTRUCTION.
5. WEARING COURSE SHALL HAVE A MINIMUM SURFACE SLOPE OF 0.5% TO ALLOW FOR SURFACE OVERFLOW AND A MAXIMUM SURFACE SLOPE AS LISTED BELOW:
 - a. POROUS ASPHALT SURFACE: = 5 PERCENT SLOPE
 - b. PERVIOUS CONCRETE SURFACE: = 10 PERCENT SLOPE
 - c. PERMEABLE PAVERS OR PERMEABLE INTERLOCKING PAVERS: = 10 PERCENT SLOPE (PER MANUFACTURER'S RECOMMENDATION)
 - d. SLOPES EXCEEDING 2% TYPICALLY REQUIRE SUBSURFACE CHECKDAMS.
6. WHILE THERE IS NO MAXIMUM SLOPE FOR THE SUBGRADE UNDER THE PERVIOUS PAVEMENT COURSES, THERE MAY BE ENGINEERING CHALLENGES ASSOCIATED WITH SUBSURFACE CHECK DAM REQUIREMENTS ON SUBGRADE SLOPES EXCEEDING 5%. SEE SUBSURFACE CHECK DAMS (PC 2.1 AND PC 2.2).
7. PERMEABLE GEOTEXTILES MAY BE USED ALONG BASE AND SIDES. IMPERMEABLE LINERS MAY BE USED ALONG SIDES. IMPERMEABLE LINERS MAY NOT BE USED ALONG BASE.
8. REFER TO SECTION 6.10 OF THE SCVURPPP C.3 STORMWATER HANDBOOK (2024) FOR MORE DETAILED INFORMATION REGARDING SITING AND DESIGN GUIDELINES FOR PERVIOUS PAVEMENT.

DESIGNER CHECKLIST (MUST SPECIFY, AS APPLICABLE):

- PERVIOUS PAVEMENT SPECIFICATIONS AND/OR PAVEMENT TYPE AND GAP WIDTH
- PERVIOUS PAVEMENT WIDTH AND LENGTH
- ELEVATIONS AND CONTROL POINTS AT EVERY CORNER OR POINT OF TANGENCY
- THICKNESS OF EACH LAYER IN THE PAVEMENT SECTION
- JOINT SPACING AND TYPE
- SUBGRADE SLOPE
- SUBSURFACE CHECK DAM SPACING, HEIGHT, AND TYPE
- ELEVATIONS OF EACH PIPE INLET AND OUTLET INVERT
- TYPE AND DESIGN OF PERVIOUS PAVEMENT COMPONENTS (E.G., EDGE TREATMENTS, GEOTEXTILES, LINERS, OUTLETS, UNDERDRAINS, etc.)
- TREE PROTECTION PLAN
- SUBSURFACE UNDERDRAIN
- DETAIL OF PAVEMENT EDGE SHOWING STRUCTURAL SUPPORT AND TRANSITION TO ADJACENT SURFACE

Removed language to provide designer flexibility

NOTES		KEY MAP	SECTIONS		
PP 1.1	PP 1.2	PP 1.3	PP 2.1	PP 3.1	PP 4.1

	GREEN INFRASTRUCTURE TYPICAL DETAILS	DATE OCTOBER 2024	PERVIOUS PAVEMENT DESIGNER NOTES (2 OF 2)	REV. NO.
	DETAIL ADAPTED FROM SAN FRANCISCO PUBLIC UTILITIES COMMISSION PP 1.2	VERSION 2.0		PP 1.2
		REVISED		

Component Clarification

7. PERMEABLE GEOTEXTILES MAY BE USED ALONG BASE AND SIDES. IMPERMEABLE LINERS MAY BE USED ALONG SIDES. IMPERMEABLE LINERS MAY NOT BE USED ALONG BASE.
8. REFER TO SECTION 6.10 OF THE SCVURPPP C.3 STORMWATER HANDBOOK (2024) FOR MORE DETAILED INFORMATION REGARDING SITING AND DESIGN GUIDELINES FOR PERVIOUS PAVEMENT.

Edge Treatment

PURPOSE:

EDGE TREATMENTS ARE USED TO DEFINE THE BOUNDARIES OF A BIORETENTION FACILITY AND ARE INTENDED PRIMARILY TO STABILIZE THE EDGE OF ADJACENT PAVEMENT AND MINIMIZE LATERAL MOVEMENT OF WATER, AS APPLICABLE. IN CASES WHERE ADEQUATE SPACE IS AVAILABLE, THE FACILITY SIDESLOPE CAN BE LAID BACK SUCH THAT THE SURROUNDING NATIVE SOIL IS STABLE AND CAN FUNCTION AS THE FACILITY EDGE TREATMENT. HOWEVER, WHEN SPACE IS LIMITED, EDGE TREATMENTS SUCH AS VERTICAL WALLS MAY BE USED TO MAINTAIN THE STRUCTURAL INTEGRITY OF THE SURROUNDING SURFACES. THESE EDGE TREATMENTS RETAIN STORMWATER WITHIN THE FACILITY (AND OUT OF THE SURROUNDING PAVEMENT SECTIONS, AS APPLICABLE) UNTIL WATER INFILTRATES, IS COLLECTED BY THE UNDERDRAIN, OR OVERFLOWS VIA THE DESIGNATED OUTLETS.

DESIGNER NOTES & GUIDELINES:

1. THE DESIGNER MUST ADAPT DRAWINGS TO ADDRESS SITE-SPECIFIC CONDITIONS.
2. MINIMUM EDGE TREATMENT EMBEDMENT DEPTHS ARE SPECIFIED TO PREVENT LATERAL SEEPAGE UNDER THE EDGE TREATMENT AND INTO ADJACENT PAVEMENT SECTIONS, AS APPLICABLE.
3. DESIGNER MAY ELIMINATE CONSTRUCTION BENCH TO INCREASE EFFECTIVE FACILITY AREA (I.E. INFILTRATION AND STORAGE FOOTPRINT) PROVIDED PLANTER WALL EXTENDS TO BOTTOM OF AGGREGATE STORAGE.
4. DESIGNER MAY SPECIFY ALTERNATIVE MATERIAL TYPE FOR EDGE TREATMENTS PROVIDED MATERIAL MEETS STRUCTURAL REQUIREMENTS FOR LOADING CONDITIONS, SERVES AS A WATER BARRIER BETWEEN THE FACILITY AND ADJACENT PAVEMENT SECTIONS (AS APPLICABLE), AND COMPLIES WITH MUNICIPAL STANDARD ACCESSIBILITY REQUIREMENTS.
5. FOOTING OR LATERAL BRACING SHALL BE PROVIDED FOR ALL PLANTER WALLS UNLESS THE DESIGNER DEMONSTRATES THAT THE PROPOSED WALL DESIGN MEETS LOADING REQUIREMENTS AND STRUCTURAL INTEGRITY.
6. FOOTINGS AND LATERAL BRACING SHALL BE DESIGNED TO WITHSTAND ANTICIPATED LOADING ASSUMING NO REACTIVE FORCES FROM THE UNCOMPACTED BIOTREATMENT SOIL WITHIN THE FACILITY.
7. LATERAL BRACING SHALL MEET HYDROLOGIC AND HYDRAULIC DESIGN REQUIREMENTS FOR CHECK DAMS WHEN USED AS CHECK DAMS. SEE BC 6.1.
8. PLANTER WALLS EXTENDING MORE THAN 36 INCHES BELOW ADJACENT LOAD-BEARING SURFACE, OR WHEN LOCATED ADJACENT TO PAVERS, MUST HAVE FOOTING OR LATERAL BRACING. SEE BC 1.5
9. ALL WALLS (I.E., SHORT AND EXTENDED) SHALL BE DESIGNED FOR APPROPRIATE SITE-SPECIFIC LOAD CASES. COORDINATE WITH ENGINEER AS NEEDED.
10. PLANTER WALLS THAT RETAIN SOIL SHALL BE DESIGNED TO RESIST SLIDING, OVERTURNING, AND APPROPRIATE SITE-SPECIFIC LOAD CASES. COORDINATE WITH ENGINEER AS NEEDED.

DESIGNER CHECKLIST (MUST SPECIFY, AS APPLICABLE):

- EDGE TREATMENT TYPE AND MATERIAL
- EDGE TREATMENT WIDTH AND HEIGHT
- EMBEDMENT DEPTH INTO SUBGRADE SOILS
- LATERAL BRACING/FOOTING REQUIREMENTS
- PIPE MATERIAL AND DIAMETER FOR ALL WALL PENETRATIONS
- WATER TIGHT CONNECTOR TYPE FOR ALL WALL PENETRATIONS (E.G., GROUTED, COMPRESSION, BOOT) SEE GC 2.9 AND GC 2.10.
- ELEVATIONS - INLET, OUTLET, OVERFLOW STRUCTURE (RIM & INVERT), CLEANOUT (RIM & INVERT)
- ELEVATIONS - TOP OF SLOPE AND TOE OF SLOPE

EDGE TREATMENTS							INLETS				OUTLETS				UNDERDRAINS		CHECK DAM	
NOTES	COMPONENTS						NOTES	COMPONENTS			NOTES	COMPONENTS			NOTES	COMPONENTS	NOTES	COMPONENTS
BC 1.1	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC
	1.2	1.3	1.4	1.5	1.6	1.7	2.1	2.2	2.3	2.4	3.1	3.2	3.3	3.4	5.1	5.2	6.1	6.2



**GREEN INFRASTRUCTURE
TYPICAL DETAILS**

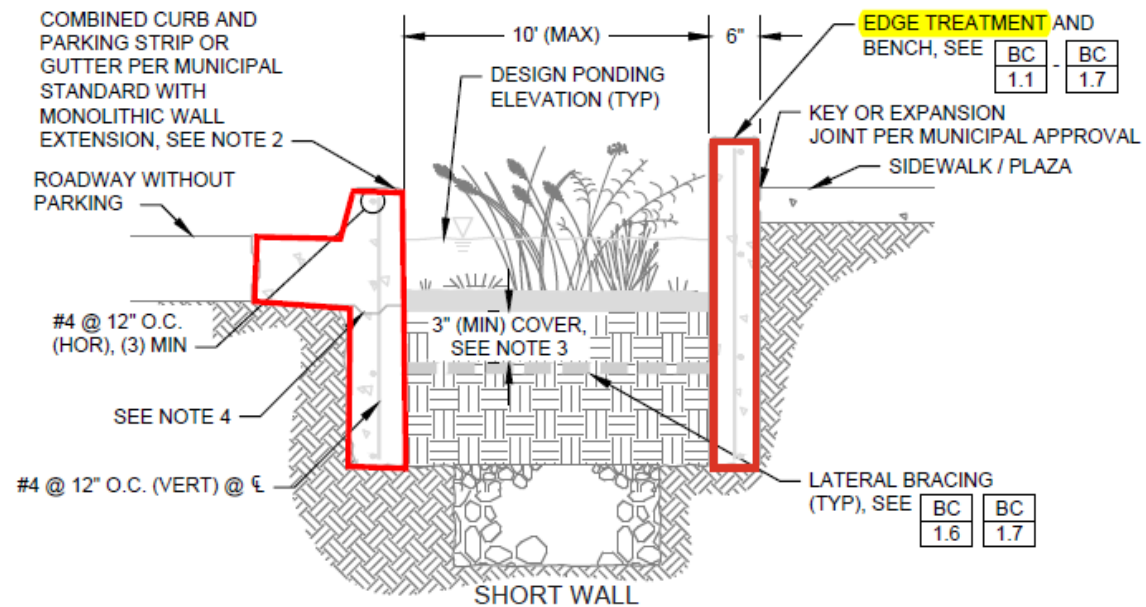
DETAIL ADAPTED FROM SAN FRANCISCO PUBLIC UTILITIES COMMISSION BC 1.1

**BIORETENTION COMPONENTS
EDGE TREATMENTS
DESIGNER NOTES**

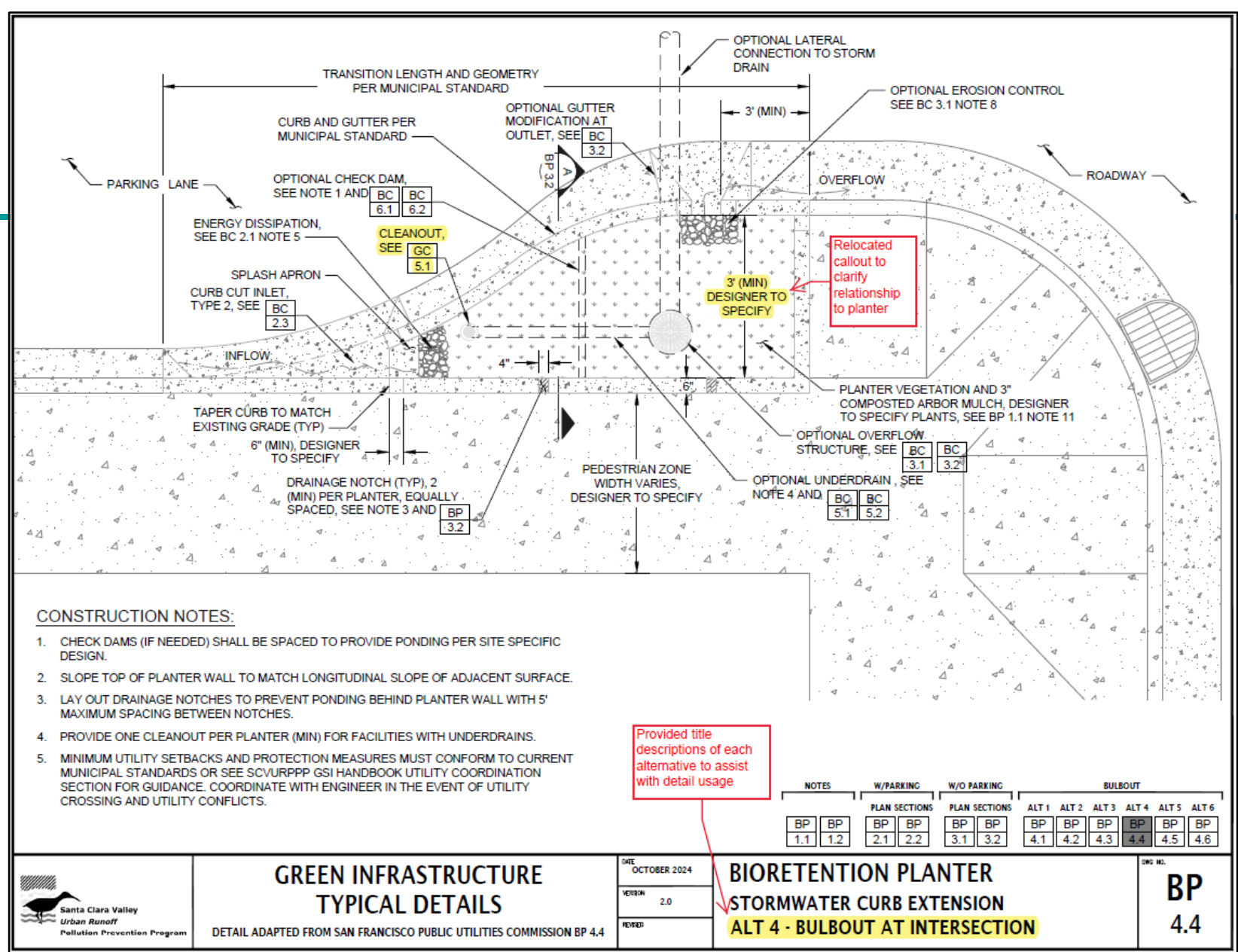
REV. NO. **BC**
1.1

Edge Treatment

9. ALL WALLS (I.E., SHORT AND EXTENDED) SHALL BE DESIGNED FOR APPROPRIATE SITE-SPECIFIC LOAD CASES. COORDINATE WITH ENGINEER AS NEEDED.
10. PLANTER WALLS THAT RETAIN SOIL SHALL BE DESIGNED TO RESIST SLIDING, OVERTURNING, AND APPROPRIATE SITE-SPECIFIC LOAD CASES. COORDINATE WITH ENGINEER AS NEEDED.



Stormwater Curb Extensions



Provided title descriptions of each alternative to assist with detail usage

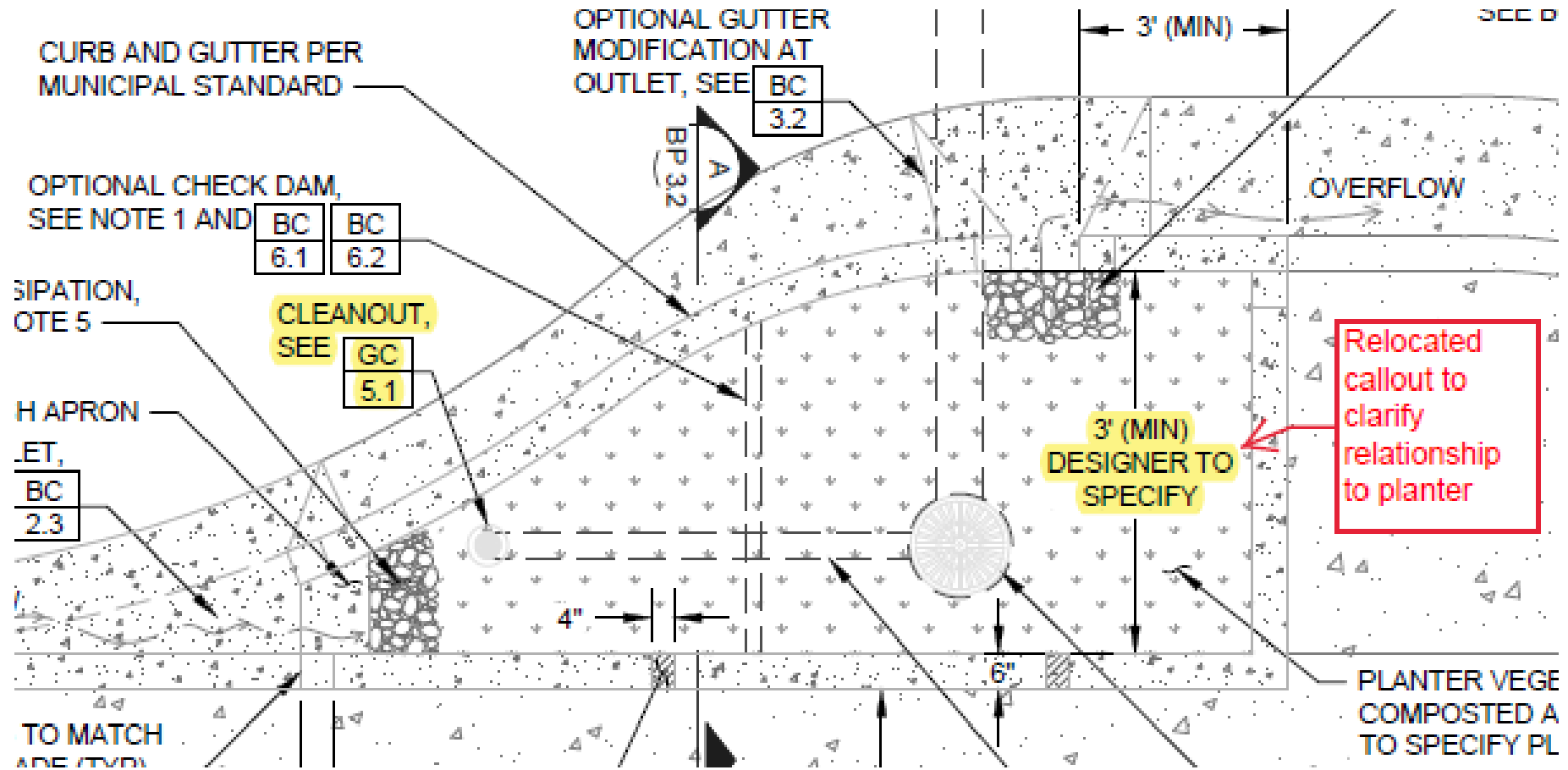
Stormwater Curb Extensions

Enhanced title descriptions for each alternative, to assist with detail usage

NOTES		W/PARKING		W/O PARKING		BULBOUT					
		PLAN SECTIONS		PLAN SECTIONS		ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6
BP	BP	BP	BP	BP	BP	BP	BP	BP	BP	BP	BP
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	4.4	4.5	4.6

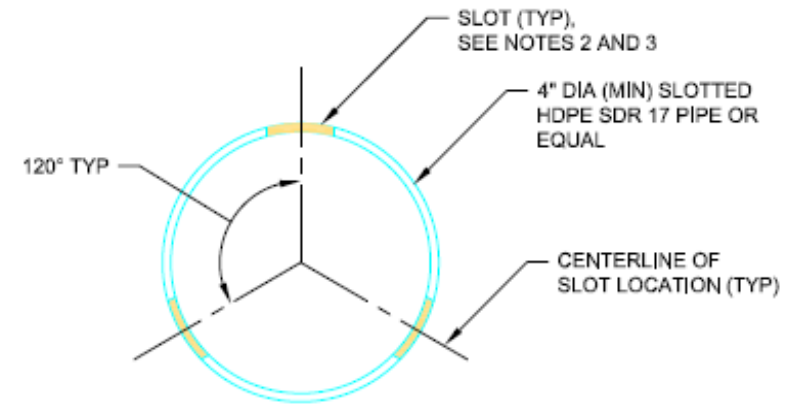
DATE OCTOBER 2024	<h2>BIORETENTION PLANTER</h2> <h3>STORMWATER CURB EXTENSION</h3> <h3>ALT 4 - BULBOUT AT INTERSECTION</h3>	DWG NO.
VERSION 2.0		BP
REVISED		4.4

Stormwater Curb Extensions



Underdrains

- Detail update in process
- Perforated vs. slotted
- Location of openings
 - SCVURPPP guidance: perforations facing downward
- Underdrain Considerations
 - Material availability
 - Condition
 - Maintenance
 - Long-term operation



SLOTTED UNDERDRAIN PIPE



Questions?

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