

What Do We Look For During Installation Inspections?

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Outline of Presentation

- Installation inspection requirements
- Pre-construction preparation
- Pre-inspection preparation
- Where to start on an installation inspection
- Phases of construction
- What to look for in each phase
- Trouble shooting
- Documentation and tracking
- Resources

Installation Inspection Requirements

- Stormwater Control Measure (SCM) inspections are:
 - **Recommended** during construction
 - **Required** at completion of construction or installation (Installation Inspection)
 - **Required** at least once every five years for on-going operation and maintenance (O&M Inspection)

Pre-Construction Meeting

- Attend Pre-con meeting and obtain:
 - Contact information for the general contractor site superintendent (and/or project manager)
 - Site map with locations of construction trailer, site entrance and parking area
 - Contact information of landscape construction contractor project manager
 - Approximate dates of construction phases
 - Inform project managers of your role, goals and inspection-sensitive construction issues (such as underdrains)
-

Pre-Inspection Preparation

- Obtain status of construction on a regular basis from building or other inspectors, if possible
- General understanding of Stormwater Control Plan
 - Site plan with location of Drainage Management Areas (DMAs) and location/type of corresponding SCMs
 - Construction phase(s) currently underway
 - Schedule inspections with key milestones (e.g. underdrain installation)
- Review previous inspection results, if any
- Bring a camera & personal protective equipment!

Where To Start on the Installation Inspection

- Go one time around the site perimeter, if possible
 - Go to the construction trailer
 - Review stormwater control plan with site superintendent and identify all DMAs & SCMs
 - Understand the phases of the project construction
 - Tour site and follow the rain: start at the top and work your way down from rooftops -> podiums -> roof-leaders -> on-grade impervious surfaces-> SCMs
 - Look for protection of SCMs before activation
-

Phases of Construction

- Grading and trenching
- Vertical construction
- Concrete form work and curb cuts
- Underdrains and cleanouts
- Aggregate layers
- Flatwork/paving
- Inlets/downspouts
- Biotreatment Soil Mix (BSM), plants & mulch

What to look for in each phase of construction

Grading and Trenching

- Rough outline of DMAs and SCM areas
- Avoid heavy machinery use within SCM footprint
- Avoid glazing of native soil
- Scarify underlying native soil after excavation
- Check for protection of trees
- Removal and/or protection of topsoil



Proper Infiltration Area Excavation

Avoid surface sealing and/or smearing of soil.



Surface Sealing-

compaction at the soil surface, rendering it impermeable.



Smearing / Glazing-

Impermeability caused by the bottom of a backhoe bucket sliding across the soil surface under pressure.

Proper Infiltration Area Excavation Example

Soil surface must be scarified to improve infiltration and avoid compaction.



Bio-Filtration Bed Detail Sheet 82, Drawing L-7.2, Typical Section D-D











Vertical Construction

- Rooftop and podium-level SCMs built to plan
- Roof leaders drain to correct SCMs
- Check planters for incompatible features (Mechanical, Electrical, Plumbing)



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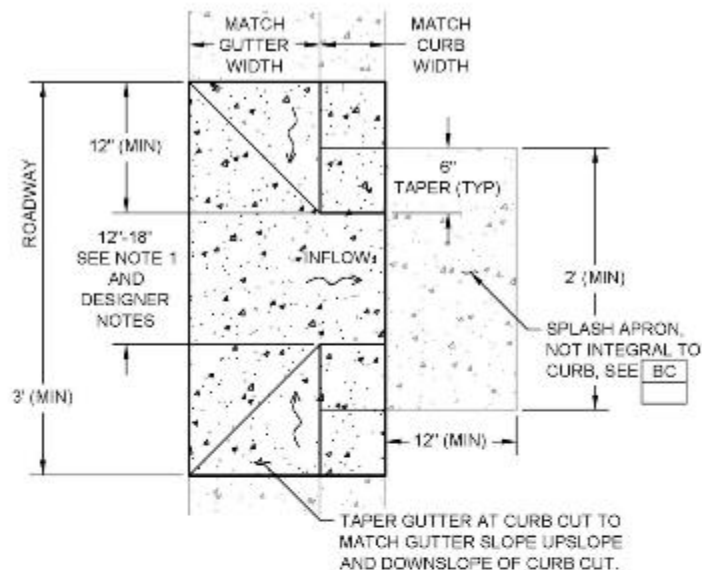




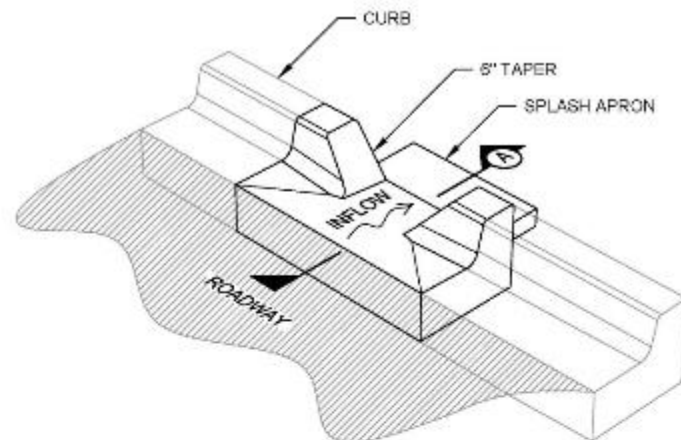
Concrete Forms/Curb Cuts

- Curb cuts are in the right place and are the right size
- Wide curb cuts: 18"- 36"
- Provide sufficient drop and slope from pavement to finished grade of BSM (1"- 2" drop/slope in gutter and 2"- 6" drop in SCM)
- Waterproofing
- Slope away from building





PLAN



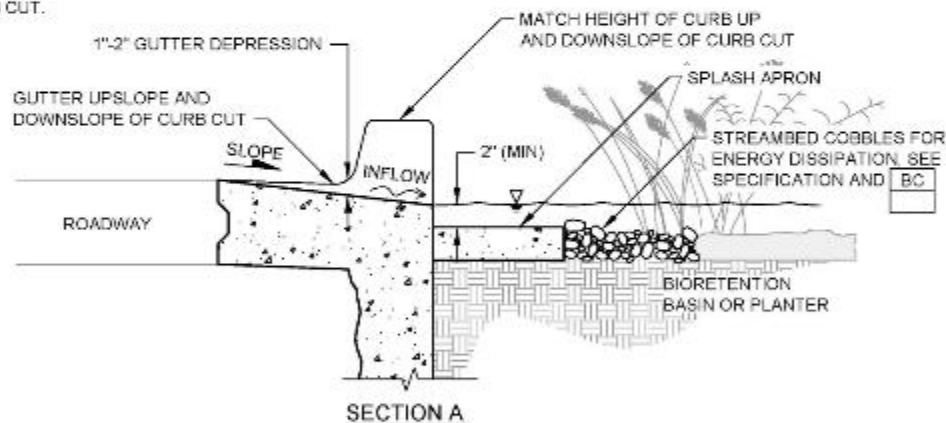
ISOMETRIC

CONSTRUCTION NOTES:

1. INCREASE CURB CUT OPENING FOR FACILITIES ON SLOPE TO PROMOTE CAPTURE OF GUTTER FLOW. SEE DESIGNER NOTES FOR SIZING GUIDANCE.

GENERAL NOTES:

1. ALL MATERIAL AND WORKMANSHIP FOR CURB CUTS SHALL CONFORM TO SAN FRANCISCO STANDARD SPECIFICATIONS AND APPLICABLE CODES PER SAN FRANCISCO DBI.
2. CURB CUT INLETS MAY ALSO FUNCTION AS OUTLETS, SEE DESIGNER NOTES FOR GUIDANCE.
3. BOND NEW CURB AND GUTTER TO EXISTING CURB AND GUTTER WITH EPOXY AND DOWEL CONNECTION.



SECTION A

INLET - CURB CUT 1

EDGE TREATMENTS							INLETS		OUTLETS			GRAVEL STORAGE COMPONENTS		UNDERDRAINS		CHECK DAM	
NOTES	COMPONENTS						NOTES	COMPONENTS	NOTES	COMPONENTS	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 2.5	BC 3.1	BC 3.2	BC 3.3	BC 4.2	BC 5.1	BC 5.2	BC 6.1	BC 6.2

PHASE I DETAILS



**GREEN STORMWATER INFRASTRUCTURE
TYPICAL DETAILS**

SAN FRANCISCO PUBLIC UTILITIES COMMISSION

DATE: JULY 2014 DESIGN: 1.0 REVISIONS:

**BIORETENTION COMPONENTS
INLETS
CURB CUTS TYPE 1**

SHO NO.

**BC
2.2**

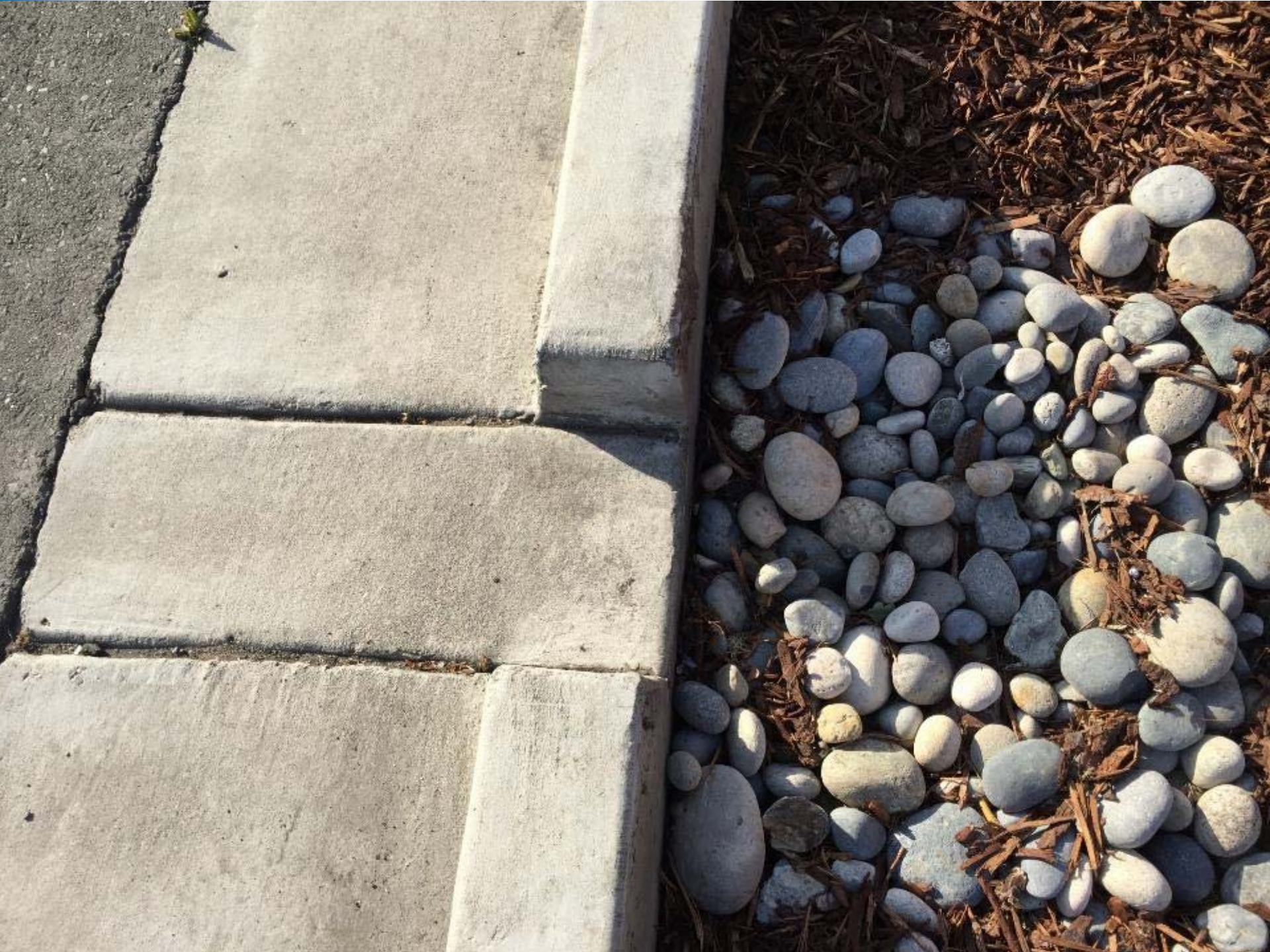


**Curbcuts
not
working
at full
capacity**





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Underdrains/Cleanouts and Overflows

- Min. 2" Caltrans Class 2 Perm material bedding
- NO filter fabric over/around the underdrain (aka burrito wrap)
- Perforations or slots on bottom/side
- Cleanout pipes not perforated
- Minimum 4" diameter pipe
- Max of 45-degree angles at junctions
- Raised overflow/outlet to allow ponding
- Cleanout lids can be at grade or raised







ON LID
VALVE
AND 4

EXTEND CLEANOUT
2" (MIN) ABOVE DESIGN
PONDING ELEVATION

STREAMBED COBBLES,
SEE SPECIFICATIONS

DESIGN PONDING ELEVATION

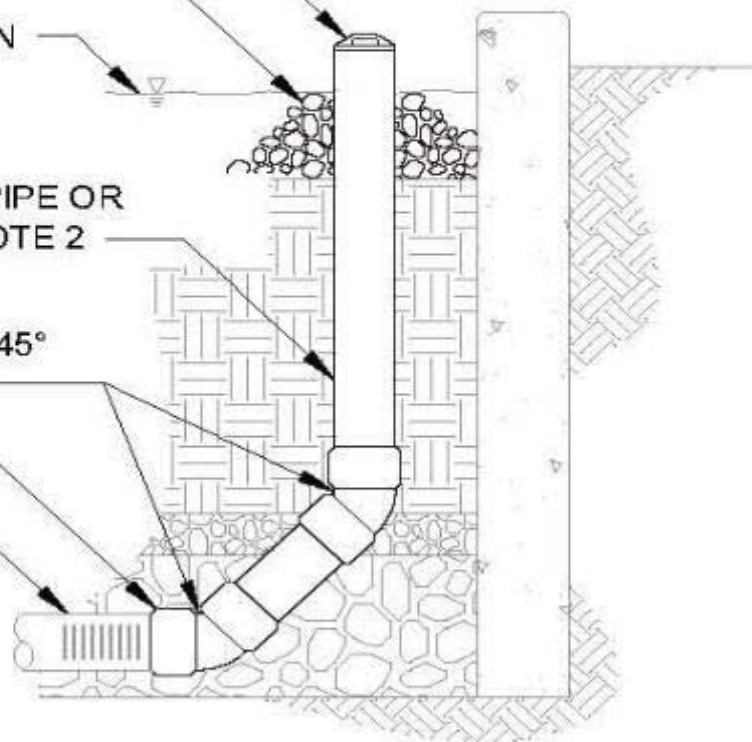
HDPE SDR 17 PIPE OR
EQUAL, SEE NOTE 2

SOIL TIGHT 45°
BENDS

SOIL TIGHT COUPLER

UNDERDRAIN PIPE, SEE

BC
5.2



CLEANOUT - ALTERNATIVE 2

2







Aggregate Layer

- For Bioretention systems:
 - Use Caltrans Class 2 Permeable Material 68-2.02F(3)*
 - Typically 12" deep section with 4" over a 4" underdrain pipe and 4" below pipe.
 - Do not use clean drain rock unless you have a layer above it with gravel or something finer
- For Pervious Pavement – see typical details for appropriate aggregate depth and type
- For both systems the layer can be increased for more storage

*Section 68 of the 2018 Caltrans Standards Specifications Manual

Class 2 Perm. Material



Flatwork/Paving

- Fine grading
- Slope to drain (the right one!)
- Pervious Pavement
 - Subbase depth
 - Subbase compaction testing
 - Raised underdrain or upturned elbow
 - Geotextiles and supporting grids
 - No sand! (Gravel leveling base and in joints)



STOP

RESERVED
NHI
STUDENTS

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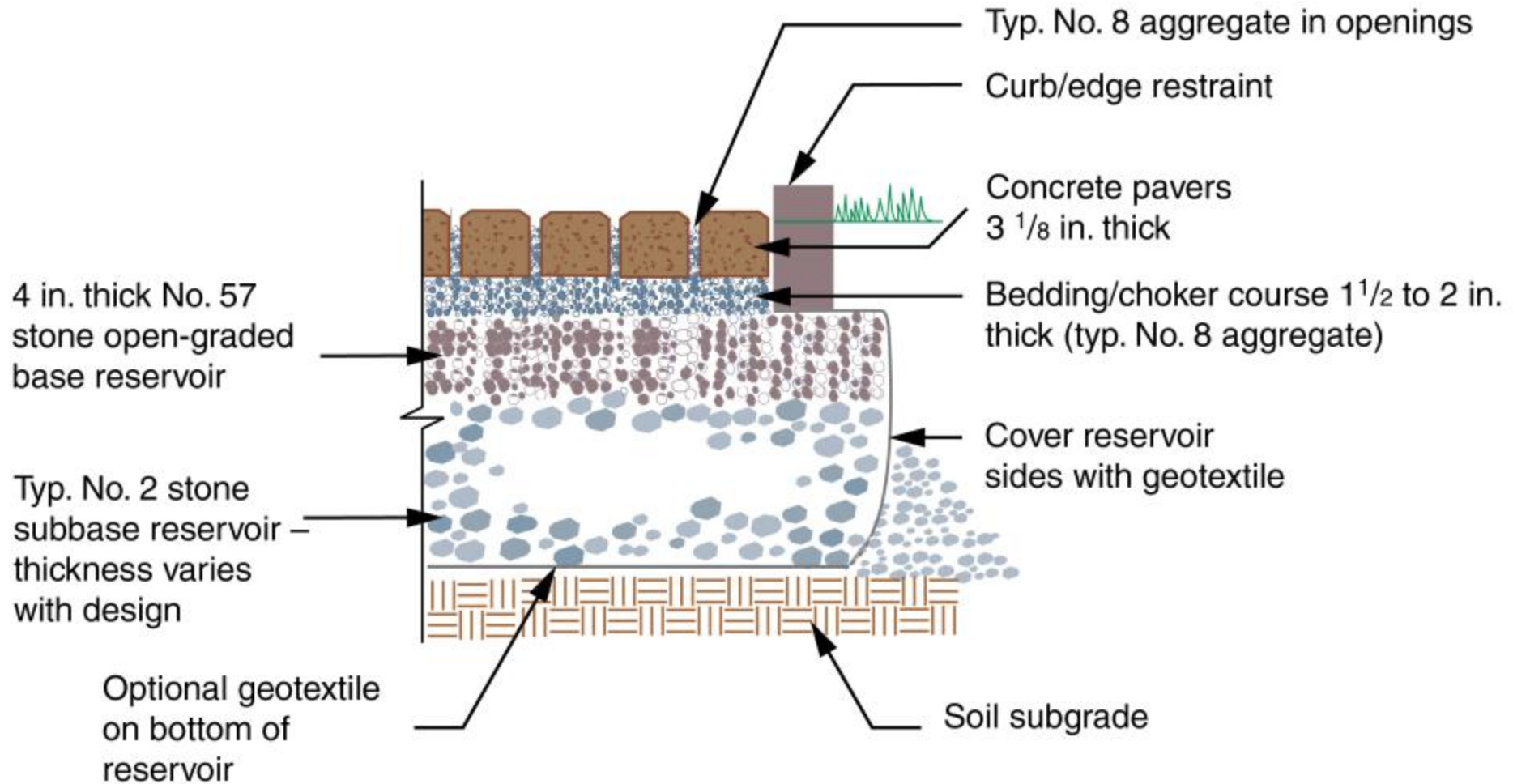
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SALES CENTER

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Permeable Interlocking Paver Cross Section



Not impervious fabric!

No Sand!

Commonly Used Aggregates



No. 2 (3 or 4) subbase



No. 8 bedding



No. 57 base

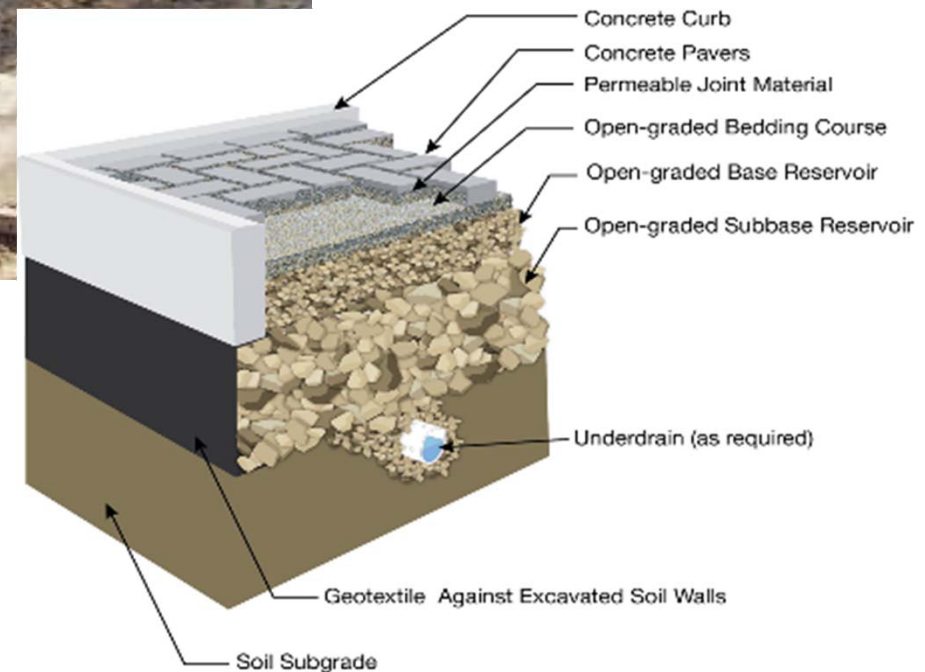


No. 8, 89 or 9 jointing





Underdrains in Pervious Pavement



Inlets/Downspouts

- Away from overflows and outlets
- Spread the flow
- Towards center of SCM area
- Slow and direct the flow
- Protect BSM from erosion









Backwards!







BSM, Plants and Mulch

- Use the SCVURPPP BSM Supplier List and Verification Checklist
- If your own project, you may want to have a permeability test done on a sample of the BSM
- No mechanical compaction of the BSM
- Use plants from the recommended palette in the C3 Handbook
- Recommend 3" of composted tree trimming mulch (arbor mulch)



















Protect During Construction and Plant Establishment

- Bioretention inlet protection (stop sediment)
- Protect plants before submitting to high velocity flows
- Outlet protection (stop mulch at exit)
- Remove sediment and erosion controls after activating the system
- Protect pervious pavement from sediment







Sediment Management



- Stabilization of soil in area draining into pavement
- Min. 20 ft (6 m) wide vegetative strips recommended

Prevent Contamination/Clogging

An ounce of prevention....



Trouble Shooting

- Catchment area doesn't all flow to treatment area (faulty grading)
- Treatment area not as large as in plans
- Flow spreading needed
- Wrong BSM
- Wrong plants
- No Mulch
- Overflow not raised per plan
- Insufficient drop from pavement

Documentation and Tracking

- Fill out inspection forms completely
- Organize photos from inspection back in office
- Follow up with contractor in a timely fashion on violations or punch list items
- Re-inspect as needed
- Keep records in case of WB audit
- Assemble data for annual report

O&M Agreement

- If using recorded O&M agreements, the agreement should be signed and notarized before the project is granted occupancy
- A good time to check on the O&M agreement status is right before the first installation inspection
- The O&M agreement can have construction details of the as-built SCMs

Maintenance Staff Hand-Off

- Municipal staff performing the O&M inspections should be notified when installation inspections are complete
- Information from the installation inspection related to the project can be documented and recorded for later use when O&M inspections are done in the future

Resources...



- SCVURPPP New Development Resources
 - <https://scvurppp.org/2016/06/20/c-3-stormwater-handbook-june-2016/>
 - <https://scvurppp.org/2019/09/01/scvurppp-green-stormwater-infrastructure-handbook/>

Questions?

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