

BIORETENTION CONSTRUCTION INSPECTION CHECKLIST

Layout (prior to beginning excavation)

- Square footage of the facility meets or exceeds minimum shown in Stormwater Control Plan
- Site grading and grade breaks are consistent with the boundaries of the tributary Drainage Management Area(s) (DMAs) shown in the Stormwater Control Plan
- Inlet elevation of the facility is low enough to receive drainage from the entire tributary DMA
- Locations and elevations of overland flow or piping, including roof leaders, from impervious areas to the facility have been laid out and any conflicts resolved
- Rim elevation of the facility is laid out to be level all the way around, or elevations are consistent with a detailed cross-section showing location and height of interior dams
- Locations for vaults, utility boxes, and light standards have been identified so that they will not conflict with the facility
- Location for signage is identified
- Facility is protected as needed from construction-phase runoff and sediment

Excavation (prior to backfilling or pipe installation)

- Excavation conducted with materials and techniques to minimize compaction of soils within the facility area
- Excavation is to accurate area and depth
- Slopes or side walls protect from sloughing of native soils into the facility
- Vertical moisture barrier, if specified, has been added to protect adjacent pavement or structures
- Native soils at bottom of excavation are ripped or loosened to promote infiltration

Overflow or Surface Connection to Storm Drainage (prior to backfilling with any materials)

- Overflow is at specified elevation
- No knockouts or side inlets are in overflow riser
- Overflow location selected to minimize surface flow velocity (near, but offset from, inlet recommended)
- Grating excludes mulch and litter (beehive or atrium-style grates with 1/4" openings recommended)
- Overflow is connected to storm drain via appropriately sized piping

Underground Connection to Storm Drain/Outlet Orifice (prior to backfilling with any materials)

- Perforated pipe underdrain (PVC SDR 35 or approved equivalent) is installed with holes facing down
- Perforated pipe is connected to storm drain at specified elevation (typ. bottom of soil elevation)
- Cleanouts are in accessible locations and connected via sweep bends
- Monitoring well, if required, is installed
- Structures (arches or large diameter pipes) for additional surface storage are installed as shown in plans and specifications and have the specified volume

Drain Rock/Subdrain (prior to installation of soil mix)

- Rock is installed as specified; class 2 permeable, Caltrans specification 68-2.02(F)(3)

recommended, or 4"-6" depth of pea gravel is installed at the top of the crushed rock layer to prevent migration of fines into gravel layer

- Rock is smoothed to a level top elevation; depth and top elevation are as shown in plans
- Slopes or side walls protect from sloughing of native soils into the facility
- No filter fabric is placed between the subdrain and soil mix layers

Soil Mix

- Soil mix is as specified
- Mix installed in lifts not exceeding 12"
- Mix is not compacted during installation but may be thoroughly wetted to encourage consolidation
- Mix is smoothed to a level top elevation; depth of mix (24" min.) and top elevation are as shown in plans, accounting for depth of mulch to follow and required reservoir depth

Irrigation

- Irrigation system is installed so it can be controlled separately from other landscaped areas; smart irrigation controllers and drip emitters are recommended
- Spray heads, if any, are positioned to avoid direct spray into outlet structures

Planting

- Plants are installed consistent with approved planting plan
- Any trees and large shrubs are staked securely
- No fertilizer is added; compost tea may be used
- No native soil or clayey material are imported into the facility with plantings
- 1"-2" mulch may be applied following planting; mulch selected to avoid floating
- Final elevation of soil mix maintained following planting
- Curb openings are free of obstructions

Final Engineering Inspection

- Drainage Management Area(s) are free of construction sediment and landscaped areas are stabilized
- Inlets are installed to ensure entry of runoff from adjoining pavement, have sufficient reveal (drop from the adjoining pavement to the top of the mulch or soil mix, and are not blocked)
- Rock or other energy dissipation at piped or surface inlets is adequate
- Inflows from roof leaders and pipes are connected and operable
- Temporary flow diversions are removed
- Overflow outlets are configured to allow the facility to flood and fill to near rim before overflow
- Plantings are healthy and becoming established
- Irrigation is operable
- Facility drains rapidly; no surface ponding is evident
- Any accumulated construction debris, trash, or sediment is removed from facility
- Permanent signage is installed and is visible to site users and maintenance personnel

PERMEABLE INTERLOCKING CONCRETE PAVEMENT (PICP)

Planning/Pre-construction

Pre-construction meeting

- Walk through site with builder/contractor/subcontractor to review erosion and sediment control plan/stormwater pollution prevention plan (SWPPP)
- Determine when PICP is built in project construction sequence; before or after building construction, and measures for PICP protection and surface cleaning
- Aggregate material stockpile locations identified (hard surface or on geotextile)
- Protect finished product from contamination

Detail drawings on the plans

- Decide material delivery location(s) and flow
- Manufactured edge pavers (if applicable)
- String or sailor course of pavers against curbs, and concrete collars for utility structures, trees wells, and other related structures
- Location and size of curb cut-outs (if applicable)
- Location elevation and size of underdrains (if applicable)

Submittals

- PICP aspect ratio & thickness appropriate for application as specified by the design engineer

On Site Preparation Pre-Excavation

Mock-up

- Location, size, completion date
- Surcharge (settlement after plate compaction)
- Shows color range
- Joint widths per specs/manufacturer's literature
- Paver pattern(s) and direction per drawings

Storage

- Paver cubes stacked up 2 high maximum on level ground
- Pavers should be kept off any unpaved ground surface by pallets, plywood, etc.
- Stockpile aggregate on hard surfaces or geotextile to prevent contamination from site soils and sediment

Sediment management

- Access routes for delivery and construction vehicles identified
- Vehicle tire/track washing station (if specified in Erosion & Sediment plan/SWPPP) location and maintenance

Sediment management post-excavation

- Excavation hole as sediment trap: cleaned to final subgrade elevation immediately before subbase stone placement and runoff sources with sediment diverted away from the PICP

or

- All runoff diverted away from excavated area
- Temporary soil stockpiles should be protected from run-on, run-off from adjacent areas and from erosion by wind
- Ensure linear sediment barriers (if used) are properly installed, free of accumulated litter, and built up sediment less than 1/3 the height of the barrier

- No runoff enters PICP until soils stabilized in area draining to PICP

Verify Site Conditions

Foundation walls

- PICP should be installed no closer than 10 ft (3 m) from foundation walls with no waterproofing or consideration for subsurface drainage

Proximity to water supply

- PICP should be installed no closer than 100 ft (30 m) from municipal water supply wells or open water

Subgrade

- Rocks & roots removed, voids refilled with aggregate & compacted
- No groundwater seepage or standing water
- If no compacted subgrade, confirm no compaction from construction equipment, scarify if needed
- Soil compacted as specified – verify soil density & infiltration (saturated hydraulic conductivity)

Materials

Pavers

- Source on tags matches specification
- Dimensions match specification
- Colors match samples submitted and mock up
- Delivery amounts and dates recorded

Aggregates

- Sieve analysis from quarry and general appearance of subbase, base, bedding, and jointing aggregates conforms to specifications

Additional Materials

- Edge restraints matches specification
- Geotextile matches specification
- Geomembrane matches specification

Excavate and Construct Subbase & Base

Weather conditions

- No work in heavy rain or snow – bedding is not saturated
- No aggregates and pavers placed on frozen base or subgrade
- No frozen aggregates

Excavation

- Utilities located and marked by local service
- Excavated area marked with paint and/or stakes
- Excavation size and location conforms to plan
- Soil compaction as specified – verify soil subgrade infiltration (hydraulic conductivity) with testing

Geotextile (if specified)

- Placement and down slope overlap (min. 1 ft or 0.3 m) conform to specifications and drawings
- Sides of excavation covered with geotextile prior to placing aggregate base/subbase
- No tears or holes
- No wrinkles, pulled taught and staked

Geomembranes (if specified)

- Placement
- Field welding, seams, and seals at pipe penetrations done per specifications
- Top and bottom protected with non-woven geotextile (typ. 10 oz/sy)

Drain pipes, observations wells and cleanouts

- Size, perforations, locations, slope, and outfalls meet specifications and drawings
- Verify elevation of overflow pipes

Subbase, base and bedding aggregates

- Spread (not dumped) with a front-end loader to avoid aggregate segregation
- Storage on hard surface or geotextile to keep sediment-free
- Thickness, placement, compaction and surface tolerances meet specifications and drawings
- Subbase and base compaction equipment meets specifications
- Subbase and base stiffness testing for consistency
- Bedding layer screeding: not compacted using various installation methods (manual & powered)

Edge restraints

- Elevation, placement meet specifications and drawings

Installation

Paver installation

- Elevations, slope, laying pattern, joint widths, and placement/compaction meet drawings and specifications
- No cut paver subject to tire traffic is less than 1/3 of a whole paver
- Six passes: min. 5,000 lbf (22 kN) plate compactor (or 2 passes w/ min. 10,000 lbf (44 kN) plate compactor)
- All pavers within 6 ft (2 m) of the laying face fully compacted at the completion of each day
- Surface tolerance of compacted pavers deviate no more than $\pm 3/8$ in. (10 mm) under a 10 ft (3 m) long straightedge

Jointing aggregate

- Remove any aggregate from the pavement surface before compacting pavers and vibrating jointing aggregate
- Broken and chipped pavers marked, removed and replaced after initial compaction
- Alternate sweeping and vibrating sand into joints with minimum of 6 passes of plate compactor
- No compaction within 6 ft (2 m) of an unrestrained edge of pavers
- All pavers compacted within 6 ft (2 m) of the laying face at the end of each day

Quality control

- Surface elevation of pavers 1/8 to 3/8 in. (3 to 10 mm) above edge restraints, drainage inlets, concrete collars, or channels (for non-ADA accessible paths of travel); to 1/4 in. (6 mm) (for ADA accessible paths of travel)
- Surface elevations conform to drawings
- Pavers 1/8 to 1/4 in. (3 to 6 mm) above curbs, inlets, concrete collars and channels
- Lippage: no greater than 1/8 in. (3 mm) difference in height between adjacent pavers
- Bond (joint lines) lines: $\pm 1/2$ in. (15 mm) over 50 ft (15 m) string line
- Check filling of joints with sand with putty knife: max 1/4 in. (6 mm) below chamfer edge at completion; fill and re-compact if necessary

Finished Product

Final inspection

- Surface swept clean

- Elevations and slope(s) conform to drawings
- Transitions to impervious paved areas separated with edge restraints
- Stabilization of soil in area draining into permeable pavement (min. 20 ft or 6 m wide vegetative strips recommended)
- Drainage swales or storm sewer inlets for emergency overflow; if storm sewer inlets are used, confirm overflow drainage to them
- Runoff from non-vegetated soil diverted from PICP surface
- Test surface for infiltration rate per specifications using ASTM C1781; minimum 100 in./hr (254 cm/hr) recommended

Maintenance pavers

- Delivery location, date and time
- Verify amount delivered

Protection

- General contractor to protect paver area after paver installation subcontractor completes work and leaves site

STORMTECH DETENTION, RETENTION AND STORAGE CHAMBERS

Excavation

- Excavation conducted and subgrade prepared per engineer's plans (soil compacted as specified – verify soil density and infiltration)
- Excavation is to accurate area and depth
- Slopes or side walls protect from sloughing of native soils into the facility
- Vertical moisture barrier, if specified, has been added to protect adjacent pavement or structures

Installation of Chambers

- Excavation is to accurate area and depth
- Non-woven geotextile placed over prepared soils and up excavation walls; underdrains installed (if required)
- Stone foundation (6 in. or 150 mm minimum) installed as specified; compacted to achieve a flat surface
- Geo textile and chambers installed as specified per plans
- Care should be taken in the handling of the chambers and end caps; avoid dropping, prying or excessive force on chambers during removal from pallet and initial placement

Isolator row

- Invert of isolator row connected to catch basin or manhole should be installed to account for sump depth in catch basin or manhole, as specified per the site engineer's plans

Backfill of Embedment Stone

- No equipment shall be operated on the bed at this stage of the installation; excavators must be located off the bed; it is not acceptable to use a dozer to push embedment stone between the rows of chambers; dump trucks shall not dump stone directly onto the bed
- Embedment stone installed to centerline of chamber to anchor lower portion of chamber
- Chambers backfilled evenly; stone height should never differ by more than 12 in. (300 mm) between adjacent chamber rows or between chamber rows and perimeter
- Perimeter stone must be brought up evenly with chamber rows; perimeter must be fully backfilled, with stone extended horizontally to the excavation wall
- Only after chambers have been backfilled to top of chamber and with a minimum 6 in. (150 mm) of cover stone on top of chambers can small dozers be used over the chambers for backfilling remaining cover stone
- Any chambers damaged by construction shall be removed and replaced

Final Backfill

- Install non-woven geotextile over stone; geotextile must overlap 24 in. (600 mm) min. where edges meet.
- Compact each lift of backfill as specified per the site design engineer's drawings; roller travel must be parallel with rows
- Concrete collar required around inspection port when located in paved area; no concrete collar required for unpaved applications