



GI Design Manual

CSO REMEDIAL MEASURES PROGRAM

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Revision Summary

May 2023

Section 4.0	Added references to Figure 1 and Figure 2.
Figure 1	Added new flow chart to show GI technology selection process.
Figure 2	Added new figure to show pre-construction infiltration testing results.
Section 5.1.1.3	Added reference to specific design guidance.
Section 5.1.2.3	Added reference to specific design guidance.
Section 5.1.3.3	Added reference to specific design guidance.
Section 5.1.4.1	Clarified difference between stormwater bumpouts / bumpins and bioretention.
Section 5.1.4.3	Added reference to specific design guidance.
Section 5.1.5.3.	Added reference to specific design guidance.
Section 5.2.1.3.	Added reference to specific design guidance.
Section 5.3.1.3	Added reference to specific design guidance.
Section 5.4.1.3	Added reference to specific design guidance.
Section 5.4.2.3	Added reference to specific design guidance.
Section 5.4.3.3	Added reference to design resources from other jurisdictions.
Section 5.4.3.5	Added description of pretreatment for tree cells.
Section 5.5.1.3	Added reference to specific design guidance.
Section 5.5.2.3	Added reference to specific design guidance.
Section 5.5.3.3	Added reference to specific design guidance.
Section 5.5.3.4	Added reference to specific construction guidance.
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Section 6.1.1.4	Added reference to specific construction guidance.
Section 6.1.2.4	Added reference to specific design guidance.

Section 6.2.1.4	Added reference to specific construction guidance.
Section 6.2.2.4	Added reference to specific construction guidance.
Section 6.2.3.3	Updated design guidance for downspout disconnection.
Section 6.2.3.4	Added reference to specific construction guidance.
Section 7.0	Clarified references to long-term performance testing.
Section 8.0	Clarified approach to modeling green infrastructure.
Appendix E	Added volume control pretreatment measures detail.
Appendix F	New appendix describing how GI is modeled in SWMM.

January 2024

Appendix F	Updated description of how GI is modeled in SWMM.
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1.0 BACKGROUND

The City of Peoria (City) is planning to use distributed green infrastructure (GI) infiltration and storage facilities as the primary method to reduce the frequency and severity of combined sewer overflows (CSOs) to the Illinois River. To accomplish this, the City will install GI in suitable locations to reduce peak flow rates in the collection system allowing additional flow to be conveyed by the existing sewers and treated at the wastewater treatment plant (WWTP).

The City will use GI solutions to maximize social, economic, and environmental benefits to the community. When installing GI, the City plans to leverage community redevelopment efforts to improve neighborhoods, encourage economic development, and support local businesses.

CSO control will be the largest public works program implemented by the City of Peoria. Because of the substantial investment by local stakeholders, the selected CSO Remedial Measures should provide the greatest community benefits possible in addition to meeting the CSO control objectives. Projects that provide the opportunity for local small business and minority business participation, mentoring, and business capacity expansion have benefits to the community beyond CSO control, allowing businesses to develop, expand and become competitive regionally. Additionally, projects that provide neighborhood improvements and aesthetic amenities at equivalent cost are favored over alternatives without these features.

The City of Peoria has maintained a combined sewers system for over 100 years. Most of the combined sewers were originally constructed between 1880 and 1930 and initially discharged directly to the Illinois River. After the Greater Peoria Sanitary District (GPSD) was formed and the Riverfront Interceptor (RFI) sewer and WWTP were constructed in 1931, the combined sewers only discharged to the river during rainfall events. Past improvements to the combined sewer system were constructed to reduce CSO discharges during rainfall events.

The City of Peoria and GPSD own a sewer system that drains 12.2 square miles of service area to the RFI, of which 4.3 square miles are combined sewer areas and 7.9 square miles are separate sewer areas. The RFI runs parallel to the Illinois River and discharges to the WWTP. Flow from the combined sewer area to the RFI is controlled by a series of regulator structures. Excess flow is conveyed from the regulator structures to the Illinois River via 16 outfall pipes, or combined sewer overflow outfalls, which are permitted by the Illinois Environmental Protection Agency (IEPA) through the National Pollution Discharge Elimination System (NPDES). The regulator structures, RFI, WWTP, and some separate sewers are owned and operated by GPSD. The outfalls, combined sewers, and some of the separate sewers are owned by the City of Peoria.

The City of Peoria is committed to improvements to further reduce CSO discharges from its combined sewer system. As GI technologies have emerged as viable, cost-effective solutions to address CSOs, the City of Peoria has chosen to implement GI stormwater management as the primary method to reduce CSO volume.

Green infrastructure uses vegetation, soils, and natural processes to manage stormwater and create healthier urban environments. At the scale of a neighborhood or streetscape, GI refers to stormwater management systems that mimic nature by soaking up and storing water. The incorporation and enhancement of GI systems minimize costs by providing natural solutions to manage stormwater runoff rate, volume, and quality while employing strategies to maintain or restore natural hydrology. Green infrastructure includes surface infiltration, subsurface infiltration, and storage, e.g., bioretention, naturalized areas, permeable pavement, subsurface infiltration cells, stormwater retention, and other innovative GI technologies.

2.0 PURPOSE

This GI Design Manual describes the process for selecting, designing, and constructing GI for CSO control. It provides a narrative on stormwater GI technologies including description, feasibility, design, construction, and general considerations. This Manual also includes the process for selecting, designing, and constructing gray infrastructure for CSO control. The Manual describes pre-construction and post-construction testing requirements. The Manual also summarizes the GI modeling process to size and design GI for CSO control and describes how GI will be modeling in Peoria's Final Conditions Hydrologic and Hydraulic (H&H) model.

2.1 Benefits Of Green Infrastructure

The employment of GI solutions within the combined sewer area is intended to provide detention and infiltration to reduce peak runoff flow rates. Like traditional stormwater detention systems, GI does this by storing and infiltrating stormwater runoff and slowly releasing it to the collection system at rates that can be conveyed to the WWTP without overflowing. Compared to traditional stormwater detention, GI technologies tend to handle less runoff volume per square foot and thus need to cover a larger area to handle the same volume of water. The larger surface area to volume ratio allows GI to infiltrate and evapotranspire more water than traditional stormwater detention such that less runoff has to be conveyed to and treated at the WWTP. GI's ability to infiltrate water is dependent on the infiltration capacity of the native soil. The amount of evapotranspiration possible is dependent on weather conditions and the presence and types of plants used in a GI facility.

GI technologies tend to blend into traditional landscaping and infrastructure. Because of this, GI is often retrofitted into developed areas to provide additional community benefits. GI co-benefits to the community include neighborhood scale economic redevelopment, safe and accessible transportation infrastructure, creating jobs (both short-term construction and long-term maintenance), beautifying public spaces, and creating urban habitat for pollinators, birds, and wildlife.

3.0 CITY OF PEORIA GI FOR CSO CONTROL

The City of Peoria is constructing projects to reduce CSOs as required by the Consent Decree. The Consent Decree provides the City with the flexibility to meet the CSO reduction requirements using various technologies, including both green and gray infrastructure, that are cost-effective and suitable to the specific locations. This manual will serve as a guide in the design of green and gray infrastructure constructed towards CSO compliance. GI projects will be located and designed to reduce stormwater runoff entering the combined sewer system and sized to meet Final Performance Criteria described in the Consent Decree performance criteria. Gray infrastructure will be designed to provide additional storage or conveyance for the combined sewer system, or to reduce wet weather flows entering the combined sewer system. The Consent Decree allows the City of Peoria until December 31, 2039, to meet the final performance criteria. It is likely that GI technologies will advance significantly over time and, therefore, there may be additional suitable GI technologies available. Peoria will amend and resubmit this GI Design Manual as necessary to include additional GI technologies or make updates to the GI technologies presented herein.

4.0 CONSIDERATIONS IN SELECTING A GI TECHNOLOGY

GI can reduce collection system peak flow rates by removing (via infiltration or evapotranspiration) or delaying (via storage) stormwater flow to the collection system. Stormwater is removed from the collection system when a GI technology causes stormwater to infiltrate into the ground instead of entering the collection system. Flow is delayed when a GI device stores stormwater and releases it to the collection system slowly over time.

GI technologies are most suitable in areas with a high infiltration potential, which tends to be below the bluff in Peoria. The land use and area tributary to the future GI technology should be considered as areas with a higher percent impervious area will generate more runoff, thus managing that volume will have a greater impact on the combined sewer system. Future land uses should be considered. The topography of an area should also be considered, GI tends to be most effective when constructed flat to maximize the potential infiltration area. A treatment train approach that links multiple GI facilities to direct stormwater to areas that are most efficient at managing the volume and provide redundancy should be considered. A flow chart that can be used to guide the selection of GI technology for a particular project and site is provided in Figure 1. The pre-construction infiltration testing results, identifying the CSO areas where field measurements indicate good and poor infiltration rates, are shown in Figure 2.

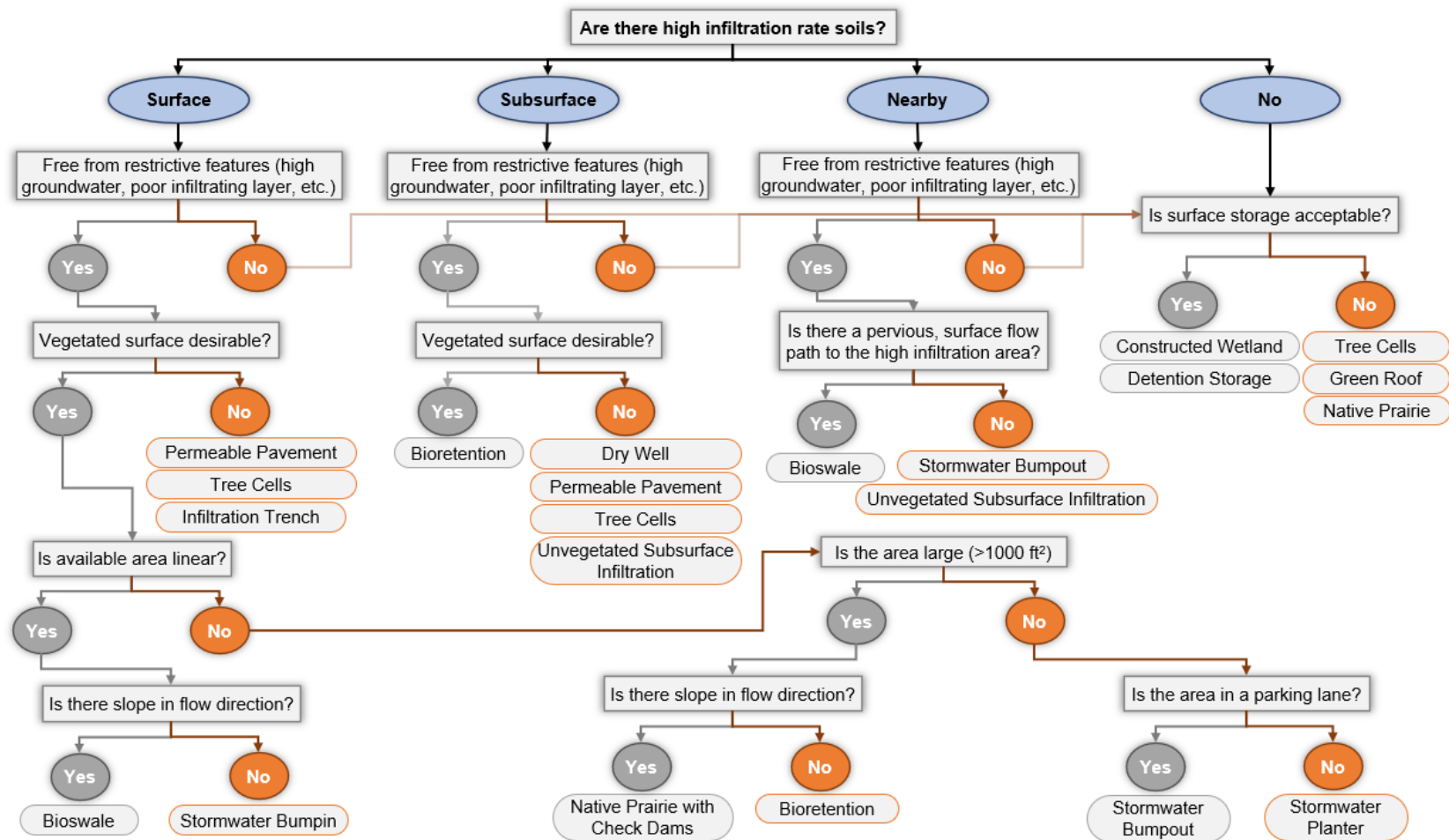


Figure 1 | Flow Chart for Green Infrastructure Technology Selection

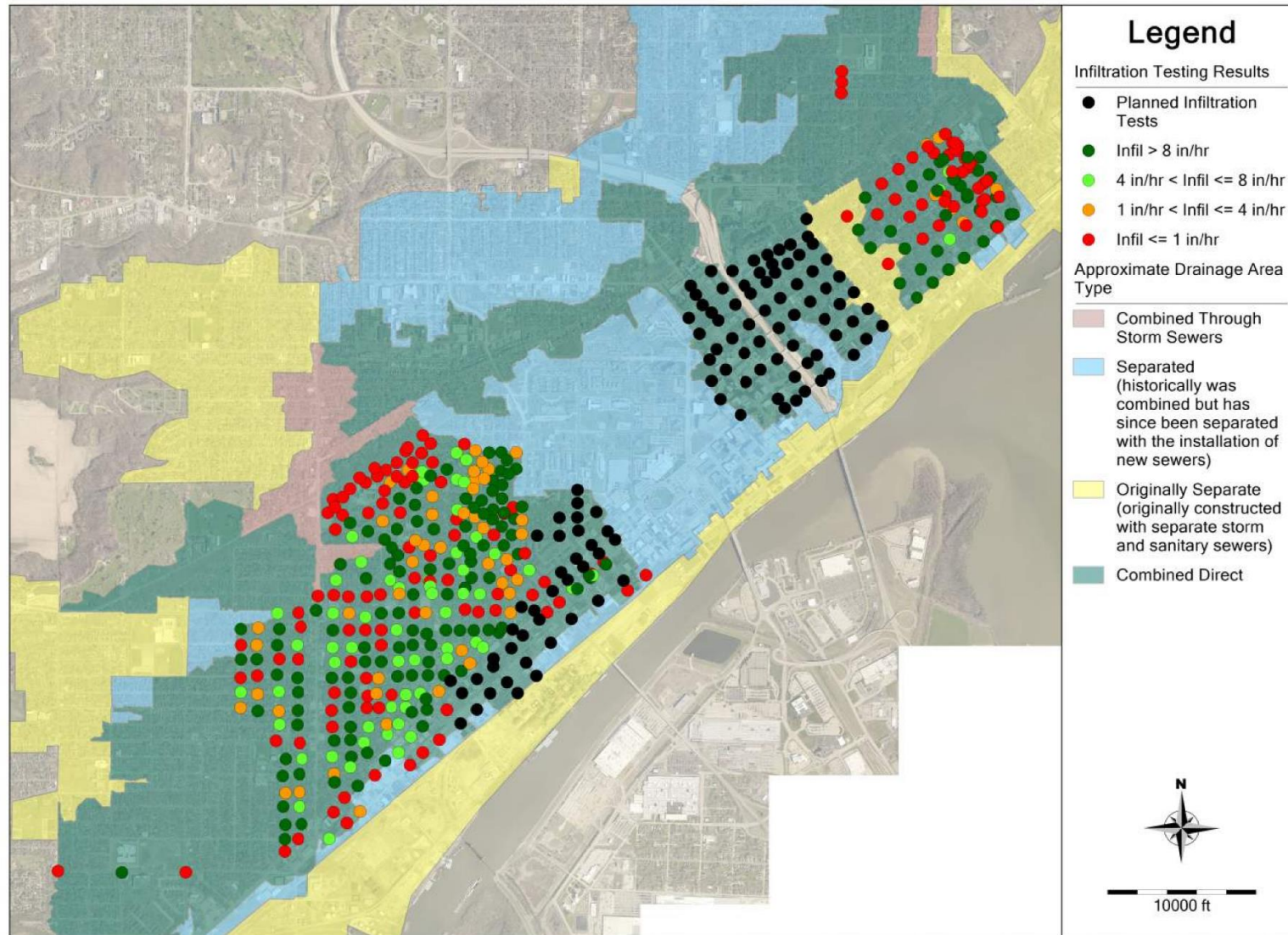


Figure 2 | Pre-Construction Infiltration Testing Results

5.0 GREEN INFRASTRUCTURE

5.1 SURFACE INFILTRATION AND STORAGE

Surface infiltration and storage GI are shallow depressions on the landscape that allow stormwater to pond, infiltrate, and evapotranspire. Surface infiltration and storage GI attenuates runoff volumes when actively infiltrating stormwater and attenuates runoff peak flow rates by storing then slowly releasing stormwater to the combined sewer system. Many variations of surface infiltration and storage operate relatively similarly, with slight variations in their design. Bioretention is the typical surface infiltration and storage GI, while stormwater planters, bioswales, stormwater bumpins or bumpouts, and infiltration trenches are variations of bioretention. These variations follow the design recommendations of bioretention unless specified otherwise.

5.1.1 Bioretention

5.1.1.1 Description

Bioretention is a vegetated, surface GI designed to receive and infiltrate stormwater runoff. The vegetation slows the stormwater, promotes filtration of pollutants, supports the uptake of dissolved nutrients, allows for evapotranspiration, and helps prevent clogging. Bioretention includes an engineered media layer that promotes infiltration and filtration of pollutants and supports vegetation growth. Below the engineered media, bioretention systems may include an aggregate storage reservoir or stormwater chambers to allow for additional stormwater storage. Bioretention systems located in areas of low infiltration potential should include an underdrain system that either connects to a GI technology in an area with high infiltration potential, connects to the storm sewer, connects to the combined sewer, or daylights to grade to slowly release the stored stormwater.

5.1.1.2 Feasibility

Bioretention manages stormwater close to the source and is suitable in many urban locations. Stormwater from residential, commercial, industrial, institutional, and transportation land uses can be effectively managed by bioretention. Bioretention typically consists of a shallow depression in an upland area and can be adaptable to many sites. Identifying a suitable site is critical to long-term performance.

A suitable site is recommended to have soils where the vertical saturated hydraulic conductivity (K_{sat}) will allow the bioretention to drain entirely in the specified drawdown time. Adequate vertical separation from the seasonal high groundwater table, bedrock, and other restrictive features in the soil profile are necessary to allow stormwater to infiltrate. Adequate horizontal separation from drinking water wells, septic fields, and basements is necessary to minimize the risk of contamination or flooding. Bioretention is not suitable in areas of known soil contamination, as the infiltrating stormwater can mobilize the contamination. Liners and underdrains may be used in these areas where infiltration is not recommended.

5.1.1.3 Design

The design of a bioretention should follow all applicable local, state, and federal guidelines, including the Illinois Urban Manual Practice Standard Code 800 and Standard Drawing Number IUM-500 (Illinois Urban Manual, 2021). Key design criteria for bioretention are summarized in Table 1. See the standard detail in Appendix E for a typical bioretention system.

5.1.1.4 Construction

A bioretention system should be protected from sediment during construction. This may be achieved through sequencing the construction to allow the bioretention to be constructed once the contributing drainage area is stabilized.

Compaction shall be avoided or mitigated within the footprint of the bioretention area. This includes the native soil interface and all soil and stone layers. Heavy construction equipment should not be permitted within the footprint of the bioretention area.

The engineered media should be thoroughly mixed prior to placement in the bioretention system. Some settling of the engineered media is anticipated and should be accounted for through overfilling or other approved methods.

Post-construction verification of the bioretention performance should be performed, see the City of Peoria CSO Remedial Measures Operation & Maintenance and GI Performance Testing Plan.

5.1.1.5 Considerations

Sites that are visible to the public and offer additional benefits are particularly suitable for bioretention. Visibility encourages routine maintenance. Additional benefits may include urban green space, shade, aesthetics, and a microhabitat for wildlife, amongst others.

Bioretention is not suitable for drainage areas where slopes exceed 20%. Bioretention should not be constructed in areas of steep slope to avoid contributing to slope instability. Bioretention should not be constructed in fill soils.

Safety should be considered, and a fence or alternative safety measure should be included if a safety concern is identified.

Table 1 | Recommended Surface Infiltration and Storage Design Criteria

Design Parameter	Bioretention Criteria	Stormwater Planter Criteria	Bioswale Criteria	Stormwater Bumpin and Stormwater Bumpout Criteria	Infiltration Trench Criteria
Surface Ponding Depth	6 to 9 inches (preferred), 12 inches (maximum)	See bioretention	See bioretention	See bioretention	See bioretention
Engineered Media Depth	18 inches (minimum), 24 inches (preferred)	See bioretention	See bioretention	See bioretention	N/A
Storage Reservoir	Storage reservoir may be constructed of rock, gravel, coarse sand, pipes, or chambers. Optional to increase storage volume, 12 inches (minimum)	See bioretention	See bioretention	See bioretention	See bioretention
Storage Reservoir Porosity	40% minimum (preferred)	See bioretention	See bioretention	See bioretention	See bioretention
GI Footprint	> 200 ft ² Length:Width ratio greater than 2:1 (preferred)	< 200 ft ²	No max Length:Width ratio	No minimum surface area	No max Length:Width ratio
Engineered Media Composition	Volumetric proportions: 20% sand, 40% topsoil, 40% compost, or an alternative approved media composition	See bioretention	See bioretention	See bioretention	N/A
Underdrain Outlet	An active underdrain is recommended if the required drawdown time cannot be achieved through infiltration alone.	See bioretention	See bioretention	See bioretention	See bioretention
Primary Surface Outlet	Recommended 6 to 9 inches above surface.	See bioretention	See bioretention	Recommended flush with engineered media surface.	See bioretention
Overflow Outlet	Required to pass excess flow	See bioretention	See bioretention	Required to pass excess flow. Recommended 6 to 9 inches above surface.	See bioretention
Surface Slope	Flat	See bioretention	Longitudinal slope 0% - 1% (preferred), 2% (maximum)	See bioretention	Longitudinal slope 0% - 1% (preferred), 2% (maximum)
Side Slopes	4(H):1(V) (preferred), up to 3(H):1(V) (maximum)	See bioretention	See bioretention	See bioretention	See bioretention
Vegetation	Native vegetation capable of withstanding periods of inundation and drought as approved by City. Appendix A contains trees and plants that are suitable. Appendix B contains common invasive species to be avoided.	See bioretention	See bioretention. In addition, vegetation must withstand design velocity.	See bioretention	N/A
Pretreatment	Pretreatment is recommended and may include vegetated filter strips, grass swales, sumped catch basins, isolation chambers, forebay, or other approved technologies.	See bioretention	See bioretention	See bioretention	See bioretention
Drawdown Time	72 hours (maximum)	See bioretention	See bioretention	See bioretention	See bioretention

5.1.2 Stormwater Planters

5.1.2.1 Description

Stormwater planters, also commonly referred to as rain gardens, are a variation of bioretention. Similar to bioretention, stormwater planters are a vegetated, surface GI facility designed to receive and infiltrate stormwater runoff. Stormwater planters are generally smaller than a typical bioretention area. Stormwater planters may be located in the ground and receive stormwater from the surface or storm sewer system or may be in a planter box that receives runoff from roof areas.

5.1.2.2 Feasibility

Stormwater planters have the same feasibility considerations as bioretention.

5.1.2.3 Design

Stormwater planters have many of the same design considerations as bioretention. The design of a stormwater planter should follow all applicable local, state, and federal guidelines, including the Illinois Urban Manual Practice Standard Code 897 (Illinois Urban Manual, 2021). Table 1 describes the design criteria for a typical stormwater planter. See the rendering in Appendix C for a typical stormwater planter.

5.1.2.4 Construction

Stormwater planters have the same construction considerations as bioretention.

5.1.2.5 Considerations

Stormwater planters have the same considerations as bioretention.

5.1.3 Bioswales

5.1.3.1 Description

Bioswales are a variation of bioretention. Similar to bioretention, bioswales are a vegetated, surface GI facility designed to receive and infiltrate stormwater runoff. Bioswales are long, narrow, and may have a longitudinal slope greater than 0%. Bioswales may be designed to convey stormwater, in addition to capturing and infiltrating stormwater. Bioswales that have a positive longitudinal slope may include check dams that pond water to promote infiltration and storage.

5.1.3.2 Feasibility

Bioswales have the same feasibility considerations as bioretention.

5.1.3.3 Design

Bioswales have many of the same design considerations as bioretention. The design of a bioswale should follow all applicable local, state, and federal guidelines, including the MWRD Appendix C Standard Drawing Number 2 (Metropolitan Water Reclamation District of Greater Chicago). Table 1 describes the design criteria for a typical bioswale. See the rendering in Appendix C and standard details in Appendix D and Appendix E for a typical bioswale.

5.1.3.4 Construction

Bioswales have the same construction considerations as bioretention.

5.1.3.5 Considerations

Bioswales have many of the same considerations as bioretention. When bioswales are designed for conveyance, flow velocity should be verified and minimized to avoid erosion of the bioswale surface. Modifications to the bioswale cross-section, longitudinal slope, or the addition of check dams may be useful in reducing the velocity to a non-erosive level.

5.1.4 Stormwater Bumpins and Bumpouts

5.1.4.1 Description

Stormwater bumpins and bumpouts are a variation of bioretention. Stormwater bumpouts are a small version of bioretention located in the parking lane. Stormwater bumpins are a version of bioretention typically located behind the edge of the roadway pavement, between the curb and sidewalk. Similar to bioretention, stormwater bumpins and bumpouts are a vegetated, surface GI facility designed to receive and infiltrate stormwater runoff or direct it to subsurface storage. The primary difference between bioretention and stormwater bumpins / bumpouts is the primary inlet may be an inlet directly connected to the aggregate storage for stormwater bumpins / bumpouts.

5.1.4.2 Feasibility

Stormwater bumpins and bumpouts have many of the same feasibility considerations as bioretention.

5.1.4.3 Design

Stormwater bumpins and bumpouts have many of the same design considerations as bioretention. The design of a stormwater bumpin or bumpout should follow all applicable local, state, and federal guidelines, including the Illinois Urban Manual Practice Standard Code 800 and Standard Drawing Number IUM-500 (Illinois Urban Manual, 2021). Table 1 describes the design criteria for a typical stormwater bumpin and bumpout. See the rendering in Appendix C for a typical stormwater bumpin. See the rendering in Appendix C and the standard detail in Appendix D for a typical stormwater bumpout.

5.1.4.4 Construction

Stormwater bumpins and bumpouts have the same construction considerations as bioretention.

5.1.4.5 Considerations

Stormwater bumpins and bumpouts have many of the same considerations as bioretention. In addition, stormwater bumpins and bumpouts should be integrated with the transportation and parking requirements of the area.

5.1.5 Infiltration Trench

5.1.5.1 Description

Infiltration trenches are a variation of bioretention GI. Similar to bioretention, infiltration trenches are depressions in the landscape that infiltrate and store stormwater. The primary difference between bioretention and infiltration trenches is that infiltration trenches typically are not vegetated and do not have an engineered media. Infiltration trenches are typically filled with a coarse stone aggregate with the aggregate exposed at the surface. Infiltration trenches are often long, narrow, and may have a longitudinal slope greater than 0%.

5.1.5.2 Feasibility

Infiltration trenches have many of the same feasibility considerations as bioretention. Infiltration trenches may be particularly suitable in long, narrow areas such as between the sidewalk and curb. Infiltration trenches located in areas of low infiltration potential should include an underdrain system that either connects to the combined sewer, connects to the storm sewer, connects to adjacent subsurface storage, or daylights to grade. Infiltration trenches with an underdrain provide stormwater storage, attenuate peak flows, and slowly release stormwater.

5.1.5.3 Design

Infiltration trenches have many of the same design considerations as bioretention. The design of an infiltration trench should follow all applicable local, state, and federal guidelines, including the Illinois Urban Manual Practice Standard Code 847 and Standard Drawing Number IL-547 (Illinois Urban Manual, 2021). Table 1 describes the design criteria for a typical infiltration trench. See the standard detail in Appendix E for a typical infiltration trench.

5.1.5.4 Construction

Infiltration trenches have the same construction considerations as bioretention.

5.1.5.5 Considerations

Infiltration trenches have the same considerations as bioretention.

5.2 NATURALIZED AREAS

5.2.1 Native Prairie

5.2.1.1 Description

Native prairie is a naturalization technique that restores predevelopment vegetation into the urban environment. A native prairie utilizes open space in the urban environment to provide habitat for a diverse array of grasses, sedges, and trees. These native plants capture, store, infiltrate, and evapotranspire stormwater through rainfall interception, promoting infiltration, and providing root zone storage. Stormwater infiltration and storage can be increased by creating shallow check dams or furrows parallel to the topographic contour to allow shallow ponding depth.

5.2.1.2 Feasibility

Native prairie is most suitable for urban open space that is not presently being used such as vacant lots. The areas may be small, large, irregularly shaped, or have a significant topographic slope that would create difficulties for conventional development. Areas that have high infiltration rate soils would provide the most benefit, but areas with low infiltration potential soils are acceptable with the appropriate native plants. Native prairie may have the greatest impact in an upland area, where stormwater can be captured prior to entering the combined sewer system.

5.2.1.3 Design

The design of a native prairie should follow all applicable local, state, and federal guidelines, including the Illinois Urban Manual Construction Specification 6 (Illinois Urban Manual, 2021). Particular consideration should be given to the landscaping and ecologic function of the native prairie. Consideration should be given to the type of habitat including plants, pollinators, birds, and other wildlife. Table 2 contains recommended design considerations for native prairie. See Appendix E for a typical native prairie seed mixture.

Table 2 | Recommended Naturalized Area Design Considerations

Design Parameter	Native Prairie Criteria
Surface ponding depth	Minimal, can be created using check dams or furrows
Vegetation	Native grasses, sedges, and trees. Appendix A contains trees and plants that are suitable. Appendix B contains common invasive species to be avoided.
Surface Slope	Flat to steep
Habitat	Consider habitat for vegetation, pollinators, birds, and other wildlife

5.2.1.4 Construction

Native vegetation should be used to the maximum extent practicable. Compaction of soils should be minimized or mitigated to promote infiltration. Off-site construction sediment should be prevented from flowing onto the site. Post-construction verification of vegetation establishment is critical to the long-term success of the native prairie.

5.2.1.5 Considerations

Native prairie should be designed to be low to no maintenance following vegetation establishment. Some trash removal may be necessary if pretreatment does not capture trash prior to entering the native prairie.

5.3 PERMEABLE PAVEMENT

5.3.1 Porous Asphalt, Pervious Concrete, Permeable Paver Bricks or Blocks

Porous asphalt is a flexible pavement that allows stormwater to drain through the surface voids to a subsurface aggregate storage layer and infiltrate into the underlying native soils. Pervious concrete is a rigid pavement that allows stormwater to drain through the surface voids to a subsurface aggregate storage layer and infiltrate into the underlying native soils. Permeable paver bricks or blocks allow stormwater to pass through the joint space into a subsurface aggregate storage layer and infiltrate into the underlying native soils. Depending on the type of brick or block and the intended use, the joint space can be open, filled with a coarse aggregate, or support a vegetated surface such as grass.

5.3.1.1 Description

Permeable pavement allows stormwater to infiltrate into the void spaces or joints of the pavement and ultimately into the subsurface. Permeable pavement allows a traditionally impervious land use to effectively function as pervious land use. Permeable pavements can be effectively used in parking areas, sidewalks, driveways, alleys, plazas, and low-traffic roads. In addition to providing stormwater storage volume, permeable pavement can also reduce pollutant loading, reduce urban heat island effects, and provide an aesthetic pavement surface. Permeable pavement can be installed with an underdrain in areas where the native soil has low or moderate infiltration capacity. Permeable pavement with an underdrain provides stormwater storage and slowly releases stormwater to the combined sewer system or routes stormwater to adjacent native soils with higher infiltration capacity.

5.3.1.2 Feasibility

A suitable site is recommended to have soils where the vertical saturated hydraulic conductivity (K_{sat}) will allow the permeable pavement to drain entirely in the specified drawdown time. Permeable pavements are not suitable for all paving applications and should not be utilized for high traffic or high-speed areas. Permeable pavement requires adequate vertical separation from the seasonal high groundwater table, bedrock, and other restrictive features in the soil profile to allow stormwater to infiltrate. Permeable pavement is not suitable in areas with high pollutant loading or known soil contamination. Permeable pavement should have adequate separation from structures such that the permeable pavement does not contribute to issues such as basement seepage.

5.3.1.3 Design

The design of permeable pavement should follow all applicable local, state, and federal guidelines, including the Illinois Urban Manual Practice Standard Code 890 (Illinois Urban Manual, 2021). Additional design resources from other jurisdictions may be used with City of Peoria approval such as the City of Chicago Stormwater Management Ordinance Manual Appendix C (City of Chicago, 2016), the permeable pavement discussion in the Minnesota Stormwater Manual (Minnesota Pollution Control Agency), or the Wisconsin Department of Natural Resources Technical Standard 1008 (Wisconsin Department of Natural Resources, 2021). Select design criteria for permeable pavement are summarized in Table 3. All suppliers' guidelines should be followed for the selected permeable pavement. See the

rendering in Appendix C and the standard details in Appendix D and Appendix E for typical permeable pavement installations.

Table 3 | Recommended Permeable Pavement Design Criteria

Design Parameter	Criteria
Pavement Surface	Porous asphalt, pervious concrete, permeable paver bricks, permeable paver blocks, or other approved permeable or porous pavement
Bedding Layer	Bedding requirements vary with pavement surface
Storage Reservoir	A recommended 12-inch (minimum) aggregate storage reservoir can increase the storage volume. Aggregate storage can extend laterally beyond the extents of the permeable pavement to increase storage volume. Storage reservoir may be constructed of rock, gravel, coarse sand, pipes, or chambers.
Storage Reservoir Porosity	40% minimum (preferred)
Total Facility Depth	4 feet (preferred) to avoid utility conflicts
Surface Slope	0.5% (minimum) to 5% (maximum)
Surface Infiltration Rate	25 inches/hour (minimum)
Native Soil Infiltration Rate	Greater than 4 inches/hour (preferred)
Underdrain Outlet	Recommended when native soil has K_{sat} less than 0.5 inches/hour
Drawdown time	72 hours (maximum)
Sealant	A salt inhibiting sealer may be applied to particular products, in accordance with manufacturer recommendation, to resist damage caused by salting adjacent pavement. Application of a sealer may result in the surface becoming impermeable and is prohibited unless specifically allowed by the manufacturer.

5.3.1.4 Construction

All layers of the permeable pavement system, including the native soil interface, should be protected from construction sediment to the maximum extent possible. Consideration should be given to construction sequencing that minimizes the amount of construction sediment during permeable pavement installation.

Post-construction verification of the permeable pavement performance should be performed, see the City of Peoria CSO Remedial Measures Operation & Maintenance and GI Performance Testing Plan.

5.3.1.5 Considerations

Permeable pavements require routine cleaning to maintain the infiltration capacity. Methods and frequency of cleaning should be considered early in the design of a permeable pavement system.

5.4 SUBSURFACE INFILTRATION CELLS

Subsurface infiltration cells slow stormwater and allow for infiltration in areas where the existing surface does not have high infiltration potential. Subsurface infiltration cells reduce stormwater peak flow rate and runoff volume. Stormwater is stored in an engineered subsurface area and slowly infiltrates into the deeper soil layers.

5.4.1 Unvegetated Subsurface Infiltration

5.4.1.1 Description

Unvegetated subsurface infiltration can be achieved using the pore space of rock, gravel, or coarse sand. Alternatively, underground pipes or chambers can be used to increase the available storage volume. Pipes and chambers should be perforated, open-bottomed, or both to allow infiltration. There are several proprietary suppliers of stormwater perforated pipes and chambers. Proprietary products are acceptable with the approval of the City of Peoria, or custom solutions can be designed by the engineer.

5.4.1.2 Feasibility

Subsurface infiltration cells are particularly suitable for sites where surface space is limited such that a surface infiltration GI facility is not practicable. Identifying a suitable site is critical to long-term performance. A suitable site is required to have soils where the vertical saturated hydraulic conductivity (K_{sat}) will allow the subsurface infiltration cell to drain completely in the specified drawdown time. Adequate vertical separation from the seasonal high groundwater table, bedrock, and other restrictive features in the soil profile are necessary to allow stormwater to infiltrate. Adequate horizontal separation from drinking water wells, septic fields, and basements is necessary to minimize the risk of contamination or flooding. Subsurface infiltration cells are not suitable in areas of known soil contamination, as the infiltrating stormwater can mobilize the contamination.

5.4.1.3 Design

The design of subsurface infiltration cells should follow all applicable local, state, and federal guidelines, including the Illinois Urban Manual Practice Standard Code 845 (Illinois Urban Manual, 2021). Additional design resources from other jurisdictions may be used with City of Peoria approval such as the City of Chicago Stormwater Management Ordinance Manual Appendix C (City of Chicago, 2016), or the underground infiltration discussion in the Minnesota Stormwater Manual (Minnesota Pollution Control Agency). Select design criteria for unvegetated subsurface infiltration cells are summarized in Table 4. See the standard details in Appendix D and Appendix E for a typical unvegetated subsurface infiltration cell.

Table 4 | Recommended Subsurface Infiltration Cell Design Criteria

Design Parameter	Unvegetated Subsurface Infiltration Cell Criteria	Dry Well Criteria	Tree Cell Criteria
Storage Reservoir	Rock, gravel, coarse sand, pipes, or chambers	See Unvegetated Subsurface Infiltration Cell	Planting soil is recommended around the root ball with bioretention engineered media throughout
Ponding Depth	Limited by the drawdown time	See Unvegetated Subsurface Infiltration Cell	As specified by manufacturer
Surface Cover	As specified by manufacturer or engineer	See Unvegetated Subsurface Infiltration Cell	See Unvegetated Subsurface Infiltration Cell
Underdrain Outlet	A capped underdrain is recommended as a backup. An active underdrain may be used to meet the drawdown time	N/A	See Unvegetated Subsurface Infiltration Cell
Overflow Outlet	Required to pass flow exceeding the design volume	See Unvegetated Subsurface Infiltration Cell	See Unvegetated Subsurface Infiltration Cell
Bottom Slope	The bottom slope should be flat.	See Unvegetated Subsurface Infiltration Cell	As specified by manufacturer
Pretreatment	Required and may include vegetated filter strips, grass swales, sumped catch basins, forebay, or other approved technologies	See Unvegetated Subsurface Infiltration Cell	See Unvegetated Subsurface Infiltration Cell
Vegetation	N/A	N/A	Trees, preferably native, tolerant of inundation and drought
Drawdown Time	72 hours (maximum)	See Unvegetated Subsurface Infiltration Cell	See Unvegetated Subsurface Infiltration Cell
Inspection Port	Inspection ports are required to verify the ongoing performance	See Unvegetated Subsurface Infiltration Cell	See Unvegetated Subsurface Infiltration Cell
Maintenance Access	Access to perform maintenance is required.	See Unvegetated Subsurface Infiltration Cell	Access to perform maintenance is preferable if approved by manufacturer
Inlet Configuration	Storm sewer, permeable paving, roof leader, trench drains, stormwater bumpout, pretreatment devices, or other approved configurations	See Unvegetated Subsurface Infiltration Cell	See Unvegetated Subsurface Infiltration Cell

5.4.1.4 Construction

A subsurface infiltration cell should be protected from sediment during construction. This may be achieved through sequencing the construction or isolating the infiltration area using approved erosion control methods.

Excessive compaction shall be avoided or mitigated within the footprint of the subsurface infiltration cell. Compaction may be necessary to provide the required strength to support the subsurface infiltration cell and the surface land use.

Post-construction verification of the infiltration performance should be performed, see the City of Peoria CSO Remedial Measures Operation & Maintenance and GI Performance Testing Plan.

5.4.1.5 Considerations

Subsurface infiltration cells do not have vegetation that contributes to maintaining the infiltration capacity and effective porosity. Therefore, pretreatment is critical to keep subsurface infiltration cells clean. Consideration should be given to the type of maintenance equipment in designing the maintenance access.

5.4.2 Dry Well

5.4.2.1 Description

Dry wells are subsurface infiltration facilities where the depth is greater than the maximum width. Dry wells can be used to infiltrate stormwater to lower soil layers, particularly in areas where a restrictive layer near the surface is underlain by a high permeability material. Dry wells are often used in combination with other GI that can collect, pre-treat, and store stormwater before infiltration.

5.4.2.2 Feasibility

Dry wells have the same feasibility as unvegetated subsurface infiltration cells.

5.4.2.3 Design

The design of a dry well should follow all applicable local, state, and federal guidelines and regulations, including the Illinois EPA Class V Injection Well Inventory Forms and Instructions (Illinois Environmental Protection Agency, n.d.), and US EPA Stormwater Drainage Wells (United States Environmental Protection Agency, n.d.). Select design criteria for dry wells are summarized in Table 4. See the standard details in Appendix D and Appendix E for a typical dry well.

5.4.2.4 Construction

Dry wells have the same construction considerations as unvegetated subsurface infiltration cells.

5.4.2.5 Considerations

Dry wells have many of the same considerations as unvegetated subsurface infiltration cells.

Dry wells may be subject to regulation under the Illinois EPA Underground Injection Control Program and the US EPA.

5.4.3 Tree Cells

5.4.3.1 Description

Tree cells are modular systems that provide the structural support required for a hardscaped land surface while allowing an uncompacted soil volume within the tree cell to promote a hearty root system and healthy tree. Tree cells allow roots to extend laterally to a larger soil volume than typically available for street trees. Stormwater can be directed to the uncompacted soil similar to an unvegetated subsurface infiltration cell, where the stormwater is stored in the soil pore space. Tree cells mitigate runoff peak flow rate and runoff volume by promoting storage, infiltration, and evapotranspiration.

There are several proprietary suppliers of tree cells. Proprietary products are acceptable with the approval of the City of Peoria, or custom solutions can be designed by the engineer.

5.4.3.2 Feasibility

Tree cells have many of the same design considerations as Unvegetated Subsurface Infiltration. Tree cells are most suitable in areas where the surface land use is paved but a large healthy tree is desirable. Tree cells can be used beneath sidewalks, plazas, parking lots, and other paved surfaces that are used by pedestrians or low-speed vehicles.

5.4.3.3 Design

The design of tree cells should follow all applicable local, state, and federal guidelines. Tree cells should be designed following all manufacturers' recommendations. Additional design resources from other jurisdictions may be used with City of Peoria approval such as the tree trench and tree box discussion in the Minnesota Stormwater Manual (Minnesota Pollution Control Agency). Select design criteria for subsurface infiltration cells are summarized in Table 4. See the rendering in Appendix C and standard detail in Appendix E for a typical tree cell.

5.4.3.4 Construction

Tree cells should be installed following all manufacturer's recommendations. Trees should be planted following the guidance of a qualified landscape architect. Post-construction verification of the tree cell performance should be performed, see the City of Peoria CSO Remedial Measures Operation & Maintenance and GI Performance Testing Plan.

5.4.3.5 Considerations

Tree cells often do not have easy maintenance access to the soil volume beneath the surface hardscape, therefore pretreatment is critical. Pretreatment using inlets with sumps, or an equivalent technology, upstream of tree cells may be suitable.

5.5 STORMWATER RETENTION

5.5.1 Constructed Wetland

5.5.1.1 Description

Wetlands, including constructed wetlands, are areas inundated or saturated to support vegetation typically adapted to saturated soil conditions (Environmental Laboratory, 1987). Wetlands typically have groundwater within at least 12 inches of the surface and can have surface ponding up to 6 feet. The wetland soil surface is often characterized by microtopography that supports diverse habitat elements like micropools. Wetlands are characterized by hydrophytic vegetation, hydric soils, and hydrology that result in permanent or periodic surface saturation during the growing season.

Stormwater can be stored in a constructed wetland to allow for infiltration and evapotranspiration. Stormwater storage can be achieved in the void space of the soil above the groundwater table, if available, as well as surface ponding.

Constructed wetlands provide the opportunity for many environmental co-benefits including a naturalized hydrologic regime, habitat creation, and vegetation establishment. The specific goals should be established early in the planning process.

5.5.1.2 Feasibility

Constructed wetlands require careful consideration of the water budget to ensure an adequate natural water supply to support the wetland vegetation. The water budget is influenced by rainfall, runoff, infiltration, and evapotranspiration. A persistent, natural source of water that is not diverted from another wetland resource may be necessary to maintain wetland hydrology.

A constructed wetland is most suitable in sites with existing hydric soils such as degraded or historical wetlands. Constructed wetlands may be possible in historically upland sites but may require the import of hydric soil. Sites with contaminated soils are not suitable prior to remediation of the contamination.

5.5.1.3 Design

The design of a constructed wetland should follow all applicable local, state, and federal guidelines, including the Illinois Urban Manual Practice Standard Code 997, Code 998, or Code 999 (Illinois Urban Manual, 2021), MWRD Appendix C Standard Drawing Number 3, and US Army Corps of Engineers Wetland Delineation Manual (Environmental Laboratory, 1987). Select design criteria for constructed wetland are summarized in Table 5. See the standard detail in Appendix E for a typical constructed wetland.

Table 5 | Recommended Stormwater Retention Design Criteria

Design Parameter	Constructed Wetland Criteria	Detention Storage Criteria	Green Roof Criteria
Surface Ponding Depth	<6 feet	<4 feet (preferred)	Minimal
Available Subsurface Depth	0 – 12 inches (typ.)	N/A	2 – 12 inches (typ.)
Subsurface Porosity	Variable	N/A	0.25 (typ.)
Soil Composition	Hydric	Low to high permeability (dry pond), Low permeability (wet pond)	Growing media and drainage layer
Primary Outlet	Maintains wetland hydrology	At active storage invert	Roof drain
Overflow Outlet	Convey excess flow	See Constructed Wetland	See Constructed Wetland
Vegetation	Hydrophytic	Emergent to upland	Sedums, grasses, mosses, annuals
Pretreatment	Pretreatment is recommended and may include vegetated filter strips, grass swales, sumped catch basins, forebay, or other approved technologies.	See Constructed Wetland	N/A
Drawdown Time	Sufficient to avoid drowning vegetation	72 hours (maximum)	As approved by City

5.5.1.4 Construction

The construction shall minimize the disturbance and compaction of the hydric soils. The system should be protected from off-site sediment during construction. These goals may be achieved through construction sequencing, construction methods, or other means.

5.5.1.5 Considerations

Ecologic considerations should be included in a constructed wetland. This may include site accessibility to vector predators to minimize vector presence. The availability of carbon sources such as dead trees, nesting structures, fish passage structures, or other habitat elements should be considered. The constructed wetland connection to existing natural vegetative corridors should be considered. Provisions for ongoing operations and maintenance of the wetland, including invasive species control, should be incorporated into the design.

5.5.2 Detention Storage

5.5.2.1 Description

Detention storage consists of a depressed area in the landscape that can store and slowly release stormwater. The depression can be created by excavation, constructing a berm, utilizing an existing depression, or other appropriate measures. Detention storage is commonly in the form of a dry pond, but a wet pond can also be used if additional water quality benefits are desired. A wet pond can be used as pretreatment for other GI facilities. Detention storage can be located in areas where the surface provides multiple functions, such as recreational space or parking during dry weather and detention storage during wet weather.

5.5.2.2 Feasibility

Detention storage should be located in an area where surface water can be diverted. Detention storage should be sufficiently separated from buildings and other infrastructure such that the detention storage does not increase flood risk. Liners may be used to prevent mobilization of known soil contaminants or to retain stormwater for a wet pond.

5.5.2.3 Design

The design of detention storage should follow all applicable local, state, and federal guidelines, including the Illinois Department of Transportation Drainage Manual Chapter 12 (Illinois Department of Transportation, 2011). Select design criteria for detention storage are summarized in Table 5. In addition, the bottom and side slopes of dry detention storage should be sloped towards the outlet to facilitate drainage. See the standard detail in Appendix E for a typical detention storage system.

5.5.2.4 Construction

Any accumulated construction sediment should be removed from the detention storage.

5.5.2.5 Considerations

Safety should be considered and may include safety shelves, fences, signs, or other appropriate measures.

5.5.3 Green Roofs

5.5.3.1 Description

Green roofs allow vegetation to be grown on rooftops, typically in dense urban environments where growing space is not available at ground level. Green roofs typically have multiple layers including a growing media, drainage layer, leak detection system, waterproofing, and roof structure. Extensive green roofs are generally thinner, lighter weight, have smaller plants, and capture less water. Intensive green roofs are generally thicker, heavier, can support larger vegetation, capture more water, and are generally more expensive. Green roofs can be used as functional space for the building occupants or can be accessible for maintenance purposes only.

Green roofs can provide numerous co-benefits to the building including reduced energy usage, reduced noise levels, reduced heat island effects, provides habitat, and improved air quality.

5.5.3.2 Feasibility

Green roofs are most suitable in dense urban environments. Green roofs that are intended for building occupant usage should be flat, while green roofs that are intended for stormwater capture only may be pitched.

5.5.3.3 Design

The design of a green roof should follow all applicable local, state, and federal guidelines, including the Green Roof or Rooftop Garden Requirements and Plant List (Illinois Department of Natural Resources, n.d.), and Soak Up the Rain: Green Roofs (United States Environmental Protection Agency, n.d.). Additional design resources from other jurisdictions may be used with City of Peoria approval such as MWRD Appendix C Standard Drawing Number 5, (Metropolitan Water Reclamation District of Greater Chicago). Green roofs should also be installed following all manufacturer recommendations. Select design criteria for green roofs are summarized in Table 5. See the standard detail Appendix E for a typical green roof.

5.5.3.4 Construction

Green roofs should be installed following manufacturer's recommendations by an experienced installer. Section 3.9 of the Design Guidelines for Green Roof provides recommendations that one company should handle the whole installation to avoid scheduling and damage claim conflicts between trades. Local climate considerations should be given to the timing of planting to minimize irrigation needs for plant establishment. Protection from wind erosion, such as burlap covers, should be installed if the roof is constructed substantially before planting (Peck, Retrieved April 21, 2023). Staging and sequencing should be reviewed prior to the start of construction to ensure the allowed structural loads of building are not exceeded. Leak-testing should be performed on the roof membranes and installed items to ensure the system is leak proof. If significant construction traffic occurs on

the roof after the leak-test, the leak-testing should be repeated. Vegetation should be watered and maintained while stored onsite prior to installation. Whenever possible, green roofs should be installed after other trades are done, such as mechanical equipment installers, to limit traffic on the green roof (Minnesota Pollution Control Agency, Retrieved February 7, 2023). Green roofs construction should follow all local, state, and federal guidelines, building codes, and safety regulations.

5.5.3.5 Considerations

Safety is a major concern with green roofs. Consideration should be given to the impacts of the additional loading on the roof, wind impacts on the green roof, type of allowable access, railings, or parapets, amongst others. Irrigation is often necessary due to the lack of shade and wind exposure.

6.0 GRAY INFRASTRUCTURE

Gray infrastructure is a traditional approach to reduce combined sewer overflows. Gray infrastructure may be constructed to store or convey additional combined sewage volume, or to reduce wet weather inflows to the combined sewer system. Gray infrastructure includes many conventional technologies such as pipes and storage chambers.

6.1 STORAGE

Storage provides a volume that can safely hold combined sewage until the conveyance system and treatment plant have the capacity to handle the additional flow. Storage attenuates peak flow rates and reduces overflow volume.

6.1.1 In-System Storage

6.1.1.1 Description

Collection system trunk sewers, which are currently up to 84 inches (7 feet) in diameter in some areas, can store excess volume when the peak flow rate entering the collection system is higher than the peak flow rate that the system can convey to the WWTP. To utilize this storage, the sewers must be partially empty when the peak flow rate occurs. Sewers with a mild slope promote storage. Storage can be created in the sewers by using weirs, orifices, gates, or similar restrictors. Oversized manhole structures can also provide in-system storage. The ability to attenuate peak flow rates using collection system storage requires a detailed analysis of trunk sewer slopes, basement elevations, and peak flow rates at multiple entry points to the subbasin collection systems.

6.1.1.2 Feasibility

In system storage is most feasible in pipes that have sufficient excess capacity to make modifications cost effective. Preferred pipes are large diameter, deep with low slope, and in good condition (minimal inflow and infiltration). Ideal locations also have limited upgradient connections thus reducing potential for backups to structures or surface discharge.

6.1.1.3 Design

A detailed profile of the selected pipe section, including all connection locations and elevations, is required for in-system storage design. Design also includes development of existing and proposed hydraulic grade lines to determine storage capacity and impacts on upstream and downstream components. The design of in-system storage should follow all local, state, and federal guidelines including the Illinois Department of Transportation Drainage Manual Chapter 12-500 Linear Stormwater Detention (Illinois Department of Transportation, 2011).

6.1.1.4 Construction

In-system storage is implemented in existing collection system piping. Construction related to in-system storage includes installation of flow restricting device(s) to control flow, such as

gates, weirs, and/or orifices, with additional items including flow or level sensors and instrumentation and controls equipment as needed for gate operation. In-system storage should be constructed following all local, state, and federal guidelines, including Standard Specifications for Water and Sewer Construction in Illinois (Illinois Society of Professional Engineers, 2020) and Illinois Recommended Standards for Sewage Works (Illinois Administrative Code, 1997), and all manufacturer and supplier recommendations.

6.1.1.5 Considerations

The ability to maintain existing sewer performance during both dry and wet weather flow conditions while providing storage for CSO control is an important consideration for in-system storage.

6.1.2 Offline Storage

6.1.2.1 Description

Offline storage requires a diversion from the primary conveyance path of the sewer system. The diversion may utilize side weirs, offset pipes, pumps, or other diversion structures. Offline storage can be located deep underground, below the primary conveyance network, or in above grade or shallow underground structures adjacent to the conveyance network where space is available. Offline storage may consist of pipes, tanks, or other structures. Offline storage is drained back to the conveyance system to be treated at the WWTP when capacity is available using pipes or pumps once the peak of the storm event has receded.

6.1.2.2 Feasibility

Offline storage is most feasible when it can provide additional benefits or when other alternatives are not cost effective. Additional benefits of underground offline storage include potential use of the area above the tank for green space, athletic fields, etc.

6.1.2.3 Design

Design of offline storage should include review of adjacent land use and potential impacts, site access, and method to clean and remove solids. Storage should be located to minimize pumping requirements, ideally situated where the tank inlet and outlet can be controlled by gravity. Where pumping is required, tank elevation should be considered to allow for smaller pumping equipment. The design of offline storage should follow all local, state, and federal guidelines. Additional design resources may be utilized such as the Combined Sewer Overflow Technology Fact Sheet Retention Basins (United States Environmental Protection Agency, 1999).

6.1.2.4 Construction

Offline storage should be constructed following all local, state, and federal guidelines, including Standard Specifications for Water and Sewer Construction in Illinois (Illinois Society of Professional Engineers, 2020) and Illinois Recommended Standards for Sewage Works (Illinois Administrative Code, 1997), and all manufacturer and supplier recommendations.

6.1.2.5 Considerations

Selection of storage location and method of conveyance to and from the offline storage are important considerations.

6.2 WET WEATHER FLOW REDUCTION

Gray infrastructure can be used to reduce the rate and volume of wet weather inflows to the combined sewer system. Reducing wet weather inflows frees up conveyance system capacity and reduces overflow volume.

6.2.1 Sewer Separation

6.2.1.1 Description

Sewer separation involves installing additional subsurface pipes to provide independent conveyance for sanitary sewage and stormwater. Sewer separation reduces the risk of CSO by providing an alternative conveyance system for stormwater to the downstream receiving water. Sewer separation requires that the storm inlets and subsurface stormwater connections be disconnected from the sanitary sewer.

6.2.1.2 Feasibility

Sewer separation is most feasible near the border of the combined sewer area when an existing separate storm sewer has available conveyance capacity. Sewer separation is most feasible when full street reconstruction and utility replacement are required.

6.2.1.3 Design

Sewer separation design requires analysis of the capacity of the existing combined system and of the system receiving the additional wet weather flow from the point of connection to the ultimate receiving water body. Review of design sanitary and storm flows, sewer capacity, and number of sanitary and storm connections will factor into the decision to maintain the combined sewer as a sanitary sewer and install new storm sewer or convert the existing combined sewer to storm sewer and install new sanitary sewer.

6.2.1.4 Construction

Sewer separation should be constructed following all local, state, and federal guidelines, including Standard Specifications for Water and Sewer Construction in Illinois (Illinois Society of Professional Engineers, 2020), Illinois Recommended standards for Sewage Works (Illinois Administrative Code, 1997), the Illinois Department of Transportation Drainage Manual (Illinois Department of Transportation, 2011), and all manufacturer and supplier recommendations.

6.2.1.5 Considerations

Co-benefits such as replacing other utilities and roadways should be considered with a sewer separation project. A cost benefit analysis should also be performed since sewer separation can be one of the more expensive gray infrastructure methods of CSO control.

6.2.2 Sewer Lining

6.2.2.1 Description

Sewer lining involves installing a liner or coating on the existing combined sewer pipes. The sewer lining can reduce inflow and infiltration by reducing gaps, cracks, and other defects in the existing combined sewer pipes.

6.2.2.2 Feasibility

Sewer lining is most suitable in areas where existing pipes are degraded and known to have a high volume of inflow and infiltration. Existing pipes must be sufficiently sound to support liner installation. Severely degraded or collapsed pipes are not suitable for lining.

6.2.2.3 Design

Sewer lining should be designed such that conveyance capacity is not adversely impacted.

6.2.2.4 Construction

Sewer lining should be constructed following all local, state, and federal guidelines, including the GPSD Combined Specification Manual, Section 063-Pipe Rehabilitation (Greater Peoria Sanitary and Sewage Disposal District, 2023), ASTM F1216-Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube (American Society of Testing and Materials, 2022), ASTM F1743-Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP) (American Society of Testing and Materials, 2021), and all manufacturer and supplier recommendations.

6.2.2.5 Considerations

Consideration should be given to the existing pipe size, age, and condition and future planned development in the sewershed.

6.2.3 Downspout Disconnection

6.2.3.1 Description

Downspout connections exist where a roof drain is connected directly to a sewer or where discharge is directed to an impervious surface that is directly tributary to a combined sewer inlet. Downspout disconnection removes stormwater from the combined sewer system by removing a direct sewer connection or directing roof areas from an impervious surface, such as a driveway or sidewalk, to a pervious surface, such as a lawn or garden, or collecting the roof runoff in a rain barrel or cistern. City ordinances prohibit connection of downspouts to building sewers or into sanitary sewers and require property owners with existing downspouts connected to a combined sewer to disconnect downspouts and reconnect them to a storm sewer within one year after a public storm sewer becomes reasonably available.

6.2.3.2 Feasibility

Downspout disconnection is most feasible when there is an existing pervious surface near the downspout discharge location or where connection to a storm sewer is available.

6.2.3.3 Design

Downspout disconnection should be designed to have no adverse impact to the disconnected building or downstream infrastructure.

6.2.3.4 Construction

Downspout disconnection should be constructed following all local, state, and federal guidelines including City of Peoria Municipal Code Section 31-56—Downspout Connections (City of Peoria, 1998).

6.2.3.5 Considerations

Downspout disconnection may require work on private property; coordination with private property owners is critical to successful implementation. The new surface and subsurface flow path of roof runoff should be considered, particularly with consideration to building foundations.

7.0 PRE-CONSTRUCTION AND POST- CONSTRUCTION TESTING REQUIREMENTS

Pre-construction infiltration testing of native soils will be completed prior to design. The results of the pre-construction infiltration testing will be used to identify the most suitable type of project for each potential site. Infiltration testing will be completed on the native soils at the elevation of the future GI and native soil interface. Infiltration testing will be completed following applicable industry-standard methods. Post-construction and long-term performance testing will be completed to verify the initial and ongoing performance of GI systems designed for infiltration. The City of Peoria CSO Remedial Measures Operation & Maintenance and GI Performance Testing Plan provides details on pre-construction, post-construction, and long-term performance testing.

8.0 HYDROLOGIC AND HYDRAULIC MODELING OF GI

Peoria's calibrated hydrologic and hydraulic (H&H) model will be used to size and design GI for CSO control. Modeled subcatchments will be further broken down to delineate the drainage area to each GI facility. The design runoff rate and volume will be determined using the modeled runoff from Peoria's Six-Month Design Storm and Peoria's Typical Year rainfall, as defined in the Consent Decree. The GI will use a design native soil infiltration rate based on pre-construction infiltration tests. Other design parameters will be based on manufacturer's specifications, aggregate characteristics, and guidance documents, as described in Appendix F.

Each GI facility will be sized to fully capture the Six-Month Design Storm runoff from the tributary drainage area. If space is not available to fully capture the Six-Month Design Storm runoff at a particular location, the GI facility will be designed to capture the maximum volume practicable. When the GI project design is complete, the Six-Month Design Storm and Typical Year rainfall will be run through the model with the GI project represented as described in Appendix F. The amount of stormwater managed will be estimated using the modeled volume of stormwater infiltrated by the GI project.

Peoria will use an adaptive management approach for GI design, utilizing monitoring data to evaluate project performance and refine future assumptions and design parameters. Following construction of GI, gray infrastructure will be used to manage the remaining flow required to meet the interim and final performance criteria in the Consent Decree.

GI installed for CSO control will be modeled in the City of Peoria's Final Conditions H&H Model. The GI will be modeled to suitably represent the incoming flow, surface infiltration, subsurface infiltration, storage, and overflow, as appropriate. The native soil infiltration rate in the Final Conditions H&H Model will be based on performance testing. The GI will be represented in the model using the methods below. Descriptions of how each GI technology will be represented in the model are provided in Appendix F.

1. Representing GI using low impact development (LID) controls on an individual GI facility and individual GI drainage area basis.
2. Representing GI facilities using LID controls in a regional subcatchment and adjusting the percent of the impervious area treated as appropriate to reflect the area tributary to each GI facility.
3. Representing GI facilities using hydraulic entities such as storages and conduits and using seepage to represent infiltration to the native soil.

The Final Conditions H&H Model will be calibrated and finalized following completion of Post-Construction Compliance Monitoring, which will begin by January 1, 2040. It is likely that GI modeling approaches will advance over time; and therefore, there may be other more suitable GI modeling methods for the Final Conditions H&H Model. Peoria will amend this plan as necessary and resubmit the plan for US EPA and IEPA approval prior to January 2040 to provide updates to the GI modeling approach, if appropriate.

REFERENCES

- American Society of Testing and Materials. (2021). *ASTM F1743–Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)*.
- American Society of Testing and Materials. (2022). *ASTM F1216-Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube*.
- City of Chicago. (2016). *Stormwater Management Ordinance Manual*. Retrieved from <https://www.chicago.gov/content/dam/city/depts/water/general/Engineering/SewerConstStormReq/2016StormwaterManual.pdf>
- City of Peoria. (1998). *Municipal Code Section 31-56 – Downspout Connections*. Retrieved from https://library.municode.com/il/peoria/codes/code_of_ordinances/179607?nodeId=CO_CH31_WASESEDIDR
- Engineers, I. S. (2020). *Standard Specification for Water and Sewer Main Construction in Illinois*.
- Environmental Laboratory. (1987). *Corps of Engineers Wetland Delineation Manual*. Vicksburg, MS: US Army Corps of Engineers Waterways Experiment Station. Retrieved from https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/16/nrcs143_020653.pdf
- Greater Peoria Sanitary and Sewage Disposal District. (2023, February). *Combined Specification Manual, Section 063–Pipe Rehabilitation*. Retrieved from Greater Peoria Sanitary and Sewage Disposal District: https://www.gpsd.org/uploads/1/2/0/6/120645325/2023_gpsd_specifications_-_building_sewer_regs_bot_approved_02212023.pdf
- Illinois Administrative Code. (1997). *Illinois Recommended Standards for Sewage Works (Subparts A-C)*. Retrieved from Illinois Administrative Code: <https://ilga.gov/commission/jcar/admincode/035/03500370sections.html>
- Illinois Department of Natural Resources. (n.d.). *Green Roof or Rooftop Garden Requirements and Plant List*. Retrieved January 7, 2022, from Illinois Department of Natural Resources: <https://www2.illinois.gov/dnr/education/Pages/PlantListRoof.aspx>
- Illinois Department of Transportation. (2011). *IDOT Drainage Manual*. Springfield, IL. Retrieved from <https://idot.illinois.gov/Assets/uploads/files/Doing-Business/Manuals-Guides-&-Handbooks/Highways/Bridges/Hydraulics/IDOT%20DRAINAGE%20MANUAL.pdf>

- Illinois Environmental Protection Agency. (n.d.). *Class V Injection Well Inventory Forms and Instructions*. Retrieved January 5, 2022, from Illinois Environmental Protection Agency: <https://epa.illinois.gov/topics/forms/land-forms/underground-injection-control/class-v-injection-well-forms.html>
- Illinois Society of Professional Engineers. (2020). *Standard Specification for Water and Sewer Main Construction in Illinois*.
- Illinois Urban Manual. (2021, December 13). Retrieved from Illinois Urban Manual: <https://illinoisurbanmanual.org/>
- Metropolitan Water Reclamation District of Greater Chicago. (n.d.). *Watershed Management Ordinance Technical Guidance Manual*. Chicago, IL: Metropolitan Water Reclamation District of Greater Chicago. Retrieved January 7, 2022, from Metropolitan Water Reclamation District of Greater Chicago
- Minnesota Pollution Control Agency. (n.d.). *Minnesota Stormwater Manual*. Retrieved December 2021, from https://stormwater.pca.state.mn.us/index.php?title=Main_Page
- Minnesota Pollution Control Agency. (Retrieved February 7, 2023). *Construction Specification for Green Roofs*. Retrieved from Minnesota Pollution Control Agency: https://stormwater.pca.state.mn.us/index.php?title=Construction_specifications_for_green_roofs
- Peck, S. K. (Retrieved April 21, 2023). *Design Guidelines for Green Roofs*. Retrieved from United States Environmental Protection Agency: https://www.epa.gov/sites/default/files/documents/design_guidelines_for_green_roofs.pdf
- Tiway, A., Godsmark, K., & Smethurst, J. (2018). Field Evaluation of Precipitation Interception Potential of Green Facades. *Ecological Engineering*, 69-75.
- United States Environmental Protection Agency. (1999, September). *Combined Sewer Overflow Management Fact Sheet Sewer Separation*. Retrieved from <https://www3.epa.gov/npdes/pubs/sepa.pdf>
- United States Environmental Protection Agency. (1999, September). *Combined Sewer Overflow Technology Fact Sheet Retention Basins*. Retrieved from <https://www3.epa.gov/npdes/pubs/csoretha.pdf>
- United States Environmental Protection Agency. (n.d.). *Soak Up the Rain: Disconnect / Redirect Downspouts*. Retrieved January 12, 2022, from United States Environmental Protection Agency: <https://www.epa.gov/soakuptherain/soak-rain-disconnect-redirect-downspouts>
- United States Environmental Protection Agency. (n.d.). *Soak Up the Rain: Green Roofs*. Retrieved January 7, 2022, from United States Environmental Protection Agency: <https://www.epa.gov/soakuptherain/soak-rain-green-roofs>

United States Environmental Protection Agency. (n.d.). *Stormwater Drainage Wells*. Retrieved January 5, 2022, from United States Environmental Protection Agency:
<https://www.epa.gov/uic/stormwater-drainage-wells>

Wisconsin Department of Natural Resources. (2021). *Technical Standard Permeable Pavement 1008*. Retrieved from
https://dnr.wisconsin.gov/sites/default/files/topic/Stormwater/1008_PermeablePavement_06-2021.pdf

APPENDIX A

Project Tree and Plant List

APPENDIX A. PROJECT TREE AND PLANT LIST

DECIDUOUS TREES



crataegus spp

Thornless Hawthorn

Size: 20-30 feet tall, 20-35 feet wide

Habit: moderate growth rate; broad, round shape

Hardiness: zones 3 to 7

Tolerance: salt spray, drought

Foliage: dark glossy green leaves turn purplish in fall

Characteristics: beautiful white flowers in spring; persistent fruit in fall and winter



gleditsia triacanthos f. inermis

Thornless Honey Locust

Size: 30-70 feet tall, 30-70 feet wide

Habit: fast-growing, oval-shaped

Hardiness: zones 3 to 9

Tolerance: pollution, salt, and drought

Foliage: lacy green foliage, showy yellow in fall

Characteristics: yields brown seed pods 7-8" long by 1" wide

Note: transplants well, easy to grow

Suggested Cultivars: moraine, skyline



gymnocladus dioicus

Kentucky Coffee Tree

Size: 60-75 feet tall, 40-50 feet wide

Habit: moderate growth rate; irregular oval shape

Hardiness: zones 3 to 8

Tolerance: salt spray, pollution, drought

Foliage: blue-green leaves with mild yellow fall color

Characteristics: spreading canopy capable of blocking sunlight and adds visual interest and beauty to landscaping

Note: consider male cultivars to avoid messy fruit

Suggested Cultivars: Espresso, Prairie Titan, Stately Manor



platanus × acerifolia

London Plane Tree

Size: 70-100 feet tall, 65-80 feet wide

Habit: medium growing in a pyramidal shape that shifts to a more oval silhouette over time

Hardiness: zones 5 to 8

Tolerance: very tolerant of urban conditions

Characteristics: bark has gray-brown flaky scales that shed to expose mottled peeling patches of white, gray, and green

Note: easily transplanted, prefers large spaces

Suggested Cultivars: encore, exclamation



taxodium distichum

Bald Cypress

Size: 50-70 feet tall, 20-30 feet wide

Habit: medium-growing pyramid shape

Hardiness: zones 4-11

Tolerance: salt spray

Foliage: soft, feathery green needles turn russet-red in autumn before falling

Characteristics: deciduous conifer

Suggested Cultivars: Monarch of Illinois, Shawnee Brave



ulmus parvifolia

Chinese Elm

Size: 40-60 feet tall, 50-60 feet wide

Habit: fast-growing vase shaped

Hardiness: zones 5-9

Tolerance: dry sites and alkaline soils

Foliage: shiny dark green turns purplish in fall with exfoliating, mottled bark

Characteristics: resistant to Dutch elm disease and air pollution

SHRUBS



aronia melanocarpa

Black Chokeberry

Size: 5-8 feet

Habit: slow to moderate growing

Hardiness: zones 3-8

Foliage: dark green turns deep mahogany red in fall

Characteristics: attracts birds and butterflies

Suggested Cultivars: Iroquois Beauty

PERENNIALS



liatris spicata

Dense Blazing Star

Height: 3-5 feet

Color: Purple

Bloom Time: July-September



aster novae-angliae

New England Aster

Height: 3-6 feet

Color: pink, purple

Bloom Time: August-October



baptisia australis

Blue False Indigo

Height: 3-5 feet

Color: blue, purple

Bloom Time: April-July



penstemon digitalis

Foxglove Beard Tongue

Height: 1.5-3 feet

Color: white

Bloom Time: May-July



rudbeckia subtomentosa

Sweet Black-Eyed Susan

Height: 3-6 feet

Color: yellow

Bloom Time: July-September



iris virginica shrevei

Blue Flag Iris

Height: 1-3 feet

Color: blue, purple

Bloom Time: May



physostegia virginiana

Obedient Plant

Height: 3-5 feet

Color: pink, purple

Bloom Time: August-November



asclepias tuberosa

Butterfly Milkweed

Height: 1-1 feet

Color: orange, yellow

Bloom Time: May-September



echinacea purpurea

Purple Coneflower

Height: 2-5 feet

Color: pink, purple

Bloom Time: April-September

ORNAMENTAL GRASSES



sporobolus heterolepis

Prairie Dropseed

Height: 2-3 feet

Color: green leaves with golden fall color

Bloom Time: August-September



carex brachyglossa

Yellow Fox Sedge

Height: 1.5-3 feet

Color: green leaves with yellow spikelets

Bloom Time: late spring-early summer



deschampsia cespitosa

Tufted Hair Grass

Height: 1-2 feet

Color: brown

Bloom Time: May-June



schizachyrium scoparium

Little Blue Stem

Height: 3-6 feet

Color: white, green, brown

Bloom Time: June-December



panicum virgatum

Shenandoah Grass

Height: 3-4 feet

Color: green, golden, red-tinged

Bloom Time: July-February

APPENDIX B

Invasive Plant Species

APPENDIX B. INVASIVE PLANT SPECIES

Below are photos of invasive plant species and a species list of invasive plants that may be commonly found in vegetated areas.



Common Reed



Canada Thistle



Garlic Mustard



Purple Loosestrife



Reed Canary Grass



Cheatgrass

Below is a list of invasive plants that may be found in vegetated areas.

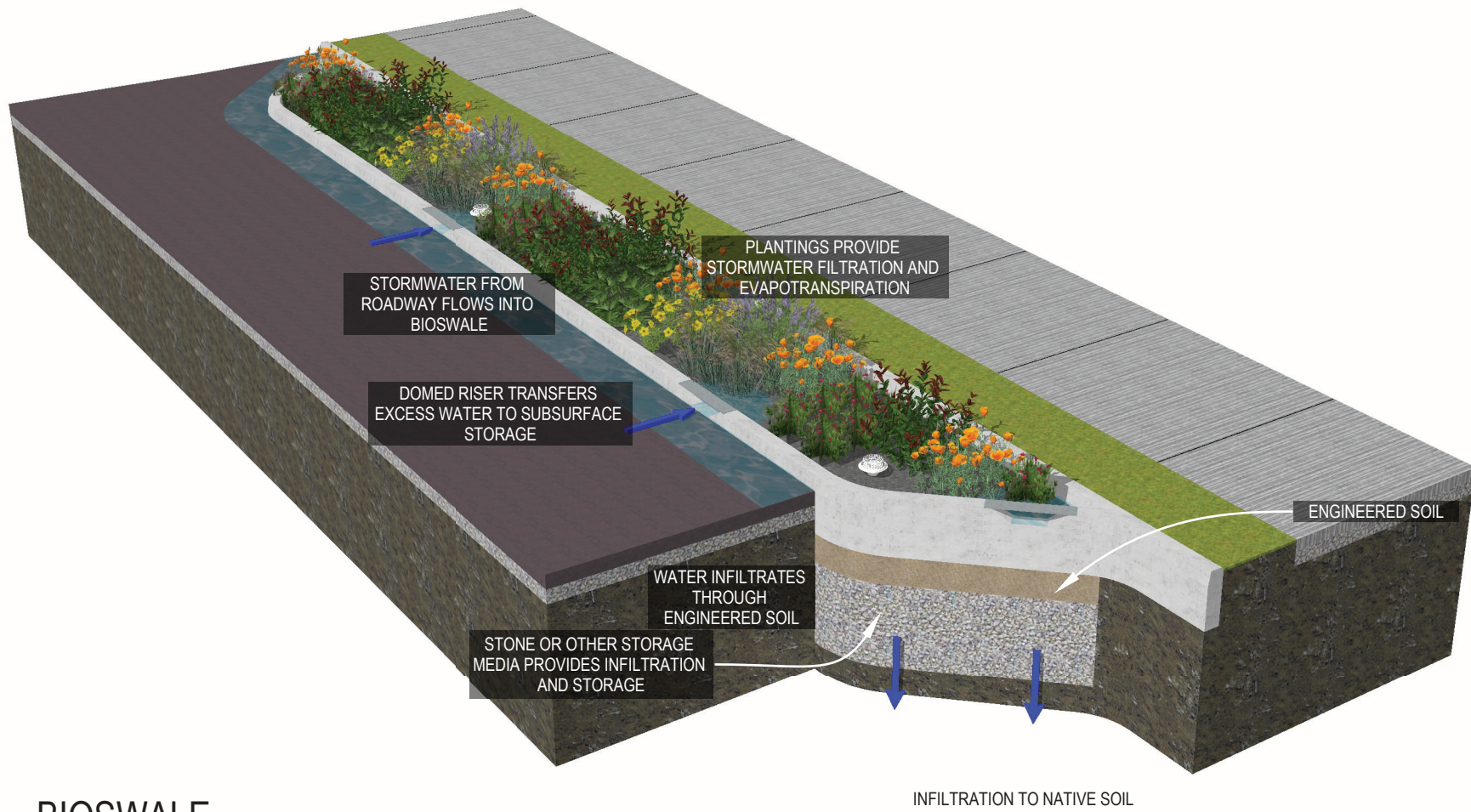
- Autumn Olive
- Black Locust Reed
- Chinese Silvergrass
- Common Reed
- Creeping Jenney
- Dames Rocket
- Japanese Honeysuckle
- Japanese Knotweed
- Multiflora Rose
- Norway Maple
- Purple Loosestrife
- Canarygrass
- Russian Olive
- Siberian Elm
- Smooth Brome
- Star-of-Bethlehem
- Tall Fescue
- Tree-of-Heaven
- White Mulberry
- Winged Burning Bush

A complete list of Illinois invasive plant species can be found at
<http://www.invasive.org/species/list.cfm?id=152>

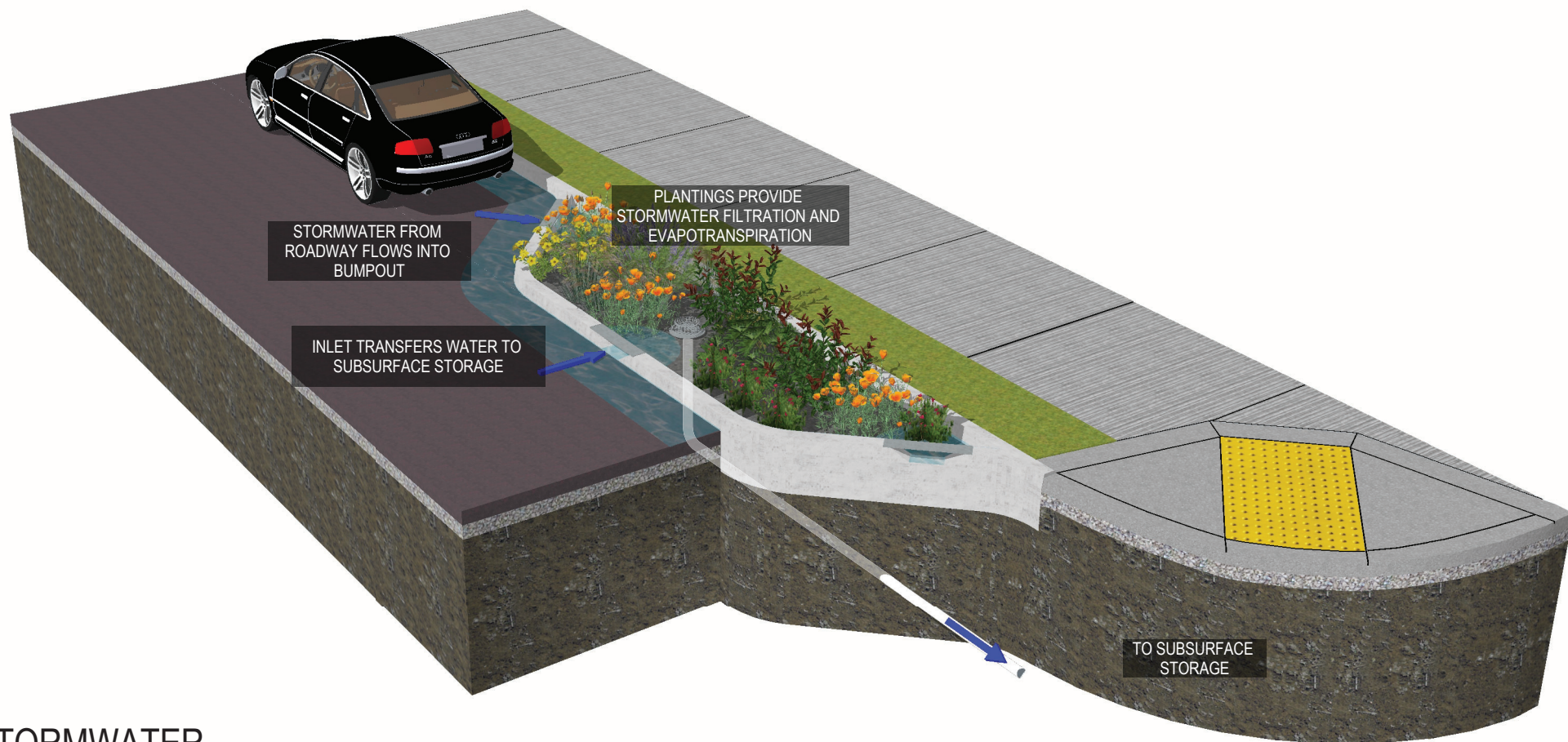
APPENDIX C

Green Infrastructure Renderings

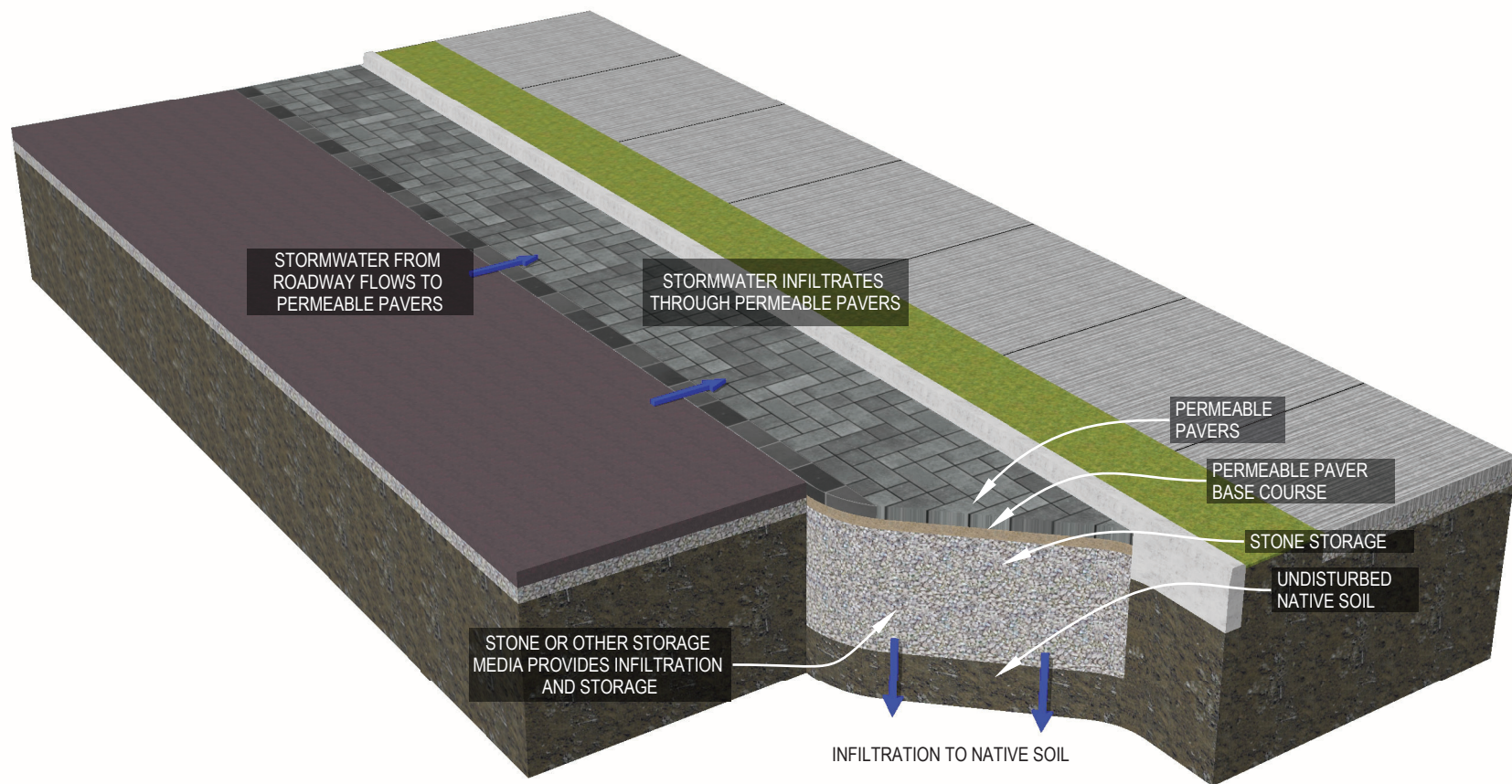




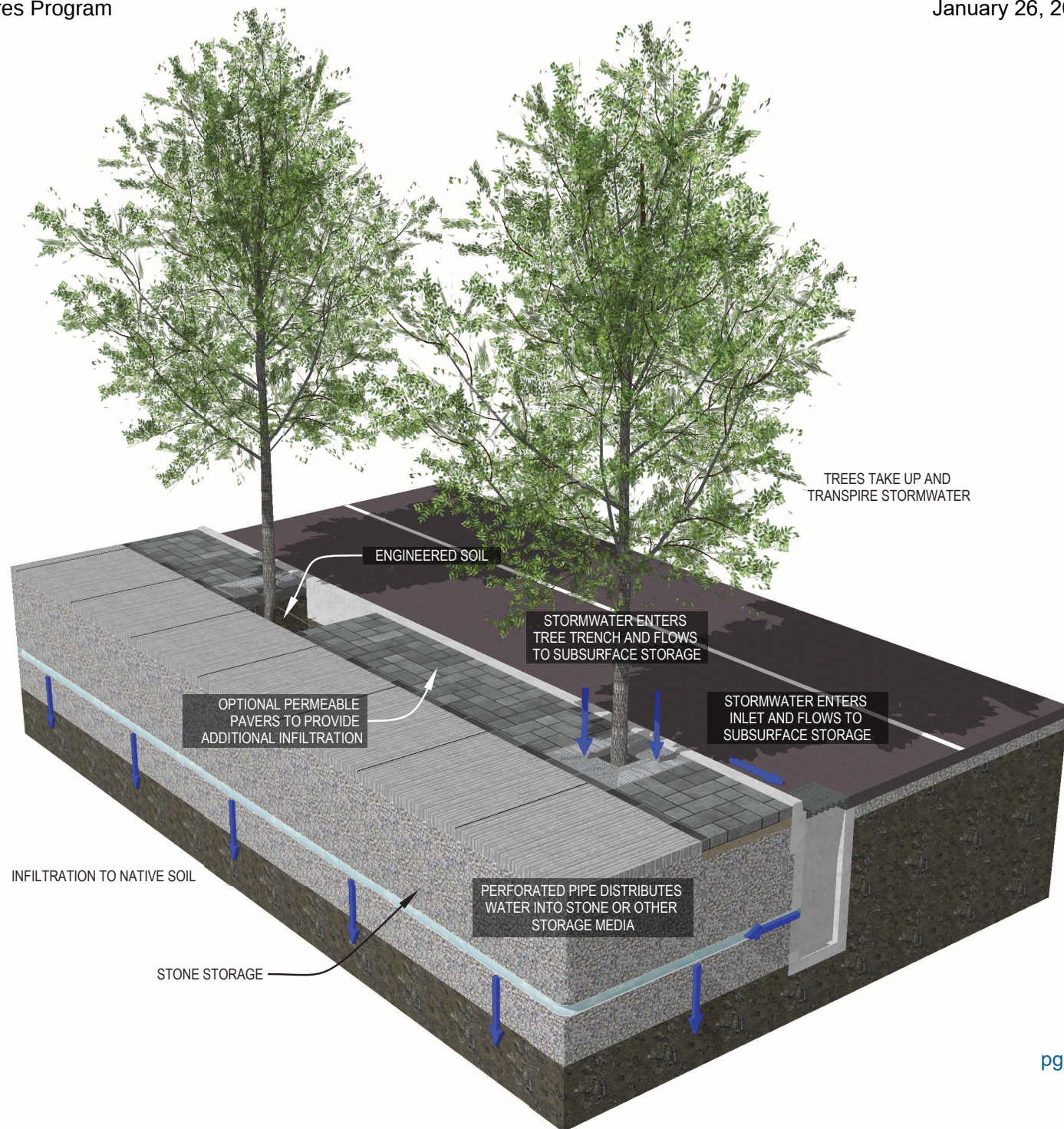
BIOSWALE



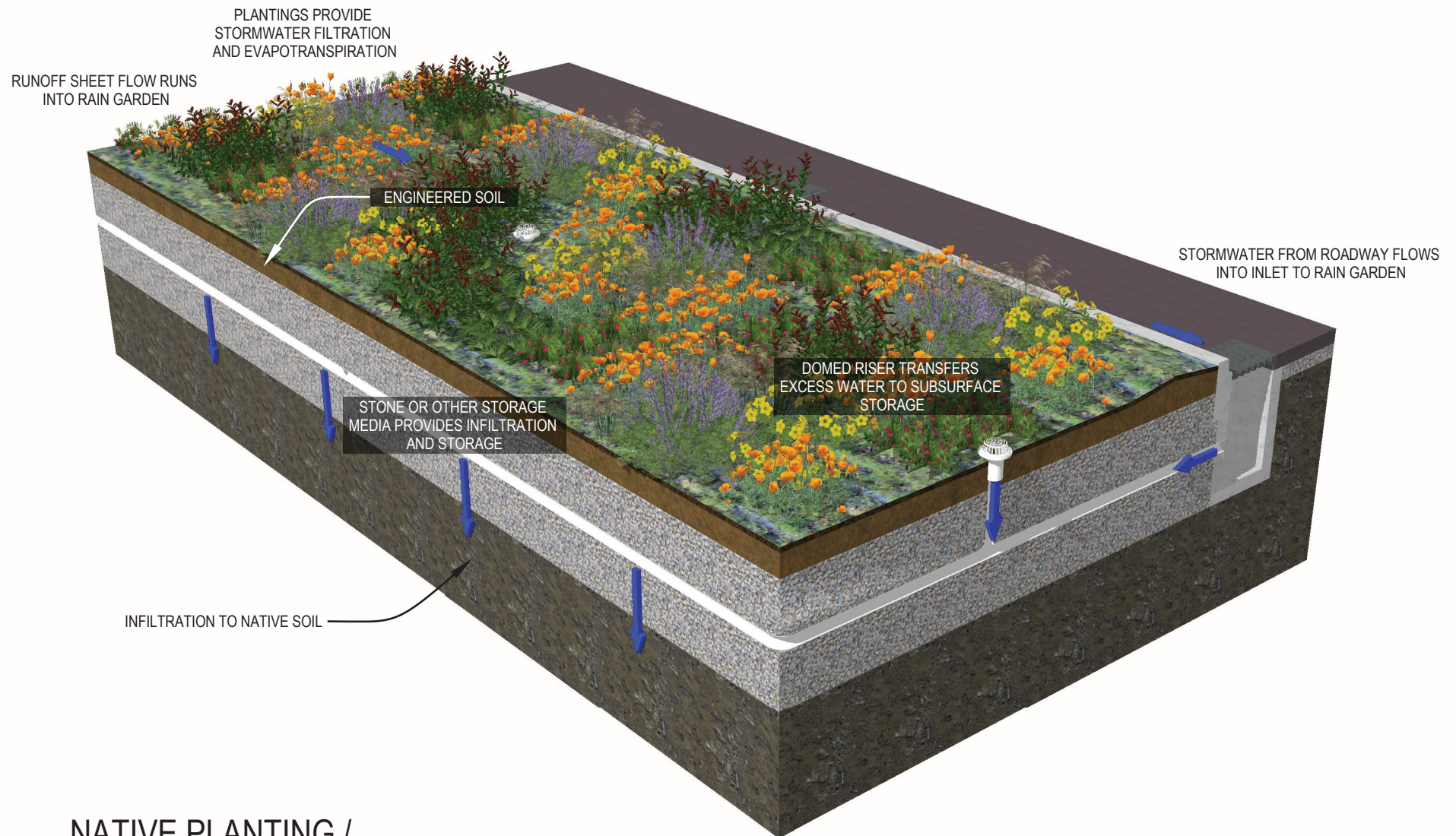
STORMWATER BUMPOUT



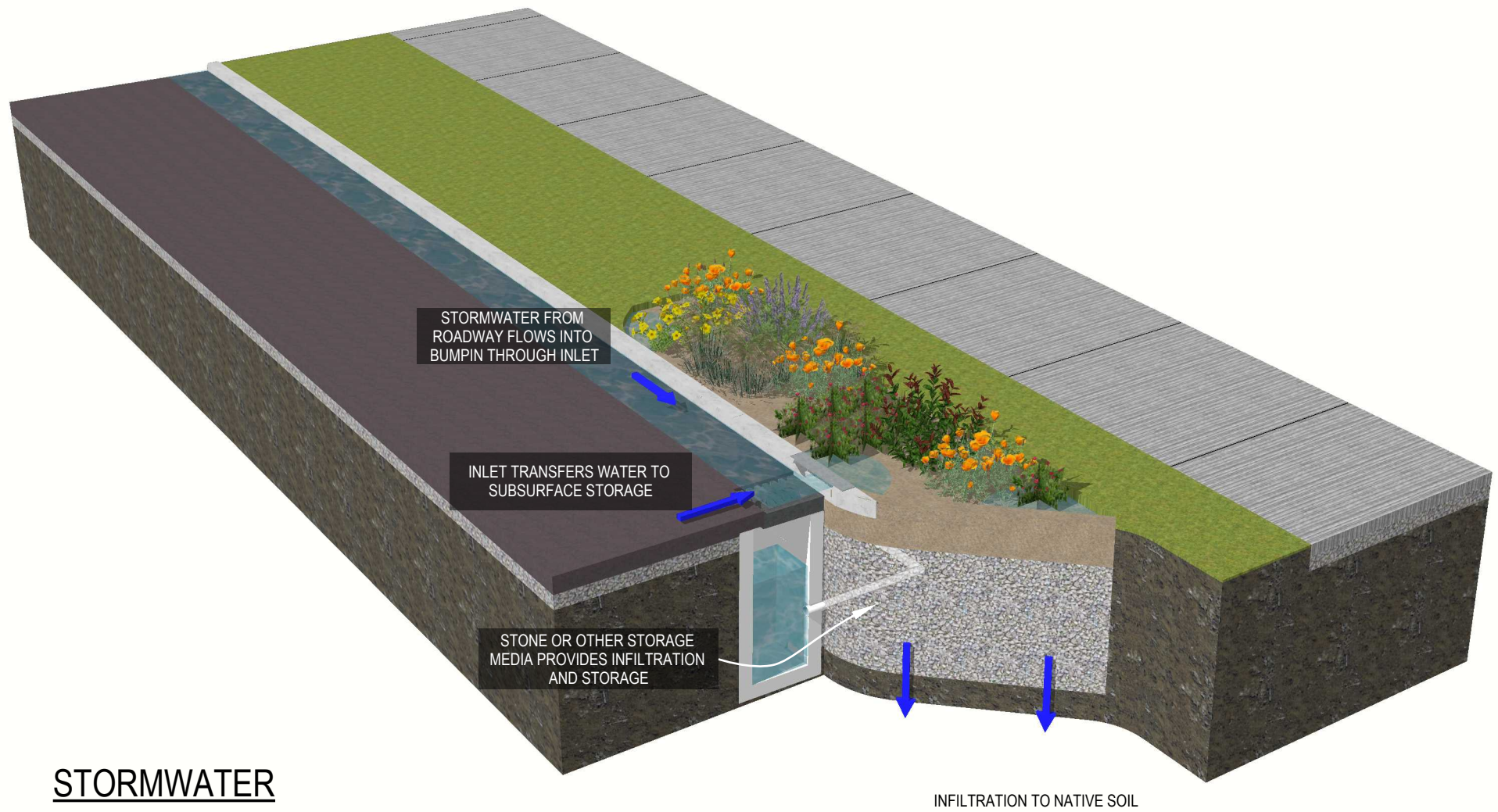
PERMEABLE PAVERS



STORMWATER TREE TRENCH



NATIVE PLANTING /
RAIN GARDEN

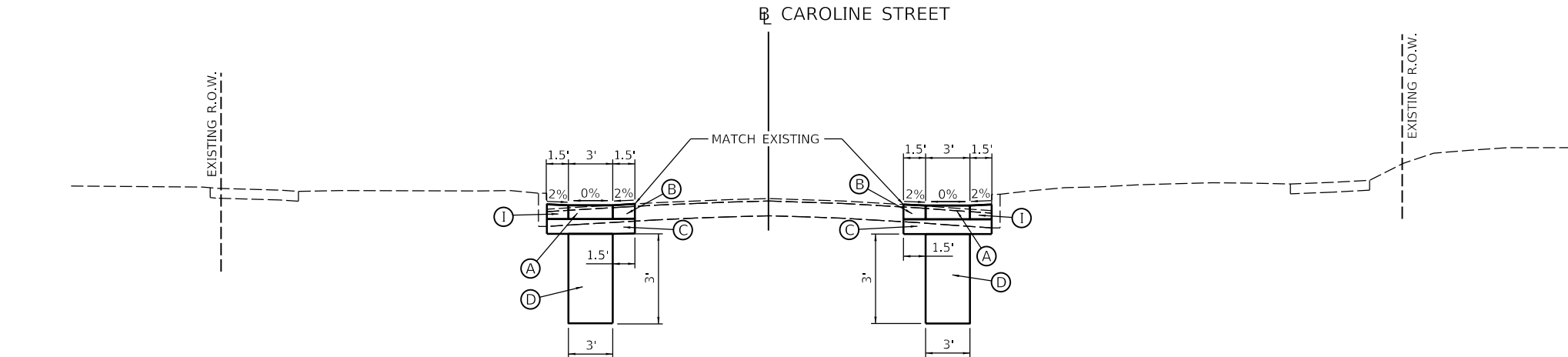


STORMWATER BUMPIN

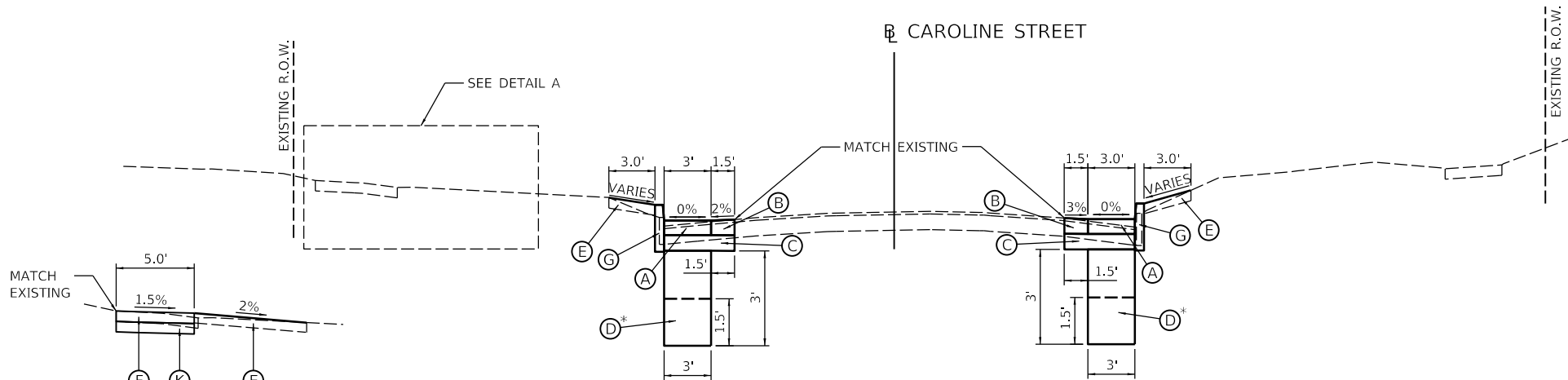
APPENDIX D

Green Infrastructure Standard Details from Peoria's Year 1 CSO Control Project and Other Recent GI Projects

LAYOUT	BAB	8/13/2021
DRAWN	RLA	10/1/2021
REVIEWED	BAB	10/14/2021

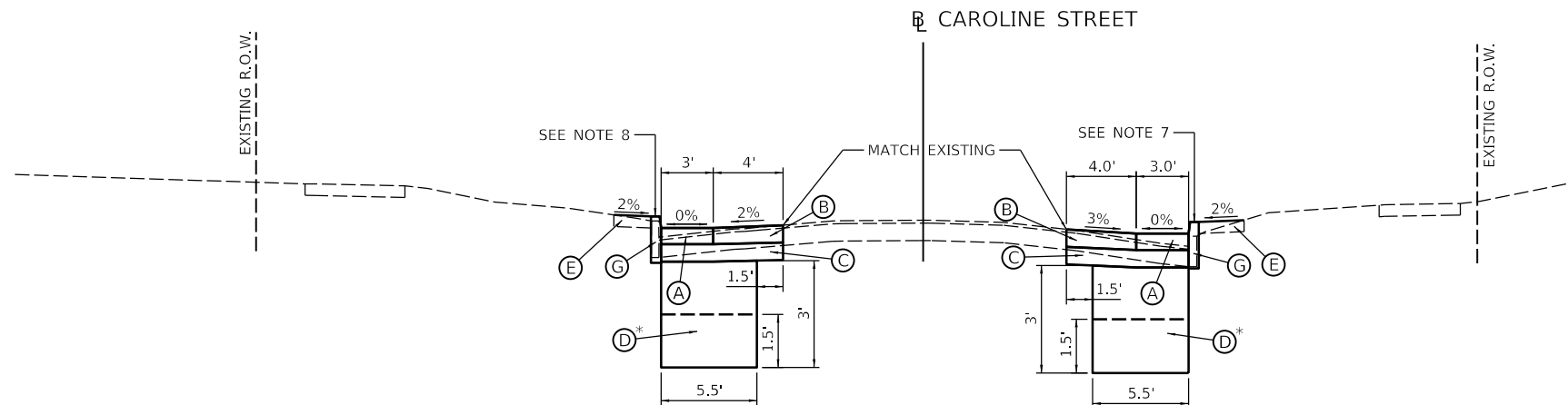


PROPOSED TYPICAL SECTION
STA. 716+00.00 TO STA. 717+68.00
STA. 718+54.00 TO STA. 720+22.00



PROPOSED TYPICAL SECTION
STA. 723+09.00 TO STA. 726+40.00

* THE BOTTOM 1.5' SHALL CONSIST OF
CA 14. SEE SPECIAL PROVISIONS FOR
ADDITIONAL INFORMATION.



PROPOSED TYPICAL SECTION
STA. 727+65.50 TO STA. 731+28.50

* THE BOTTOM 1.5' SHALL CONSIST OF
CA 14. SEE SPECIAL PROVISIONS FOR
ADDITIONAL INFORMATION.

LEGEND

- (A) CONCRETE PAVERS, TYPE A
- (B) PAVEMENT PATCHING (SPECIAL), 6"
- (C) AGGREGATE BASE COURSE, TYPE A 6"
- (D) AGGREGATE BASE COURSE, TYPE B
- (E) TOPSOIL FURNISH AND PLACE, 4"
- (F) PORTLAND CEMENT CONCRETE SIDEWALK, 4"
- (G) CONCRETE CURB, TYPE B
- (H) COMBINATION CONCRETE CURB AND GUTTER, TYPE B-6.18 (SEE DETAIL)
- (I) CONCRETE GUTTER (SPECIAL) (SEE DETAIL)
- (J) COMBINATION CONCRETE CURB AND SIDEWALK 4 INCH (SPECIAL)
- (K) SUBBASE GRANULAR MATERIAL, TYPE B, 4"

NOTES:

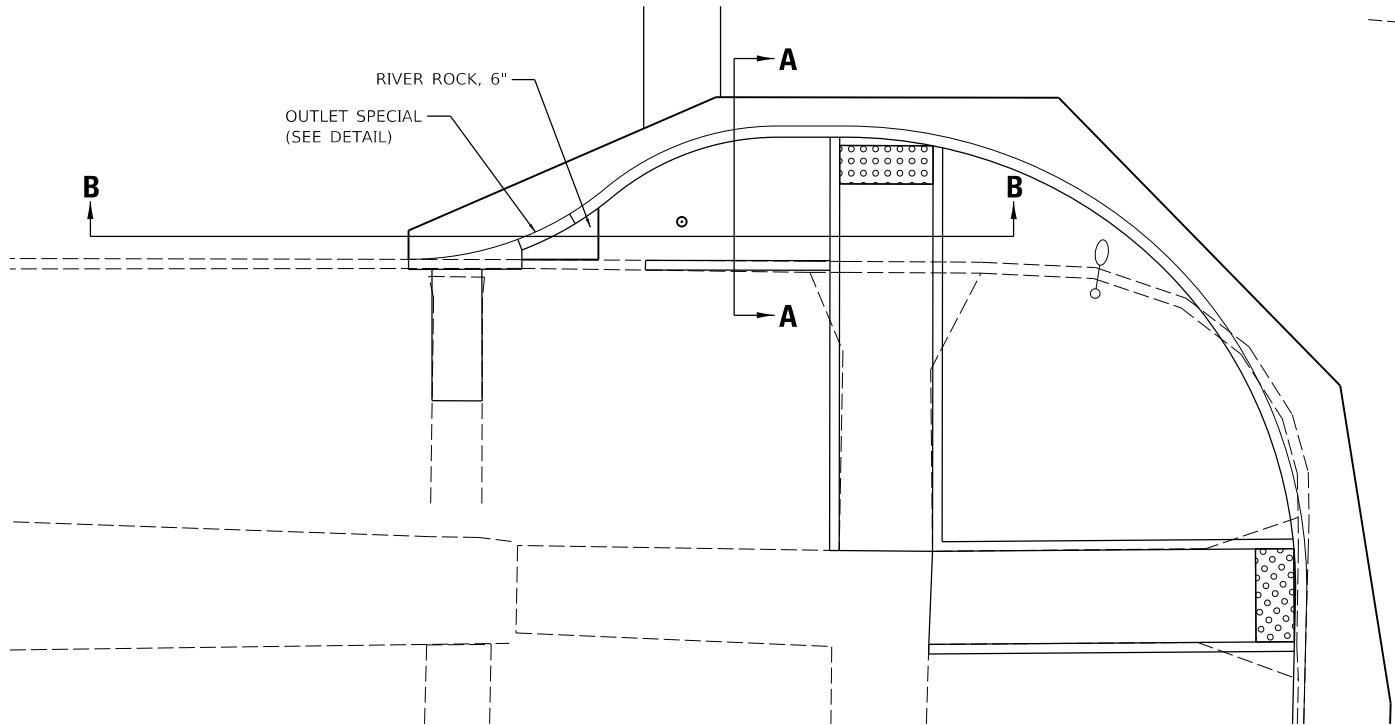
- SEE DETAILS FOR ADDITIONAL GRADING INFORMATION.
- ROW LOCATIONS ARE APPROXIMATE, BASED UPON GIS INFORMATION PROVIDED BY THE CITY OF PEORIA.
- TRANSITION THE PROPOSED PAVER SECTIONS 10' AT THE START AND END OF EACH SECTION TO MATCH THE EXISTING PAVEMENT SLOPE EXCEPT AT LOCATIONS WHERE INTERSECTION IMPROVEMENTS ARE PROPOSED. SEE INTERSECTION DETAILS FOR ELEVATIONS AND SLOPES AT THESE LOCATIONS.
- AT LOCATIONS WHERE THE AGGREGATE BASE COURSE, TYPE A TRENCH IS OFFSET FROM THE TYPICAL 1.5' IS TO PROVIDE SEPARATION FROM EXISTING UTILITES AND/OR WIDER INFILTRATION AREAS. THE OFFSETS MAY NEED ADJUSTED IN THE FIELD BASED UPON THE ACTUAL LOCATION OF THE UTILITIES IN THE FIELD AS APPROVED BY THE ENGINEER. SEE UTILITY SEPARATION DETAIL FOR ADDITIONAL INFORMATION.
- THE DEPTH OF AGGREGATE BASE COURSE, TYPE B IS BASED UPON BORING INFORMATION PROVIDED BY THE GEOTECHNICAL INVESTIGATION TO ESTABLISH QUANTITIES. THE DEPTH MAY VARY DUE TO ACTUAL FIELD CONDITIONS ENCOUNTERED. THE ENGINEER SHALL APPROVE ANY CHANGES AND NOTIFY THE CONTRACTOR.
- CURB HEIGHT SHALL BE 1.5 INCHES.
- CURB HEIGHT SHALL BE 4 INCHES.
- DEPTH WILL VARY BASED UPON THE INVERT ELEVATIONS OF THE PROPOSED STORMWATER STORAGE CHAMBERS. SEE PLAN AND PROFILES SHEETS FOR INVERT ELEVATIONS.

CITY OF PEORIA

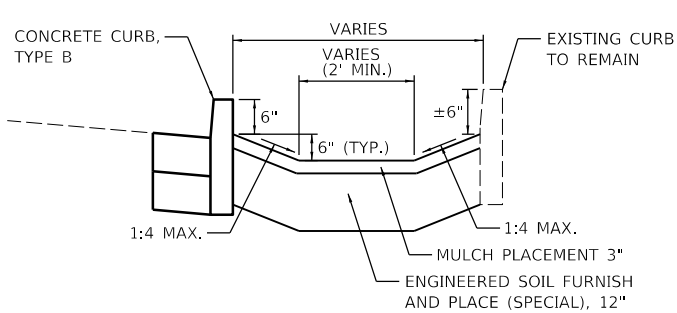
**CSO YEAR 1 IMPROVEMENTS
PROPOSED TYPICAL SECTIONS**

SCALE: N/A SHEET OF SHEETS STA. TO STA.

F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		PEORIA	114	13
CONTRACT NO.				
ILLINOIS FED. AID PROJECT				

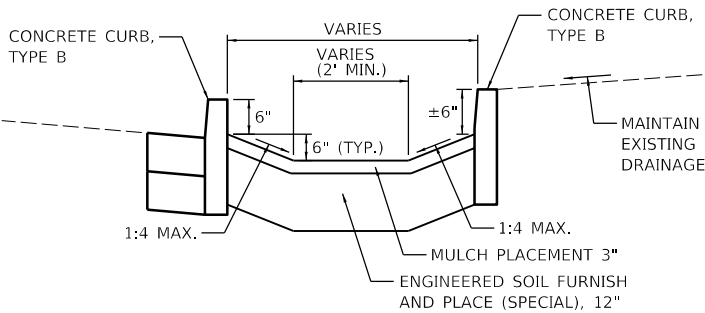


PLAN VIEW



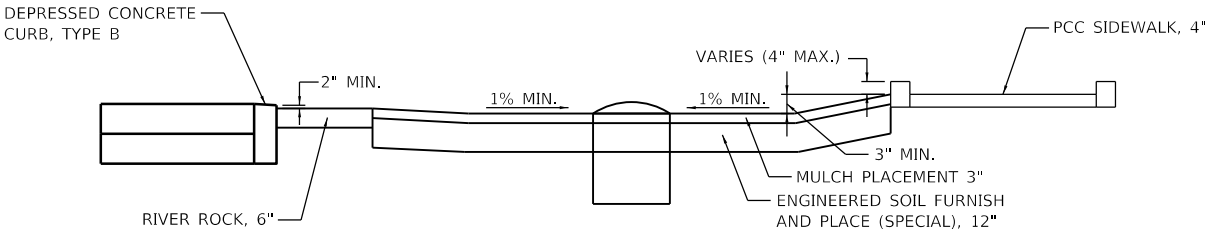
SECTION A-A

AT LOCATIONS WHERE EXISTING CURB IS TO REMAIN



SECTION A-A

AT LOCATIONS WHERE THERE IS PROPOSED CURB

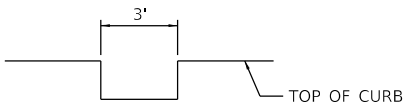


SECTION B-B

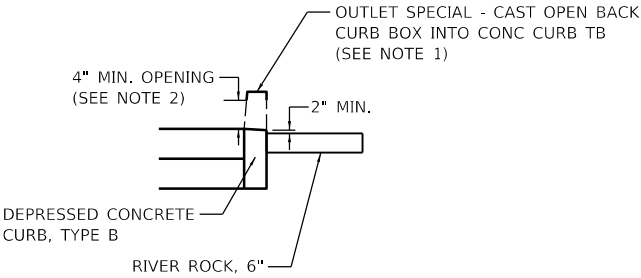
NOTES:

1. SEE PLAN SHEETS FOR LOCATIONS OF EXISTING CURB TO REMAIN OR PROPOSED CONCRETE CURB, TYPE B.
2. SEE INTERSECTION DETAILS FOR ADDITIONAL INFORMATION.
3. SEE SIDEWALK RAMP DETAILS FOR ADDITIONAL INFORMATION.
4. SEE PLAN AND PROFILE SHEETS FOR STORM SEWER STRUCTURE INFORMATION.

PLANTER TYPICAL SECTIONS



SECTION A-A



SECTION B-B

NOTES:

1. CURB BOX SHALL BE IN ACCORDANCE WITH FRAME AND GRATE DETAIL FOR INLETS, TY G-1 EXCEPT BACK SHALL BE OPEN TO ALLOW STORMWATER TO FLOW FREELY INTO THE PLANTING AREA.
2. ADJUST ADJACENT CURB HEIGHT TO PROVIDE 4" MIN. OPENING AS NEEDED. NO ADDITIONAL COMPENSATION WILL BE ALLOWED FOR THIS WORK.

OUTLET SPECIAL DETAIL

LAYOUT	BAB	8/13/2021
DRAWN	RLA	10/1/2021
REVIEWED	BAB	10/14/2021

MODEL Default
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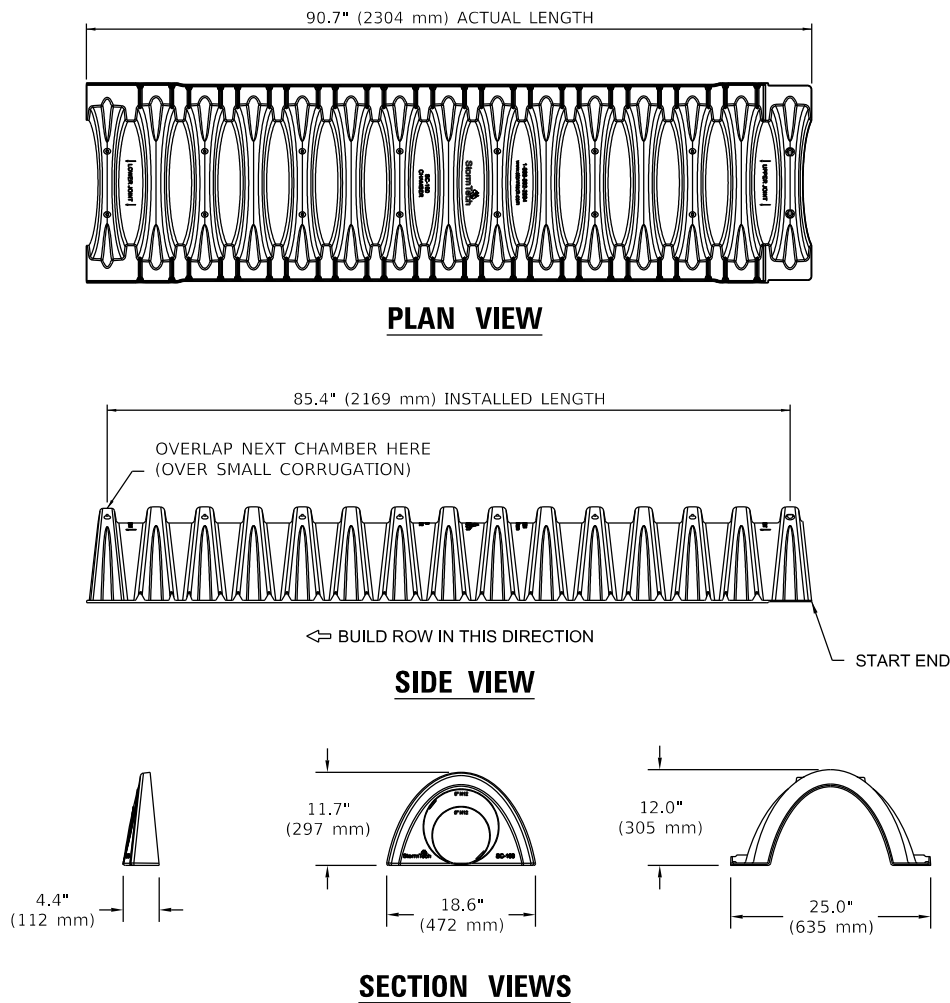
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		DRAWN -	RLA	REVISED -	
PLOT SCALE	= 10.00 " / in.	CHECKED -	BAB	REVISED -	
PLOT DATE	= 11/17/2021	DATE -	10/29/2021	REVISED -	

CITY OF PEORIA

CSO YEAR 1 IMPROVEMENTS
PLANTER DETAILS

SCALE: N/A SHEET OF SHEETS STA. TO STA.

F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		PEORIA	114	84
CONTRACT NO.				
ILLINOIS FED. AID PROJECT				

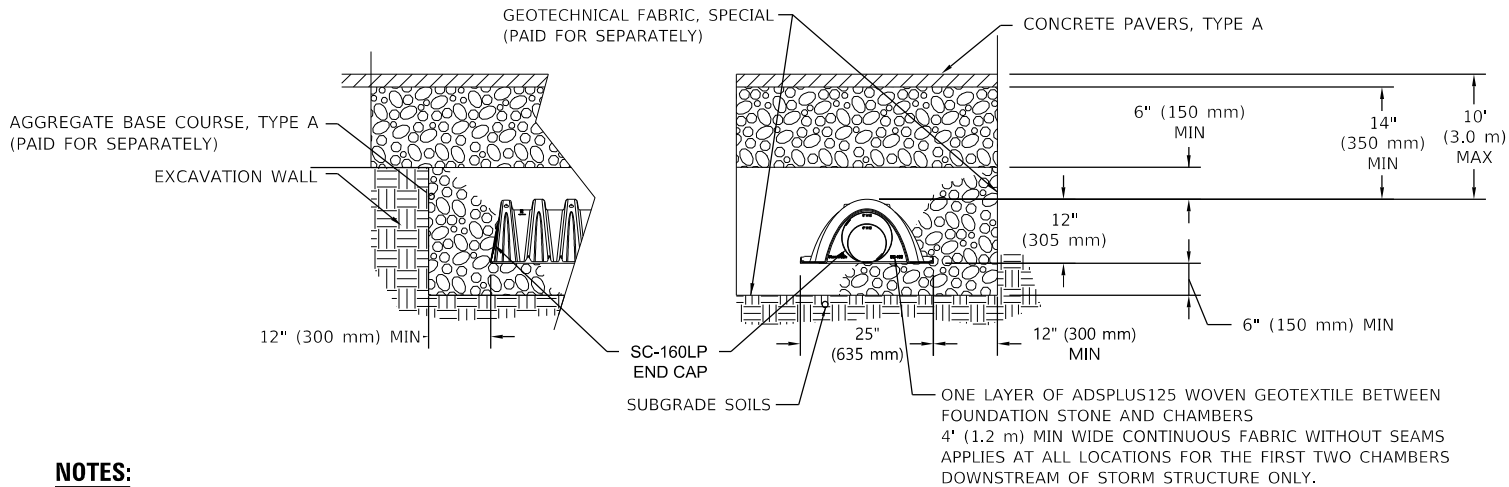
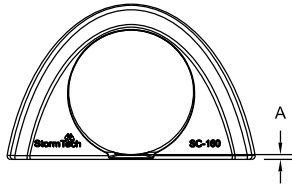


NOMINAL CHAMBER SPECIFICATIONS

*ASSUMES 6" (152 mm) ABOVE, 6" (152 mm) BELOW, AND STONE BETWEEN CHAMBERS WITH 40% STONE POROSITY.

ALL STUBS ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

NOTE: ALL DIMENSIONS ARE NOMINAL



1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
3. REQUIREMENTS FOR HANDLING AND INSTALLATION:
 - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS
 - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 1.5"
 - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 400 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

1. STORMTECH SC-160LP CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH SC-160LP CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-160LP CONSTRUCTION GUIDE".
3. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
4. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES CONCERNING CHAMBER FOUNDATION DESIGN AND SUBGRADE BEARING CAPACITIES TO THE ENGINEER.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.

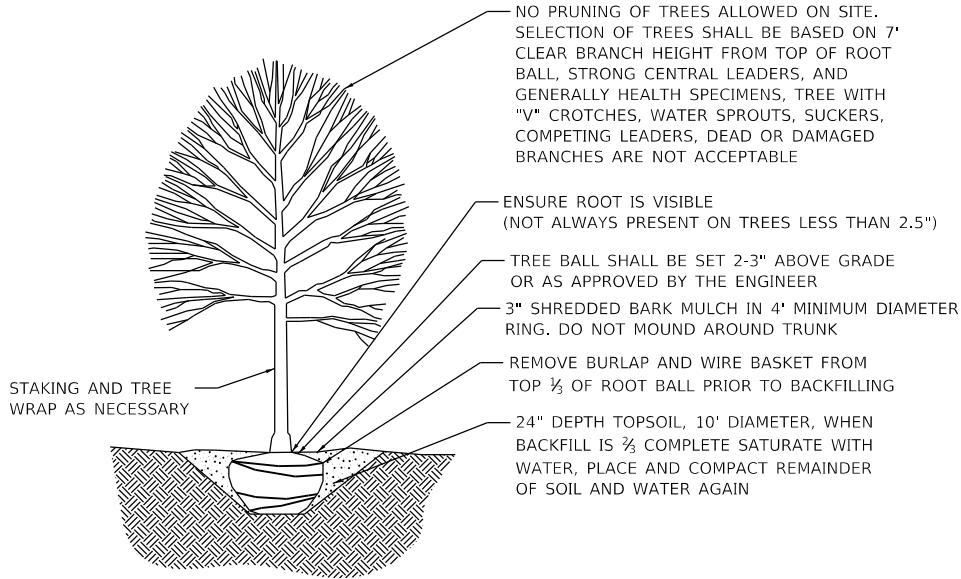
1. THE USE OF CONSTRUCTION EQUIPMENT OVER SC-160LP CHAMBERS IS LIMITED:
 - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
 - NO RUBBER TIRED LOADERS, DUMP TRUCKS, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH SC-160LP CONSTRUCTION GUIDE".
 - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH SC-106LP CONSTRUCTION GUIDE".
2. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

MATERIAL LOCATION		DESCRIPTION	IDOT MATERIAL SPECIFICATIONS	COMPACTION /DENSITY REQUIREMENT
B	EMBEDMENT STONE: FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE (AGGREGATE BASE COURSE, TYPE A - CA-7)	SECTION 1004	BEGIN COMPACTIONS AFTER 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
A	FOUNDATION STONE: FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE (AGGREGATE BASE COURSE, TYPE A - CA-7)	SECTION 1004	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.

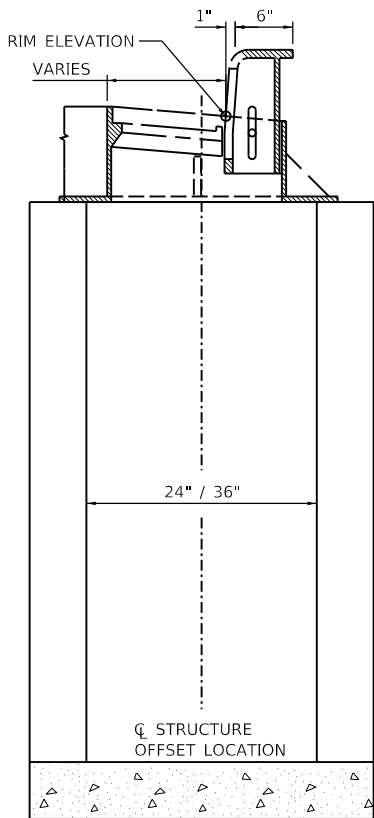
CITY OF PEORIA

CSO YEAR 1 IMPROVEMENTS STORMWATER STORAGE DETAILS				F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
						PEORIA	114	88
				CONTRACT NO.				
SCALE: N/A	SHEET	OF	SHEETS	STA.	TO STA.			
						ILLINOIS	FED. AID PROJECT	

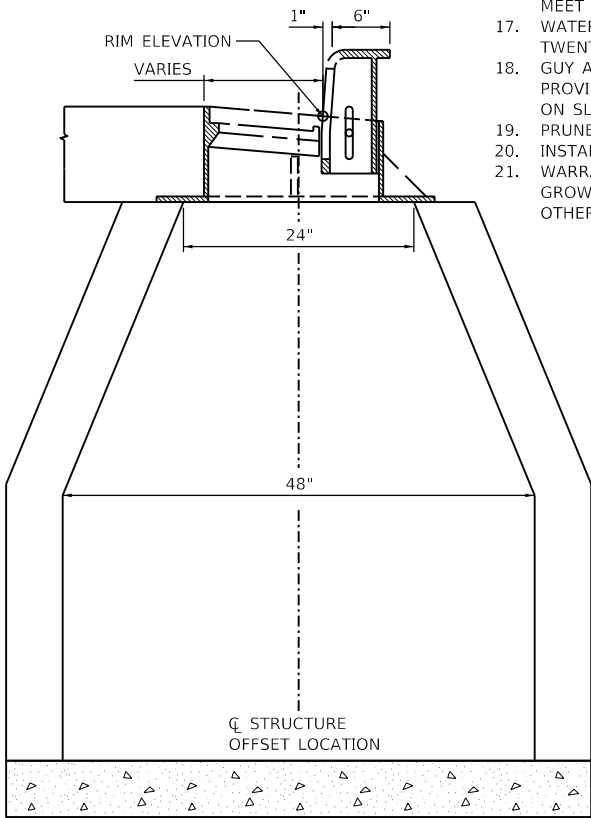
	USER NAME = ander00846	DESIGNED - BAB	REVISED -	CITY OF PEORIA	CSO YEAR 1 IMPROVEMENTS MISCELLANEOUS DETAILS				F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		DRAWN - RLA	REVISED -								PEORIA	114	85
	PLOT SCALE = 10.00' / in.	CHECKED - BAB	REVISED -		CONTRACT NO.								
	PLOT DATE = 11/17/2021	DATE - 10/29/2021	REVISED -		SCALE: N/A	SHEET	OF	SHEETS	STA.	TO	STA.		



TREE DETAIL



INLET, TYPE A /B



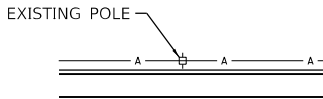
MANHOLE, TYPE A

NOTE:

STORM SEWER STRUCTURE RIM ELEVATIONS LISTED IN THE SCHEDULES ARE IN ACCORDANCE WITH THESE DETAILS EXCEPT WHEN THE STRUCTURE IS LOCATED IN COMBINATION CONCRETE CURB AND GUTTER, WHERE THE RIM ELEVATION IS LOCATED AT THE EDGE OF PAVEMENT.

GENERAL PLANTING NOTES

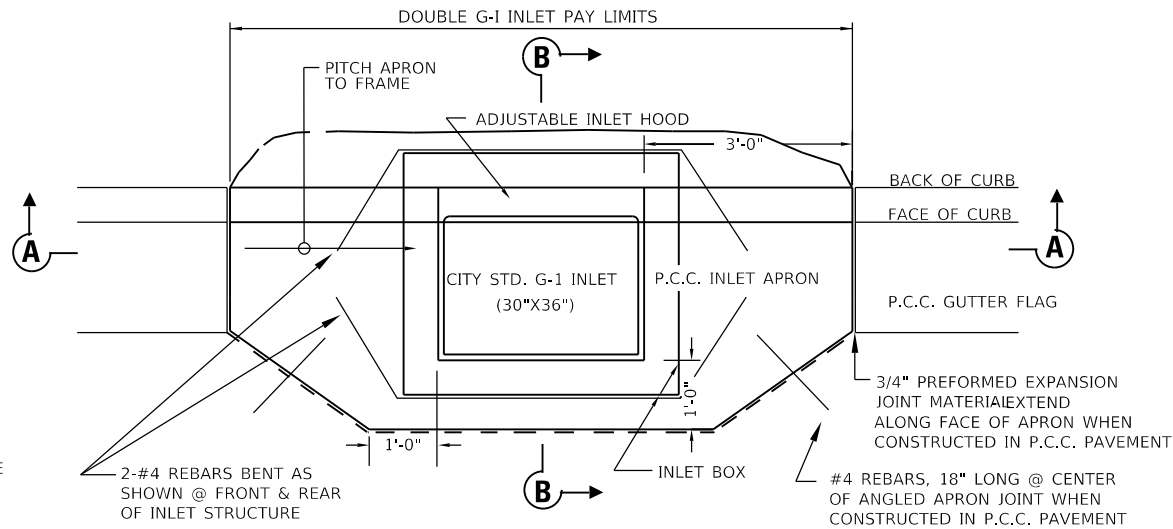
1. DETERMINE EXACT LOCATIONS OF ALL UNDERGROUND UTILITIES AND VERIFY IN FIELD. REPORT ANY CONFLICTS TO ENGINEER PRIOR TO BEGINNING WORK.
2. INFORM ENGINEER AS EACH PHASE OF WORK IS UNDERTAKEN.
3. PROTECT EXISTING VEGETATION INCLUDING ALL EXISTING PARKWAY AND PRIVATE PROPERTY TREES. REPLACE DAMAGED VEGETATION WITH APPROVED SIMILAR MATERIAL.
4. MAINTAIN SITE DRAINAGE DURING LANDSCAPE INSTALLATION.
5. PROVIDE SINGLE TRUNK STANDARD TREES UNLESS NOTED OTHERWISE
6. PROVIDE IDENTIFICATION TAG FROM THE SUPPLYING NURSERY SHOWING COMMON AND BOTANICAL PLANT NAMES FOR AT LEAST ONE PLANT OF EACH SPECIES DELIVERED TO THE SITE. PROTECT ALL PLANTS AGAINST HEAT, SUN, WIND AND FROST DURING TRANSPORTATION TO THE SITE AND WHILE BEING HELD AT THE SITE. DO NOT STORE PLANTS IN TOTAL DARKNESS MORE THAN ONE DAY.
7. DO NOT DAMAGE PLANT ROOT BALL DURING TRANSPORTATION OR PLANTING.
8. NOTIFY THE ENGINEER AT THE TIME OF DELIVERY OF ANY PLANT MATERIAL THAT IS DAMAGED OR IN POOR CONDITION.
9. ENGINEER RESERVES THE RIGHT TO INSPECT ALL PLANT MATERIALS BEFORE PLANTING. MATERIALS MAY BE REJECTED AT ANY TIME DUE TO CONDITION, FORM OR DAMAGE BEFORE OR AFTER PLANTING.
10. REMOVE ALL ROCK AND DEBRIS 1" AND LARGER FROM PLANTING AREAS. LEGALLY DISPOSE ALL EXCESS MATERIALS RESULTING FROM THE WORK.
11. IN PLANTING SOIL PIT, REMOVE CRUSHED AGGREGATE TO AN ADEQUATE DEPTH TO ENSURE THAT NO PART OF THE PLANT MATERIAL IS IN CONTACT OR AFFECTED BY THE LIME OR LIMESTONE IN THE AGGREGATE.
12. PROVIDE NEW TOPSOIL THAT IS FERTILE, FRIABLE AND NATURAL LOAM SURFACE SOIL, REASONABLY FREE OF SUBSOIL, CLAY, CLAY LUMPS, BRUSH, WEEDS, AND OTHER LITTER AND FREE OF ROOTS, STUMPS, STONES LARGER THAN 2" IN ANY DIMENSION AND OTHER EXTRANEIOUS OR TOXIC MATTER HARMFUL TO PLANT GROWTH. OBTAIN TOPSOIL FROM LOCAL SOURCES OR FROM AREAS HAVING SIMULATE SOIL CHARACTERISTICS TO THAT NECESSARY FOR VIGOROUS GROWTH OF SPECIFIED PLANTINGS. OBTAIN STOPSOIL THAT OCCURS IN A DEPTH OF NOT LESS THAN 6". DO NOT OBTAIN SOIL FROM BOGS OR MARSHES.
13. MIX SOIL AMENDMENTS AND FERTILIZERS WITH TOPSOIL ON A SITE SPECIFIC BASIS AT RATES APPROPRIATE FOR PLANTINGS IN ACCORDANCE WITH IDOT'S STANDARD SPECIFICATIONS.
14. STAKE LOCATIONS OF ALL TREES, AND NOTIFY ENGINEER FOR REVIEW PRIOR TO PLANTING.
15. REMOVE ALL PLANT TYING MATERIAL AND MARKING TAPES AT THE TIME OF PLANTING.
16. INSTALL A MIN 3" LAYER OF HARDWOOD BARK MULCH AROUND ALL TREES AND IN ALL PLANTING AREAS UNLESS NOTED OTHERWISE. CREATE A NATURAL SPADED EDGE WHERE MULCH BEDS MEET TURF AREAS.
17. WATER ALL PLANTS IMMEDIATELY AFTER PLANTING. FLOOD PLANTS TWICE DURING FIRST TWENTY-FOUR HOUR PERIOD OF PLANTING.
18. GUY AND STAKE TREES, AS DIRECTED BY THE ENGINEER, IMMEDIATELY AFTER PLANTING. PROVIDE A MINIMUM OF TWO GUY WIRES PER TREE ON THE UPHILL SIDE OF TREES PLANTED ON SLOPES STEEPER THAN 3:1.
19. PRUNE ALL DECIDUOUS SHADE TREES FOR A MINIMUM LOWEST BRANCH HEIGHT OF 7 FEET.
20. INSTALL AND MAINTAIN SOD TO PREVENT EVIDENT SEAMS.
21. WARRANTY ALL PLANTS AND LAWN EXPERIENCING DEATH AND DEFECTS INCLUDING UNSATISFACTORY GROWTH, EXCEPT FOR DEFECTS RESULTING FROM NEGLIGENCE BY OWNER, ABUSE OF DAMAGE BY OTHERS OR UNUSUAL PHENOMENON OR INCIDENTS WHICH ARE BEYOND CONTRACTOR'S CONTROL.



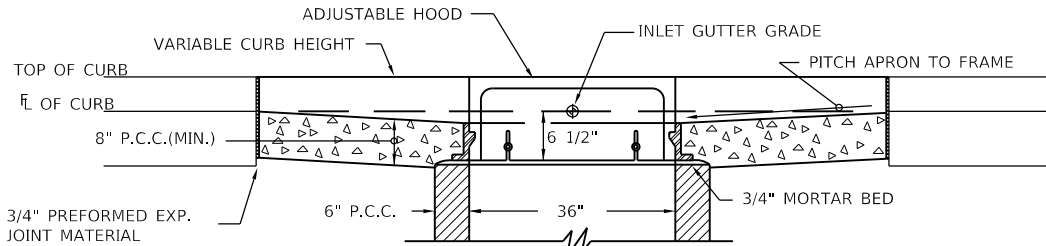
NOTES:

1. EXCAVATION SHALL NOT EXCEED 15" WITHIN 15" OF EXISTING POLES. EXCAVATION GREATER THAN 15" SHALL BE COORDINATED WITH POLE OWNER IN THE FIELD.
2. AT LOCATIONS WHERE THE INFILTRATION TRENCH ENCROACHES UPON THE RESTRICTED EXCAVATION AREAS, THE TRENCH WIDTH SHALL BE REDUCED TO STAY OUTSIDE THE RESTRICTED EXCAVATION AREA.
3. AT LOCATIONS WHERE UNAVOIDABLE EXCAVATION ENCROACHES UPON THE RESTRICTED EXCAVATION AREAS, THE CONTRACTOR SHALL COORDINATE WITH POLE OWNER TO HOLD/STABILIZE THE POLE.

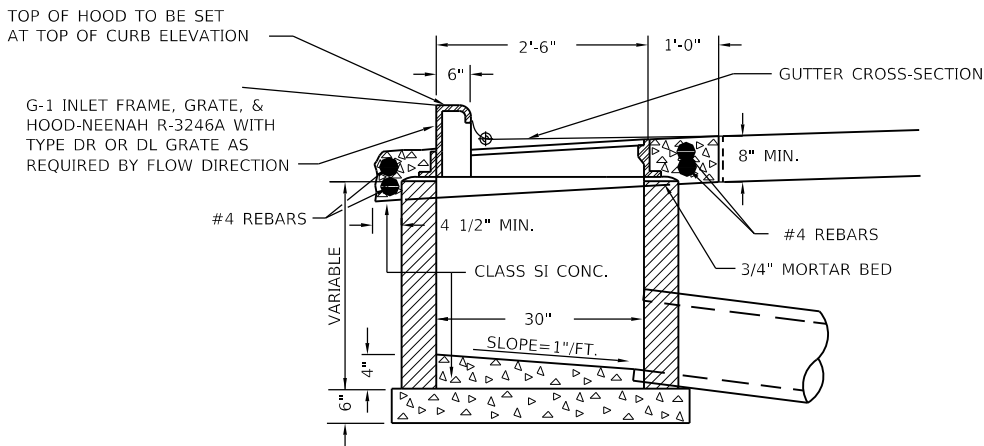
AERIAL POLE DETAIL



CITY STANDARD G-1 INLET



SECTION A-A



SECTION B-B

INLETS, TYPE G-1

LAYOUT	BAB	8/13/2021
DRAWN	RLA	10/1/2021
REVIEWED	BAB	10/14/2021

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USER NAME	= ander00846	DESIGNED -	BAB	REVISED -	
		DRAWN -	RLA	REVISED -	
PLOT SCALE	= 10.00' / In.	CHECKED -	BAB	REVISED -	
PLOT DATE	= 11/17/2021	DATE -	10/29/2021	REVISED -	

CITY OF PEORIA

CSO YEAR 1 IMPROVEMENTS				F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
MISCELLANEOUS DETAILS						PEORIA	114	86
				CONTRACT NO.				
SCALE: N/A	SHEET	OF	SHEETS	STA.	TO	STA.	ILLINOIS	FED. AID PROJECT

LEGEND

- 1

PORTLAND CEMENT CONCRETE PAVEMENT 8 1/4" (JOINTED)
- 2

AGGREGATE SUBGRADE IMPROVEMENT (CA-6, 3")
- 3

AGGREGATE SUBGRADE IMPROVEMENT (CS-01, 7")
- 4

POLYMERIZED HOT-MIX ASPHALT SURFACE COURSE, 2"
- 5

POLYMERIZED HOT-MIX ASPHALT BINDER COURSE, 2 1/2"
- 6

COMBINATION CONCRETE CURB AND GUTTER, TYPE B-6.12 (SPECIAL)
- 7

TOPSOIL, FURNISH AND PLACE, 4"
- 8

PORTLAND CEMENT CONCRETE SIDEWALK 4 INCH
- 9

SUBBASE GRANULAR MATERIAL TYPE B, 4"
- 10

COMBINATION CONCRETE CURB AND SIDEWALK 4 INCH (SPECIAL)
- 11

COMBINATION CONCRETE CURB AND GUTTER, TYPE B-6.12
- 12

NON-WOVEN GEOTEXTILE FILTER FABRIC
- 13

CONCRETE EDGING, 12" WIDE ****
- 14

BRICK PAVERS, PERMEABLE, 3 1/8"
- 15

AGGREGATE BASE COURSE, TYPE A, 1 7/8" (CA-16)
- 16

AGGREGATE BASE COURSE, TYPE A, 8" (CA-7)
- 17

AGGREGATE BASE COURSE, TYPE A, VARIES, 18"-48" (CA-1)
- 18

CONCRETE CURB, TYPE B (SPECIAL)
- 19

BRICK PAVERS, NON-PERMEABLE, 2 3/4"
- 20

AGGREGATE BASE COURSE, TYPE A, 2 1/4" (CA-16)
- 21

PORTLAND CEMENT CONCRETE BASE COURSE, 8"
- 22

CONCRETE CURB, TYPE B
- 23

PCC DRIVEWAY PAVEMENT, 8"
- 24

PORTLAND CEMENT CONCRETE SIDEWALK 6 INCH
- 25

AGGREGATE BASE COURSE, TYPE B, 10"
- 26

AGGREGATE BASE COURSE, TYPE B, 5 1/4"
- 27

PORTLAND CEMENT CONCRETE PAVEMENT 8 1/4" AND VARIES (JOINTED) SPECIAL

LEFT BIKE LANE CROSS SLOPE TABLE

STATION	CROSS SLOPE
309+80.00	-1.50%
312+72.06	-1.50%
312+97.06	1.80%
313+61.91	1.80%
314+11.91	-1.50%
319+10.40	-1.50%
319+60.40	1.80%
333+70.00	1.80%
334+20.00	-1.50%
335+80.00	-1.50%
336+30.00	1.80%
337+00.00	1.80%
337+50.00	-1.50%
339+15.00	-1.50%
339+65.00	1.80%
340+35.00	1.80%
340+85.00	-1.50%
342+50.00	-1.50%
343+00.00	1.80%
343+75.00	1.80%
344+25.00	-1.50%
350+67.50	-1.50%
350+80.00	-2.00%
352+76.53	-2.00%

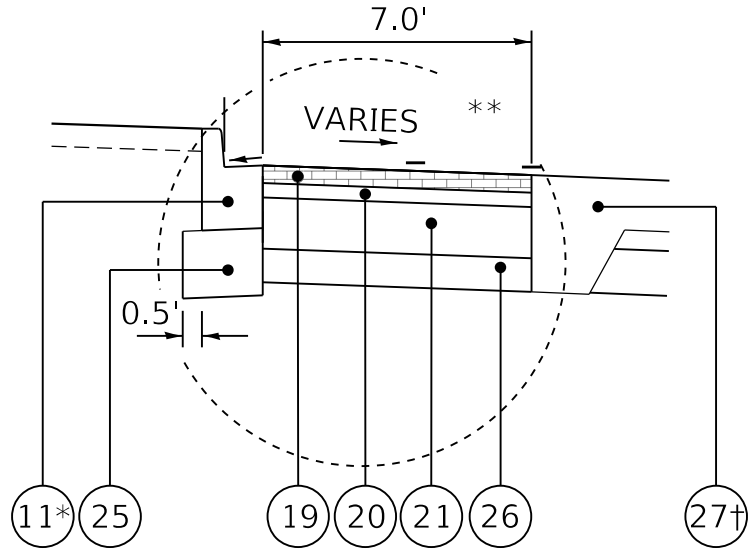
NOTE: NEGATIVE CROSS SLOPE INDICATES A DOWN GRADE AWAY FROM THE CENTERLINE. POSITIVE CROSS SLOPE INDICATES AN UP GRADE FLOWING TOWARD THE CENTERLINE.

ALTERNATE A
TYPICAL SECTIONS

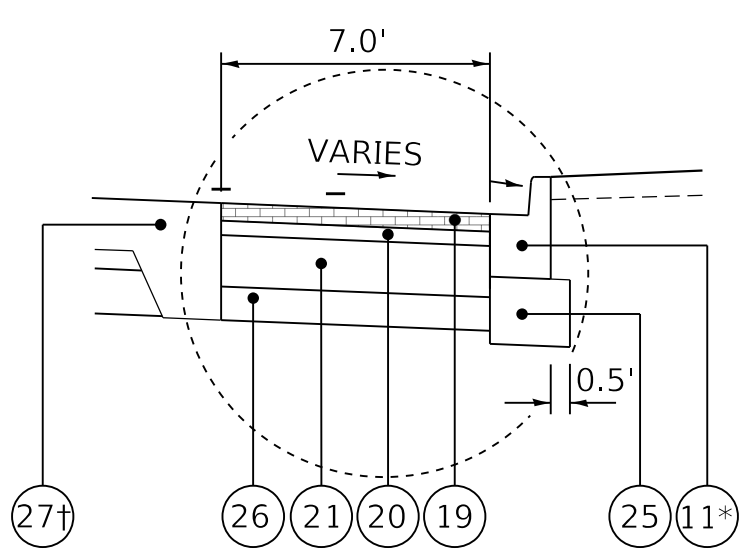
- * NOTE: SEE DETAILS FOR TABLE OF GUTTER SLOPE TRANSITIONS
- ** NOTE: SOUTHBOUND RIGHT TURN LANE IS DEVELOPED AT ADAMS STREET. BIKE LANE IS LOCATED BETWEEN THROUGH LANE AND TURN LANE. CROWN POINT REMAINS ALONG OUTSIDE EDGE OF THROUGH LANE. BIKE LANE BUFFER IS ELIMINATED IN TURN LANE TAPER BETWEEN ADAMS STREET AND HAYES STREET.
- BUFFER IS ELIMINATED JUST SOUTH OF GARDEN STREET ON THE WEST SIDE TO ACCOMODATE WIDER SIDEWALK FOR ACCESS TO BUILDING ON SW CORNER OF GARDEN STREET.
- BUFFER IS ELIMINATED JUST SOUTH OF ANTOINETTE STREET ON THE WEST SIDE TO ACCOMODATE WIDER SIDEWALK FOR ACCESS TO BUILDING ON SW CORNER OF ANTOINETTE STREET.
- BUFFER IS TRANSITIONED FROM 3 FT TO 0 FT ON THE WEST SIDE FROM ANN STREET TO WISWALL STREET.
- † NOTE: SEE PAVES DETAILS FOR THICKENED SECTION ADJACENT TO NON-PERMEABLE PAVERS.

*** CA-1 AGGREGATE DEPTH TABLE (ALTERNATE A)

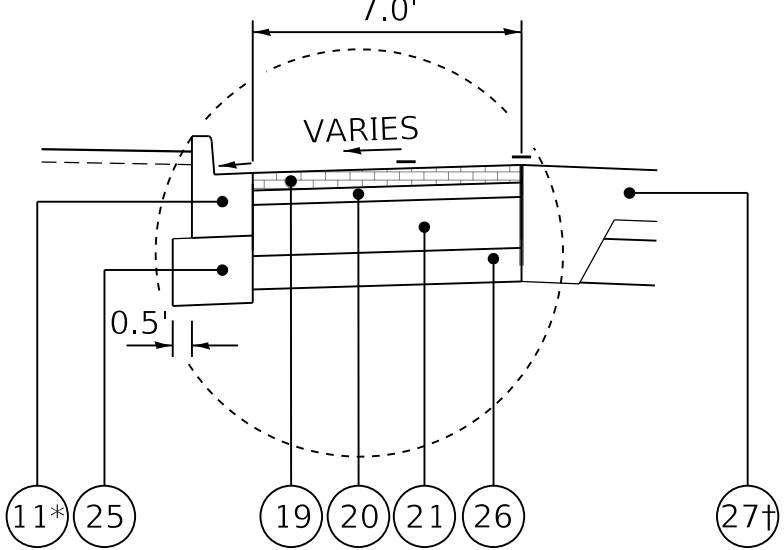
APPROXIMATE LIMITS	LT/RT	START STATION	END STATION	DEPTH
HAYES TO HUMBOLDT	LT	313+70.60	319+39.40	1.5'
HUMBOLDT TO STA. 323+00	LT	320+36.73	323+00.00	3.0'
STA. 323+00 TO STARR	LT	323+00.00	325+86.51	2.5'
STARR TO MALONE	LT	327+14.35	329+37.34	3.0'
MALONE TO GARDEN	LT	330+46.44	332+74.67	3.0'
GARDEN TO MARQUETTE	LT	334+04.42	336+05.14	3.5'
MARQUETTE TO ANTOINETTE	LT	337+08.81	339+42.09	2.5'
ANTOINETTE TO PROCTOR	LT	340+43.36	342+72.36	2.5'
PROCTOR TO ANN	LT	343+80.76	346+07.17	3.0'
ANN TO WISWALL	LT	347+10.52	349+51.32	3.0'
ADAMS TO JEFFERSON	RT	311+79.64	314+99.50	1.0'
JEFFERSON TO HUMBOLDT	RT	316+63.89	319+68.10	1.0'
HUMBOLDT TO LATROBE	RT	320+76.06	323+03.23	3.0'
LATROBE TO STARR	RT	324+06.08	326+15.37	2.5'
STARR TO GARDEN	RT	327+60.46	332+76.00	3.0'
GARDEN TO ANTOINETTE	RT	334+23.44	339+54.20	3.0'
ANTOINETTE TO STA. 344+10	RT	340+68.74	344+10.00	2.5'
STA. 344+10 TO ANN	RT	344+10.00	345+73.05	3.0'
ANN TO WISWALL	RT	346+97.14	349+84.90	3.0'



- WEST SIDE OF INTERSECTIONS ①
- STA. 319+39.40 TO STA. 320+36.73 (HUMBOLDT STREET)
- STA. 325+86.51 TO STA. 327+14.35 (STARR STREET)
- STA. 329+37.34 TO STA. 330+46.44 (MALONE STREET)
- STA. 332+74.67 TO STA. 334+04.42 (GARDEN STREET)
- STA. 336+05.14 TO STA. 337+08.81 (MARQUETTE STREET)
- STA. 339+42.09 TO STA. 340+43.36 (ANTOINETTE STREET)
- STA. 342+72.36 TO STA. 343+80.76 (PROCTOR STREET)



- EAST SIDE OF INTERSECTIONS ②
- STA. 319+68.10 TO STA. 320+76.06 (HUMBOLDT STREET)
- STA. 323+03.23 TO STA. 324+06.08 (LATROBE STREET)
- STA. 326+15.37 TO STA. 327+60.46 (STARR STREET)
- STA. 332+76.00 TO STA. 334+23.44 (GARDEN STREET)
- STA. 339+54.20 TO STA. 340+68.74 (ANTOINETTE STREET)
- STA. 345+73.05 TO STA. 346+97.14 (ANN STREET)



- WEST SIDE OF INTERSECTIONS ③
- STA. 346+07.17 TO STA. 347+10.52 (ANN STREET)

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

TYPICAL SECTIONS
ALTERNATE A

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
6594	16-00368-01-PV	PEORIA	423	35
WESTERN AVE RECONSTRUCTION		CONTRACT NO. 89766		
		ILLINOIS FED. AID PROJECT		

MODEL: Default
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USER NAME = alphonsee	DESIGNED - CC	REVISED -
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PLOT SCALE = 5.0000 ft / in.	CHECKED - ET	REVISED -
PLOT DATE = 2/24/2020 9:48:15 AM	DATE - 2/21/2020	REVISED -

SCALE: NTS SHEET 8 OF 11 SHEETS STA. TO STA.

LEGEND

- 1 PORTLAND CEMENT CONCRETE PAVEMENT 8 1/4" (JOINTED)
- 2 AGGREGATE SUBGRADE IMPROVEMENT (CA-6, 3")
- 3 AGGREGATE SUBGRADE IMPROVEMENT (CS-01, 7")
- 4 POLYMERIZED HOT-MIX ASPHALT SURFACE COURSE, 2"
- 5 POLYMERIZED HOT-MIX ASPHALT BINDER COURSE, 2 1/2"
- 6 COMBINATION CONCRETE CURB AND GUTTER, TYPE B-6.12 (SPECIAL)
- 7 TOPSOIL, FURNISH AND PLACE, 4"
- 8 PORTLAND CEMENT CONCRETE SIDEWALK 4 INCH
- 9 SUBBASE GRANULAR MATERIAL TYPE B, 4"
- 10 COMBINATION CONCRETE CURB AND SIDEWALK 4 INCH (SPECIAL)
- 11 COMBINATION CONCRETE CURB AND GUTTER, TYPE B-6.12
- 12 NON-WOVEN GEOTEXTILE FILTER FABRIC
- 13 CONCRETE EDGING, 12" WIDE ****
- 14 BRICK PAVERS, PERMEABLE, 3 1/8"
- 15 AGGREGATE BASE COURSE, TYPE A, 1 7/8" (CA-16)
- 16 AGGREGATE BASE COURSE, TYPE A, 8" (CA-7)
- 17 AGGREGATE BASE COURSE, TYPE A, VARIES, 18"-48" (CA-1)
- 18 CONCRETE CURB, TYPE B (SPECIAL)
- 19 BRICK PAVERS, NON-PERMEABLE, 2 3/4"
- 20 AGGREGATE BASE COURSE, TYPE A, 2 1/4" (CA-16)
- 21 PORTLAND CEMENT CONCRETE BASE COURSE, 8"
- 22 CONCRETE CURB, TYPE B
- 23 PCC DRIVEWAY PAVEMENT, 8"
- 24 PORTLAND CEMENT CONCRETE SIDEWALK 6 INCH
- 25 AGGREGATE BASE COURSE, TYPE B, 10"
- 26 AGGREGATE BASE COURSE, TYPE B, 5 1/4"
- 27 PORTLAND CEMENT CONCRETE PAVEMENT 8 1/4" AND VARIES (JOINTED) SPECIAL
- B1 HOT-MIX ASPHALT PAVEMENT (FULL DEPTH), 9 1/2"
- B2 AGGREGATE BASE COURSE, TYPE A, 12"

ALTERNATE B
TYPICAL SECTIONS

LEFT BIKE LANE CROSS SLOPE TABLE

STATION	CROSS SLOPE
309+80.00	-1.50%
312+72.06	-1.50%
312+97.06	1.80%
313+61.91	1.80%
314+11.91	-1.50%
319+10.40	-1.50%
319+60.40	1.80%
333+70.00	1.80%
334+20.00	-1.50%
335+80.00	-1.50%
336+30.00	1.80%
337+00.00	1.80%
337+50.00	-1.50%
339+15.00	-1.50%
339+65.00	1.80%
340+35.00	1.80%
340+85.00	-1.50%
342+50.00	-1.50%
343+00.00	1.80%
343+75.00	1.80%
344+25.00	-1.50%
350+67.50	-1.50%
350+80.00	-2.00%
352+76.53	-2.00%

NOTE: NEGATIVE CROSS SLOPE INDICATES A DOWN GRADE AWAY FROM THE CENTERLINE. POSITIVE CROSS SLOPE INDICATES AN UP GRADE FLOWING TOWARD THE CENTERLINE.

†NOTE: SEE PAVER DETAILS FOR THICKENED SECTION ADJACENT TO NON-PERMEABLE PAVERS.

*NOTE: SEE DETAILS FOR TABLE OF GUTTER SLOPE TRANSITIONS

**NOTE: SOUTHBOUND RIGHT TURN LANE IS DEVELOPED AT ADAMS STREET. BIKE LANE IS LOCATED BETWEEN THROUGH LANE AND TURN LANE. CROWN POINT REMAINS ALONG OUTSIDE EDGE OF THROUGH LANE.BIKE LANE BUFFER IS ELIMINATED IN TURN LANE TAPER BETWEEN ADAMS STREET AND HAYES STREET.

BUFFER IS ELIMINATED JUST SOUTH OF GARDEN STREET ON THE WEST SIDE TO ACCOMODATE WIDER SIDEWALK FOR ACCESS TO BUILDING ON SW CORNER OF GARDEN STREET.

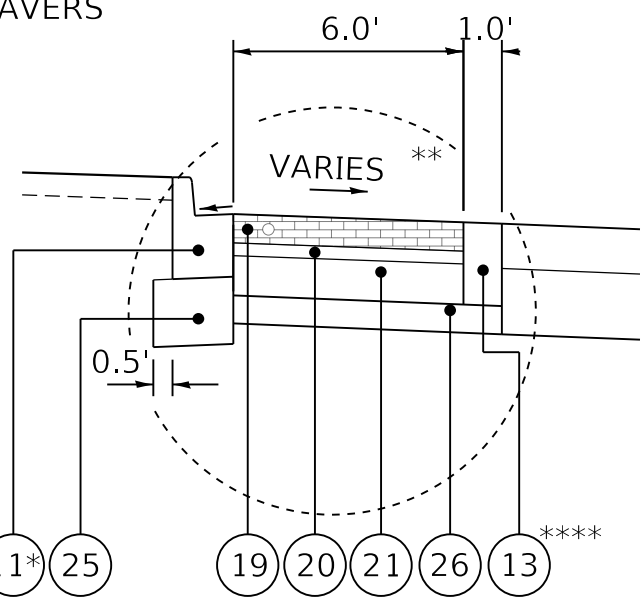
BUFFER IS ELIMINATED JUST SOUTH OF ANTOINETTE STREET ON THE WEST SIDE TO ACCOMODATE WIDER SIDEWALK FOR ACCESS TO BUILDING ON SW CORNER OF ANTOINETTE STREET.

BUFFER IS TRANSITIONED FROM 3 FT TO 0 FT ON THE WEST SIDE FROM ANN STREET TO WISWALL STREET.

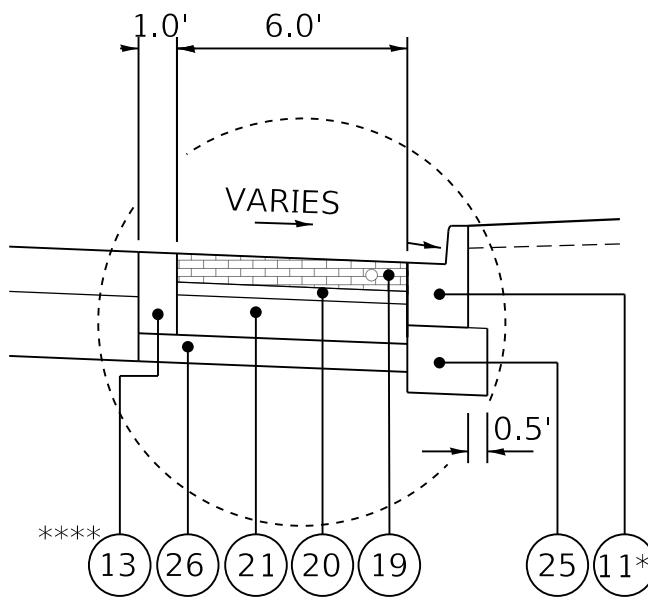
****NOTE: ALL CONCRETE EDGING:
9.5" DEPTH ADJACENT TO PERMEABLE PAVERS
13" DEPTH ADJACENT TO NON-PERMEABLE PAVERS

*** CA-1 AGGREGATE DEPTH TABLE (ALTERNATE B)

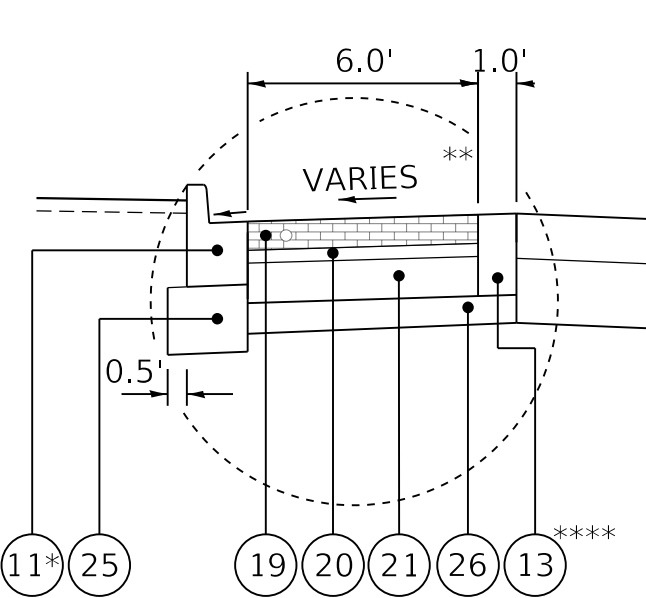
APPROXIMATE LIMITS	LT/RT	START STATION	END STATION	DEPTH
HAYES TO HUMBOLDT	LT	313+70.60	319+39.40	2.0'
HUMBOLDT TO STA. 323+00	LT	320+36.73	323+00.00	3.0'
STA. 323+00 TO STARR	LT	323+00.00	325+86.51	2.5'
STARR TO MALONE	LT	327+14.35	329+37.34	3.5'
MALONE TO GARDEN	LT	330+46.44	332+74.67	3.5'
GARDEN TO MARQUETTE	LT	334+04.42	336+05.14	4.0'
MARQUETTE TO ANTOINETTE	LT	337+08.81	339+42.09	3.0'
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PROCTOR TO ANN	LT	343+80.76	346+07.17	3.5'
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HUMBOLDT TO LATROBE	RT	320+76.06	323+03.23	3.0'
LATROBE TO STARR	RT	324+06.08	326+15.37	2.5'
STARR TO GARDEN	RT	327+60.46	332+76.00	3.0'
GARDEN TO ANTOINETTE	RT	334+23.44	339+54.20	3.0'
ANTOINETTE TO STA. 344+10	RT	340+68.74	344+10.00	2.5'
STA. 344+10 TO ANN	RT	344+10.00	345+73.05	3.0'
ANN TO WISWALL	RT	346+97.14	349+84.90	3.0'



WEST SIDE OF INTERSECTIONS ①
STA. 319+39.40 TO STA. 320+36.73 (HUMBOLDT STREET)
STA. 325+86.51 TO STA. 327+14.35 (STARR STREET)
STA. 329+37.34 TO STA. 330+46.44 (MALONE STREET)
STA. 332+74.67 TO STA. 334+04.42 (GARDEN STREET)
STA. 336+05.14 TO STA. 337+08.81 (MARQUETTE STREET)
STA. 339+42.09 TO STA. 340+43.36 (ANTOINETTE STREET)
STA. 342+72.36 TO STA. 343+80.76 (PROCTOR STREET)



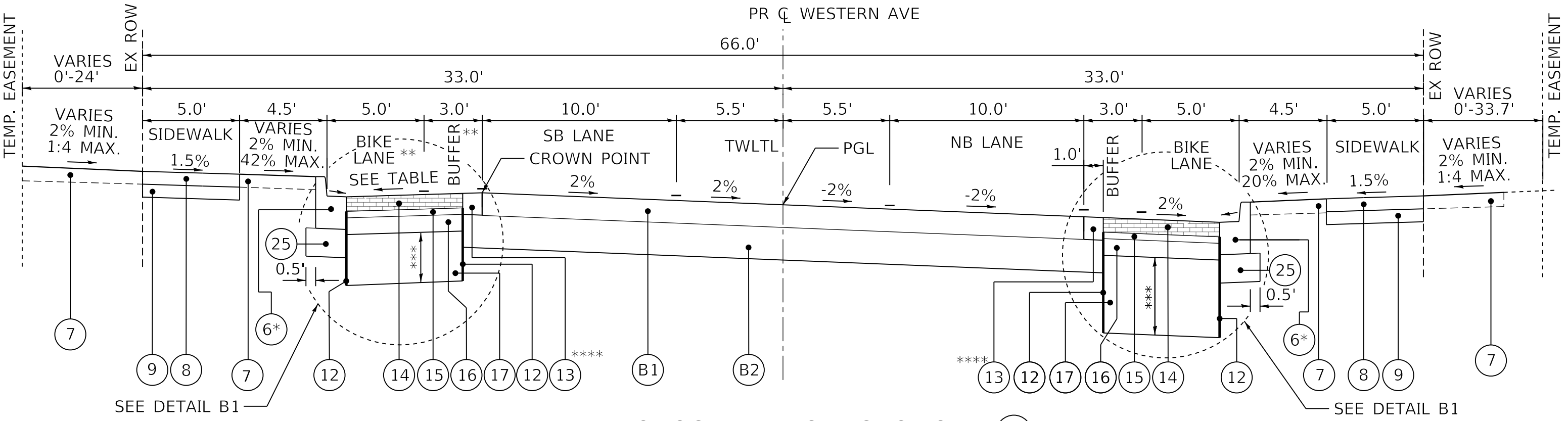
EAST SIDE OF INTERSECTIONS ②
STA. 319+68.10 TO STA. 320+76.06 (HUMBOLDT STREET)
STA. 323+03.23 TO STA. 324+06.08 (LATROBE STREET)
STA. 326+15.37 TO STA. 327+60.46 (STARR STREET)
STA. 332+76.00 TO STA. 334+23.44 (GARDEN STREET)
STA. 339+54.20 TO STA. 340+68.74 (ANTOINETTE STREET)
STA. 345+73.05 TO STA. 346+97.14 (ANN STREET)



WEST SIDE OF INTERSECTIONS ③
STA. 346+07.17 TO STA. 347+10.52 (ANN STREET)

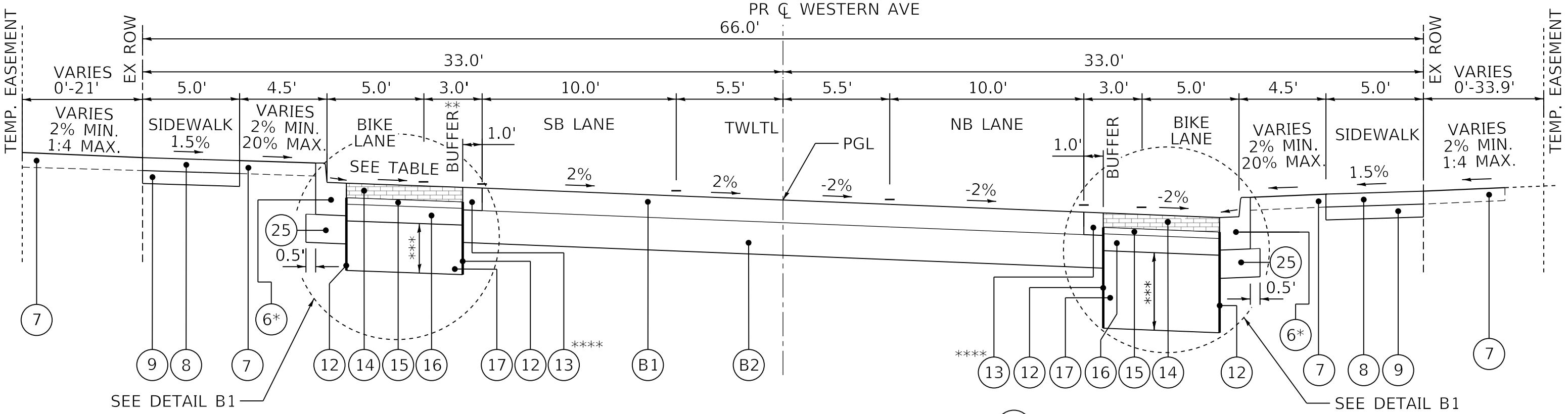
DETAIL B1

NON-PERMEABLE BIKE LANE DETAIL THROUGH INTERSECTIONS



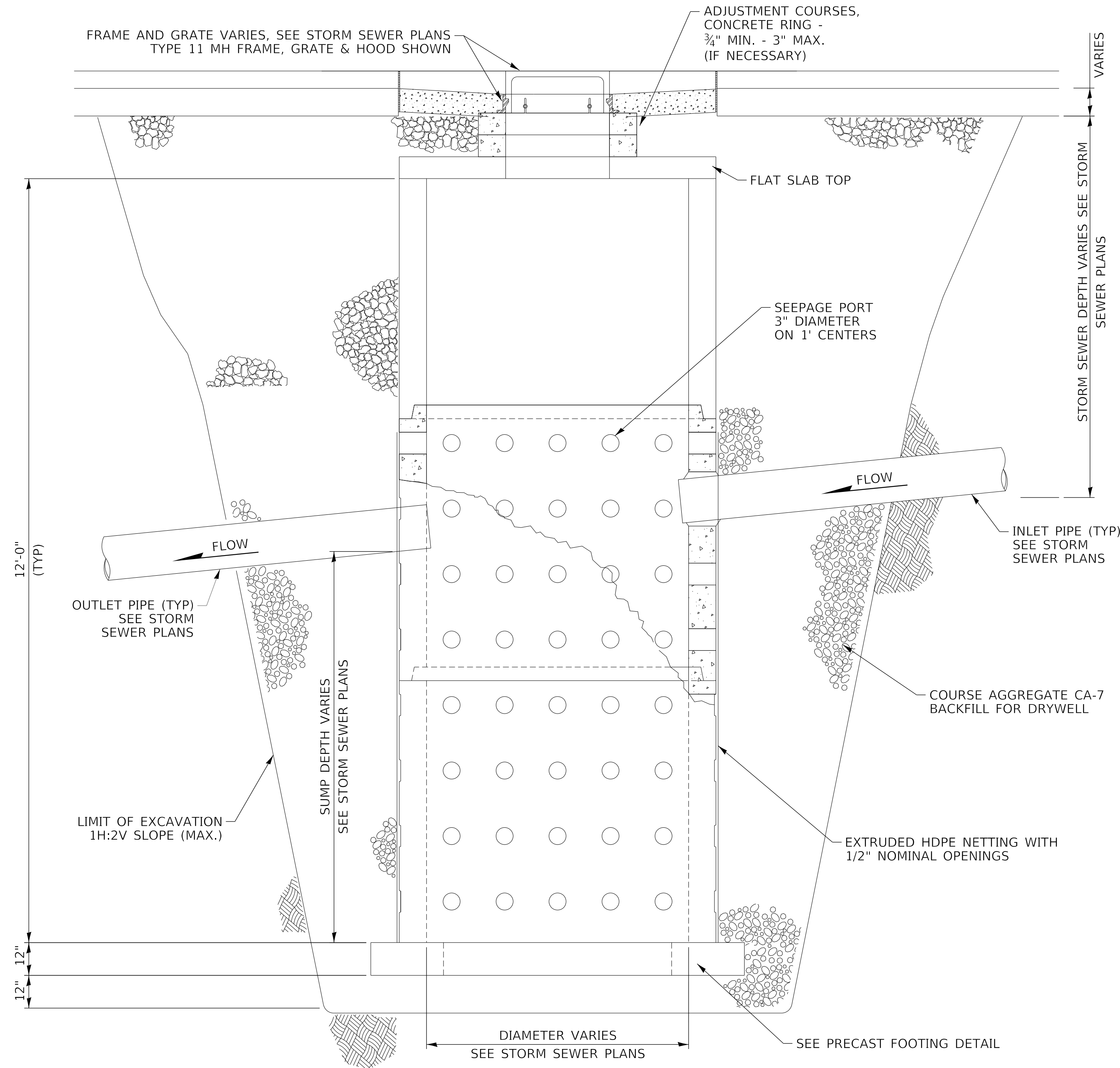
PROPOSED TYPICAL SECTION A

WESTERN AVE
STA. 308+09.42 TO STA. 320+00
STA. 333+35 TO STA. 350+00
(SW ADAMS ST TO HUMBOLDT ST
AND FROM GARDEN ST TO WISWALL ST)

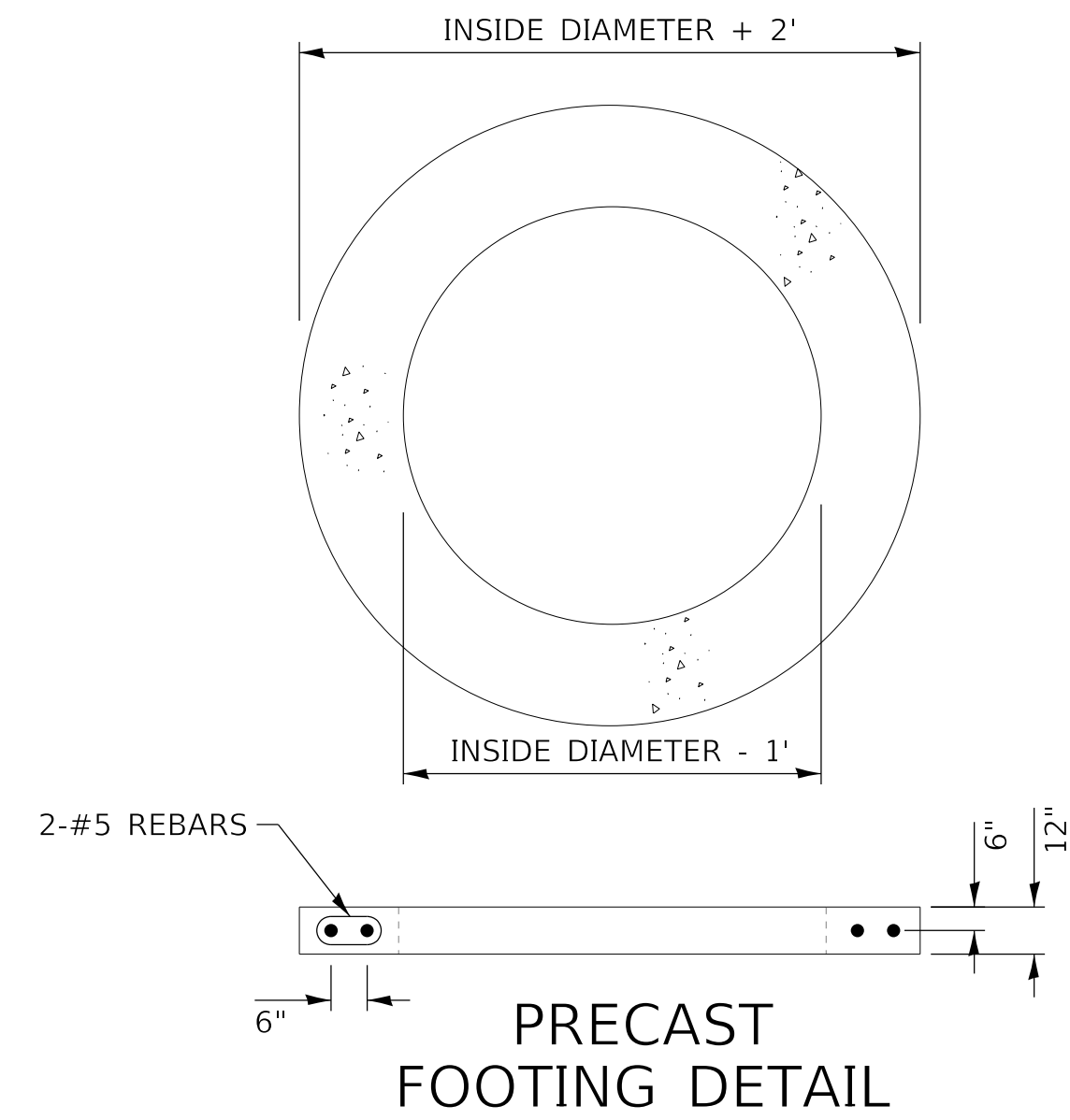


PROPOSED TYPICAL SECTION B

WESTERN AVE
STA. 320+00 TO STA. 333+35
(HUMBOLDT ST TO GARDEN ST)



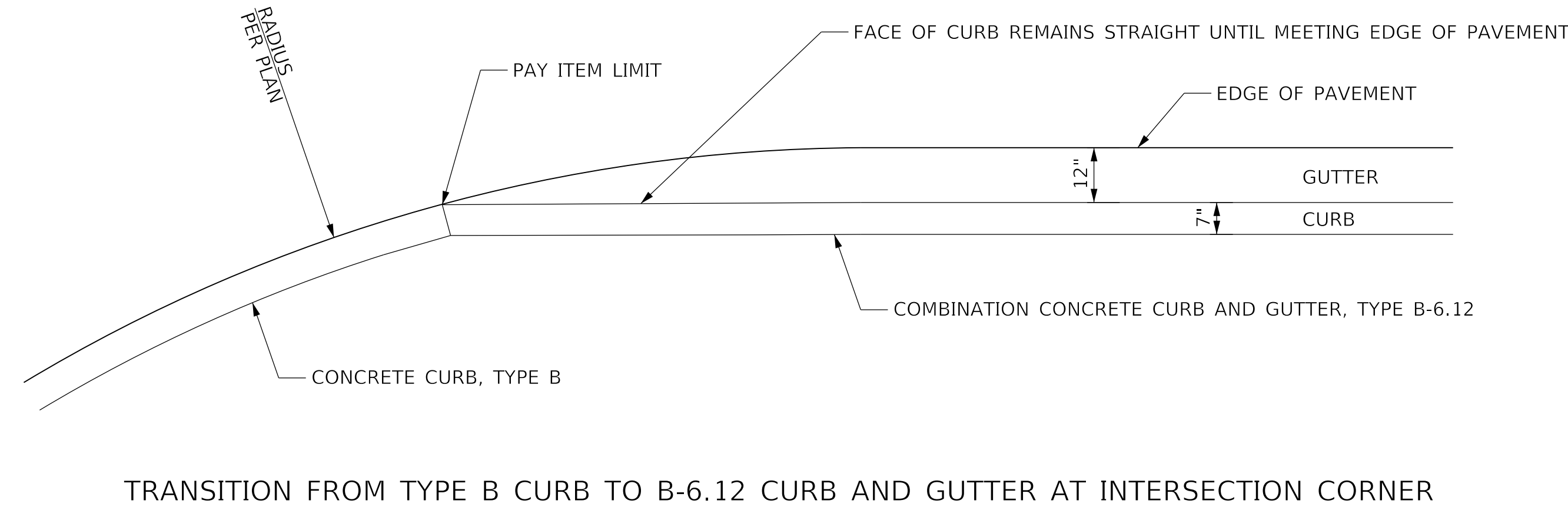
DRYWELL, VARIOUS DIAMETERS



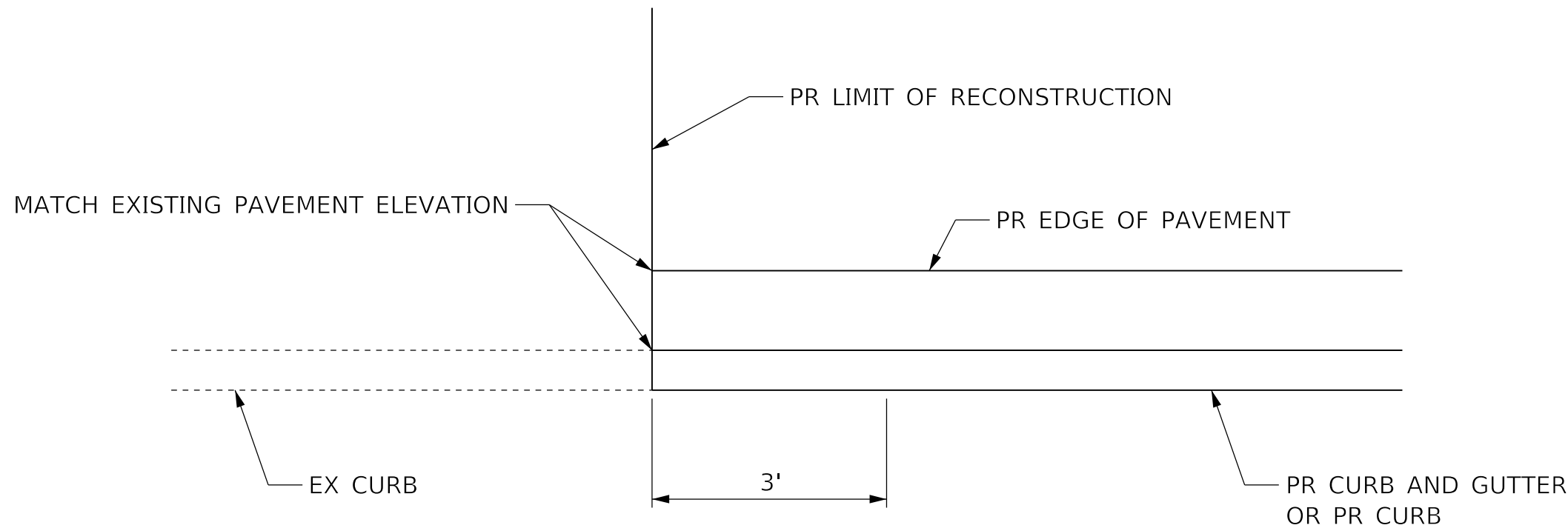
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	USER NAME = alphonsee		DESIGNED - JH	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	DETAILS DRYWELL				F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
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						SCALE: NTS	SHEET 9	OF 16	SHEETS	STA.	TO STA.			

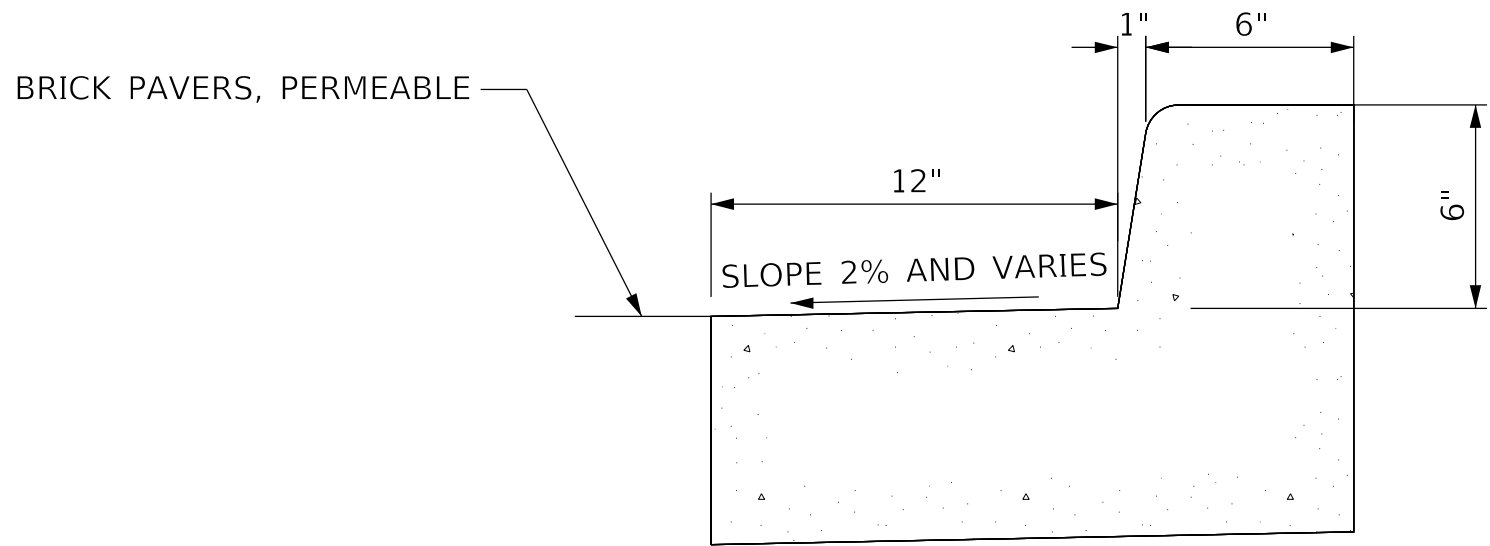
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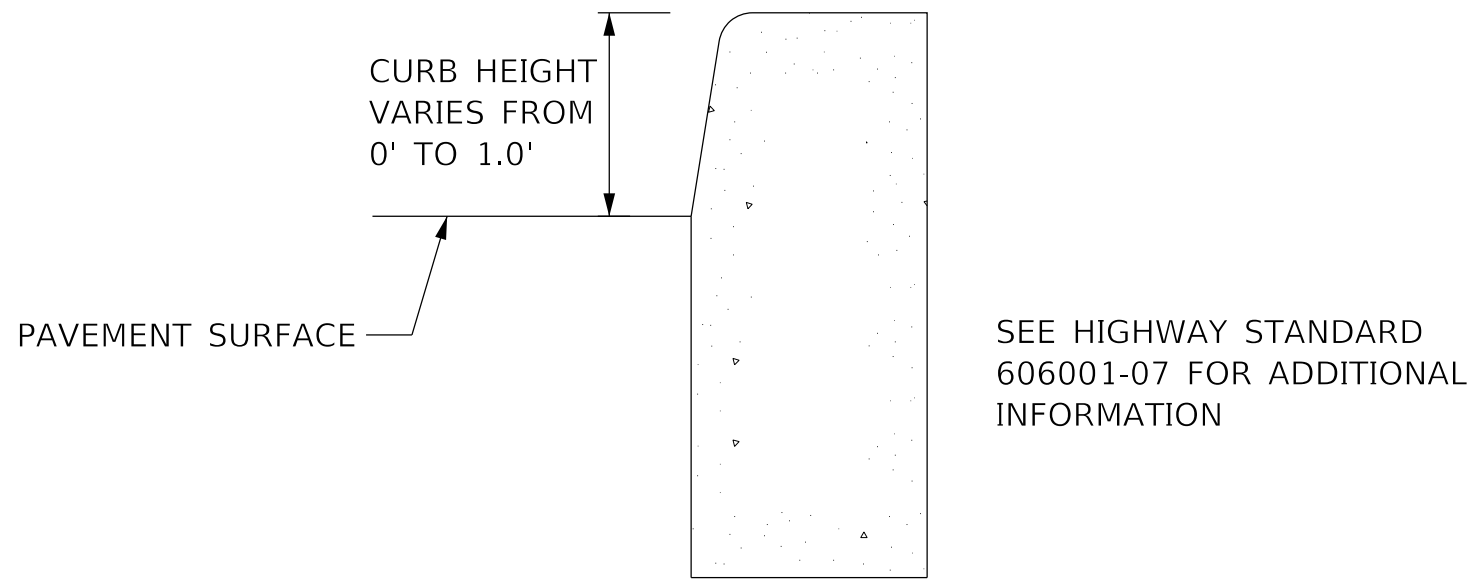
TRANSITION FROM TYPE B CURB TO B-6.12 CURB AND GUTTER AT INTERSECTION CORNER



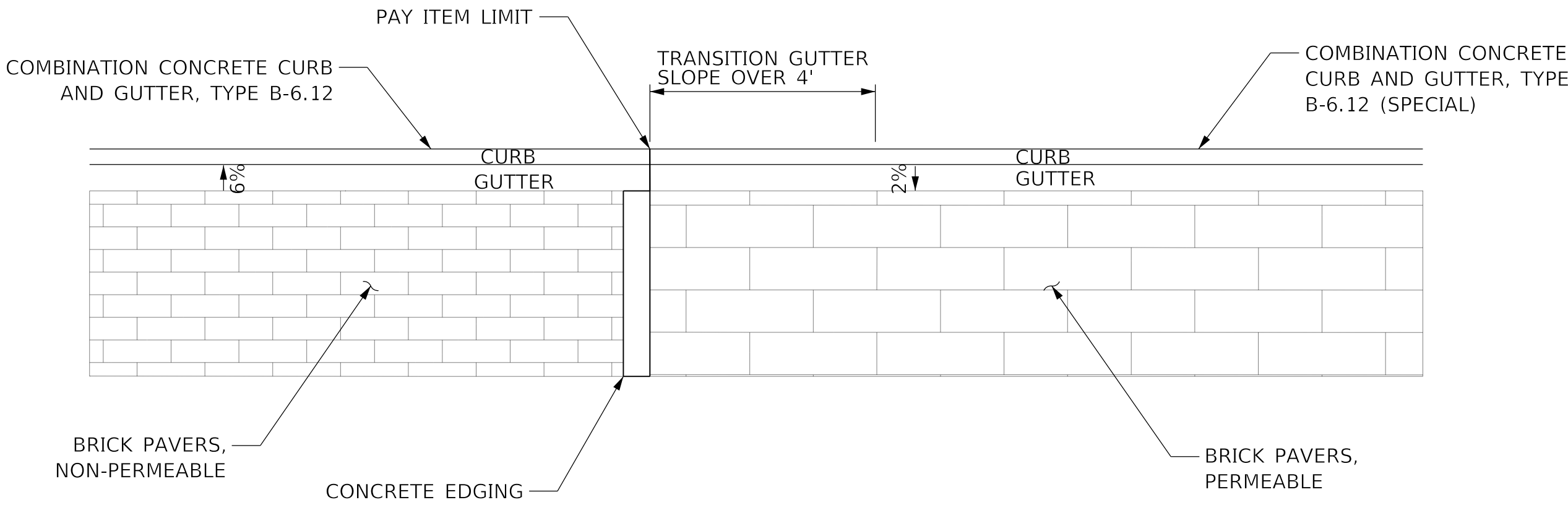
TRANSITION FROM PROPOSED CURB OR CURB AND GUTTER TO EXISTING CURB AT PROJECT LIMITS



PORTLAND CEMENT CONCRETE CURB AND GUTTER, TYPE B-6.12 (SPECIAL)



CONCRETE CURB, TYPE B (SPECIAL)



GUTTER SLOPE TRANSITION

GUTTER SLOPE TRANSITIONS
PORTLAND CEMENT CONCRETE CURB AND GUTTER, TYPE B-6.12 (SPECIAL)

	ROADWAY	START STATION	END STATION	LT/RT	START VALUE	END VALUE
GUTTER SLOPE	WESTERN	313+70.60	313+74.60	LT	6.00%	-2.00%
GUTTER SLOPE	WESTERN	319+35.40	319+39.40	LT	-2.00%	6.00%
GUTTER SLOPE	WESTERN	319+35.40	320+39.40	LT	6.00%	-2.00%
GUTTER SLOPE	WESTERN	320+36.73	320+40.73	LT	6.00%	-2.00%
GUTTER SLOPE	WESTERN	325+82.51	325+86.51	LT	-2.00%	6.00%
GUTTER SLOPE	WESTERN	327+09.34	327+13.34	LT	-2.00%	6.00%
GUTTER SLOPE	WESTERN	329+33.34	329+37.34	LT	-2.00%	6.00%
GUTTER SLOPE	WESTERN	330+46.44	330+50.44	LT	6.00%	-2.00%
GUTTER SLOPE	WESTERN	334+04.42	334+08.42	LT	6.00%	-2.00%
GUTTER SLOPE	WESTERN	336+01.14	336+05.14	LT	-2.00%	6.00%
GUTTER SLOPE	WESTERN	337+08.81	337+12.81	LT	6.00%	-2.00%
GUTTER SLOPE	WESTERN	340+43.36	340+47.36	LT	6.00%	-2.00%
GUTTER SLOPE	WESTERN	342+68.36	342+72.36	LT	-2.00%	6.00%
GUTTER SLOPE	WESTERN	343+80.76	343+84.76	LT	6.00%	-2.00%
GUTTER SLOPE	WESTERN	346+03.17	346+07.17	LT	-2.00%	6.00%
GUTTER SLOPE	WESTERN	347+10.64	347+14.64	LT	6.00%	-2.00%
GUTTER SLOPE	WESTERN	349+49.24	349+53.24	LT	-2.00%	6.00%
GUTTER SLOPE	WESTERN	311+75.64	311+79.64	RT	-6.00%	2.00%
GUTTER SLOPE	WESTERN	314+95.50	314+99.50	RT	2.00%	-6.00%
GUTTER SLOPE	WESTERN	316+63.89	316+67.89	RT	-6.00%	2.00%
GUTTER SLOPE	WESTERN	319+64.10	319+68.11	RT	2.00%	-6.00%
GUTTER SLOPE	WESTERN	320+76.06	320+80.06	RT	-6.00%	2.00%
GUTTER SLOPE	WESTERN	322+99.23	323+03.23	RT	2.00%	-6.00%
GUTTER SLOPE	WESTERN	324+06.08	324+10.08	RT	-6.00%	2.00%
GUTTER SLOPE	WESTERN	326+16.37	326+20.37	RT	2.00%	-6.00%
GUTTER SLOPE	WESTERN	326+19.37	326+15.37	RT	2.00%	-6.00%
GUTTER SLOPE	WESTERN	327+54.46	327+59.46	RT	-6.00%	2.00%
GUTTER SLOPE	WESTERN	327+60.46	327+64.46	RT	-6.00%	2.00%
GUTTER SLOPE	WESTERN	332+72.00	332+76.00	RT	2.00%	-6.00%
GUTTER SLOPE	WESTERN	334+23.44	334+27.44	RT	-6.00%	2.00%
GUTTER SLOPE	WESTERN	339+50.20	339+54.20	RT	2.00%	-6.00%
GUTTER SLOPE	WESTERN	339+50.20	339+54.20	RT	-2.00%	6.00%
GUTTER SLOPE	WESTERN	340+68.74	340+72.74	RT	-6.00%	2.00%
GUTTER SLOPE	WESTERN	340+68.74	339+72.74	RT	6.00%	-2.00%
GUTTER SLOPE	WESTERN	345+69.05	345+73.05	RT	2.00%	-6.00%
GUTTER SLOPE	WESTERN	346+97.14	347+01.14	RT	-6.00%	2.00%
GUTTER SLOPE	WESTERN	350+02.35	350+06.35	RT	2.00%	-6.00%



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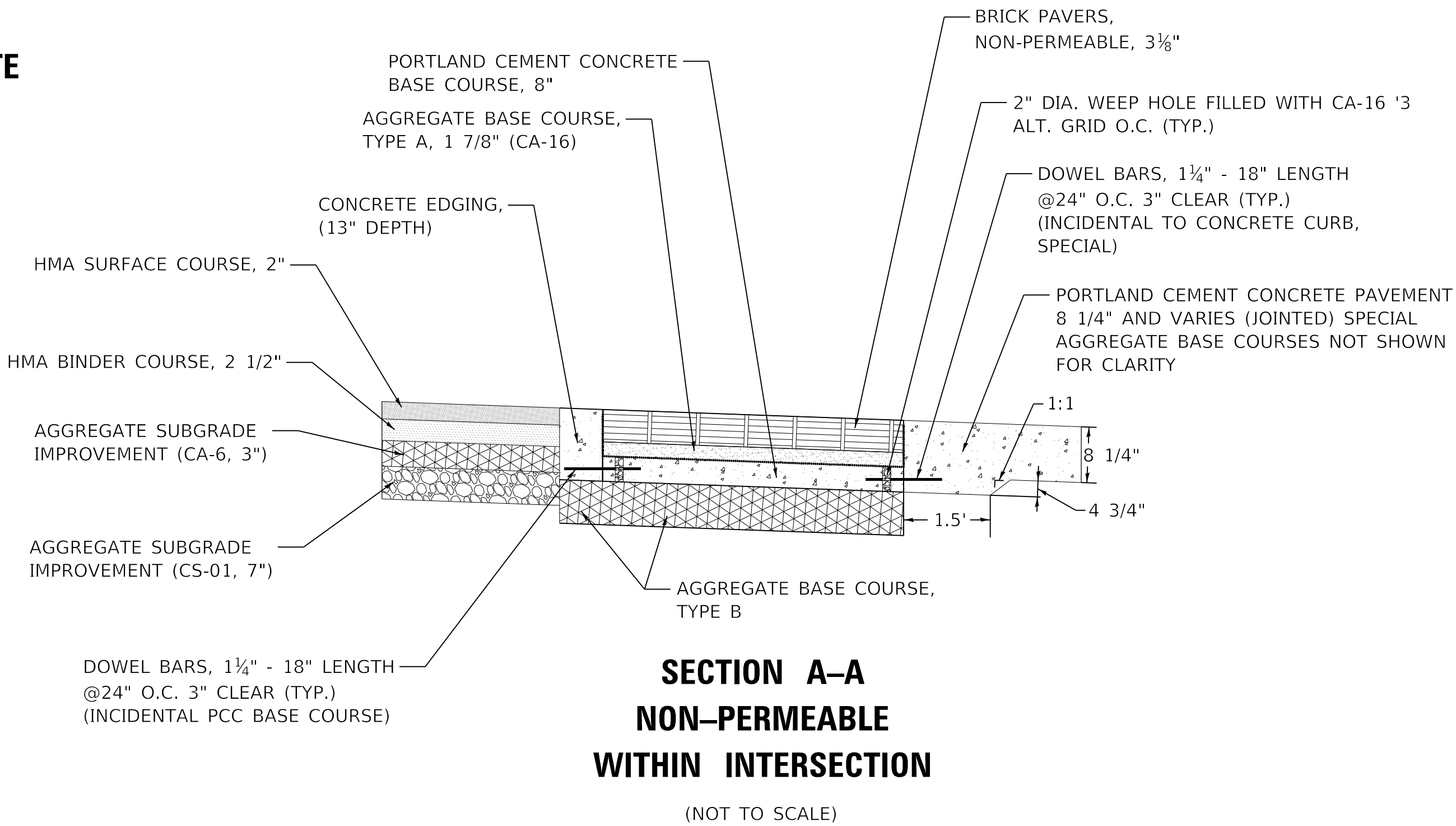
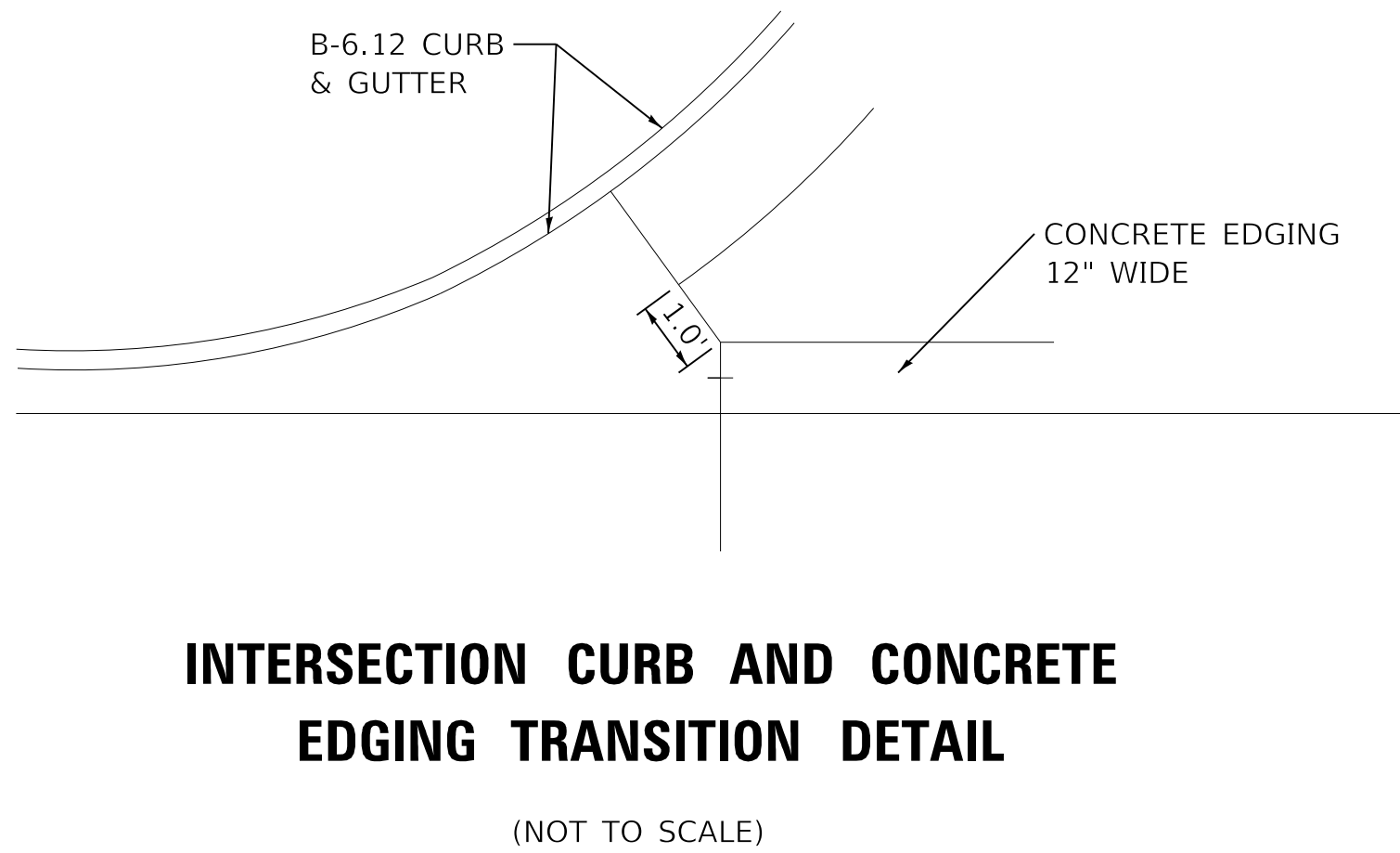
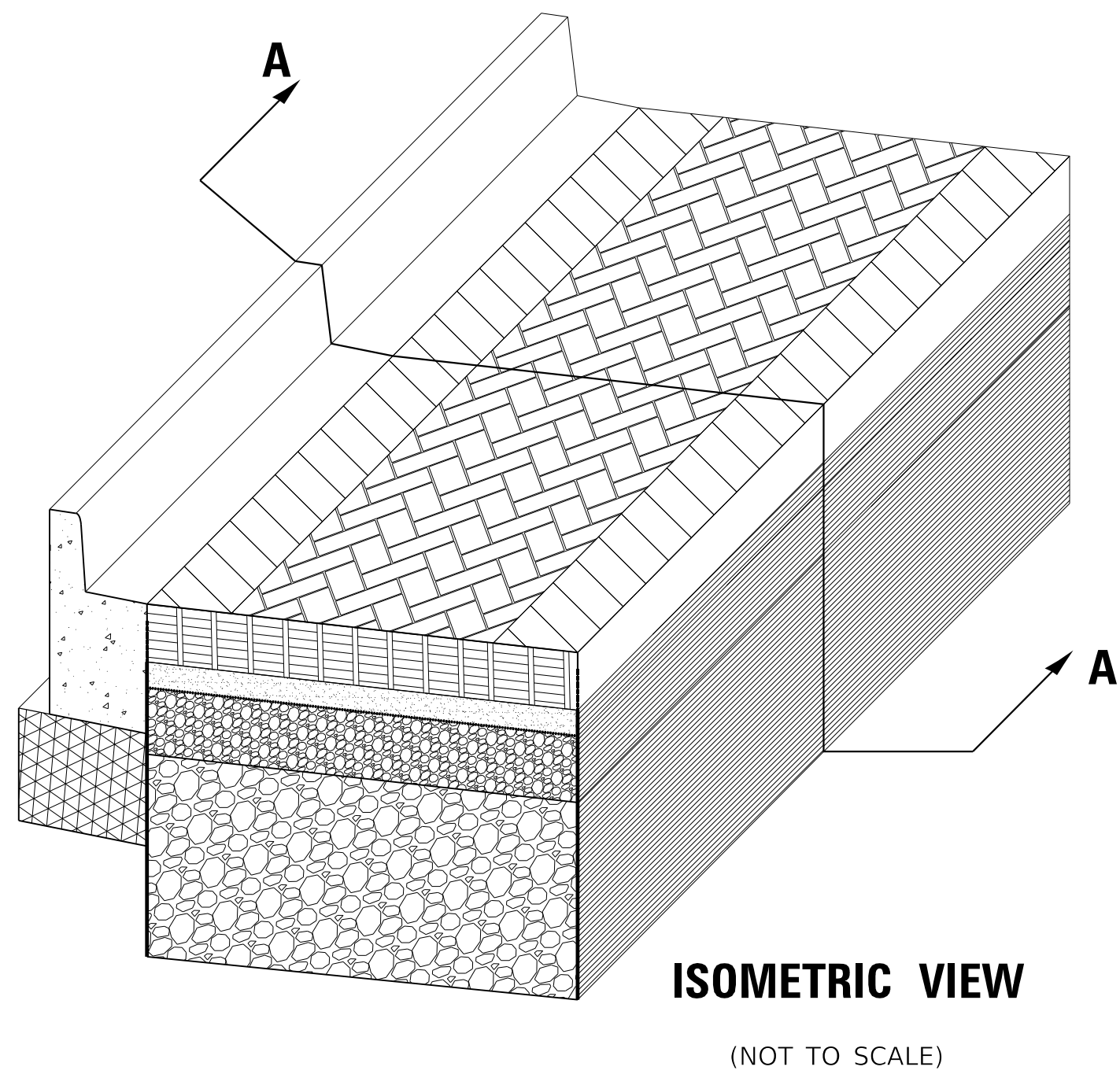
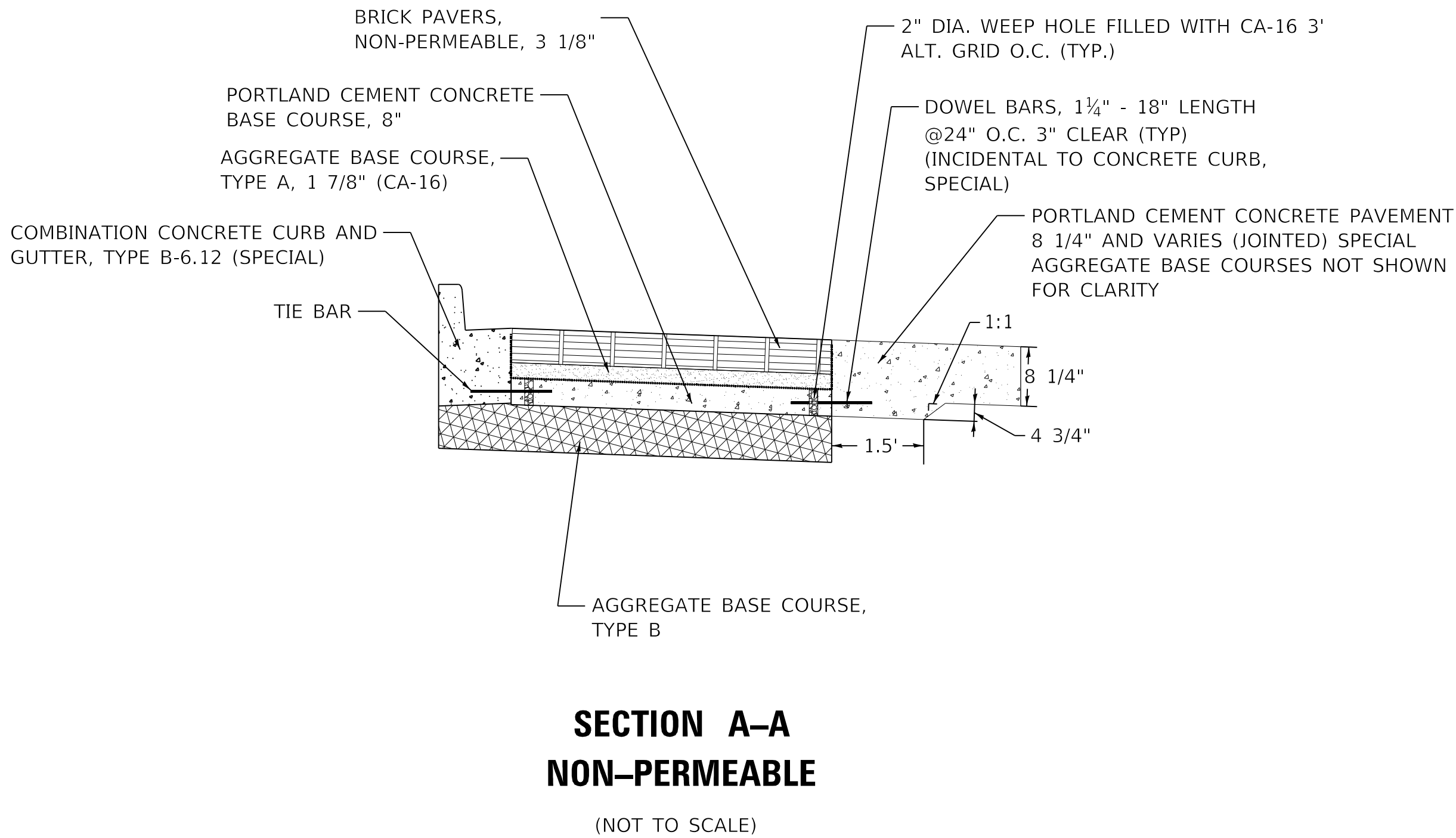
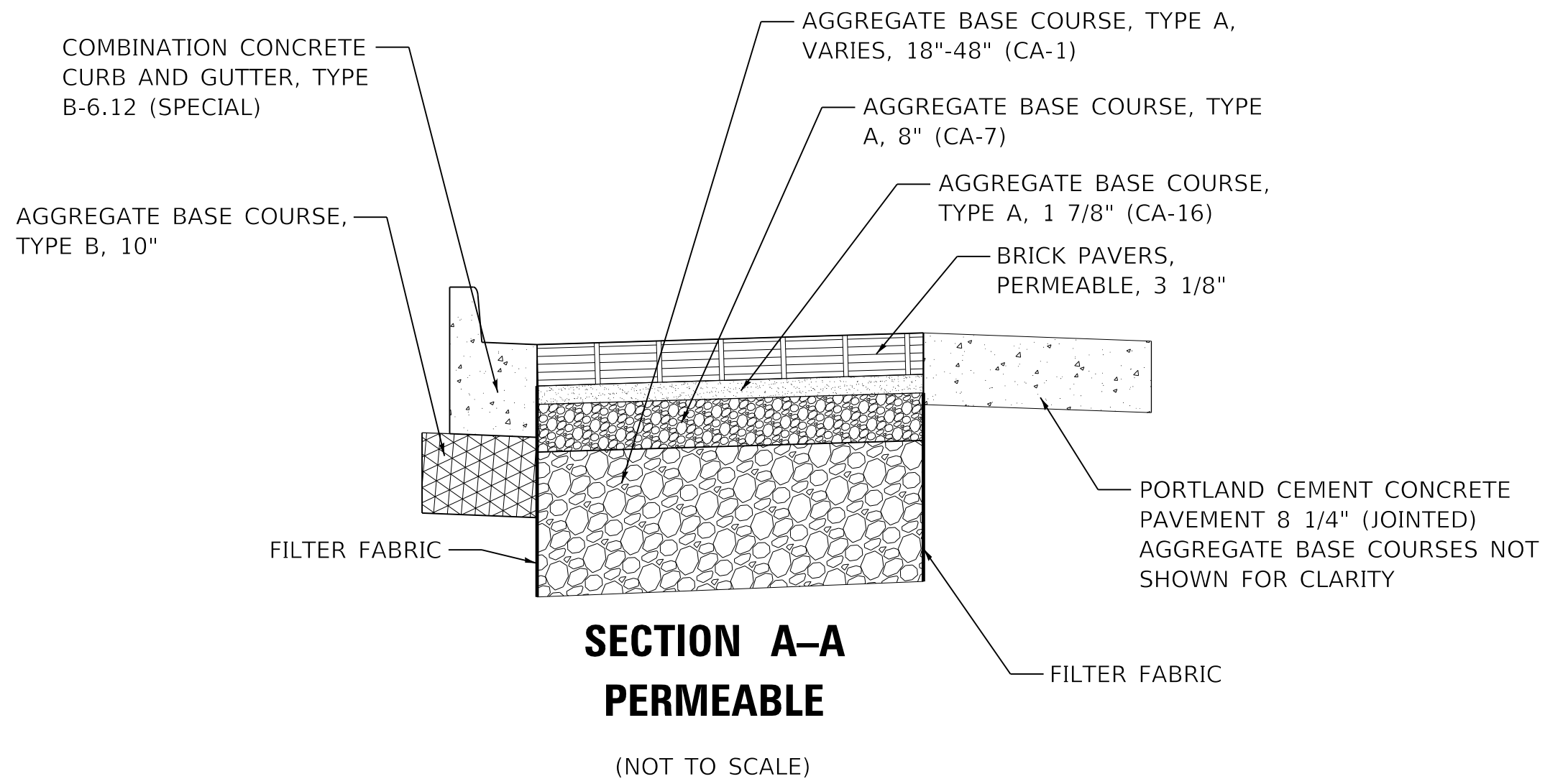
REVISED	-
REVISED	-
REVISED	-
REVISED	-

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

DETAILS
CURB AND GUTTER

SCALE: 1"=100" SHEET 5 OF 16 SHEETS STA. TO STA.

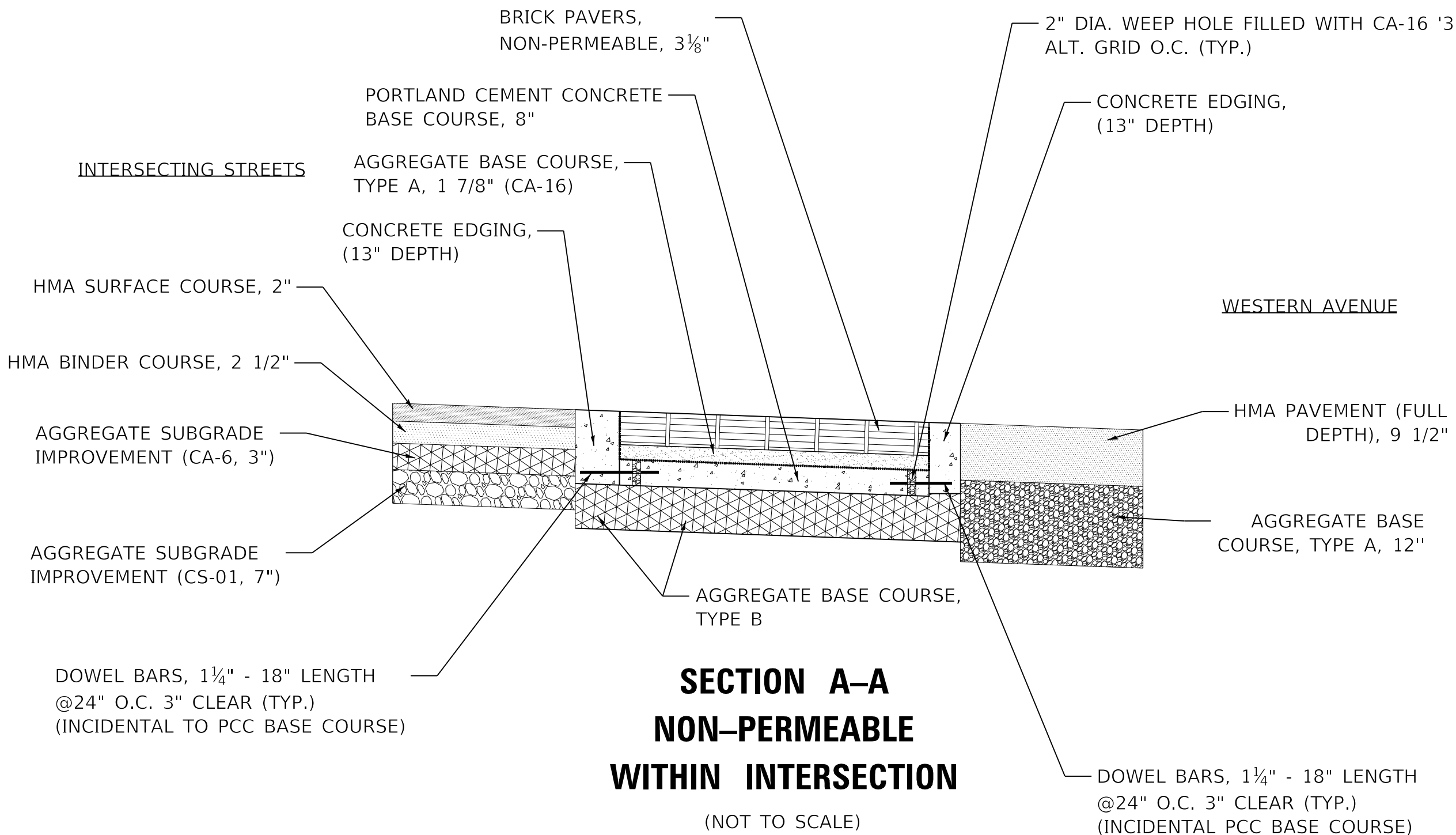
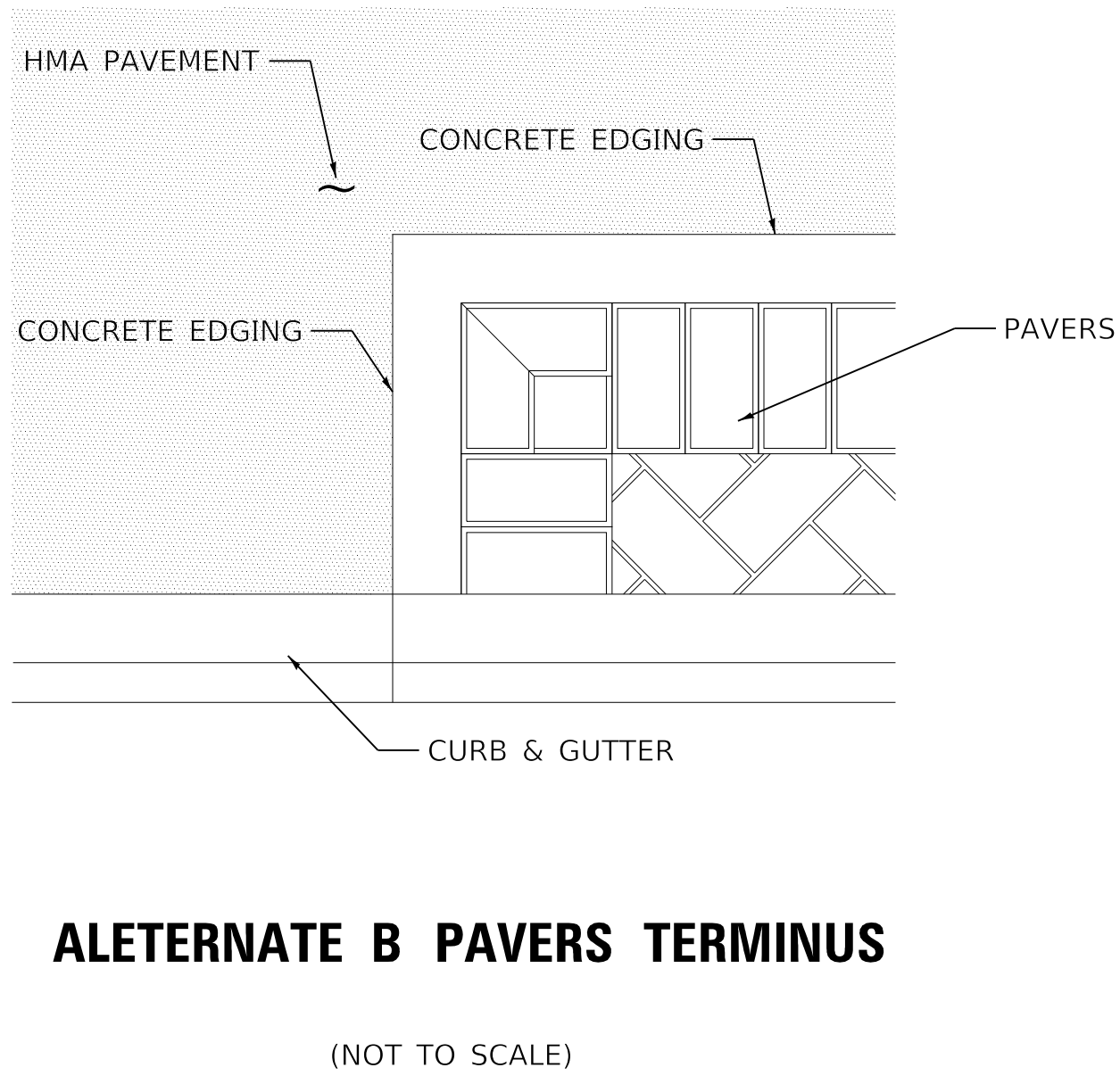
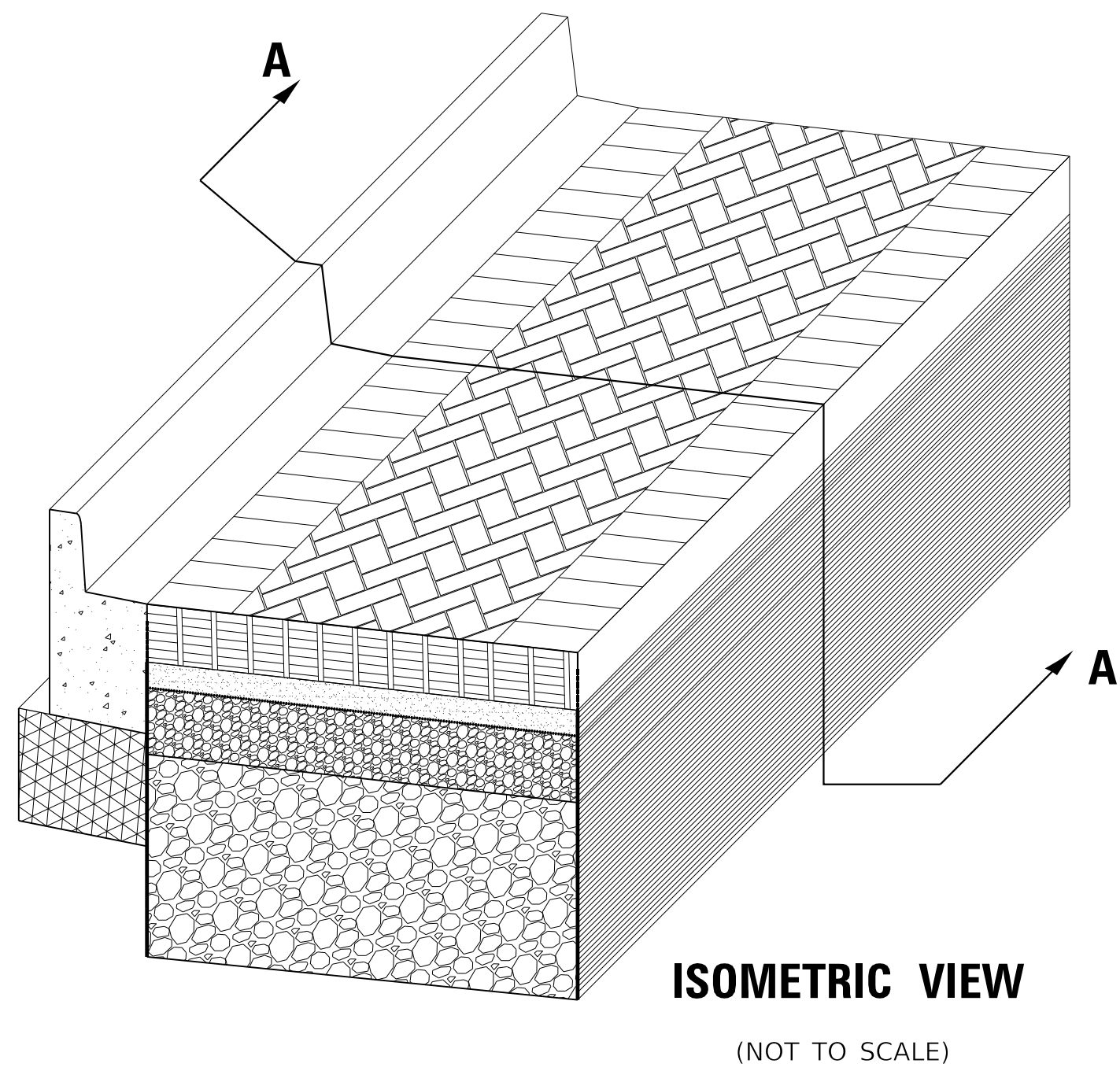
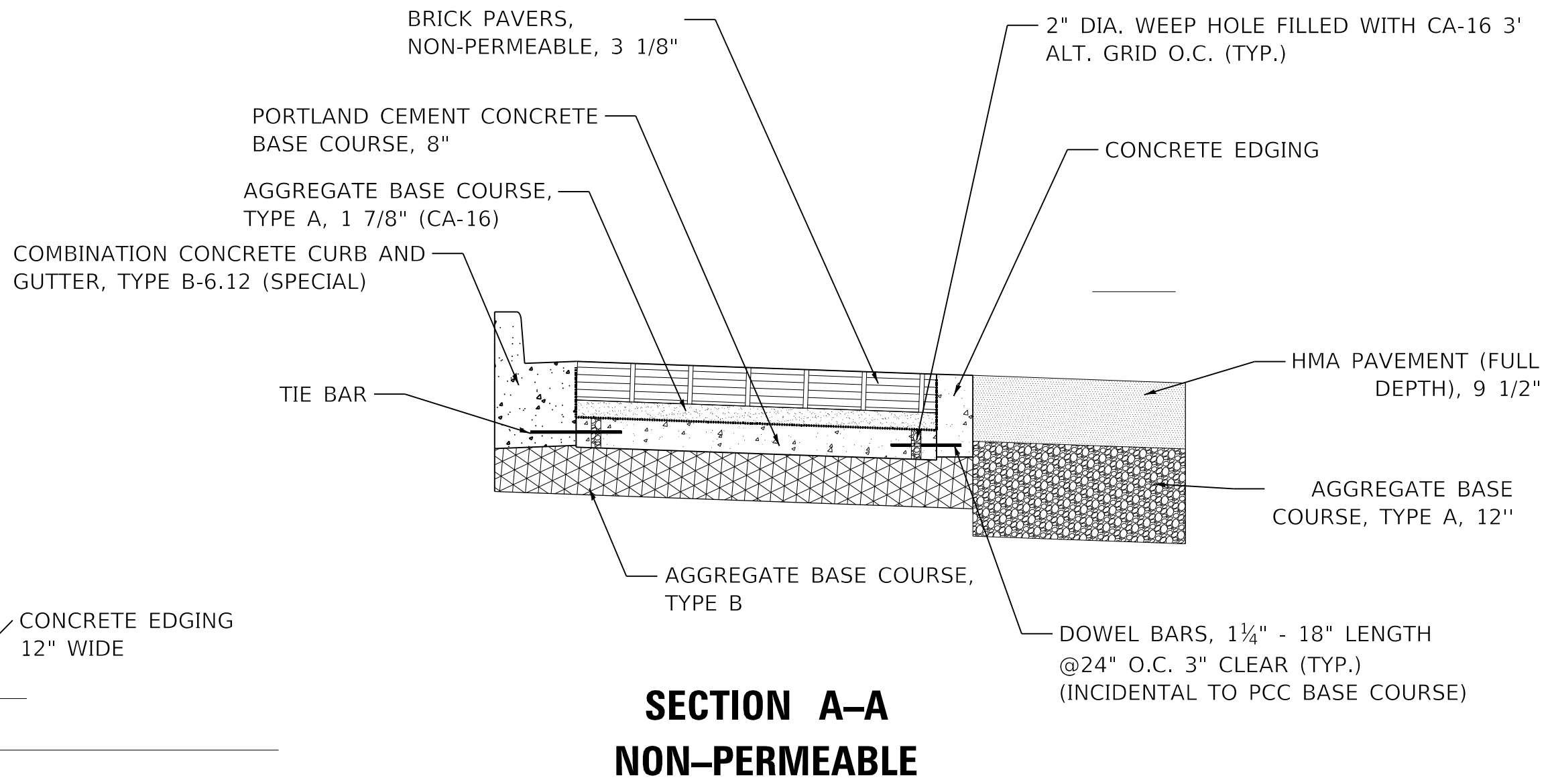
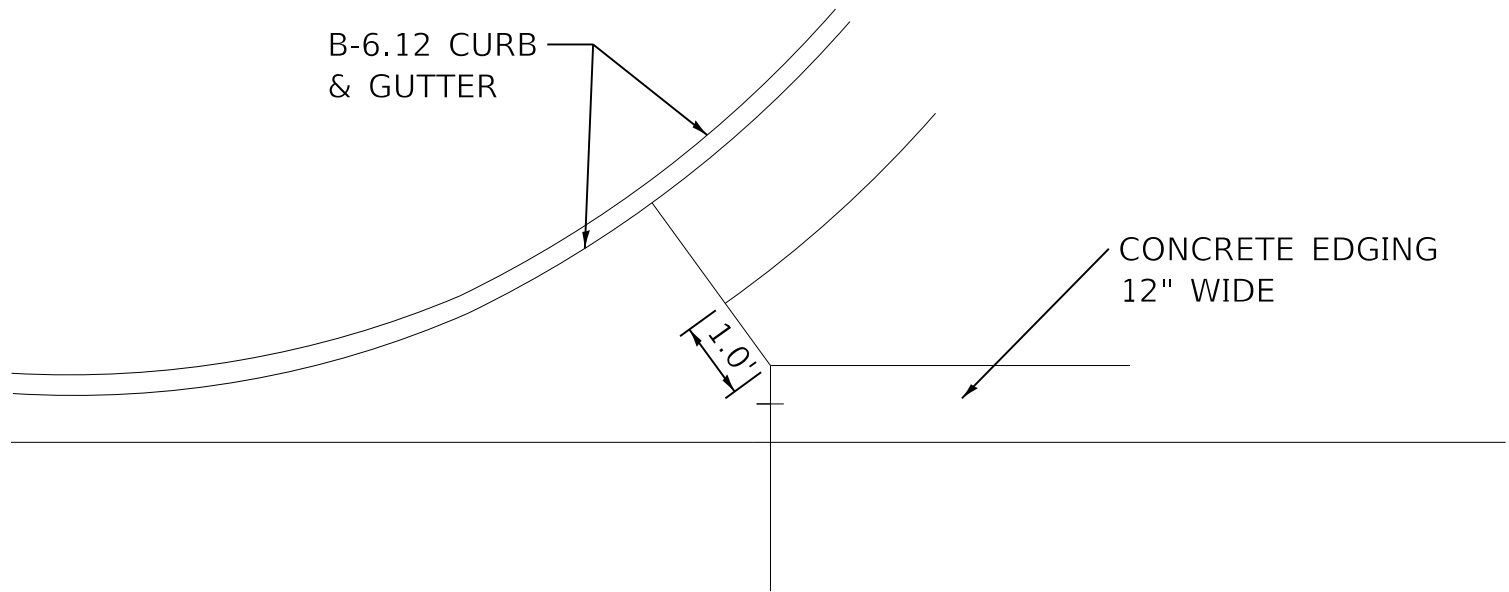
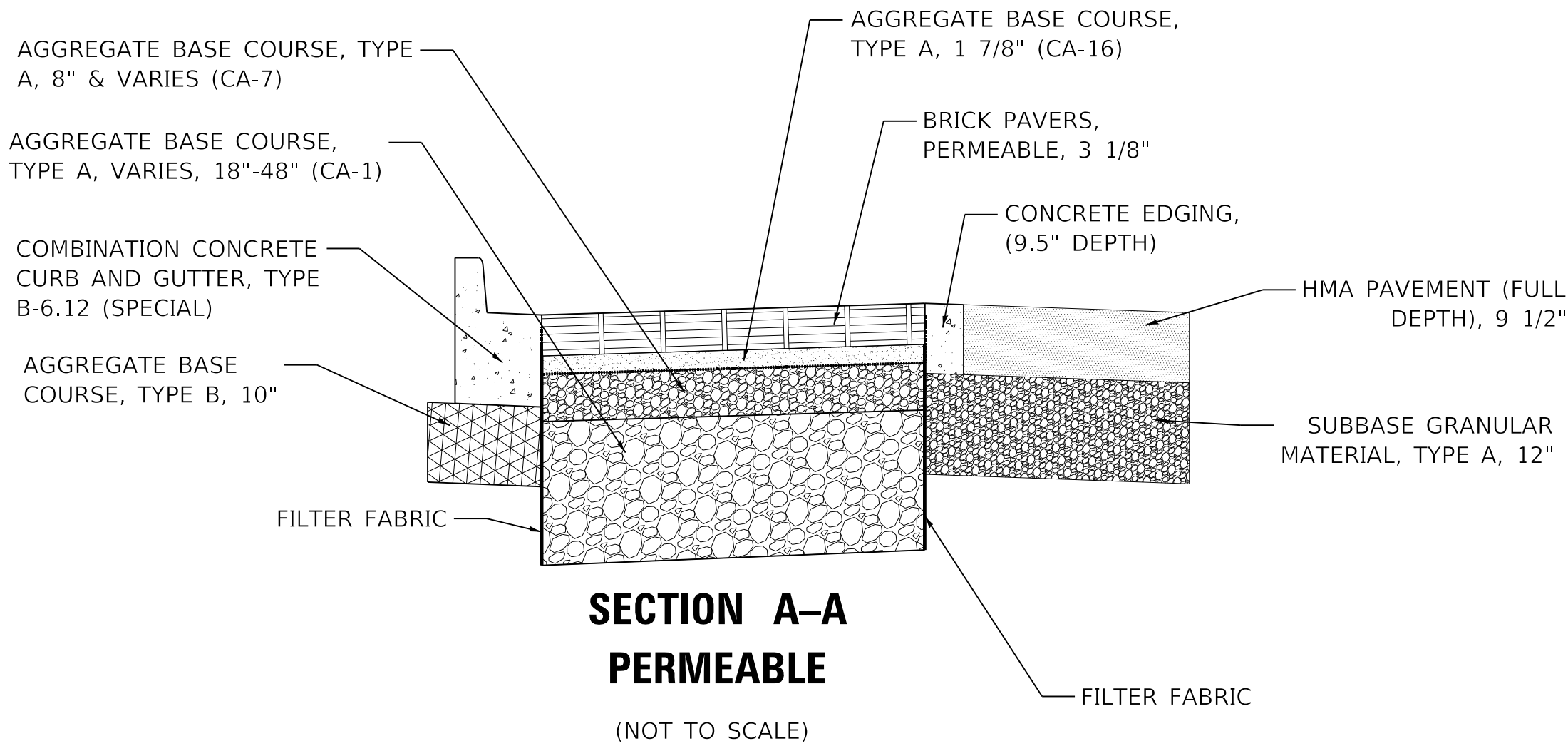
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
6594	16-00368-01-PV	PEORIA	423	356
WESTERN AVE RECONSTRUCTION		CONTRACT NO. 89766		
		ILLINOIS	FED. AID PROJECT	



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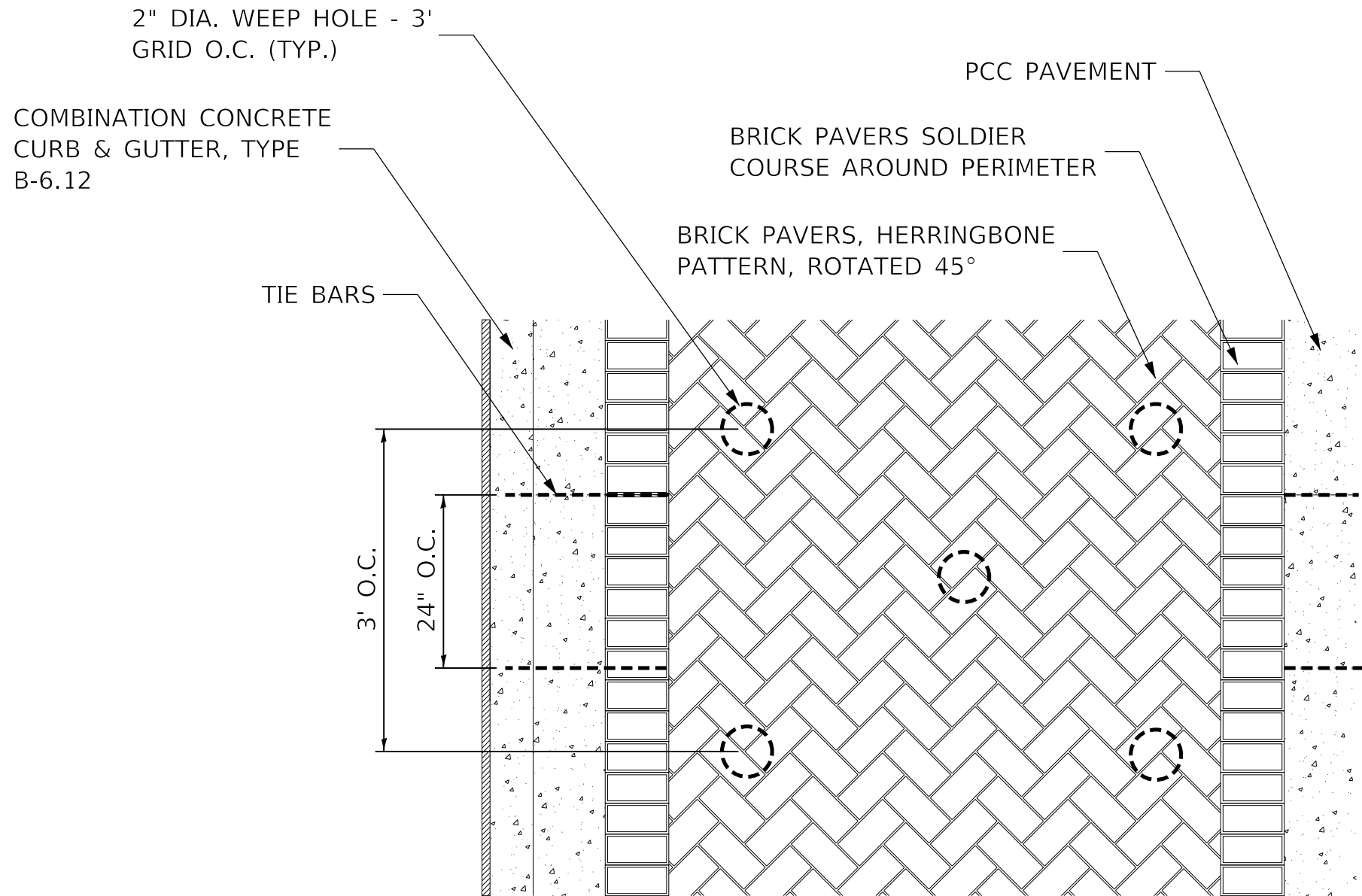
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**STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION**

**DETAILS
BRICK PAVERS – ALTERNATE B**

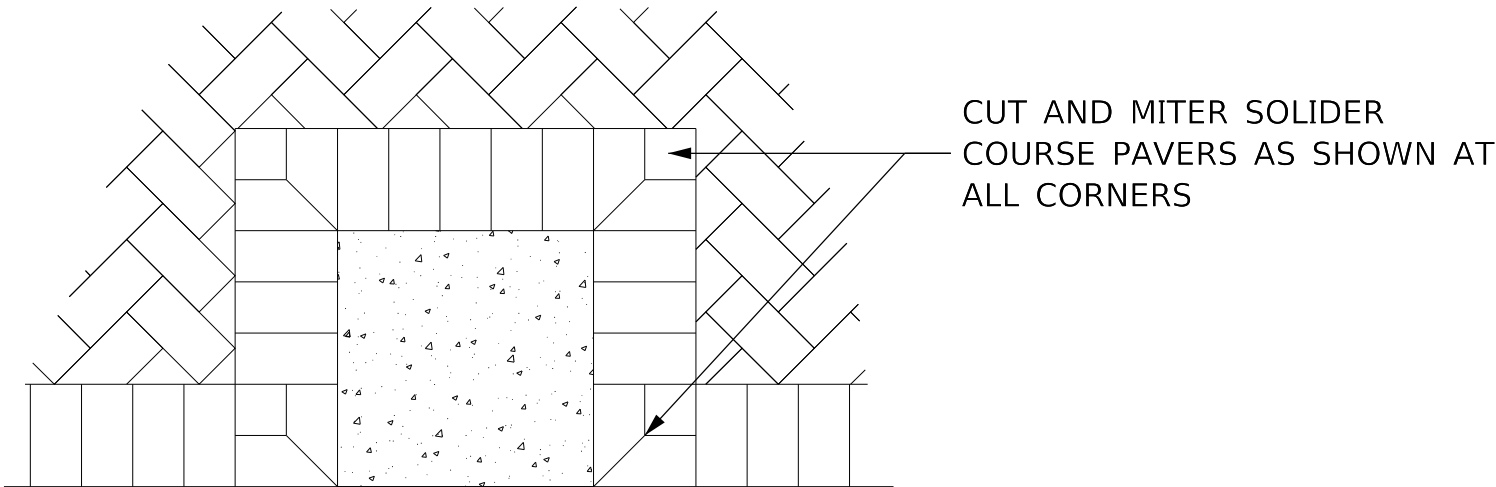
SCALE: NTS SHEET 7 OF 16 SHEETS STA. TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
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WESTERN AVE RECONSTRUCTION		CONTRACT NO. 89766		
		ILLINOIS	FED. AID PROJECT	



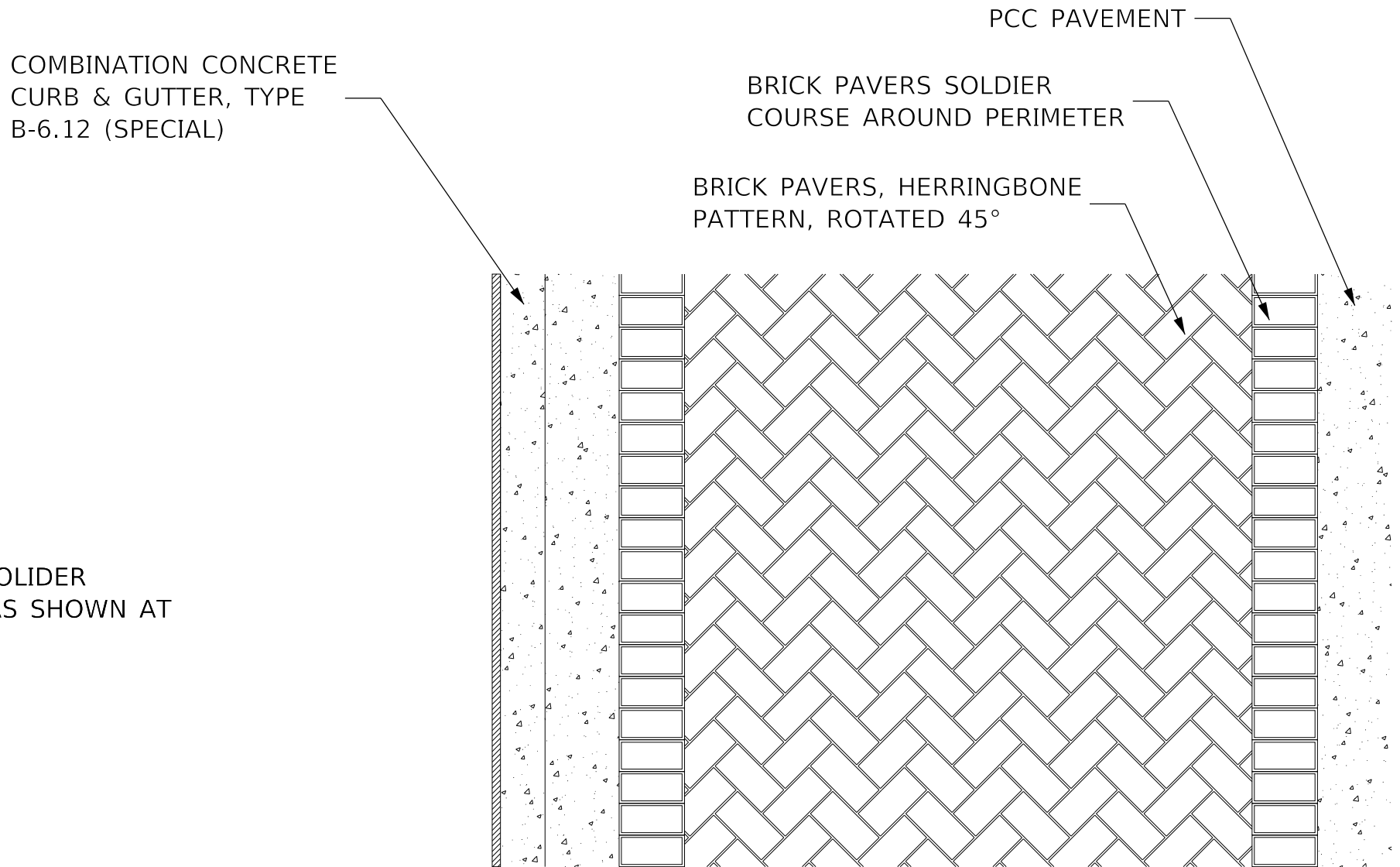
**BRICK PAVERS PATTERN
NON PERMEABLE
ALTERNATE A (PCC)
(SURFACE VIEW)**

(NOT TO SCALE)



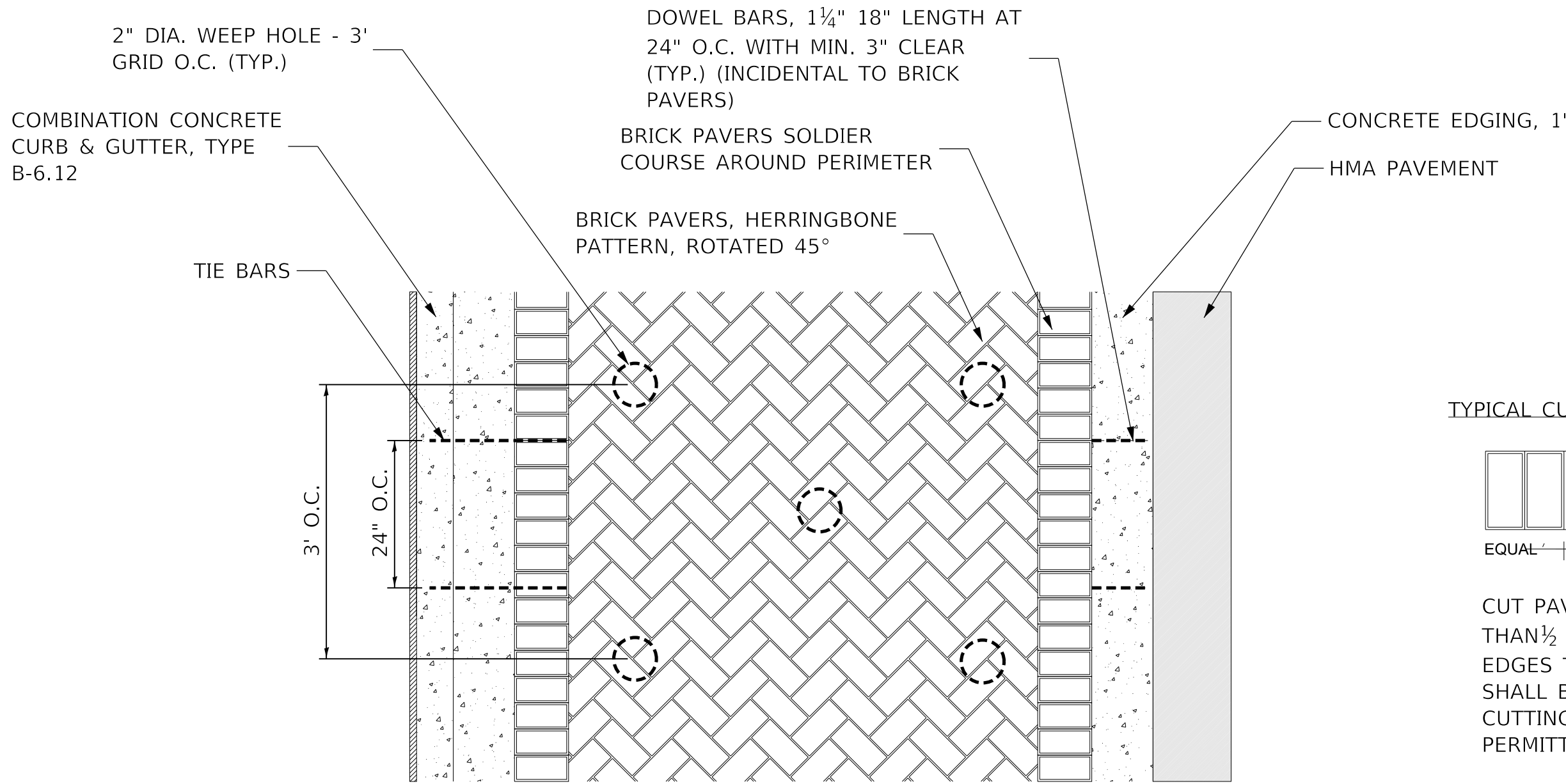
**BRICK PAVERS PATTERN
CORNER DETAIL
(SURFACE VIEW)**

(NOT TO SCALE)



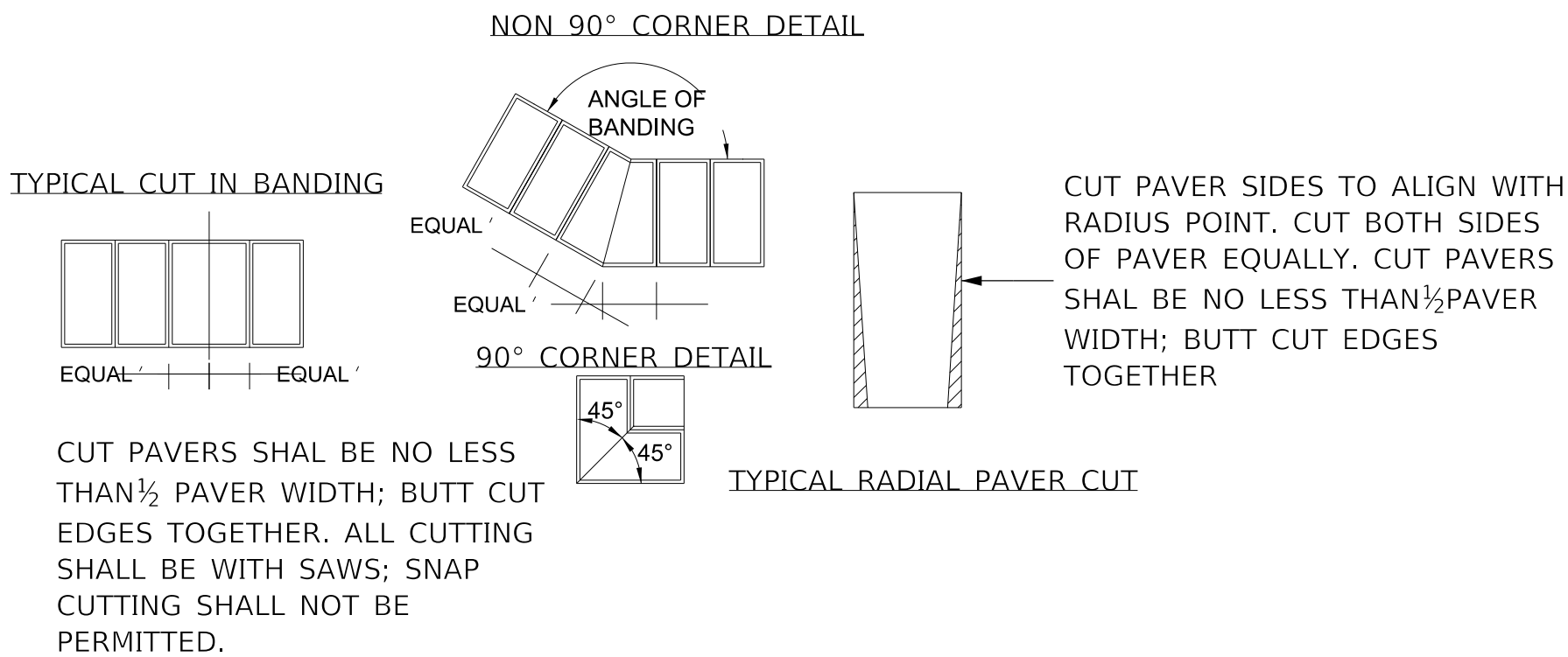
**BRICK PAVERS PATTERN
PERMEABLE
ALTERNATE A (PCC)
(SURFACE VIEW)**

(NOT TO SCALE)



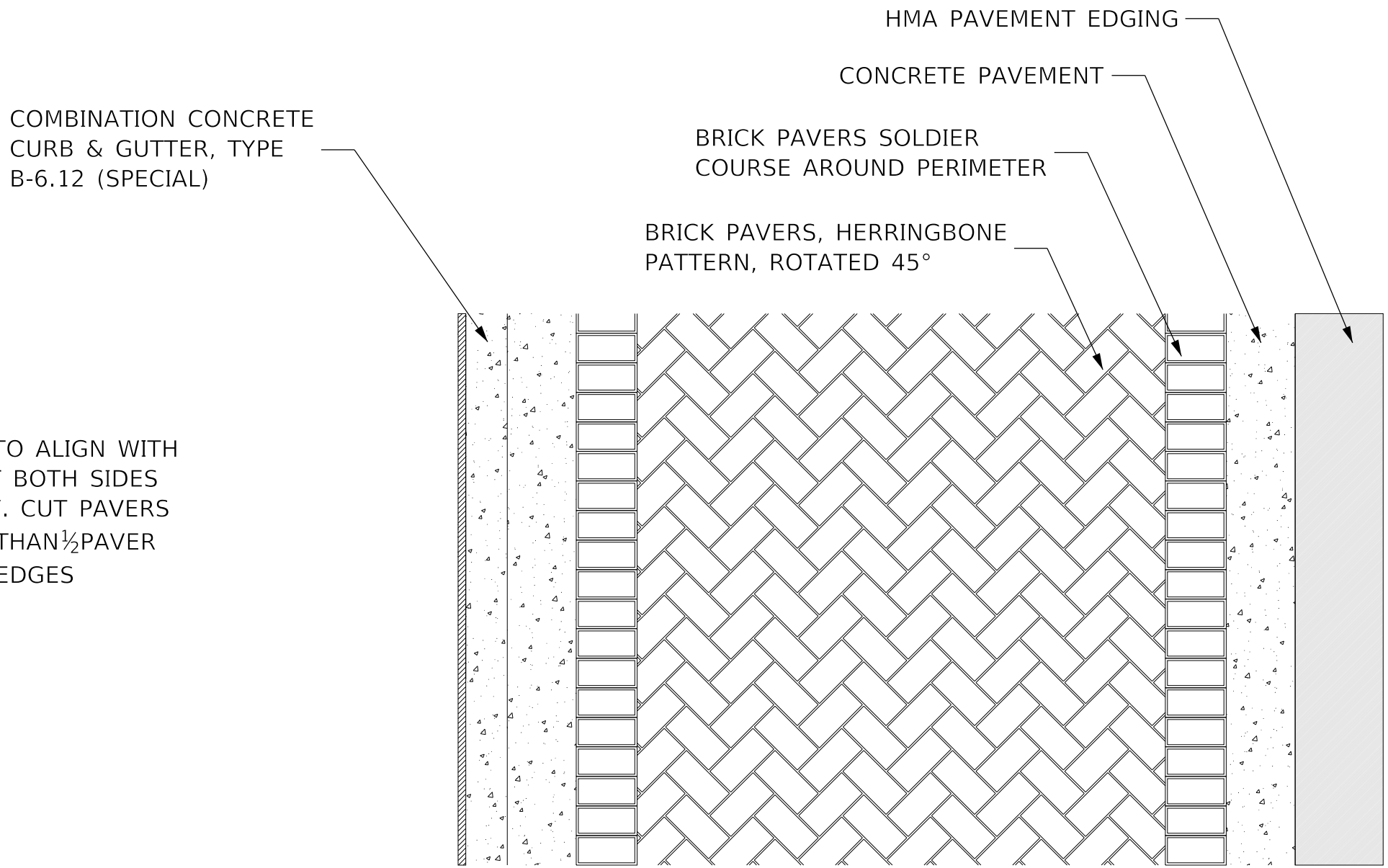
**BRICK PAVERS PATTERN
NON PERMEABLE
ALTERNATE B (HMA)
(SURFACE VIEW)**

(NOT TO SCALE)



**BRICK PAVERS
TYPICAL PAVER CUTS
DETAIL
(SURFACE VIEW)**

(NOT TO SCALE)



**BRICK PAVERS PATTERN
PERMEABLE
ALTERNATE B (HMA)
(SURFACE VIEW)**

(NOT TO SCALE)

MODEL: Default
FILE NAME: C:\Users\alphonsee\OneDrive\Documents\Projects\16-187-005 COP Western Printing\Design\CADD\Transportation\CADD Sheets\16-187-005-SHT-DETAIL-008.dgn



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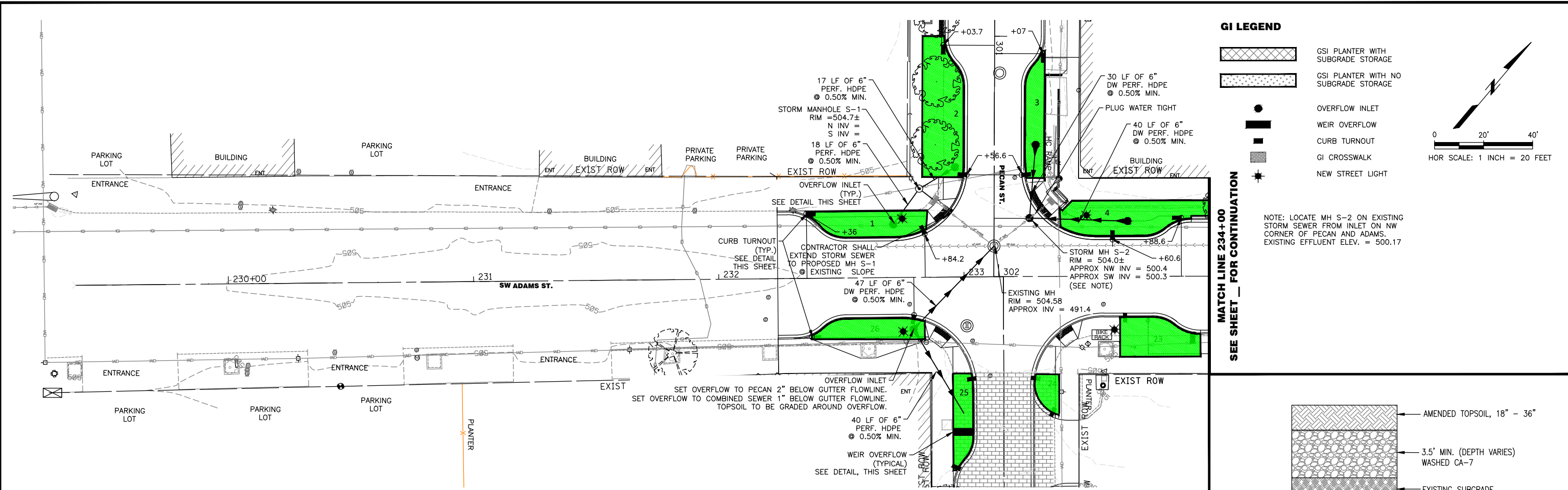
**STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION**

**DETAILS
BRICK PAVERS**

SCALE: NTS SHEET 8 OF 16 SHEETS STA. TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
6594	16-00368-01-PV	PEORIA	423	359
WESTERN AVE RECONSTRUCTION		CONTRACT NO. 89766		
ILLINOIS		FED. AID PROJECT		

P:\3160070017\Green Pilot Project 2015\Adams St Pilot Project\Drawings\Plan View_6-14-16.dwg, GI-229+37.75-234+00, 7/20/2016 1:59:20 PM



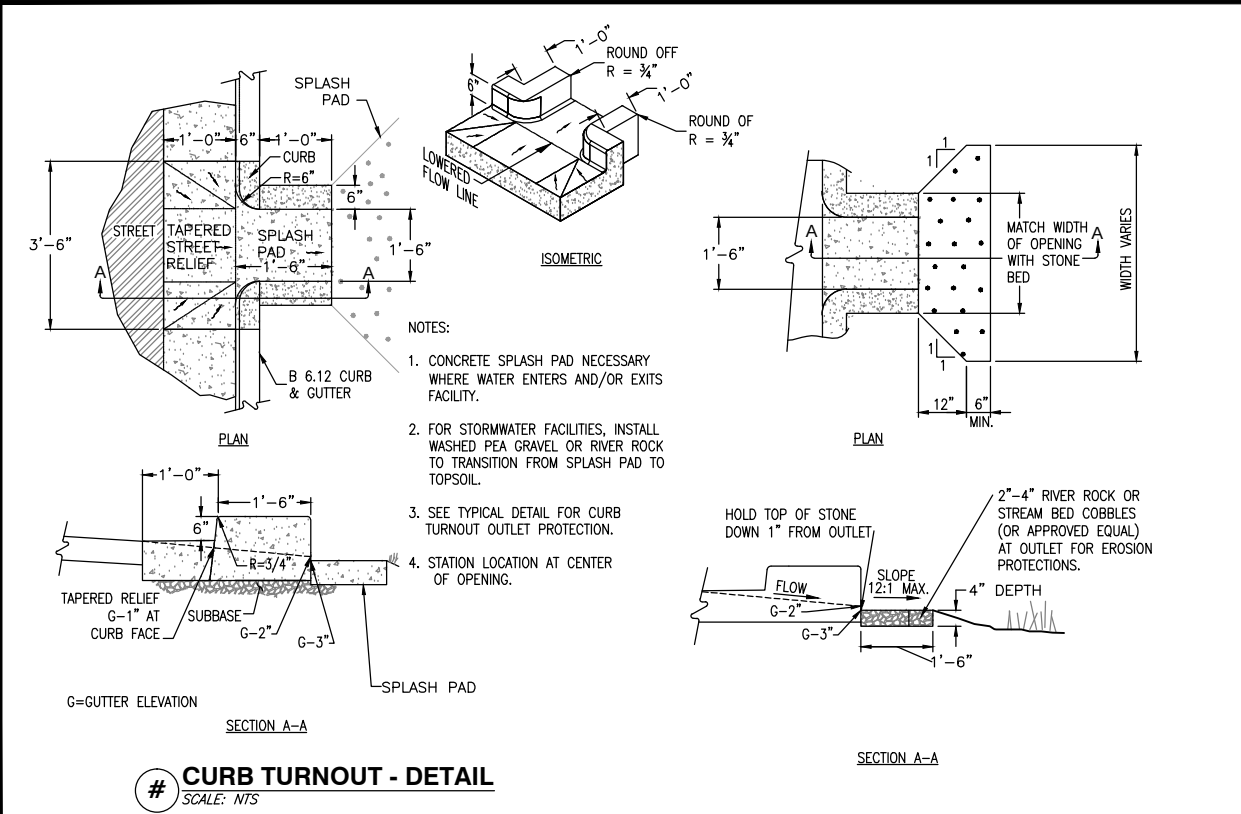
GI LEGEND

- GSI PLANTER WITH SUBGRADE STORAGE
- GSI PLANTER WITH NO SUBGRADE STORAGE
- OVERFLOW INLET
- WEIR OVERFLOW
- CURB TURNOUT
- GI CROSSWALK
- NEW STREET LIGHT

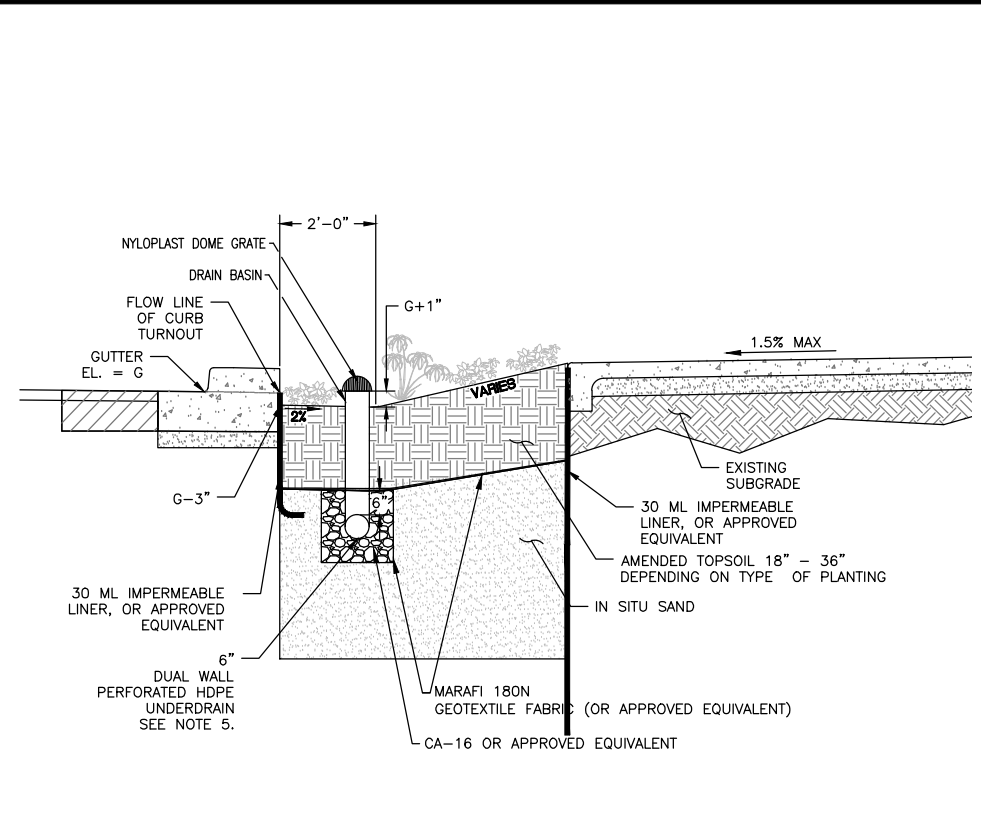
HOR SCALE: 1 INCH = 20 FEET

NOTE: LOCATE MH S-2 ON EXISTING STORM SEWER FROM INLET ON NW CORNER OF PECAN AND ADAMS. EXISTING EFFLUENT ELEV. = 500.17

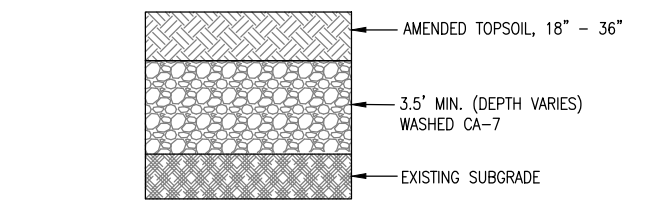
MATCH LINE 234+00
SEE SHEET _ FOR CONTINUATION



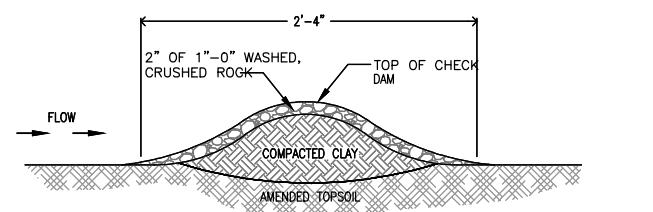
CURB TURNOUT - DETAIL
SCALE: NTS



DETAIL - OVERFLOW INLET
SCALE: NTS



NOTE: **SOIL PROFILE**
ENGINEER TO PROVIDE SOIL TESTING DATA FOR INFILTRATION RATE OF EXISTING SUBGRADE.
SOIL MODIFICATIONS MAY BE NECESSARY TO IMPROVE EXISTING SUBGRADE DRAINAGE CHARACTERISTICS.



NOTE: **WEIR OVERFLOW**
1. WEIR OVERFLOW TO BE SPACED BETWEEN INLET AND OUTLET.
2. ADDITIONAL INLETS (CURB TURNOUTS INTO BIORETENTION AREA) TO BE PLACED DIRECTLY DOWNSTREAM OF DAMS.
3. TOP OF DAM TO BE 1" BELOW GUTTER ELEVATION AT INLET (AT CURB LINE) BUT NOT GREATER THAN 2" BELOW TOP OF CURB.

DETAIL - WEIR OVERFLOW
SCALE: NTS

REVISIONS			
NO.	DATE	DESCRIPTION	APPROVED
1	04/27/16	DESIGNED - TAL	
2	04/27/16	DRAWN - JLA	
3	04/27/16	CHECKED - EJC	
4	04/27/16	DATE	

DESIGNED - TAL
DRAWN - JLA
CHECKED - EJC
DATE - 04/27/16

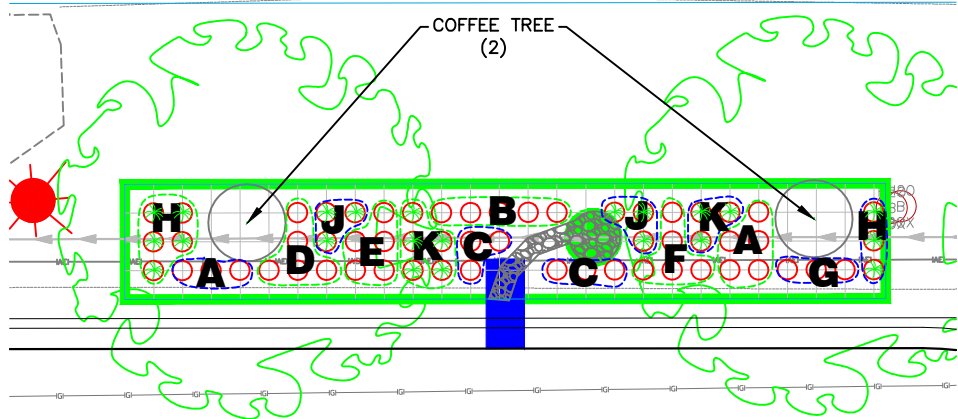
amec
foster
wheeler

4232 N. BRANDYWINE DR.
SUITE A
PEORIA, ILLINOIS 61614
PH (309) 692-4422
FX (309) 692-9364

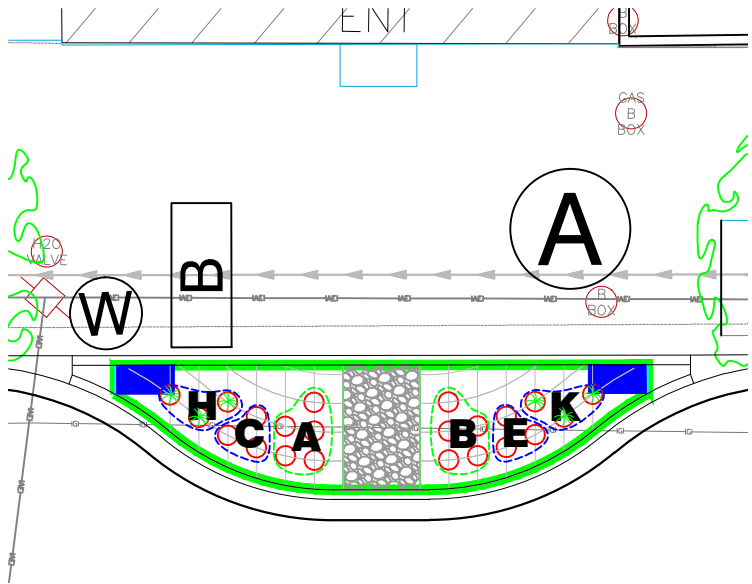
PRELIMINARY
NOT FOR CONSTRUCTION

GI PLAN VIEW
PEORIA CSO
ADAMS ST. PILOT PROJECT
CITY OF PEORIA PUBLIC WORKS
3505 N. DRIES LANE
PEORIA, IL 61604

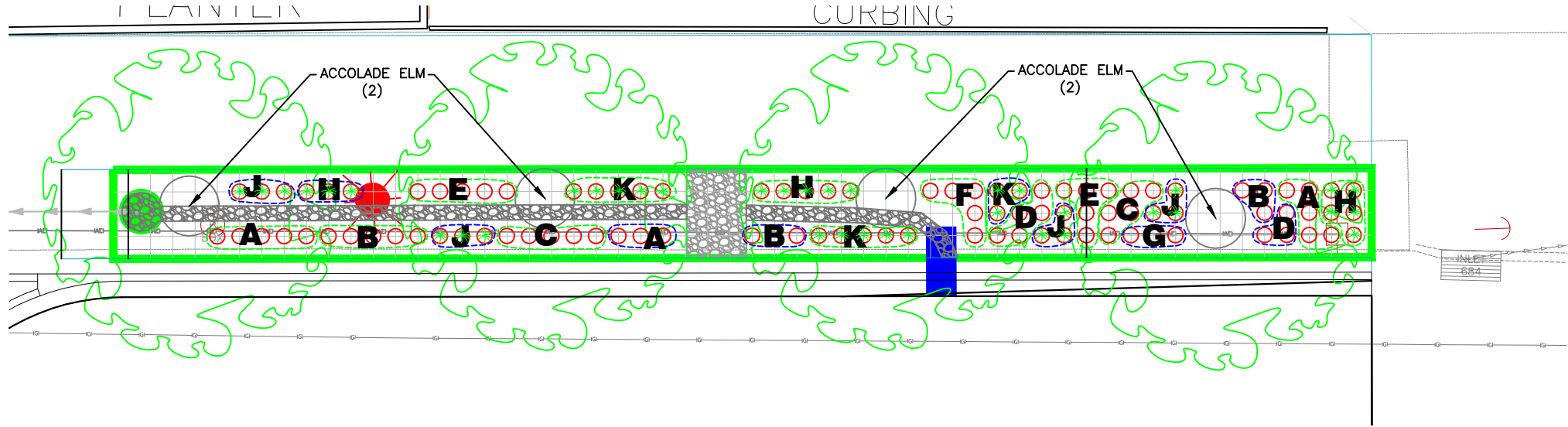
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GREEN INFRASTRUCTURE PLANTER #13
238 SQUARE FEET 239+10 LEFT



GREEN INFRASTRUCTURE PLANTER #14
140 SQUARE FEET 239+55 LEFT



GREEN INFRASTRUCTURE PLANTER #15
508 SQUARE FEET 240+15 LEFT

LEGEND

- GSI PLANTER
- OVERFLOW INLET
- WEIR OVERFLOW
- CURB TURNOUT
- GI CROSSWALK
- NEW STREET LIGHT
- EXISTING TREE
- PROPOSED TREE
- PLANTING LAYOUT GROUPS OF 3
- PLANTING LAYOUT GROUPS OF 5
- BUSH
- BENCH
- WASTE CAN
- ART
- BIKE RACK
- LOW FLOW CHANNEL

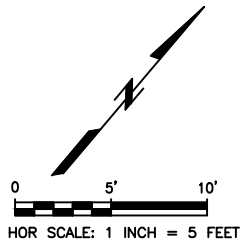
- WILDFLOWERS:
- A DENSE BLAZING STAR
 - B NEW ENGLAND ASTER
 - C BLUE FALSE INDIGO
 - D FOXGLOVE BEARD TONGUE
 - E SWEET BLACK EYED SUSAN
 - F BLUE FLAG IRIS
 - G OBEDIENT PLANT
- GRASSES:
- H PRAIRIE DROPSEED
 - J YELLOW FOX SEDGE
 - K TUFTED HAIR GRASS

REVISIONS			
NO.	DATE	DESCRIPTION	APPROVED
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-

DESIGNED TAL
DRAWN JLA
CHECKED EJC
DATE 7/13/16



4232 N. BRANDYWINE DR.
SUITE A
PEORIA, ILLINOIS 61614
PH (309) 692-4422
FX (309) 692-9364

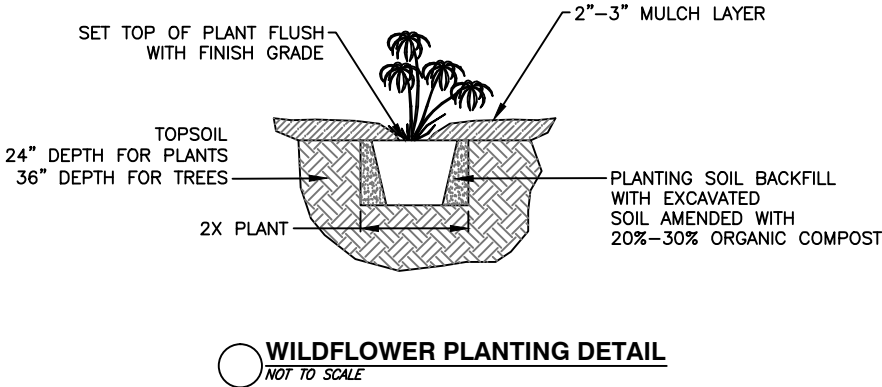
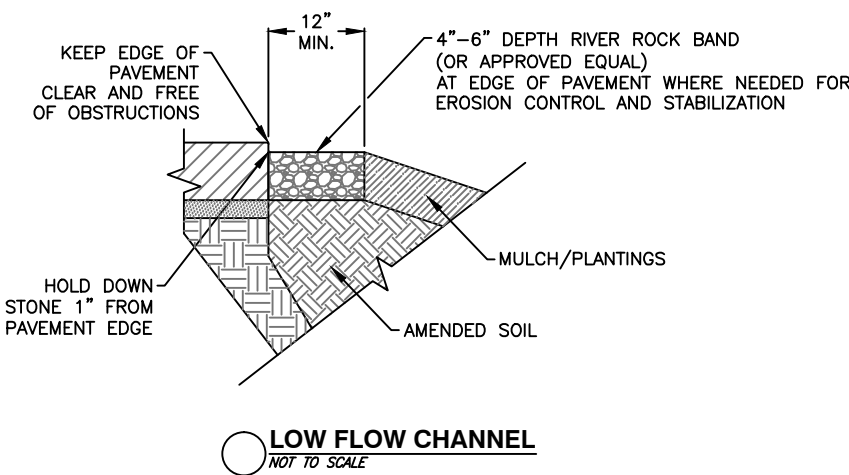
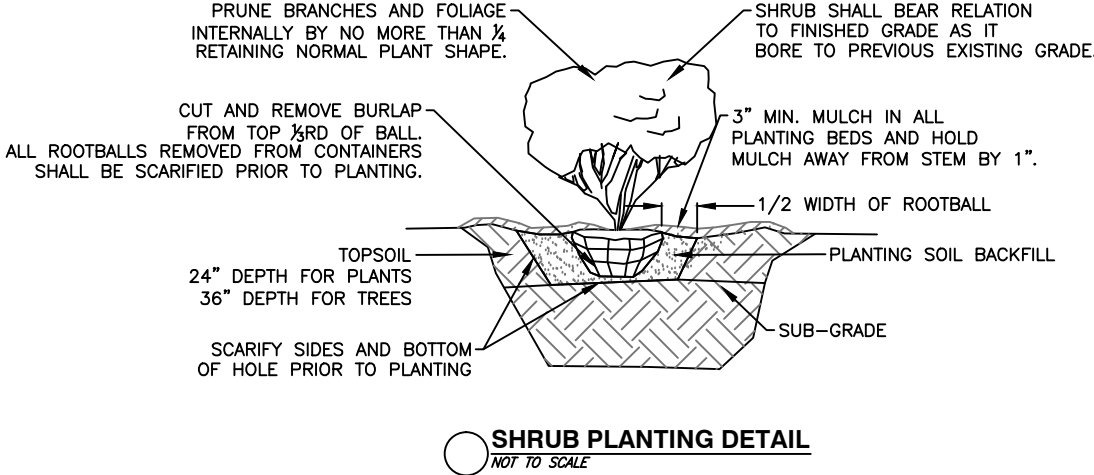
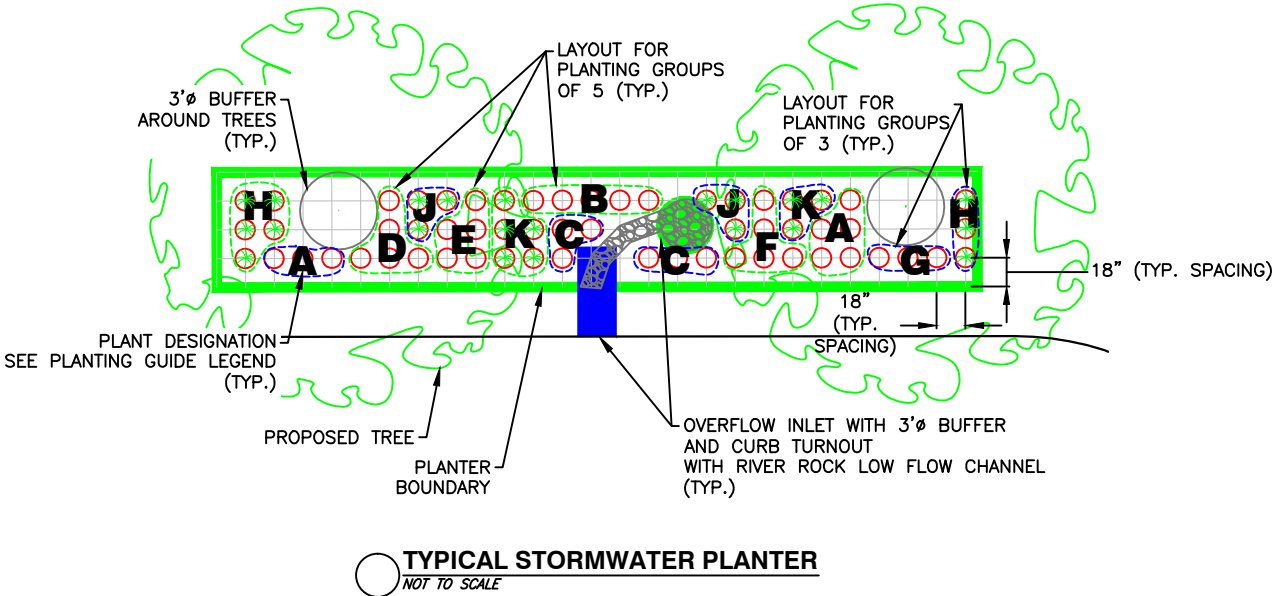
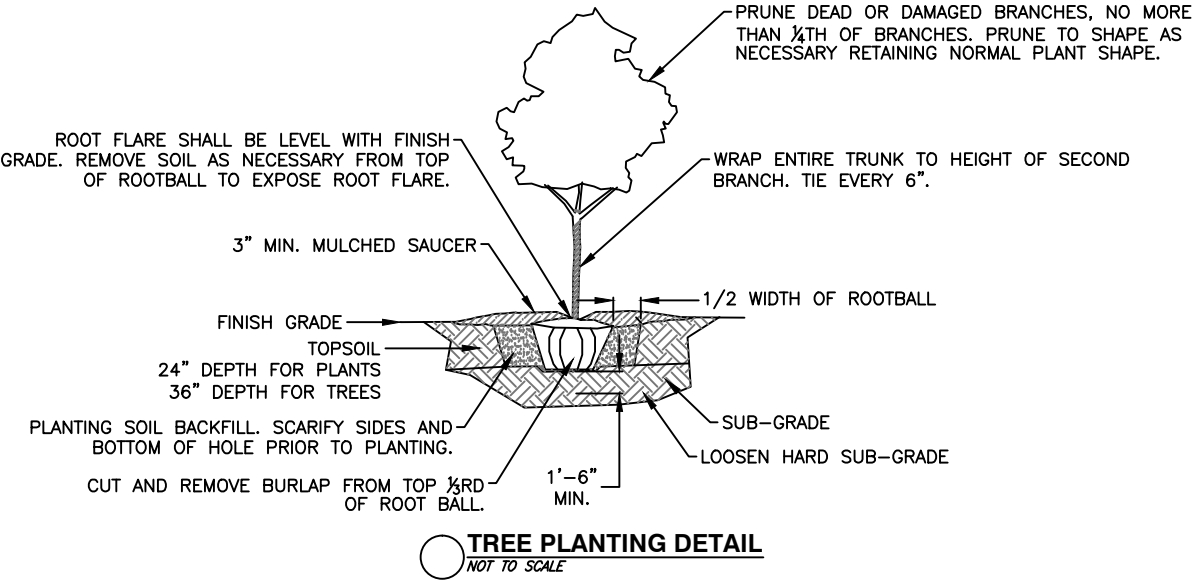


PRELIMINARY
NOT FOR CONSTRUCTION

GI PLANTING GUIDE - PLAN VIEW

PEORIA CSO
ADAMS ST. PILOT PROJECT
CITY OF PEORIA PUBLIC WORKS
3505 N. DRIES LANE
PEORIA, IL 61604

P:\3160070017\Green Pilot Project 2015\Adams St Pilot Project\Drawings\Plan View_GI Landscape Plan.dwg, 11/2/2016 9:33:17 AM



REVISIONS			
NO.	DATE	DESCRIPTION	APPROVED
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-

DESIGNED TAL
DRAWN JLA
CHECKED EJC
DATE 7/13/16



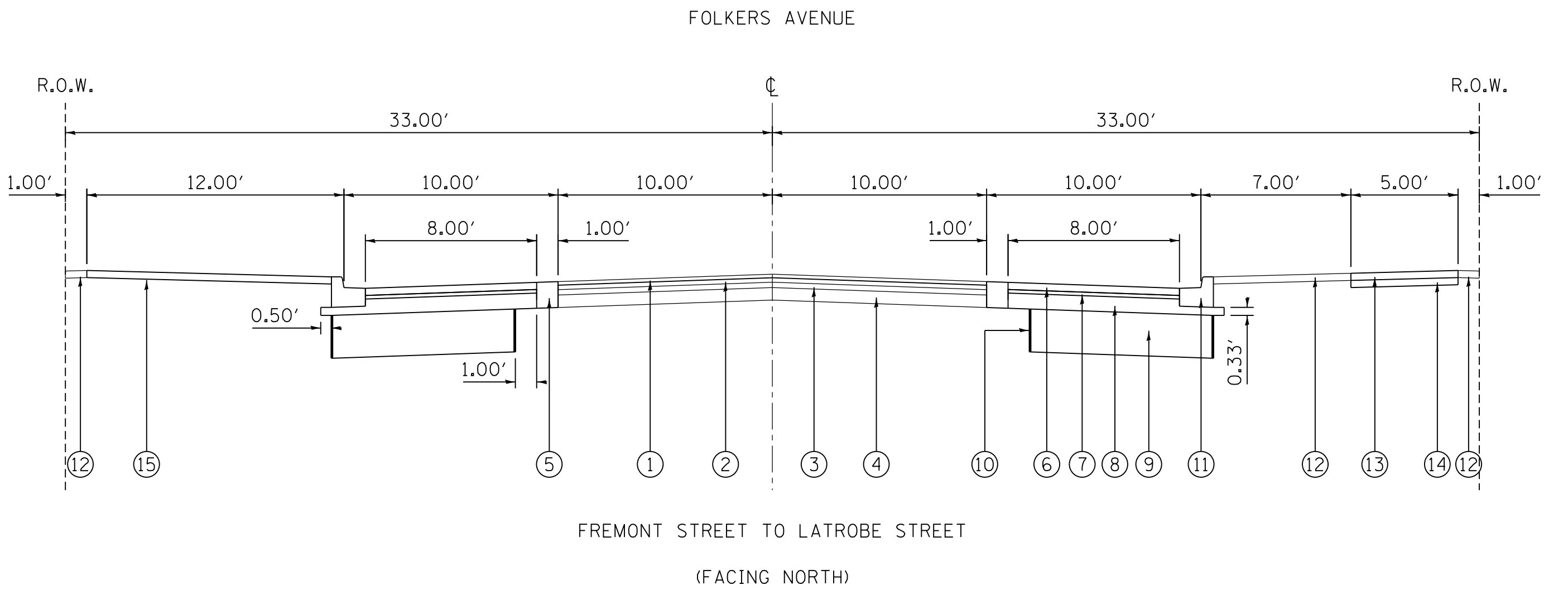
4232 N. BRANDYWINE DR.
SUITE A
PEORIA, ILLINOIS 61614
PH (309) 692-4422
FX (309) 692-9364

PRELIMINARY
NOT FOR CONSTRUCTION

GI PLANTING GUIDE - PLAN VIEW

PEORIA CSO
ADAMS ST. PILOT PROJECT
CITY OF PEORIA PUBLIC WORKS
3505 N. DRIES LANE
PEORIA, IL 61604

PROPOSED TYPICAL SECTION



- ① PROPOSED HMA SURFACE COURSE, 2"

② PROPOSED HMA BINDER COURSE, 2½"

③ PROPOSED AGGREGATE BASE COURSE, 3" (CA-6)

④ PROPOSED AGGREGATE SUBBASE, 7" (CS-01)

⑤ PROPOSED PCC PAVEMENT, 14½"

⑥ PROPOSED PERMERABLE PAVERS (4")

⑦ PROPOSED AGGREGATE PAVER BEDDING, 2" (CA-16)

⑧ PROPOSED AGGREGATE SUBBASE, 8" & VARIES (CA-7)

⑨ PROPOSED AGGREGATE BASE, 24" (CA-1)

⑩ PROPOSED NON-WOVEN GEOTEXTILE FILTER FABRIC
- ⑪ PROPOSED COMBINATION CONCRETE CURB AND GUTTER, TYPE B-6.12 (DRY CURB)

⑫ PROPOSED TOPSOIL, FURNISH AND PLACE, 4"

⑬ PROPOSED PCC SIDEWALK, 4"

⑭ PROPOSED SUBBASE GRANULAR MATERIAL TYPE A, 4"

⑮ SIDEWALK AND PLANTING AREAS. SEE PLAN VIEW.

APPENDIX E

Other Industry Accepted GI Technical Standards and Details

Volume Control Practice	Pretreatment Measures
Bioretention Facility	● Level spreader must be installed where runoff enters the facility as shallow concentrated flow to distribute the runoff as sheet flow over the entire facility. ● Vegetated filter strip, grass-lined channel, or sump must be installed upstream of the facility to filter out settleable particle and floatable materials. ● Where inflow velocities are greater than 3 ft/s, a vegetated filter strip or rock outlet protection must be installed to prevent erosion and distribute flows across the facility. ● Vegetated portions of the contributing drainage area must be stabilized.
Bioswale	● Level spreader must be installed where runoff enters the facility as shallow concentrated flow to distribute the runoff as sheet flow over the entire facility. ● Vegetated portions of the contributing drainage area must be stabilized.
Constructed Wetlands	● Where inflow velocities are greater than 3ft/s, rock outlet protection should be provided to prevent erosion and distribute the flows into the facility. ● Vegetated portions of the contributing drainage area must be stabilized.
Drywell	● Filter screens must be installed on all roof drains directed toward the facility. ● For facilities that include inflow pipes, sump shall be installed at manhole immediately upstream of facility.
Green Roof	● No Pretreatment measures required.
Infiltration Trench	● Level spreader must be installed where runoff enters the facility as shallow concentrated flow to distribute the runoff as sheet flow over the entire facility. ● Vegetated filter strip, grass-lined channel, or sump must be installed upstream of the trench to filter out settleable particle and floatable materials. ● Where inflow velocities are greater than 3 ft/s, a vegetated filter strip or rock outlet protection must be provided to prevent erosion and distribute flows across the facility. ● Vegetated portions of the contributing drainage area must be stabilized.
Permeable Pavement	● Vegetated filter strip, grass-lined channel, or sump must be installed upstream of the facility to filter out settleable particle and floatable materials. ● Vegetated portions of the contributing drainage area must be stabilized.
Storage Below Detention Basin Outlet	● Where inflow velocities are greater than 3 ft/s, rock outlet protection should be provided to prevent erosion and distribute the flows into the facility. ● Vegetated portions of the contributing drainage area must be stabilized.
Vegetated Filter Strip	● Level spreader must be installed where runoff enters the facility as shallow concentrated flow to distribute the runoff as sheet flow over the entire facility. ● Vegetated portions of the contributing drainage area must be stabilized.
Water Reuse System	● Filter screens must be installed on all roof drains directed toward the facility. ● For facilities that include inflow pipes, sump shall be installed at manhole immediately upstream of facility.

1. A porosity of 0.36 shall be used to calculate volume in CA-1 or or CA-7 gradation, 0.25 for CA-16 (volume above underdrain credited at 50%)
2. Storage calculated using average-end method between surface elevation and elevation of overflow grate/check dam.
3. Porosity of 0.25 shall be used to calculate volume in growing media (volume above underdrain at 50%)
4. Surface storage only if check dams are installed.



TECHNICAL GUIDANCE MANUAL

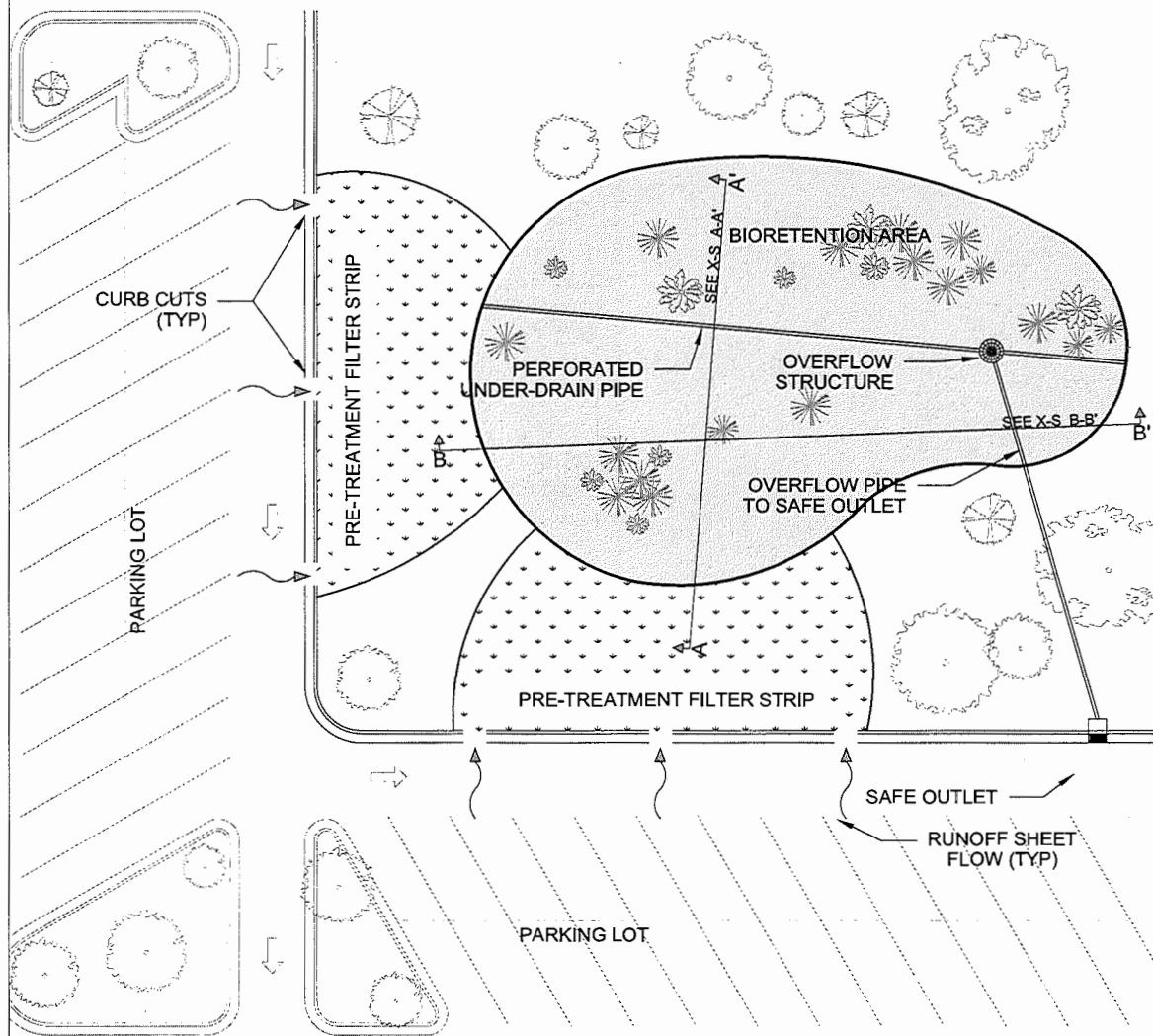
7/1/15

VOLUME CONTROL PRETREATMENT MEASURES

STD. DWG. NO.16

PAGE NO. 17

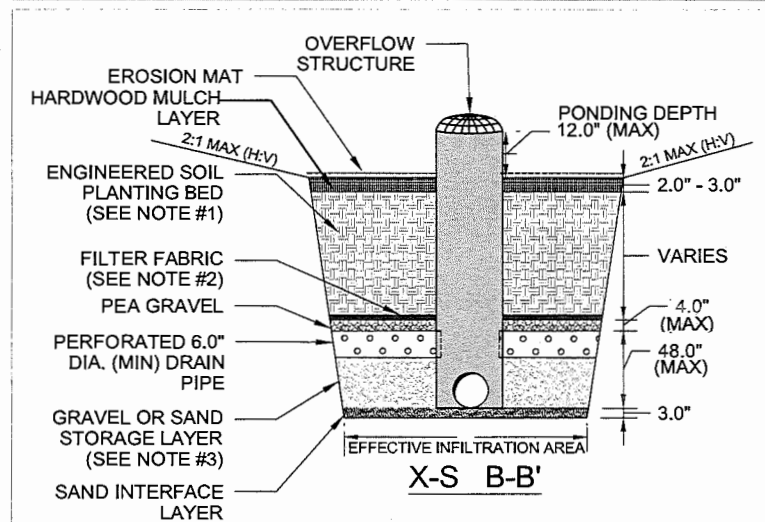
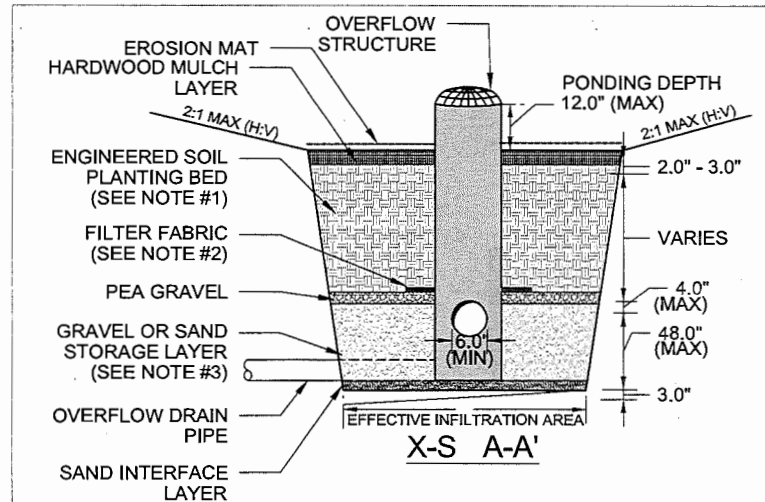
FIGURE 1. BIORETENTION DEVICE



PLAN VIEW

NOTES:

1. RECOMMENDED ENGINEERED SOIL PLANTING DEPTH IS 24.0". SHALLOWER PLANTING DEPTH IS ALLOWED WHEN SITE CONDITIONS ARE LIMITED. SOIL PLANTING DEPTH SHALL BE MINIMUM OF 18.0".
2. GEOTEXTILE FILTER FABRIC TO BE PLACED OVER PERFORATED UNDER-DRAIN.
3. GRAVEL / SAND STORAGE LAYER TO BE MAXIMUM OF 48.0" BELOW PERFORATED UNDER-DRAIN PIPE.



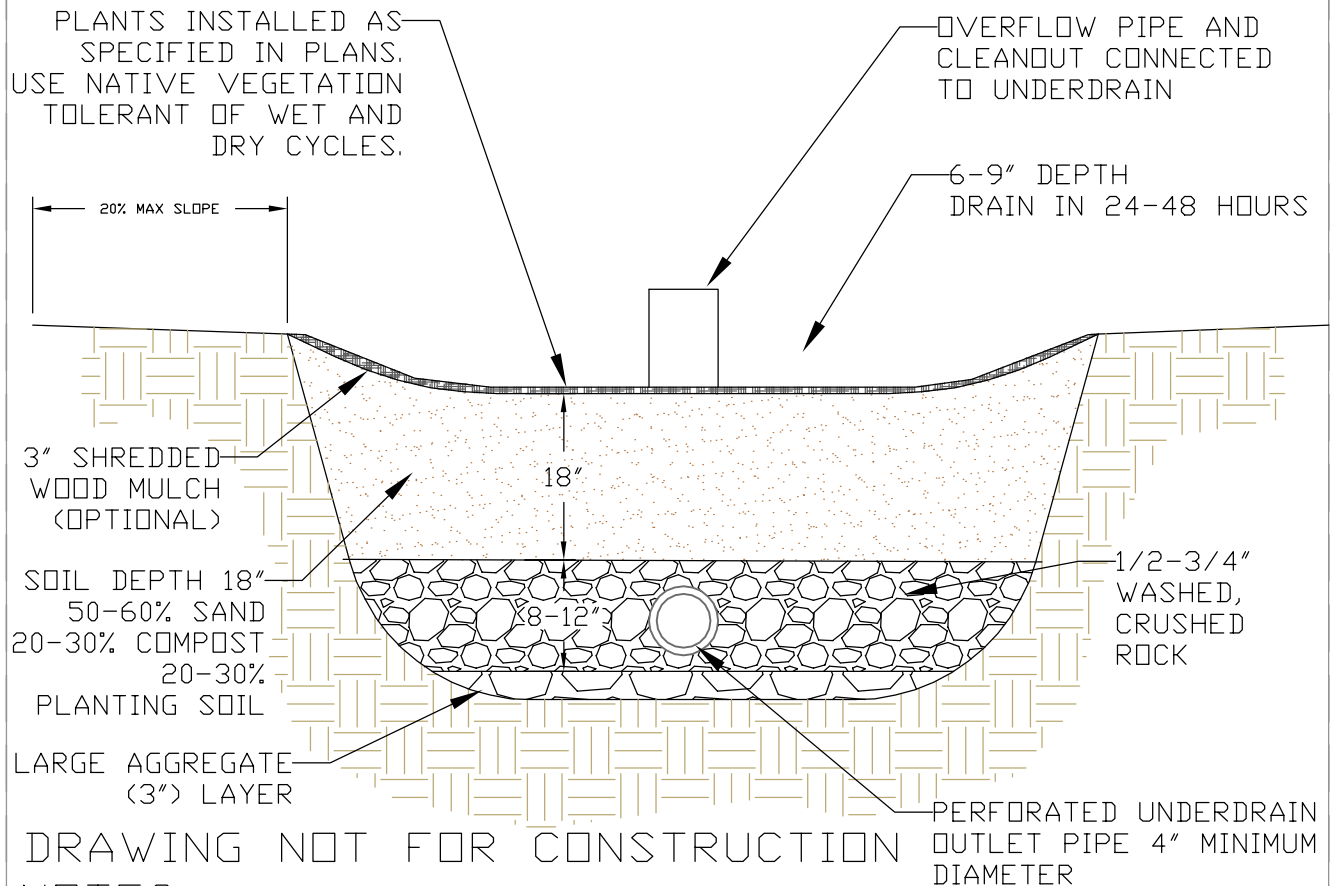
Bioretention For Infiltration (1004)

Wisconsin Department of Natural Resources
Technical Standard



1062
TECHNICAL STANDARD No.
10/17/2014
REVISION DATE
NOT TO SCALE

BIORETENTION FACILITY PLAN



NOTES:

1. LOCATE FACILITIES AT LEAST 100 FEET FROM ANY WELLS OR SOURCE WATER LOCATIONS.
2. LOCATE FACILITY AT LEAST 25 FEET FROM ANY SEPTIC FIELDS AND UPGRADIENT IF POSSIBLE.
3. LOCATE FACILITY AT LEAST 25 FEET AND DOWNGRADIENT FROM BASEMENTS.
4. LOCATE FACILITY 5 FEET OR GREATER FROM A SLAB OR FOUNDATION.
5. RECOMMENDED MINIMUM AREA SHALL BE 200 SQUARE FEET WITH THE LENGTH AT A 2:1 RATIO OF THE WIDTH.
6. ADDITIONAL REGULATIONS MAY BE REQUIRED BY LOCAL ORDINANCES.
7. A GEOTEXTILE FABRIC SEPARATING THE LARGE AGGREGATE AND SOIL IS OPTIONAL.
7. DRAWING NOT TO SCALE.

REFERENCE

Project _____
 Designed _____ Date _____
 Checked _____ Date _____
 Approved _____ Date _____

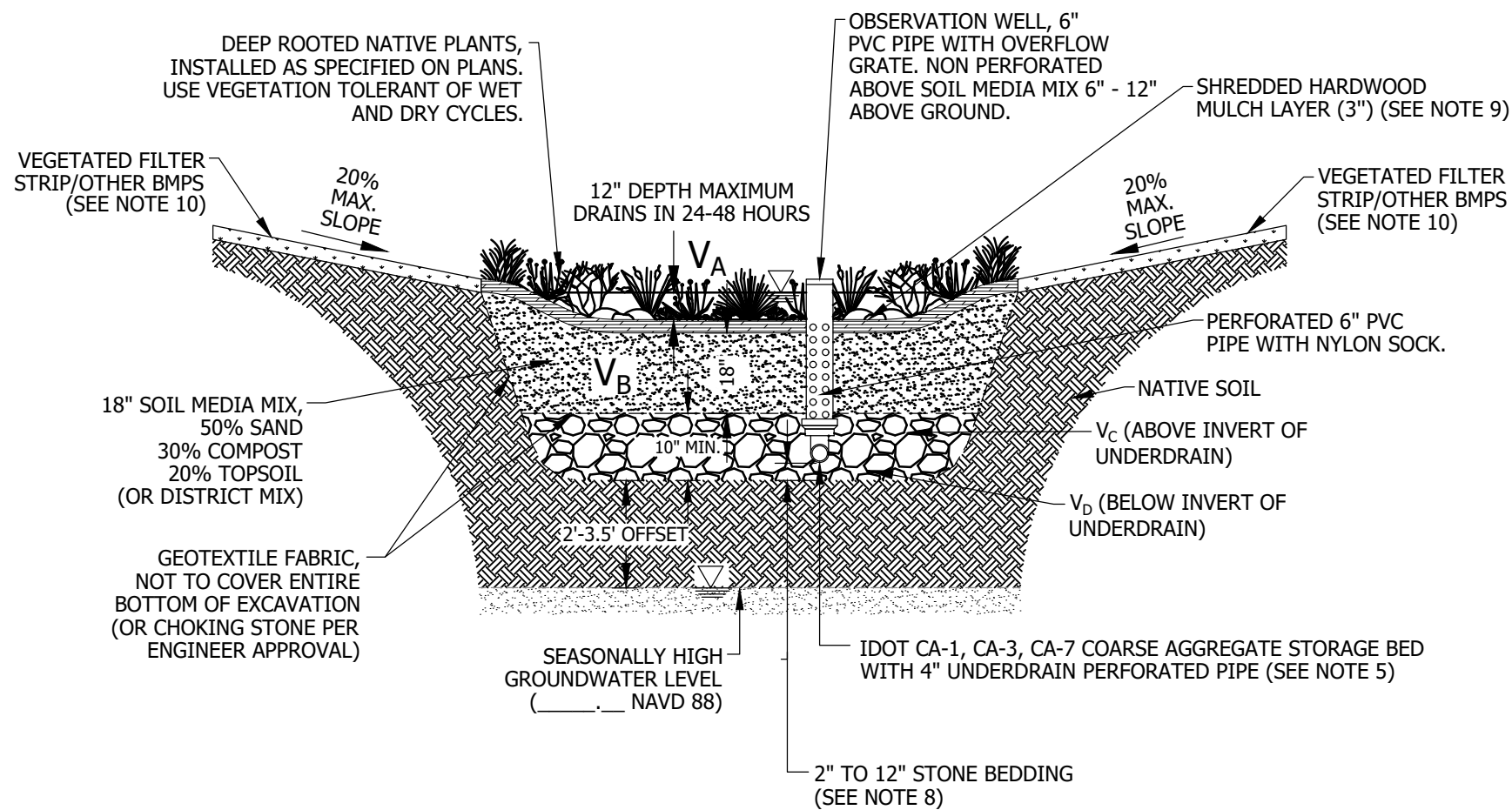


STANDARD DWG. NO.

IUM-500

SHEET 1 OF 1

DATE 11-18-13



BOTTOM OF THE FACILITY:	ELEV. _____
SEASONALLY HIGH GROUNDWATER:	ELEV. _____
SEPARATION:	FEET _____

VOLUME TYPE	SURFACE AREA	DEPTH	POROSITY	STORAGE VOLUME	VOLUME PROVIDED
V_A : SURFACE STORAGE			1.00	$1.00 \times V_A$	
V_B : SOIL MEDIA MIX			0.25	$0.50 \times 0.25 \times V_B$	
V_C : COARSE AGGREGATE (ABOVE INVERT)			0.36	$0.50 \times 0.36 \times V_C$	
V_D : COARSE AGGREGATE (BELOW INVERT)			0.36	$0.36 \times V_D$	
TOTAL					

- NOTES:
- THE PERIMETER OF THE VOLUME CONTROL FACILITY SHALL MAINTAIN THE MINIMUM HORIZONTAL SEPARATION DISTANCE OF: 10-FEET FROM FOUNDATIONS, UNLESS WATERPROOFED; 20-FEET FROM ROADWAY GRAVEL SHOULDER; AND 100-FEET FROM POTABLE WATER WELLS, SEPTIC TANKS/FIELDS, OR OTHER UNDERGROUND TANKS.
 - SANITARY OR COMBINED SEWERS SHALL NOT BE LOCATED WITHIN THE VOLUME CONTROL FACILITY. SANITARY OR COMBINED SEWERS SHALL NOT BE LOCATED BELOW THE FOOTPRINT OF THE VOLUME CONTROL FACILITY. WHEN LOCAL CONDITIONS PREVENT THE SEWER FROM BEING LOCATED OUTSIDE THE FOOTPRINT OF THE FACILITY THE SEWER SHALL BE CONSTRUCTED TO WATER MAIN QUALITY STANDARDS, OR IT SHALL BE ENCASED WITH A WATER MAIN QUALITY CARRIER PIPE WITH THE ENDS SEALED.
 - AVOID INSTALLATION ON SLOPES GREATER THAN 3.00%. AVOID COMPACTING NATIVE SOILS. SCARIFY ANY COMPACTED SOIL.
 - GEOTEXTILE FABRIC SHALL MEET REQUIREMENTS OF IUM MATERIAL SPECIFICATION 592. FOR WOVEN: APPARENT OPENING SIZE OF 0.50 MM (TABLE 1, CLASS I). FOR NON WOVEN: APPARENT OPENING SIZE OF 0.30 MM (TABLE 2, CLASS II).
 - STONE STORAGE OPTIONS ARE IDOT CA-1, CA-3, CA-7, DISTRICT VULCAN MIX, OR APPROVED ALTERNATE. NO RECYCLED MATERIALS.
 - MINIMUM DISTANCE OF 2 FEET (3.5 FEET IN COMBINED SEWER AREAS) BETWEEN BOTTOM OF BMP AND SEASONALLY HIGH GROUNDWATER LEVEL.
 - UNDERDRAINS ARE REQUIRED IN TYPICAL CLAYEY SOILS WHERE INFILTRATION RATES ARE LESS THAN 0.5 INCH/HOUR. NO MORE THAN 1 UNDERDRAIN EVERY 30 FEET ON CENTER. PROVIDE A SOIL REPORT DOCUMENTING NATIVE INFILTRATION RATE TO FOREGO UNDERDRAINS. NO FILTER FABRIC COVER/SOCK.
 - MINIMUM UNDERDRAIN BEDDING OF 2 INCHES, MAXIMUM OF 12 INCHES.
 - MULCH LAYER SHALL BE HARDWOOD MULCH OR OTHER NON-FLOATING GROUND COVER.
 - FOLLOW THE REQUIRED PRETREATMENT MEASURES LISTED ON THE VOLUME CONTROL PRETREATMENT MEASURES DETAIL.

NOT TO SCALE



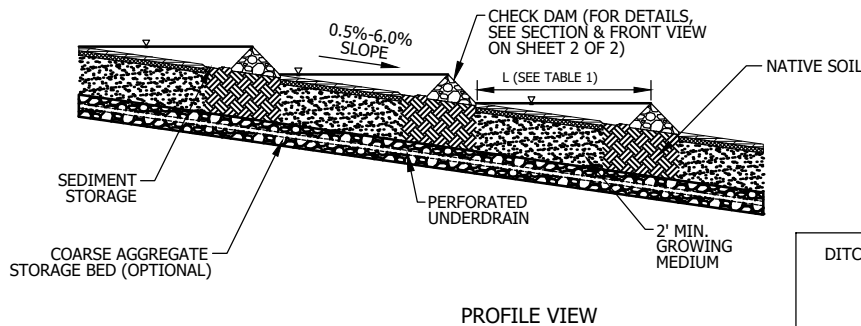
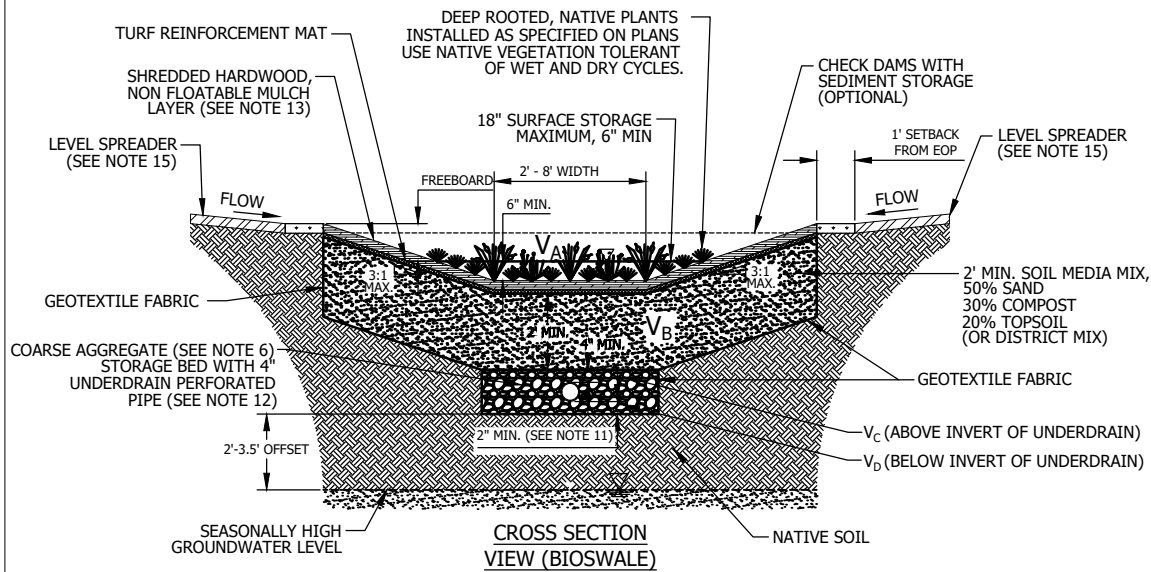


Table 1

DITCH SLOPE (%)	SPACING L (feet)
1	200
2	100
4	50
6	33

SLOPES ABOVE 6% ARE NOT RECOMMENDED

NOTES:

1. THE PERIMETER OF THE VOLUME CONTROL FACILITY SHALL MAINTAIN THE MINIMUM HORIZONTAL SEPARATION DISTANCE OF: 10-Feet FROM FOUNDATIONS, UNLESS WATERPROOFED; 20-Feet FROM ROADWAY GRAVEL SHOULDER; AND 100-Feet FROM POTABLE WATER WELLS, SEPTIC TANKS/FIELDS, OR OTHER UNDERGROUND TANKS.
2. SANITARY OR COMBINED SEWERS SHALL NOT BE LOCATED WITHIN THE VOLUME CONTROL FACILITY. SANITARY OR COMBINED SEWERS SHALL NOT BE LOCATED BELOW THE FOOTPRINT OF THE VOLUME CONTROL FACILITY. WHEN LOCAL CONDITIONS PREVENT THE SEWER FROM BEING LOCATED OUTSIDE THE FOOTPRINT OF THE FACILITY THE SEWER SHALL BE CONSTRUCTED TO WATER MAIN QUALITY STANDARDS, OR IT SHALL BE ENCASED WITH A WATER MAIN QUALITY CARRIER PIPE WITH THE ENDS SEALED.
3. AVOID INSTALLATION ON SLOPES GREATER THAN 15 TO 1. AVOID COMPACTING NATIVE SOILS. SCARIFY ANY COMPACTED SOIL.
4. GROWING MEDIUM SHALL BE 4 INCHES DEEPER THAN LARGEST PLANTED ROOT BALL.
5. GEOTEXTILE FABRIC SHALL MEET REQUIREMENTS OF IUM MATERIAL SPECIFICATION 592. FOR WOVEN: APPARENT OPENING SIZE OF 0.50 MM (TABLE 1, CLASS I). FOR NON WOVEN: APPARENT OPENING SIZE OF 0.30 MM (TABLE 2, CLASS II). STONE
6. STORAGE OPTIONS ARE IDOT CA-1, CA-3, CA-7, DISTRICT VULCAN MIX, OR APPROVED ALTERNATE. NO RECYCLED MATERIALS.
7. CHECK DAMS MUST BE INSTALLED FOR VELOCITIES GREATER THAN 1 FT/S FOR THE 2-YEAR, 24-HOUR STORM EVENT. CHECK DAM SPACING PER TABLE 1.
8. CENTER OF CHECK DAM MUST BE A MINIMUM OF 6 INCHES LOWER THAN OUTSIDE EDGES TO PASS HIGH FLOWS.
9. BOTTOM OF UPSTREAM CHECK DAM SHALL BE SAME ELEVATION AS TOP OF DOWNSTREAM CHECK DAM.
10. MINIMUM DISTANCE OF 2 FEET (3.5 FEET IN COMBINED SEWER AREAS) BETWEEN BOTTOM OF BMP AND SEASONALLY HIGH GROUNDWATER LEVEL.
11. UNDERDRAINS ARE REQUIRED IN TYPICAL CLAYEY SOILS WHERE INFILTRATION RATES ARE LESS THAN 0.5 INCH/HOUR. MAXIMUM OF 1 UNDERDRAIN PER 30 FEET. PROVIDE A SOIL REPORT DOCUMENTING NATIVE INFILTRATION RATE TO FOREGO UNDERDRAINS.
12. MINIMUM UNDERDRAIN BEDDING OF TWO INCHES, MAXIMUM OF 12 INCHES.
13. ONE OBSERVATION WELL REQUIRED PER 6,000 SQUARE FEET OF SURFACE AREA.
14. MULCH LAYER SHALL BE HARDWOOD MULCH OR OTHER NON-FLOATING GROUND COVER.
15. FOLLOW THE REQUIRED PRETREATMENT MEASURES LISTED ON THE VOLUME CONTROL PRETREATMENT MEASURES DETAIL.

NOT TO SCALE



TECHNICAL GUIDANCE MANUAL

10/2/18

BIOSWALE DETAIL (SHEET 1 OF 2)

STD. DWG. NO.2

PAGE NO.2

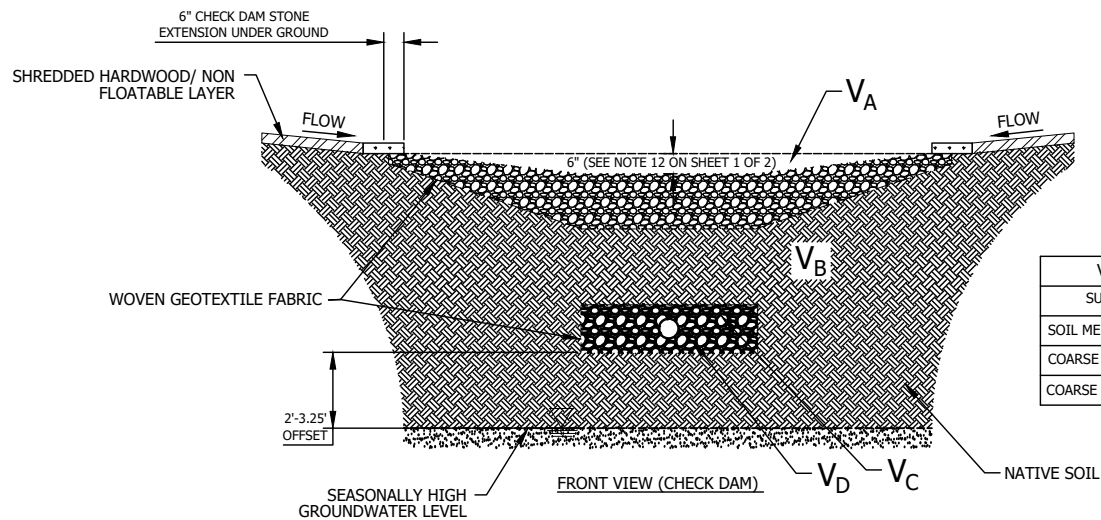
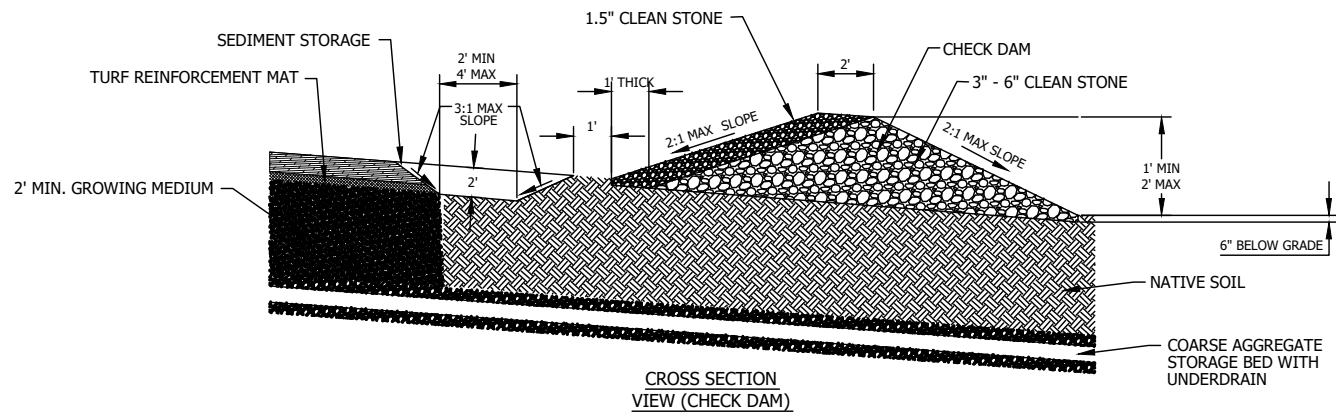


TABLE 2

VOLUME TYPE	POROSITY	MEDIA VOLUME	STORAGE VOLUME	VOLUME PROVIDED
SURFACE STORAGE	1.00	V_A	$1.00 \times V_A$	
SOIL MEDIA MIX	0.25	V_B	$0.5 \times 0.25 \times V_B$	
COARSE AGG. (ABOVE INVERT)	0.36	V_C	$0.5 \times 0.36 \times V_C$	
COARSE AGG. (BELOW INVERT)	0.36	V_D	$0.36 \times V_D$	
			TOTAL	

NOT TO SCALE

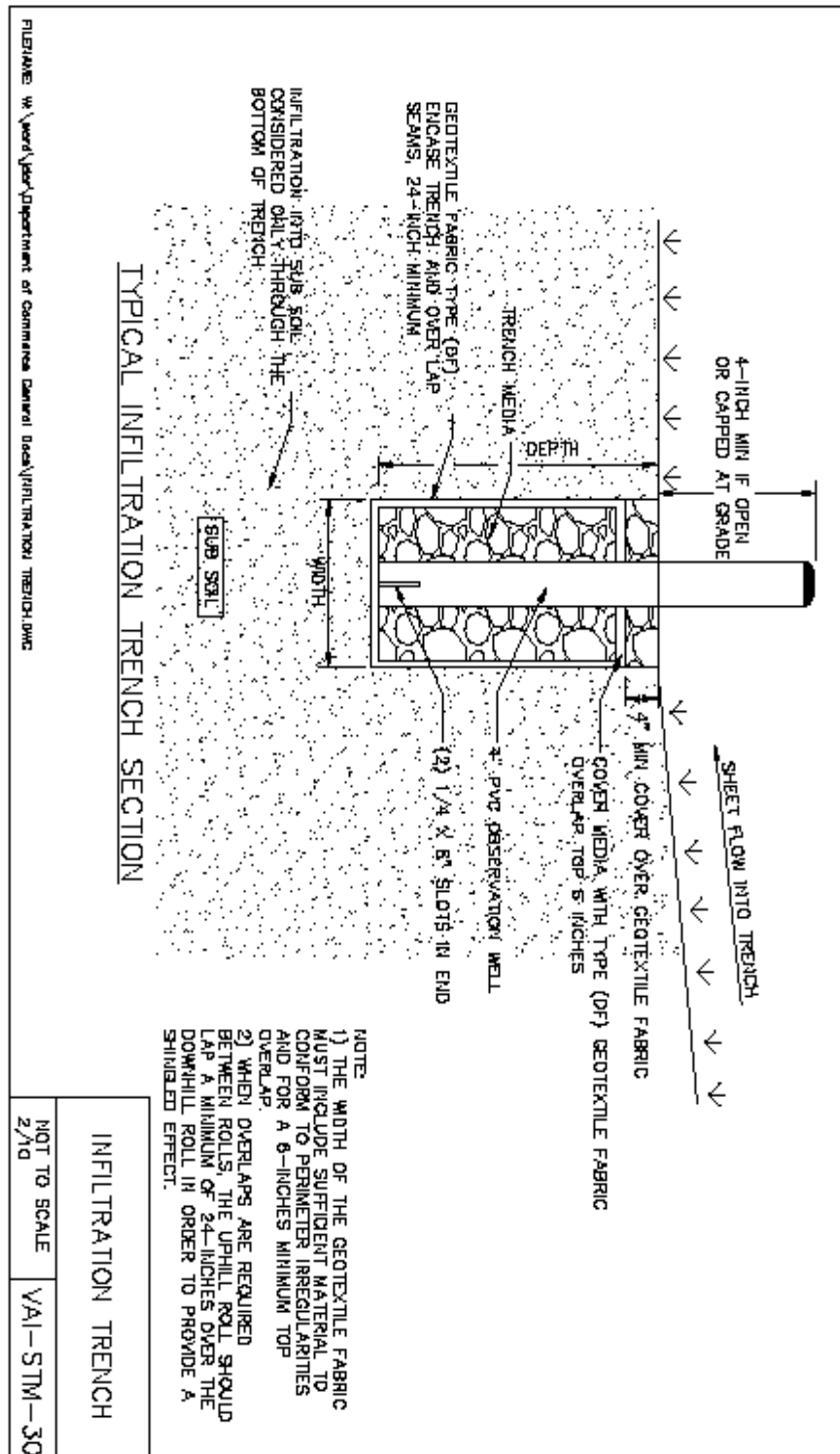


Appendix B

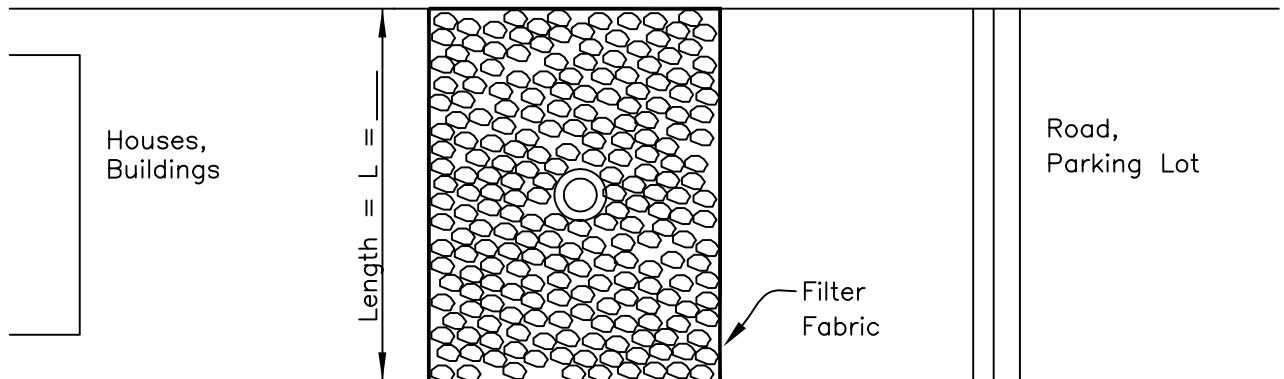
INFILTRATION TRENCH

(No. 1007)

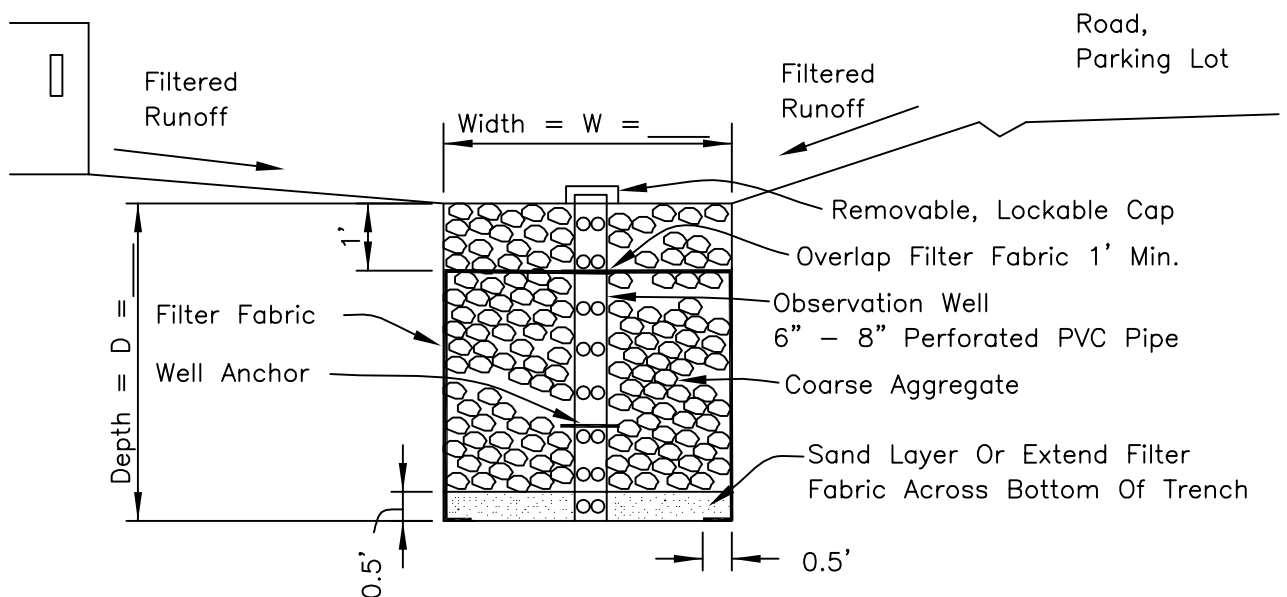
Wisconsin Department of Natural Resources
Wisconsin Department of Safety and Professional Services
Technical Standard



INFILTRATION TRENCH



PLAN VIEW



SECTION VIEW

NOTES:

1. Coarse aggregates shall meet one of the following IDOT gradations: CA-1 or CA-3.
2. Sand, if used, shall meet one of the following IDOT gradations: CA-14, CA-15 or CA-16.
3. Filter fabric shall meet the requirements of material specification 592 GEOTEXTILE Table 1 or 2, Class I with an apparent opening size of at least 30 for non-woven and 50 for woven.
4. PVC pipe shall meet material specification 547 PLASTIC (PVC, PE, ABS) PIPE.
5. See plans for L, W and D dimensions.

REFERENCE

Project	_____	Date	_____
Designed	_____	Date	_____
Checked	_____	Date	_____
Approved	_____	Date	_____



Natural Resources Conservation Service

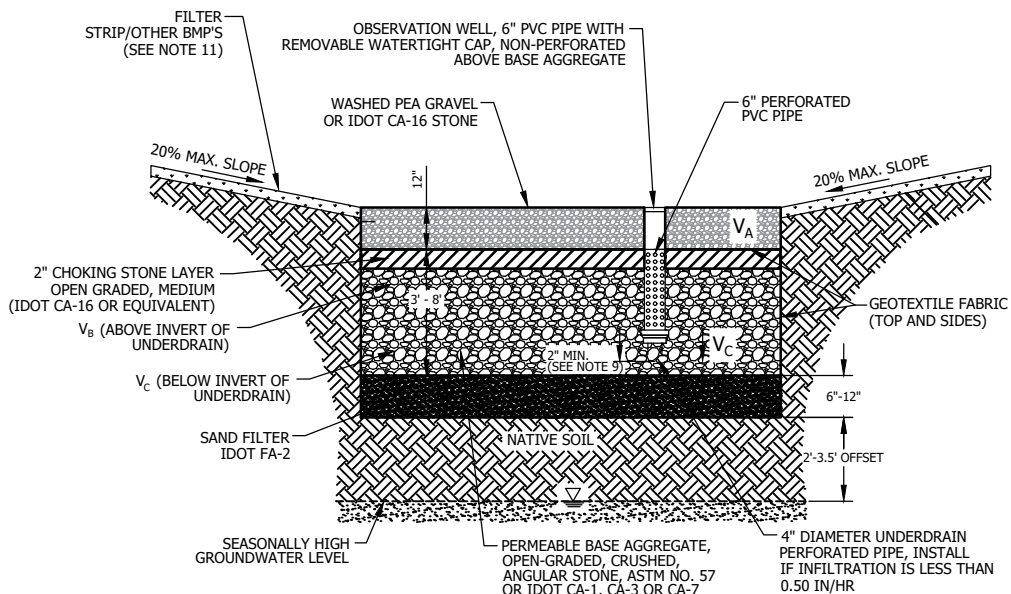
NRCS

STANDARD DWG. NO.

IL-547

SHEET 1 OF 1

DATE 1-29-99



BOTTOM OF THE FACILITY:	ELEV. _____
SEASONALLY HIGH GROUNDWATER:	ELEV. _____
SEPARATION:	FEET _____

VOLUME TYPE	SURFACE AREA	DEPTH	POROSITY	STORAGE VOLUME	VOLUME PROVIDED
V_A : PEA GRAVEL			0.25	$0.50 \times 0.25 \times V_A$	
V_B : COARSE AGGREGATE (ABOVE INVERT)			0.36	$0.50 \times 0.36 \times V_B$	
V_C : COARSE AGGREGATE (BELOW INVERT)			0.36	$0.36 \times V_C$	
TOTAL					

NOTES:

1. THE PERIMETER OF THE VOLUME CONTROL FACILITY SHALL MAINTAIN THE MINIMUM HORIZONTAL SEPARATION DISTANCE OF: 10-FEET FROM FOUNDATIONS, UNLESS WATERPROOFED; 20-FEET FROM ROADWAY GRAVEL SHOULDER; AND 100-FEET FROM POTABLE WATER WELLS, SEPTIC TANKS/FIELDS, OR OTHER UNDERGROUND TANKS.
2. SANITARY OR COMBINED SEWERS SHALL NOT BE LOCATED WITHIN THE VOLUME CONTROL FACILITY. SANITARY OR COMBINED SEWERS SHALL NOT BE LOCATED BELOW THE FOOTPRINT OF THE VOLUME CONTROL FACILITY. WHEN LOCAL CONDITIONS PREVENT THE SEWER FROM BEING LOCATED OUTSIDE THE FOOTPRINT OF THE FACILITY THE SEWER SHALL BE CONSTRUCTED TO WATER MAIN QUALITY STANDARDS, OR IT SHALL BE ENCASED WITH A WATER MAIN QUALITY CARRIER PIPE WITH THE ENDS SEALED.
3. AVOID INSTALLATION ON SLOPES GREATER THAN 3.00%.
4. AVOID COMPACTING NATIVE SOILS. SCARIFY COMPACTED FILL.
5. GEOTEXTILE FABRIC SHALL MEET REQUIREMENTS OF IUM MATERIAL SPECIFICATION 592. FOR WOVEN: APPARENT OPENING SIZE OF 0.50 MM (TABLE 1, CLASS I). FOR NON WOVEN: APPARENT OPENING SIZE OF 0.30 MM (TABLE 2, CLASS II).
6. STONE STORAGE OPTIONS ARE IDOT CA-1, IDOT CA-7, DISTRICT VULCAN MIX, OR APPROVED ALTERNATE. NO RECYCLED MATERIALS.
7. MINIMUM DISTANCE OF 2 FEET (3.5 FEET IN COMBINED SEWER AREAS) BETWEEN BOTTOM OF BMP AND SEASONALLY HIGH GROUNDWATER LEVEL.
8. UNDERDRAINS ARE REQUIRED IN TYPICAL CLAYEY SOILS WHERE INFILTRATION RATES ARE LESS THAN 0.5 INCH/HOUR. MAXIMUM OF 1 UNDERDRAIN PER 30 FEET. PROVIDE A SOIL REPORT DOCUMENTING NATIVE INFILTRATION RATE TO FOREGO UNDERDRAINS.
9. MINIMUM UNDERDRAIN BEDDING OF TWO INCHES, MAXIMUM OF 12 INCHES.
10. ONE OBSERVATION WELL REQUIRED PER 6,000 SQUARE FEET OF SURFACE AREA.
11. FOLLOW THE REQUIRED PRETREATMENT MEASURES LISTED ON THE VOLUME CONTROL PRETREATMENT MEASURES DETAIL.

NOT TO SCALE



TECHNICAL GUIDANCE MANUAL

10/4/18

INFILTRATION TRENCH DETAIL

STD. DWG. NO.6

PAGE NO. 7

NATIVE PRAIRIE SEED MIXTURE

Art. 250.07

Seeding

Class - Type	Seeds	lb/acre (kg/hectare)
5	Forb with Annuals Mixture Annuals Mixture (Below) 6/, 8/ Forb Mixture (Below) 6/, 8/ Annuals Mixture - Mixture not exceeding 25 % by weight of any one species, of the following: Coreopsis lanceolata (Sand Coreopsis) Chrysanthemum maximum (Shasta Daisy) Gaillardia pulchella (Blanket Flower) Ratibida columnitera (Long-Headed Coneflower) Rudbeckia hirta (Black-Eyed Susan) Forb Mixture - Mixture not exceeding 5 % by weight PLS of any one species, of the following: Amorpha canescens (Lead Plant) 2/ Anemone cylindrica (Thimble Weed) Asclepias tuberosa (Butterfly-Weed) Aster azureus (Sky Blue Aster) Aster laevis (Smooth Aster) Aster novae-angliae (New England Aster) Baptisia leucantha (White Wild Indigo) 2/ Coreopsis palmata (Prairie Coreopsis) Echinacea pallida (Pale Purple Coneflower) Eryngium yuccifolium (Rattlesnake Master) Helianthus mollis (Downy Sunflower) Heliopsis helianthoides (Ox-Eye) Liatris aspera (Rough Blazing Star) Liatris pycnostachya (Prairie Blazing Star) Monarda fistulosa (Prairie Bergamont) Parthenium integrifolium (WildQuinine) Petalostemum candidum (White Prairie Clover) 2/ Petalostemum purpureum (Purple Prairie Clover) 2/ Physostegia virginiana (False Dragonhead) Potentilla arguta (Prairie Cinquefoil) Ratibida pinnata (Yellow Coneflower) Rudbeckia subtomentosa (Fragrant Coneflower) Silphium laciniatum (Compass Plant) Silphium terebinthinaceum (Prairie Dock) Solidago rigida (Rigid Goldenrod) Tradescantia ohiensis (Spiderwort) Veronicastrum virginicum (Culver's Root)	1 (1) 10 (10)

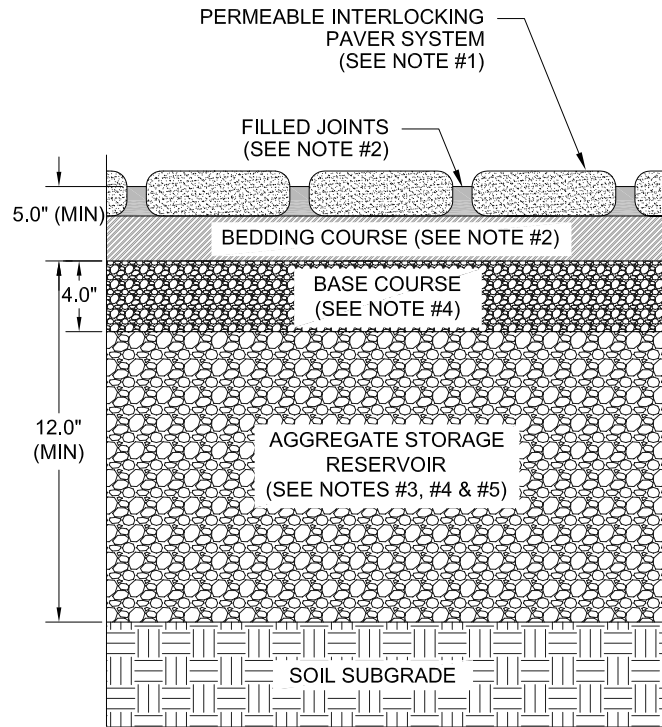
Standard Specifications for Road and Bridge Construction

Adopted April 1, 2016

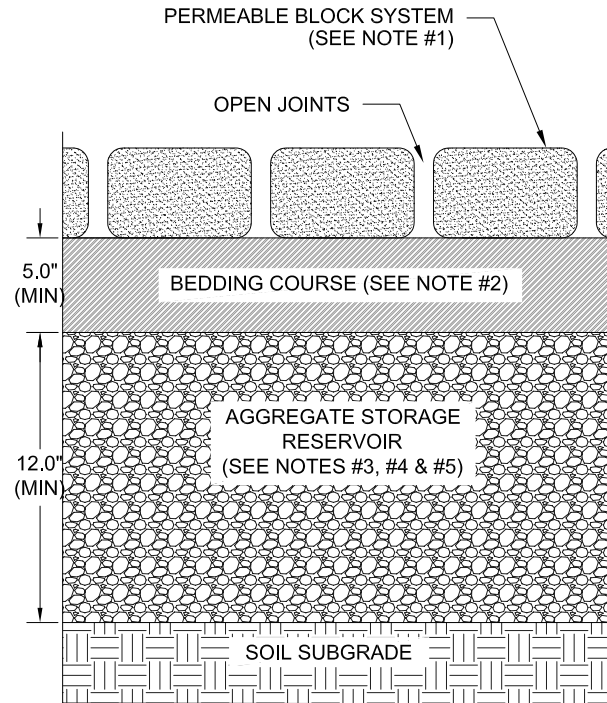


Illinois Department of Transportation

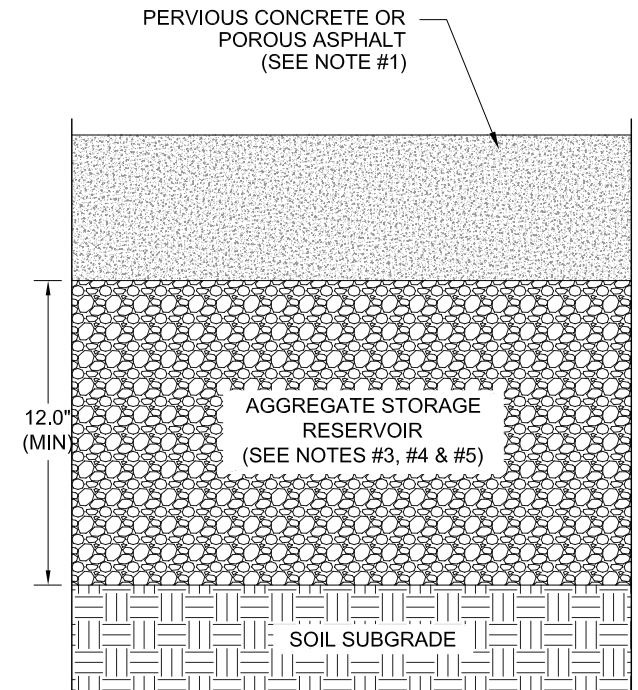
FIGURE 1. CRITERIA FOR UNDERDRAIN DISCHARGE AND INFILTRATION PRETREATMENT CREDITS



INTERLOCKING PAVERS



BLOCKS



**PERVIOUS CONCRETE OR
POROUS ASPHALT**

NOTES:

1. PAVEMENT SURFACE PERCENT VOIDS SHALL BE LESS THAN 25%.
2. JOINT STONE AND BEDDING COURSE SHALL CONSIST OF ASTM C-33, 8, 9, 89, OR 57 AGGREGATE.
3. AGGREGATE STORAGE RESERVOIR DEPTH SHALL BE A MINIMUM OF 12 INCHES.
4. BASE AND / OR SUBBASE COURSES WITH MINIMUM POROSITY OF 30% CAN BE CONSIDERED AGGREGATE STORAGE RESERVOIR. BASE COURSE FOR PERMEABLE INTERLOCKING PAVERS SHALL BE 4.0" DEPTH OF ASTM C-33, 57 AGGREGATE AND CAN BE CONSIDERED PART OF THE AGGREGATE STORAGE DEPTH.
5. UNDERDRAINS CAN BE LOCATED WITHIN OR BELOW THE AGGREGATE STORAGE RESERVOIR. UNDERDRAINS (OR EQUIVALENT) ARE REQUIRED IF THE AGGREGATE STORAGE RESERVOIR DRAIN DOWN TIME WILL EXCEED 72 HOURS.

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

**TECHNICAL STANDARD
PERMEABLE PAVEMENT**

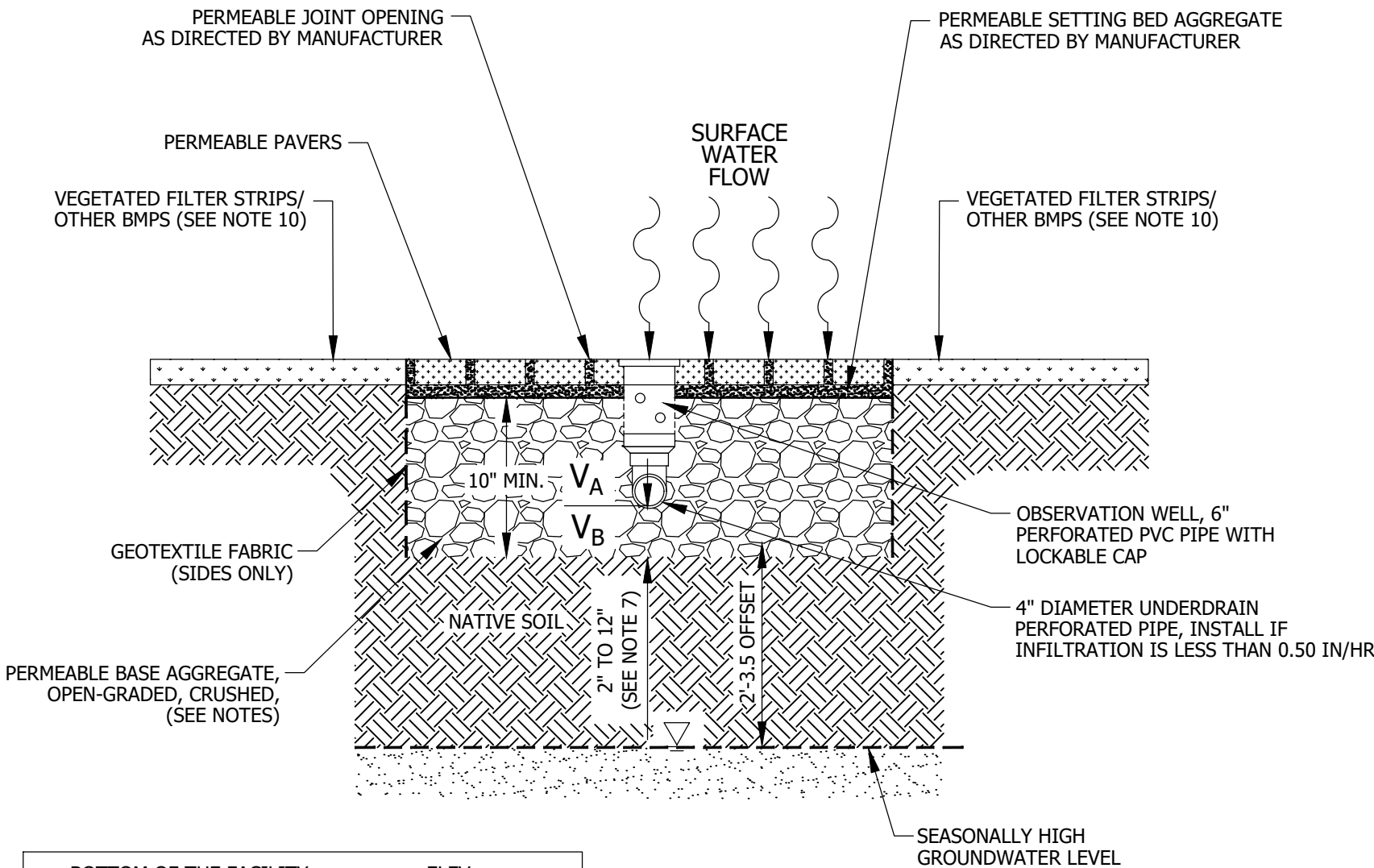
1008



1008
TECHNICAL STANDARD No.

01/2014
REVISION DATE

NOT TO SCALE



BOTTOM OF THE FACILITY: ELEV. _____
SEASONALLY HIGH GROUNDWATER: ELEV. _____
SEPARATION: FEET _____

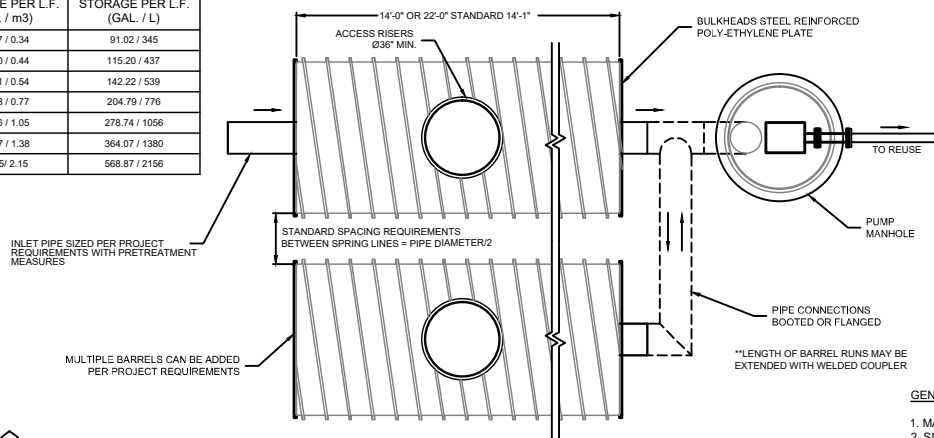
VOLUME TYPE	SURFACE AREA	DEPTH	POROSITY	STORAGE VOLUME	VOLUME PROVIDED
V_A : COARSE AGGREGATE (ABOVE INVERT)			0.36	$0.50 \times 0.36 \times V_A$	
V_B : COARSE AGGREGATE (BELOW INVERT)			0.36	$0.36 \times V_B$	
TOTAL					

- NOTES:
- THE PERIMETER OF THE VOLUME CONTROL FACILITY SHALL MAINTAIN THE MINIMUM HORIZONTAL SEPARATION DISTANCE OF: 10-FEET FROM FOUNDATIONS, UNLESS WATERPROOFED; 20-FEET FROM ROADWAY GRAVEL SHOULDER; AND 100-FEET FROM POTABLE WATER WELLS, SEPTIC TANKS/FIELDS, OR OTHER UNDERGROUND TANKS.
 - SANITARY OR COMBINED SEWERS SHALL NOT BE LOCATED WITHIN THE VOLUME CONTROL FACILITY. SANITARY OR COMBINED SEWERS SHALL NOT BE LOCATED BELOW THE FOOTPRINT OF THE VOLUME CONTROL FACILITY. WHEN LOCAL CONDITIONS PREVENT THE SEWER FROM BEING LOCATED OUTSIDE THE FOOTPRINT OF THE FACILITY THE SEWER SHALL BE CONSTRUCTED TO WATER MAIN QUALITY STANDARDS, OR IT SHALL BE ENCASED WITH A WATER MAIN QUALITY CARRIER PIPE WITH THE ENDS SEALED.
 - AVOID INSTALLATION ON SLOPES GREATER THAN 3.00%. AVOID COMPACTING NATIVE SOILS. SCARIFY ANY COMPACTED SOIL.
 - GEOTEXTILE FABRIC SHALL MEET REQUIREMENTS OF IUM MATERIAL SPECIFICATION 592. FOR WOVEN: APPARENT OPENING SIZE OF 0.50 MM (TABLE 1, CLASS I). FOR NON WOVEN: APPARENT OPENING SIZE OF 0.30 MM (TABLE 2, CLASS II).
 - STONE STORAGE OPTIONS ARE IDOT CA-1, CA-3, CA-7, DISTRICT VULCAN MIX, OR APPROVED ALTERNATE. NO RECYCLED MATERIALS.
 - MINIMUM DISTANCE OF 2 FEET (3.5 FEET IN COMBINED SEWER AREAS) BETWEEN BOTTOM OF BMP AND SEASONALLY HIGH GROUNDWATER LEVEL.
 - UNDERDRAINS ARE REQUIRED IN TYPICAL CLAYEY SOILS WHERE INFILTRATION RATES ARE LESS THAN 0.5 INCH/HOUR. MAXIMUM OF 1 UNDERDRAIN PER 30 FEET. PROVIDE A SOIL REPORT DOCUMENTING NATIVE INFILTRATION RATE TO FOREGO UNDERDRAINS.
 - MINIMUM UNDERDRAIN BEDDING OF TWO INCHES, MAXIMUM OF 12 INCHES.
 - ONE OBSERVATION WELL REQUIRED PER 6,000 SQUARE FEET OF SURFACE AREA.
 - FOLLOW THE REQUIRED PRETREATMENT MEASURES LISTED ON THE VOLUME CONTROL PRETREATMENT MEASURES DETAIL.
 - MAINTENANCE REQUIREMENTS INCLUDE ANNUAL VACUUMING AND LOW-PRESSURE POWER WASHING OF PAVEMENT SURFACE. ADJACENT VEGETATED AREAS SHALL BE WELL-MAINTAINED. BARE SPOTS AND ERODED AREAS SHALL BE REPLANTED AND STABILIZED IMMEDIATELY. DO NOT SEALCOAT OR APPLY DE-ICING SAND/GRAVEL/SALT. APPROPRIATE SIGNAGE REQUIRED FOR FACILITY, REFER TO THE TYPICAL SIGNAGE FOR PERMEABLE PAVEMENT DETAIL.

NOT TO SCALE



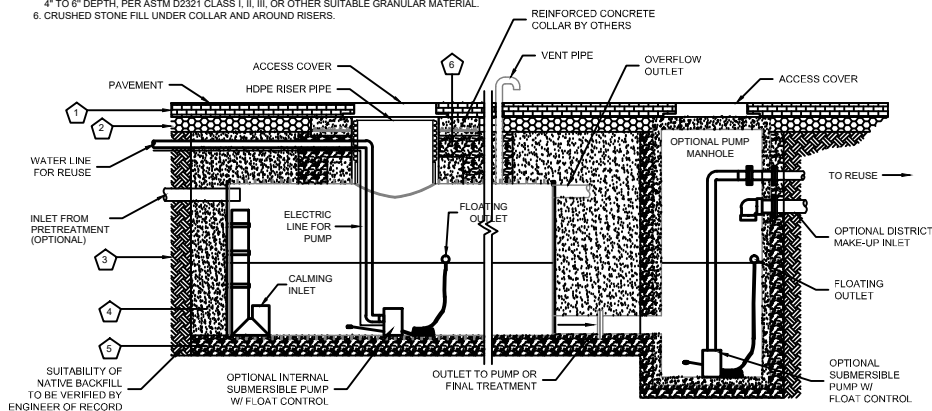
STORAGE AVAILABILITY PER DIAMETER		
DIAMETER (IN / mm)	AVAILABLE STORAGE PER L.F. (C.F. / m3)	AVAILABLE STORAGE PER L.F. (GAL. / L)
48 / 1200	12.17 / 0.34	91.02 / 345
54 / 1350	15.40 / 0.44	115.20 / 437
60 / 1500	19.01 / 0.54	142.22 / 539
72 / 1800	27.38 / 0.77	204.79 / 776
84 / 2100	37.26 / 1.05	278.74 / 1056
96 / 2400	48.67 / 1.38	364.07 / 1380
120 / 3000	76.05 / 2.15	568.87 / 2156



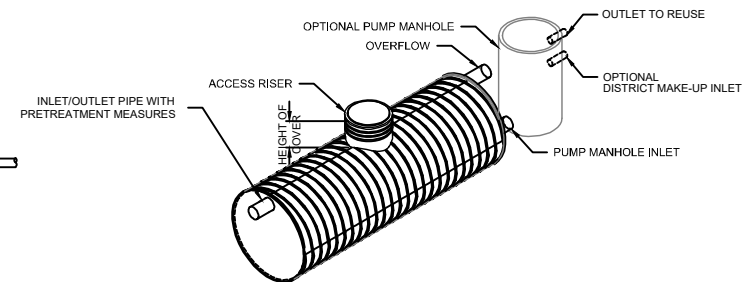
PLAN VIEW



- KEY
1. RIGID OR FLEXIBLE PAVEMENT.
 2. GRANULAR COMPACTED ROAD BASE.
 3. ANY SUITABLE NATIVE OR GENERAL BACKFILL, SEE ENGINEER PLANS.
 4. WELL GRADED GRANULAR FILL, ASTM D2321 CLASS I, II, III, OR EQUIVALENT. COMPACT TO MIN. 90% STANDARD DENSITY PER AASHTO T99. MAY INCLUDE ROAD BASE.
 5. RELATIVELY LOOSE GRANULAR BEDDING, ROUGHLY SHAPED TO FIT BOTTOM OF BARREL, 4" TO 6" DEPTH, PER ASTM D2321 CLASS I, II, III, OR OTHER SUITABLE GRANULAR MATERIAL.
 6. CRUSHED STONE FILL UNDER COLLAR AND AROUND RISERS.



ELEVATION VIEW



ISOMETRIC VIEW

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE, CAPACITY AND BACKFILL DETAILS, TO BE PROVIDED BY MANUFACTURER.
3. ALL ELEVATIONS, DIMENSIONS AND LOCATIONS OF RISERS AND INLETS SHALL BE VERIFIED BY THE ENGINEER OF RECORD.
4. PRIOR TO INSTALLATION OF THE SYSTEM A PRE-CONSTRUCTION MEETING SHALL BE CONDUCTED. THOSE REQUIRED TO ATTEND ARE THE SUPPLIER OF THE SYSTEM, THE GENERAL CONTRACTOR, SUB-CONTRACTORS AND THE ENGINEER.
5. THE CISTERN IS MANUFACTURED FROM STEEL REINFORCED POLYETHYLENE PLASTIC.
6. SYSTEM TO MEET AASHTO HS20/HS25 LIVE LOADING, PER AASHTO LRFD SECTION 12.
7. ACCESS COVERS TO MEET AASHTO M306 LOAD RATING.
8. MINIMUM COVER IS EQUAL TO PIPE DIAMETER/5 AND NO LESS THAN 12-INCHES FROM TOP OF PIPE TO BOTTOM OF PAVEMENT. Ø72" AND Ø84" PIPE MINIMUM COVER IS 18-INCHES, Ø96" PIPE MINIMUM COVER IS 24-INCHES, Ø120" PIPE MINIMUM COVER IS 36-INCHES.
9. FOLLOW THE REQUIRED PRETREATMENT MEASURES LISTED ON THE VOLUME CONTROL PRETREATMENT MEASURES DETAIL (PAGE 17).

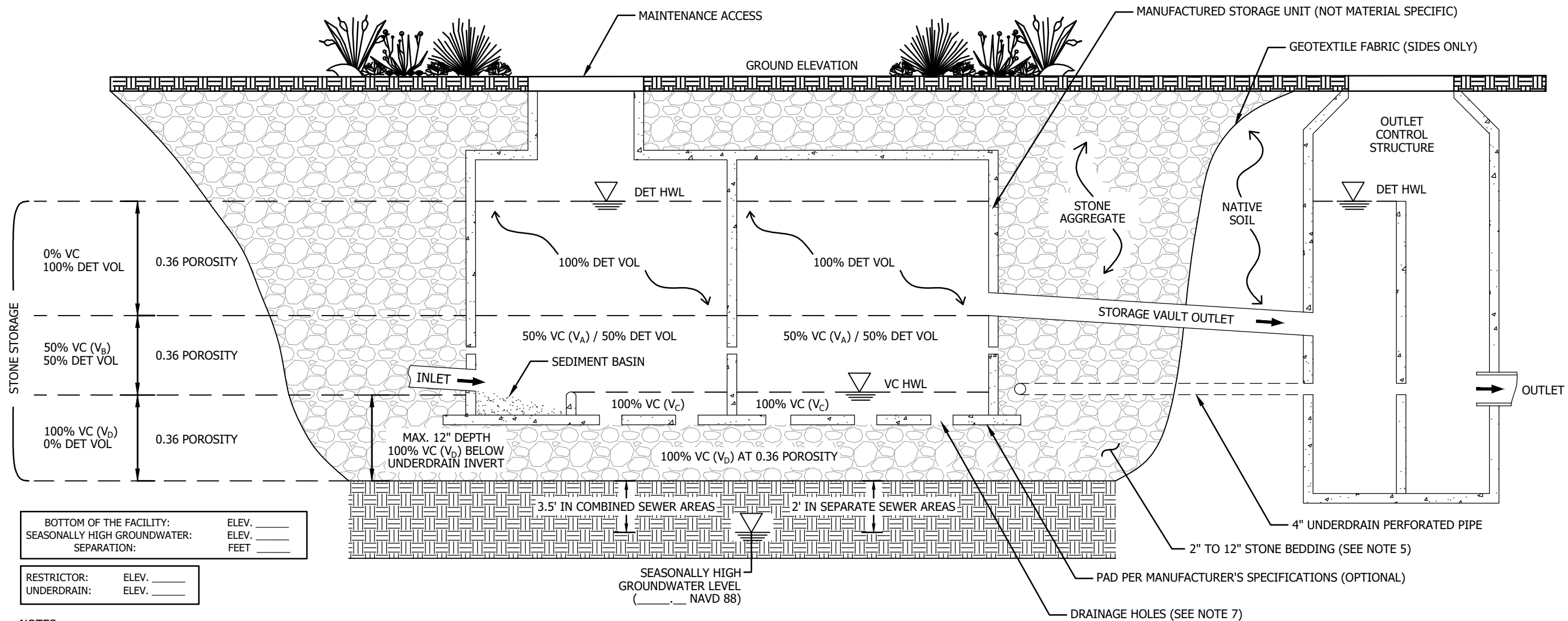
INSTALLATION NOTES

- A. INSTALLATION GUIDE TO BE REVIEWED BY CONTRACTOR PRIOR TO INSTALLATION.
- B. CONTRACTOR TO PROVIDE, INSTALL AND GROUT ALL INLET AND OUTLET PIPES.
- C. CONTRACTOR TO PROVIDE AND INSTALL ALL BEDDING AND BACKFILL MATERIAL.
- D. PRIOR TO PLACING BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, A GEOGRID SHALL BE UTILIZED OR UNSUITABLE MATERIAL SHALL BE REMOVED AND BROUGHT BACK TO GRADE WITH FILL MATERIAL AS APPROVED BY THE ENGINEER OF RECORD. ONCE THE FOUNDATION PREPARATION IS COMPLETE, THE BEDDING MATERIAL CAN BE PLACED.
- E. STONE EMBEDMENT MATERIAL SHALL BE INSTALLED TO 95% STANDARD PROCTOR DENSITY AND PLACED IN 6-INCH TO 8-INCH LIFTS SUCH THAT THERE IS NO MORE THAN A TWO LIFT DIFFERENTIAL BETWEEN ANY OF THE BARRELS AT ANY TIME. GRANULAR BACKFILL MATERIAL SHALL BE COMPACTED TO 90% SPD. BACKFILLING SHALL BE ADVANCED ALONG THE LENGTH OF THE BARRELS AT THE SAME RATE TO AVOID DIFFERENTIAL LOADING AND DISPLACEMENT OF THE BARRELS. THE MINIMUM PIPE SPACING MUST BE MAINTAINED.
- F. REFER TO INSTALLATION GUIDE FOR TEMPORARY CONSTRUCTION LOADING GUIDELINES.
- G. IT IS ALWAYS THE RESPONSIBILITY OF THE CONTRACTOR TO FOLLOW OSHA GUIDELINES FOR SAFE PRACTICES.
- H. GENERAL INSTALLATION METHODS AND MATERIALS TO BE IN ACCORDANCE WITH ASTM D2321.

OPERATION NOTES

1. PROPERTY OWNER MUST INSPECT AND EXERCISE ANNUALLY.
2. THE STORAGE MUST DEWATER IN 72 HOURS OR 12 HOURS BEFORE STORM EVENT.
3. CISTERN MUST BE PROTECTED FROM FREEZING EFFECTS.





NOTES:

1. THE PERIMETER OF THE VOLUME CONTROL FACILITY SHALL MAINTAIN THE MINIMUM HORIZONTAL SEPARATION DISTANCE OF: 10-FEET FROM FOUNDATIONS, UNLESS WATERPROOFED; 20-FEET FROM ROADWAY GRAVEL SHOULDER; AND 100-FEET FROM POTABLE WATER WELLS, SEPTIC TANKS/FIELDS, OR OTHER UNDERGROUND TANKS.
2. SANITARY OR COMBINED SEWERS SHALL NOT BE LOCATED WITHIN THE VOLUME CONTROL FACILITY. SANITARY OR COMBINED SEWERS SHALL NOT BE LOCATED BELOW THE FOOTPRINT OF THE VOLUME CONTROL FACILITY. WHEN LOCAL CONDITIONS PREVENT THE SEWER FROM BEING LOCATED OUTSIDE THE FOOTPRINT OF THE FACILITY THE SEWER SHALL BE CONSTRUCTED TO WATER MAIN QUALITY STANDARDS, AND IT SHALL BE ENCASED WITH A WATER MAIN QUALITY CARRIER PIPE WITH THE ENDS SEALED.
3. MINIMUM DISTANCE OF 2 FEET (3.5 FEET IN COMBINED SEWER AREAS) BETWEEN BOTTOM OF THE VOLUME CONTROL FACILITY AND SEASONALLY HIGH GROUNDWATER LEVEL.
4. STONE STORAGE OPTIONS ARE IDOT CA-1, IDOT CA-3, IDOT CA-7, OR APPROVED ALTERNATE. NO RECYCLED MATERIALS.
5. UNDERDRAINS ARE REQUIRED IN TYPICAL CLAYEY SOILS WHERE INFILTRATION RATES ARE LESS THAN 0.5 INCH/HOUR. NO MORE THAN 1 UNDERDRAIN EVERY 30 FEET ON CENTER. MINIMUM UNDERDRAIN BEDDING OF 2 INCHES, MAXIMUM OF 12 INCHES.
6. APPROPRIATE MAINTENANCE ACCESS SHALL BE PROVIDED TO ENSURE THAT EACH SEGMENT OF THE SYSTEM IS ACCESSIBLE BY A VACUUM, JET HOSE, OR A TELEVISION DEVICE. ACCESS IS RECOMMENDED NEAR ALL ENTRY/EXIT POINT FOR SEDIMENT REMOVAL. EGRESS RUNGS SHALL BE PROVIDED FOR SYSTEMS DEEPER THAN 42-INCHES.
7. DRAINAGE OPENINGS SHOULD COVER AT LEAST 3% OF THE PAD'S FOOTPRINT. DESIGNER / MANUFACTURER RESPONSIBLE FOR THE STRUCTURAL INTEGRITY OF THE MANUFACTURED STORAGE UNIT.
8. COMBINED SEWER AREAS REQUIRE BACKFLOW PREVENTER.
9. AVOID COMPACTION OF NATIVE SOILS WITHIN THE VOLUME CONTROL FOOTPRINT TO MAXIMIZE INFILTRATION.

VOLUME CONTROL SUMMARY

VOLUME TYPE	DEPTH	POROSITY	STORAGE VOLUME	VOLUME PROVIDED
V_A : VAULT STORAGE (BELOW THE OUTLET)		1.00	$1.00 \times 0.50 \times V_A$	
V_B : COARSE AGGREGATE (ABOVE U.D. INVERT)		0.36	$0.50 \times 0.36 \times V_B$	
V_C : VAULT STORAGE (BELOW U.D. INVERT)		1.00	$1.00 \times V_C$	
V_D : COARSE AGGREGATE (BELOW U.D. INVERT)		0.36	$0.36 \times V_D$	
* VOLUME INTENDED FOR DETENTION NOT INCLUDED *				TOTAL

NOT TO SCALE



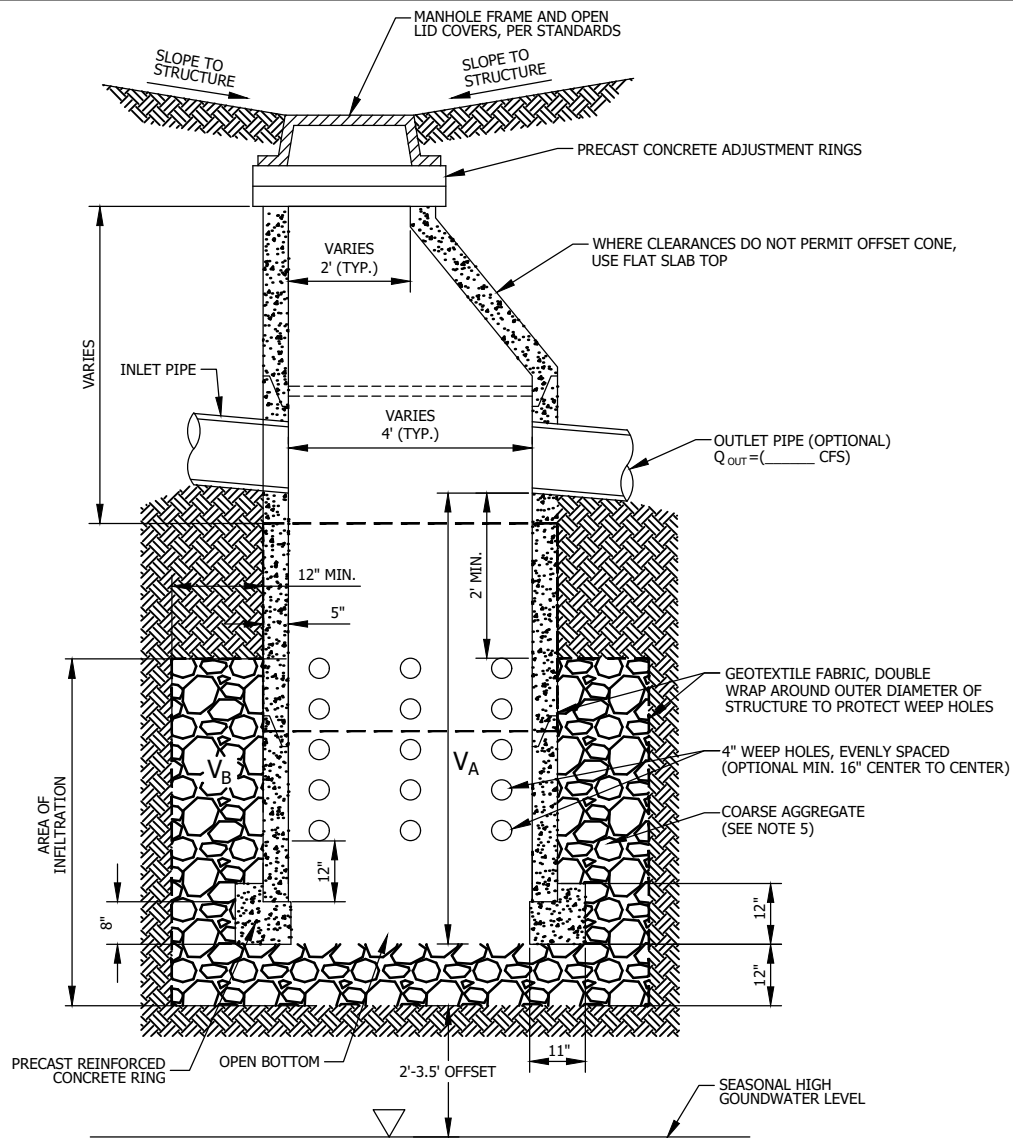
TECHNICAL GUIDANCE MANUAL

UNDERGROUND VAULT VOLUME CONTROL/DETENTION TYPICAL DETAIL

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VOLUME TYPE	POROSITY	MEDIA VOLUME	STORAGE VOLUME	VOLUME PROVIDED
MANHOLE VOL. BELOW SEWER	1.00	V_A	$1.00 \times V_A$	
COARSE AGGREGATE	0.36	V_B	$0.36 \times V_B$	
TOTAL				

NOTES

1. THE PERIMETER OF THE VOLUME CONTROL FACILITY SHALL MAINTAIN THE MINIMUM HORIZONTAL SEPARATION DISTANCE OF: 10-FEET FROM FOUNDATIONS, UNLESS WATERPROOFED; 20-FEET FROM ROADWAY GRAVEL SHOULDER; AND 100-FEET FROM POTABLE WATER WELLS, SEPTIC TANKS/FIELDS, OR OTHER UNDERGROUND TANKS.
2. SANITARY OR COMBINED SEWERS SHALL NOT BE LOCATED WITHIN THE VOLUME CONTROL FACILITY. SANITARY OR COMBINED SEWERS SHALL NOT BE LOCATED BELOW THE FOOTPRINT OF THE VOLUME CONTROL FACILITY. WHEN LOCAL CONDITIONS PREVENT THE SEWER FROM BEING LOCATED OUTSIDE THE FOOTPRINT OF THE FACILITY THE SEWER SHALL BE CONSTRUCTED TO WATER MAIN QUALITY STANDARDS, OR IT SHALL BE ENCASED WITH A WATER MAIN QUALITY CARRIER PIPE WITH THE ENDS SEALED.
3. AVOID INSTALLATION ON AREAS OF COMPACTED FILL.
4. GEOTEXTILE FABRIC SHALL MEET REQUIREMENTS OF IUM MATERIAL SPECIFICATION 592. FOR WOVEN: APPARENT OPENING SIZE OF 0.50 MM (TABLE 1, CLASS I). FOR NON WOVEN: APPARENT OPENING SIZE OF 0.30 MM (TABLE 2, CLASS II).
5. STONE STORAGE OPTIONS ARE IDOT CA-1, CA-3, CA-7, DISTRICT VULCAN MIX, OR APPROVED ALTERNATE. NO RECYCLED MATERIALS.
6. AGGREGATE BASE OF ONE FOOT (MINIMUM) BELOW PRECAST REINFORCED RING AND SHALL PROVIDE ADEQUATE STRUCTURAL STABILITY PER SOIL CONDITIONS.
7. MINIMUM DISTANCE OF 2 FEET (3.5 FEET IN COMBINED SEWER AREAS) BETWEEN BOTTOM OF BMP AND SEASONALLY HIGH GROUNDWATER LEVEL.
8. FOLLOW THE REQUIRED PRETREATMENT MEASURES LISTED ON THE VOLUME CONTROL PRETREATMENT MEASURES DETAIL.
9. PROVIDE Q_{OUT} INTO AREA OF INFILTRATION.

NOT TO SCALE



TECHNICAL GUIDANCE MANUAL

DRYWELL DETAIL

10/3/18

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MAINTENANCE NOTES:

- 1. STAKE WITH FLEXIBLE TIES FOR THE FIRST YEAR OR UNTIL TREE ESTABLISHED.
- 2. IRRIGATE TO ESTABLISH PLANTINGS PER LANDSCAPE DESIGNER. AT LEAST 1 INCH OF WATER PER WEEK FOR THE FIRST 3 YEARS.
- 3. CLEAN/REPLACE MULCH/ROCK ANNUALLY.
- 4. CLEAN/REPLACE CURB DRAINS ANNUALLY AND REMOVE DEBRIS AS NECESSARY.
- 5. INSPECT UNDERDRAIN ANNUALLY, CLEAN AS NECESSARY.

PROTECT BASAL ROOT FLARE
REFER TO MUNICIPAL PLANTING
DETAIL
(DO NOT BURY)

ROOTBALL BASKET SHALL BE CUT TO
REMOVE TOP 2/3 OF WIRE AND BURLAP

OBSERVATION WELL
(SOLID ABOVE THE GROUND
SURFACE)

VOLUME CONTROL
SURFACE STORAGE HWL

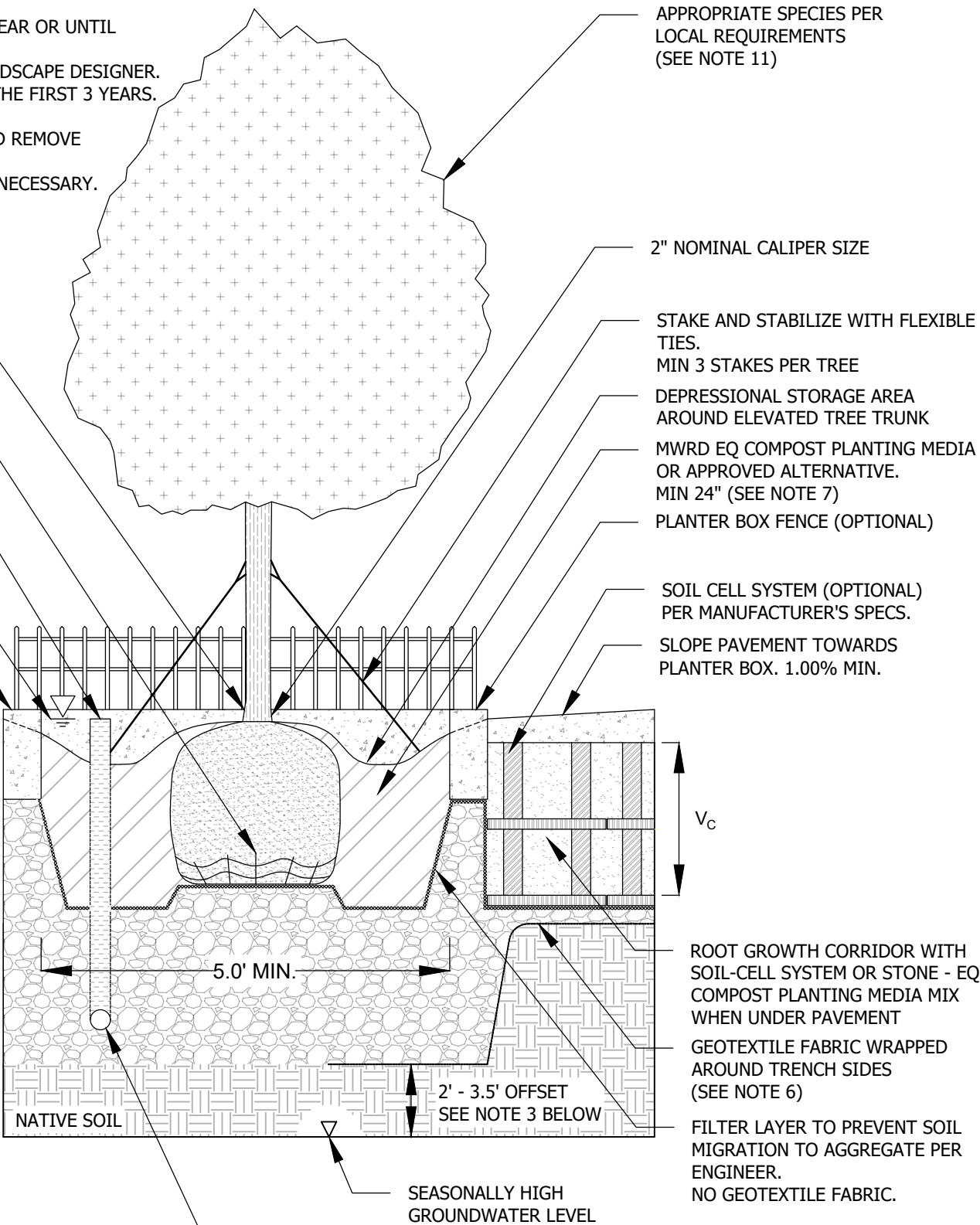
DEPRESSED CURB OPENING INTO
STORMWATER PLANTER SYSTEM

SURFACE STORAGE
12" MAX. → V_A

24" MIN. → V_B

V_D

2" MIN.
12" MAX. → V_E



BOTTOM OF THE FACILITY:	ELEV. _____
SEASONALLY HIGH GROUNDWATER:	ELEV. _____
SEPARATION:	FEET _____

VOLUME TYPE	SURFACE AREA	DEPTH	POROSITY	STORAGE VOLUME	VOLUME PROVIDED
V_A : SURFACE STORAGE			1.00	$1.00 \times V_A$	
V_B : MWRD EQ COMPOST PLANTING MEDIA MIX			0.25	$0.50 \times 0.25 \times V_B$	
V_C : SOIL - CELL SYSTEM OR STONE MIX			n - SEE NOTE 8	$0.50 \times n \times V_C$	
V_D : COARSE AGGREGATE (ABOVE INVERT)			0.36	$0.50 \times 0.36 \times V_D$	
V_E : COARSE AGGREGATE (BELOW INVERT)			0.36	$0.36 \times V_E$	
TOTAL					

NOTES:

- 1. THE PERIMETER OF THE VOLUME CONTROL FACILITY SHALL MAINTAIN THE MINIMUM HORIZONTAL SEPARATION DISTANCE 10-FEET FROM FOUNDATIONS, UNLESS WATERPROOFED; AND 100-FEET FROM POTABLE WATER WELLS, SEPTIC TANKS/FIELDS, OR OTHER UNDERGROUND TANKS.
- 2. SANITARY OR COMBINED SEWERS SHALL NOT BE LOCATED BENEATH THE VOLUME CONTROL FACILITY.
- 3. MINIMUM DISTANCE OF 2 FEET (3.5 FEET IF TRIBUTARY TO MWRD'S FACILITIES) BETWEEN BOTTOM OF VOLUME CONTROL FACILITY AND SEASONALLY HIGH GROUNDWATER LEVEL.
- 4. DO NOT INSTALL ON SLOPES GREATER THAN 3.0%.
- 5. COMPACT AGGREGATE BELOW TREE ROOT BALL. AVOID COMPACTING NATIVE SOILS, SOIL CELL SYSTEM AND PLANTING MEDIA MIX. SCARIFY COMPACTED FILL.
- 6. GEOTEXTILE FABRIC SHALL MEET REQUIREMENTS OF IUM MATERIAL SPECIFICATION 592. FOR WOVEN: APPARENT OPENING SIZE OF 0.50 MM (TABLE 1, CLASS I). FOR NON WOVEN: APPARENT OPENING SIZE OF 0.30 MM (TABLE 2, CLASS II).
- 7. MWRD EQ COMPOST PLANTING MEDIA (OR APPROVED ALTERNATIVE): TYPICALLY COMPOSED OF A MEDIA MIX (50% SAND, 30% COMPOST, AND 20% TOPSOIL). ASSUME A POROSITY OF 0.25 FOR STORMWATER STORAGE OR SPECIFY.
- 8. USE $n=0.25$ FOR STONE-EQ COMPOST PLANTING MEDIA MIX. FOR SOIL CELL SYSTEM, USE POROSITY AVAILABLE FOR STORMWATER STORAGE, PER MANUFACTURER.

NOTES CONTINUED ON PAGE 2 OF THE URBAN TREE STORMWATER PLANTER BOX DETAIL.

NOT TO SCALE



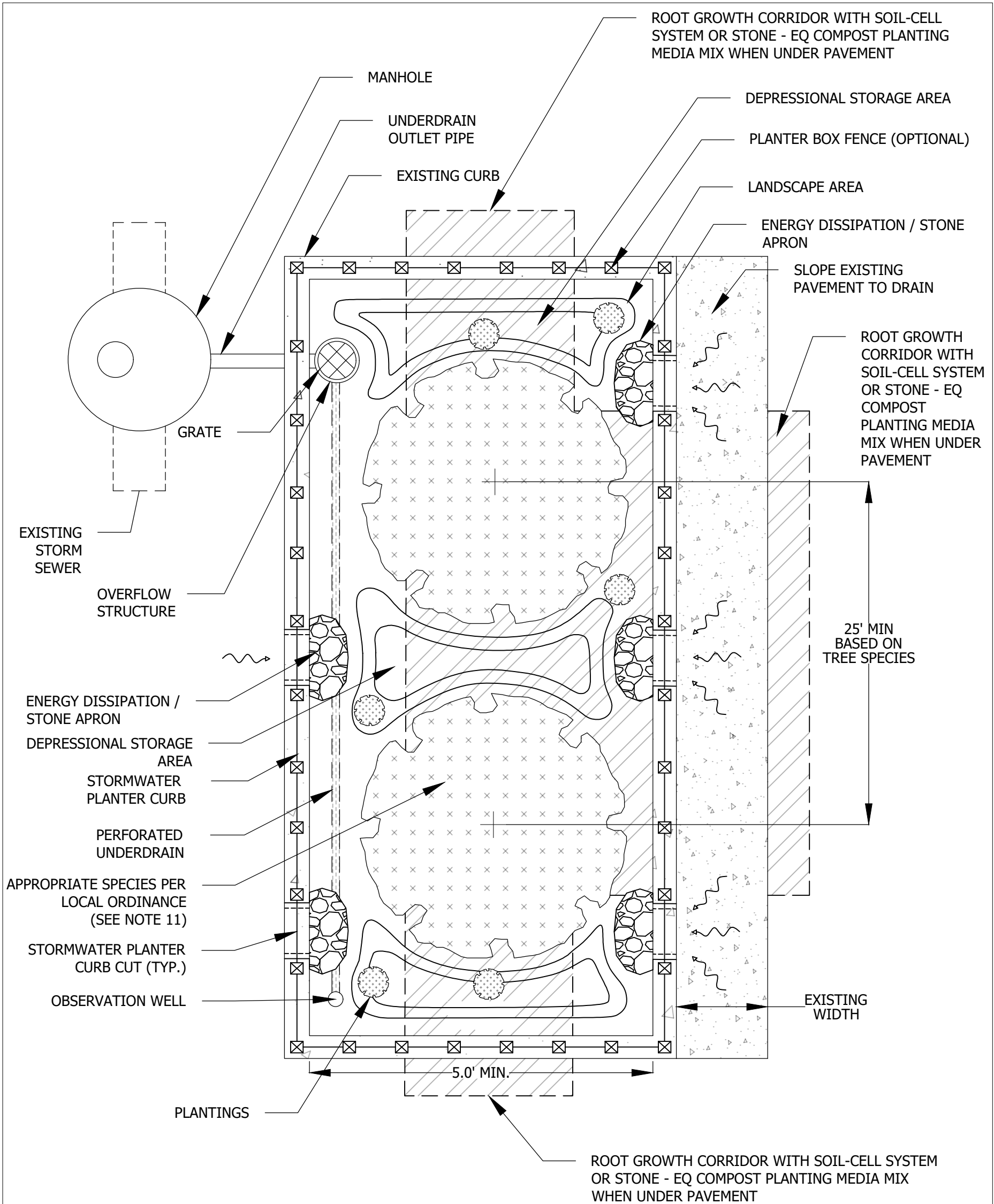
TECHNICAL GUIDANCE MANUAL

URBAN TREE STORMWATER PLANTER BOX (1 OF 2) PROFILE VIEW

12/5/2018

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NOTES CONTINUED:

9. STONE STORAGE OPTIONS ARE IDOT CA-1, CA-3, CA-7, OR APPROVED ALTERNATE. NO RECYCLED MATERIALS.
10. UNDERDRAINS ARE REQUIRED IN TYPICAL CLAYEY SOILS WHERE INFILTRATION RATES ARE LESS THAN 0.5 INCH/HOUR. NO MORE THAN 1 UNDERDRAIN EVERY 30 FEET ON CENTER. MINIMUM UNDERDRAIN BEDDING OF 2 INCHES, MAXIMUM OF 12 INCHES.
11. SELECTED SPECIES SHALL BE SALT TOLERANT.

SIZING:
MINIMUM 1000 FT³ OF PLANTING MEDIA PER TREE.

NOT TO SCALE



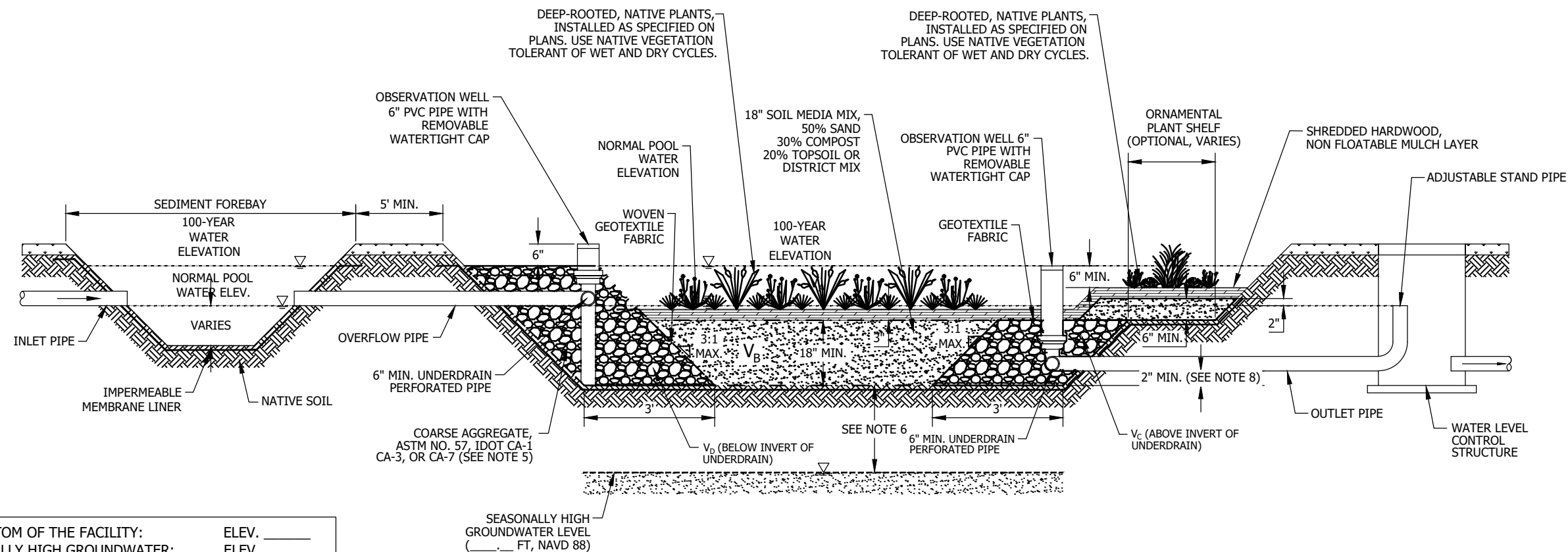
TECHNICAL GUIDANCE MANUAL

URBAN TREE STORMWATER PLANTER BOX (2 OF 2) PLAN VIEW

12/5/2018

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BOTTOM OF THE FACILITY:	ELEV. _____
SEASONALLY HIGH GROUNDWATER:	ELEV. _____
SEPARATION:	FEET _____

VOLUME TYPE	SURFACE AREA	DEPTH	POROSITY	STORAGE VOLUME	VOLUME PROVIDED
V_A : SURFACE STORAGE			N/A	$1.00 \times V_A$	
V_B : SOIL MEDIA MIX			0.25	$0.50 \times 0.25 \times V_B$	
V_C : COARSE AGGREGATE (ABOVE INVERT)			0.36	$0.50 \times 0.36 \times V_C$	
V_D : COARSE AGGREGATE (BELOW INVERT)			0.36	$0.36 \times V_D$	
TOTAL					

- NOTES:
1. OFFSET A MINIMUM OF 10 FEET FROM FOUNDATIONS UNLESS WATERPROOFED, 20 FEET FROM SANITARY SEWERS, 20 FEET FROM ROADWAY GRAVEL SHOULDER AND 100 FEET FROM POTABLE WATER WELLS OR SEPTIC TANKS.
 2. AVOID INSTALLATION ON SLOPES GREATER THAN 3.00%. AVOID COMPACTING NATIVE SOILS. SCARIFY ANY COMPACTED SOIL.
 3. WETLAND LENGTH TO WIDTH RATIO SHOULD RANGE FROM 2 TO 3.
 4. GEOTEXTILE FABRIC SHALL MEET REQUIREMENTS OF IUM MATERIAL SPECIFICATION 592. FOR WOVEN: APPARENT OPENING SIZE OF 0.55 MM (TABLE 1, CLASS I). FOR NON WOVEN: APPARENT OPENING SIZE OF 0.30 MM (TABLE 2, CLASS II).
 5. STONE STORAGE OPTIONS ARE IDOT CA-1, CA-3, CA-7, DISTRICT VULCAN MIX, OR APPROVED ALTERNATE. NO RECYCLED MATERIALS.
 6. MINIMUM DISTANCE OF 2 FEET (3.5 FEET IN COMBINED SEWER AREAS) BETWEEN BOTTOM OF BMP AND SEASONALLY HIGH GROUNDWATER LEVEL.
 7. UNDERDRAINS ARE REQUIRED IN TYPICAL CLAYEY SOILS WHERE INFILTRATION RATES ARE LESS THAN 0.5 INCH/HOUR. MAXIMUM OF 1 UNDERDRAIN PER 30 FEET. PROVIDE A SOIL REPORT DOCUMENTING NATIVE INFILTRATION RATE TO FOREGO UNDERDRAINS.
 8. MINIMUM UNDERDRAIN BEDDING OF TWO INCHES, MAXIMUM OF 12 INCHES.
 9. FOLLOW THE REQUIRED PRETREATMENT MEASURES LISTED ON THE VOLUME CONTROL PRETREATMENT MEASURES DETAIL.

NOT TO SCALE



TECHNICAL GUIDANCE MANUAL

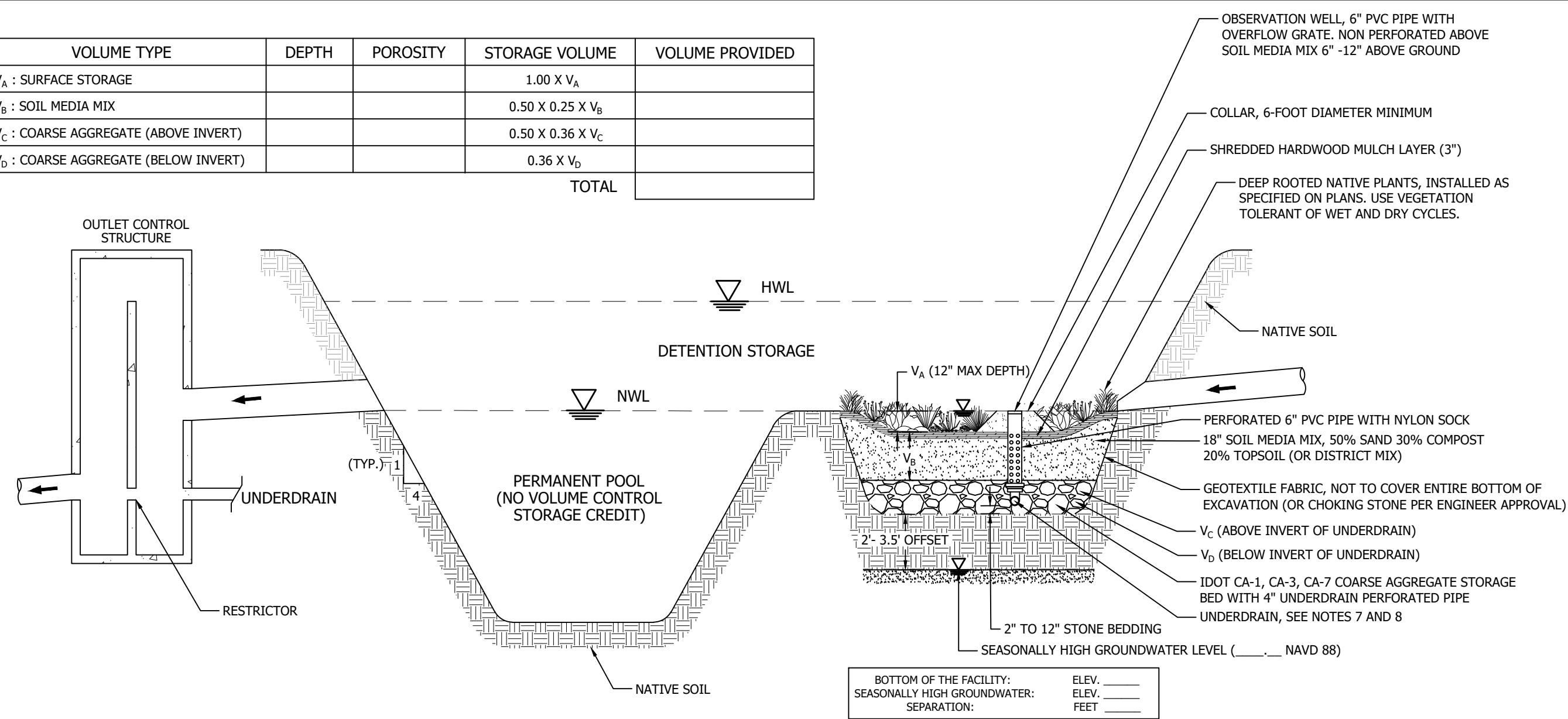
CONSTRUCTED WETLAND DETAIL

10/11/18

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VOLUME TYPE	DEPTH	POROSITY	STORAGE VOLUME	VOLUME PROVIDED
V_A : SURFACE STORAGE			$1.00 \times V_A$	
V_B : SOIL MEDIA MIX			$0.50 \times 0.25 \times V_B$	
V_C : COARSE AGGREGATE (ABOVE INVERT)			$0.50 \times 0.36 \times V_C$	
V_D : COARSE AGGREGATE (BELOW INVERT)			$0.36 \times V_D$	
TOTAL				



NOTES:

1. THE PERIMETER OF THE VOLUME CONTROL FACILITY SHALL MAINTAIN THE MINIMUM HORIZONTAL SEPARATION DISTANCE OF: 10 FEET FROM FOUNDATIONS, UNLESS WATERPROOFED; 20 FEET FROM ROADWAY GRAVEL SHOULDER; AND 100 FEET FROM POTABLE WATER WELLS, SEPTIC TANKS/FIELDS, OR OTHER UNDERGROUND TANKS.
2. SANITARY OR COMBINED SEWERS SHALL NOT BE LOCATED WITHIN THE VOLUME CONTROL FACILITY. SANITARY OR COMBINED SEWERS SHALL NOT BE LOCATED BELOW THE FOOTPRINT OF THE VOLUME CONTROL FACILITY. WHEN LOCAL CONDITIONS PREVENT THE SEWER FROM BEING LOCATED OUTSIDE THE FOOTPRINT OF THE FACILITY THE SEWER SHALL BE CONSTRUCTED TO WATER MAIN QUALITY STANDARDS, AND IT SHALL BE ENCASED WITH A WATER MAIN QUALITY CARRIER PIPE WITH THE ENDS SEALED.
3. MINIMUM DISTANCE OF 2 FEET (3.5 FEET IN COMBINED SEWER AREAS) BETWEEN THE BOTTOM OF THE VOLUME CONTROL FACILITY AND SEASONALLY HIGH GROUNDWATER LEVEL IS REQUIRED.
4. STONE STORAGE OPTIONS ARE IDOT CA-1, CA-3, CA-7, OR APPROVED ALTERNATE. NO RECYCLED MATERIALS.
5. BOTTOM OF VOLUME CONTROL FACILITY SHALL BE AS FLAT AS POSSIBLE. BOTTOM SLOPES SHALL NOT EXCEED 20:1. DETENTION BASIN SIDE SLOPES SHALL BE 3:1 MINIMUM.
6. THE DEPTH BELOW OUTLET SHALL NOT EXCEED 12 INCHES AND SHALL BE DEWATERED IN 72 HOURS OR LESS.
7. UNDERDRAINS ARE REQUIRED IN TYPICAL CLAYEY SOILS WHERE INFILTRATION RATES ARE LESS THAN 0.5 INCH/HOUR. UNDERDRAIN SHOULD BE NO LARGER THAN 4 INCHES IN DIAMETER TO ENCOURAGE RETENTION, HAVE AN OBSERVATION WELL INSTALLED AT THE TERMINAL END AND BE SPACED NO MORE THAN 30 FEET ON CENTER ACROSS A RETENTION FIELD. ONE OBSERVATION WELL REQUIRED PER 6,000 SQUARE FEET OF SURFACE AREA.
8. VOLUME CONTROL FACILITY UNDERDRAIN SYSTEM SHALL BE CONNECTED TO A DOWNSTREAM STRUCTURE, UPSTREAM OF THE RESTRICTOR.

NOT TO SCALE



TECHNICAL GUIDANCE MANUAL

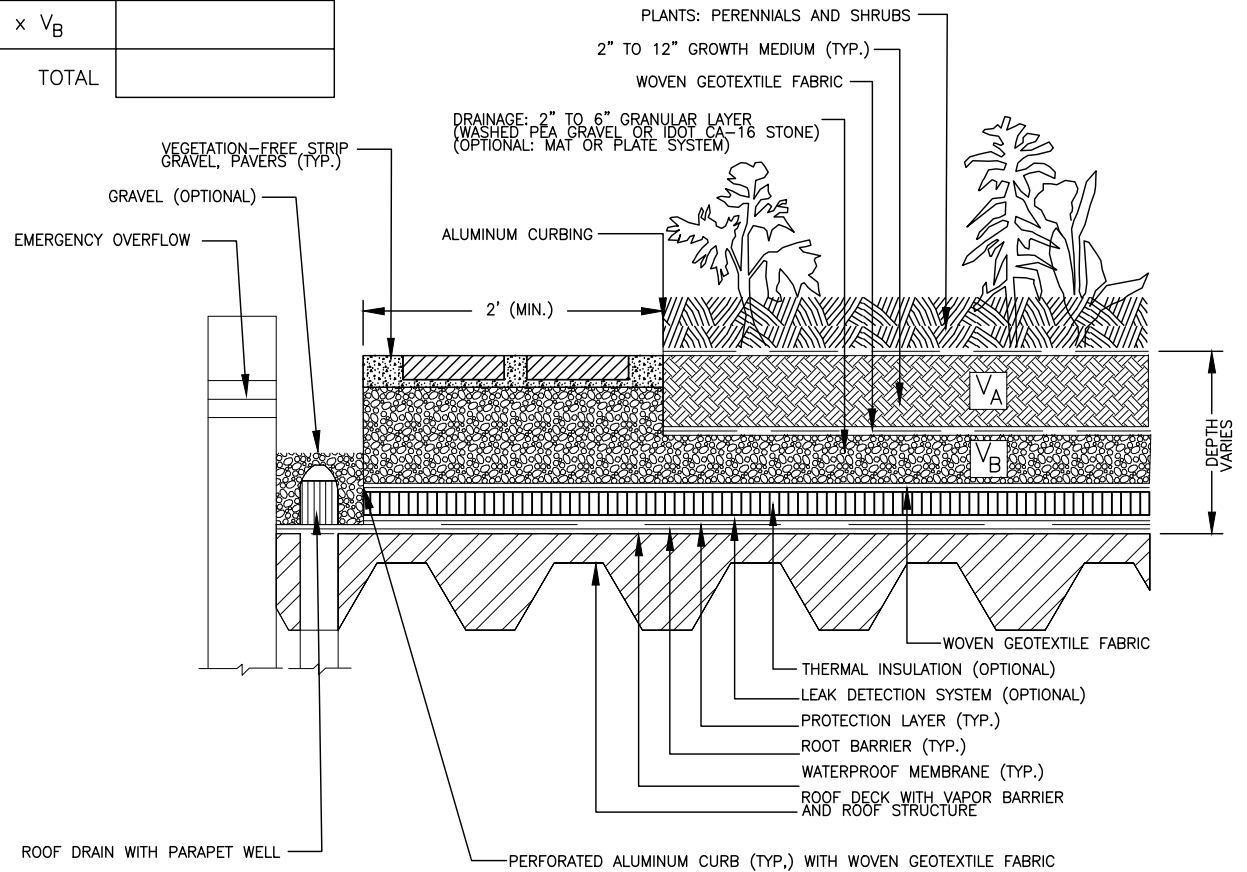
TYPICAL VOLUME CONTROL STORAGE BELOW DETENTION BASIN OUTLET

11/29/2021

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VOLUME TYPE	POROSITY	MEDIA VOLUME	STORAGE VOLUME	VOLUME PROVIDED
GROWTH MEDIUM	0.25	V_A	$0.25 \times V_A$	
DRAINAGE LAYER	0.25	V_B	$0.25 \times V_B$	
TOTAL				



NOTES:

- 1) WOVEN GEOTEXTILE FABRIC SHALL MEET REQUIREMENTS OF SPECIFICATION IUM 592 GEOTEXTILE, TABLE 1, CLASS I, WITH AN APPARENT OPENING SIZE OF 50.
- 2) PLANTINGS SHALL BE SELECTED ACCORDING TO ASTM E2400-06, *GUIDE FOR SELECTION, INSTALLATION AND MAINTENANCE OF PLANTS FOR GREEN (VEGETATED) ROOF SYSTEMS*.
- 3) GROWTH MEDIA SHALL CONSIST OF 80% LIGHTWEIGHT INORGANIC MATERIALS AND 20% ORGANIC MATTER.
- 4) THERE SHALL BE A MINIMUM SETBACK OF 2- FEET FROM ROOF PERIMETER AND ROOF PENETRATIONS.



APPENDIX F

GI Modeling in SWMM

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Revision Summary

January 2024

Section 2.0	Updated descriptions of surface width per unit area and return outflow to pervious area.
Figure 1	Updated figure to include entire dialog box.
Section 3.1	Updated descriptions of surface, pavement, soil, storage, underdrain, and drainage mat parameters.
Table 2	Added new table of surface roughness from SWMM Help Manual.
Table 3	Added new table of soil characteristics from SWMM Help Manual.
Figure 2	Updated parameters based on Table 2.
Figure 3	Updated parameters based on Table 3.

Figure 6	Updated parameters based on Table 2.
Figure 7	Updated parameters based on Table 3.
Section 3.3.1	Added new subsection for Tree Cells.
Figure 9	Added new figure for Tree Cell surface parameters.
Figure 10	Added new figure for Tree Cell soil parameters.
Figure 11	Added new figure for Tree Cell storage parameters.
Figures 12 – 23	Updated figure numbering.
Figure 12	Updated parameters based on Table 2.
Figure 15	Updated parameters based on Table 2.
Figure 20	Updated parameters based on Table 2.
Figure 21	Updated parameters based on Table 3.
Figure 22	Updated based on guidance in the SWMM Help Manual.
Section 4.0	Updated description of dry well storage curve.
Figure 23	Updated storage curve based on description in Section 4.
Section 5.0	Added References section.

1.0 Overview of Modeling GI in SWMM

Green infrastructure (GI) installed for combined sewer overflow (CSO) control is modeled in SWMM to represent the flow to the GI, surface infiltration, subsurface infiltration, storage, and overflow, as appropriate. GI technologies are modeled in SWMM using low impact development (LID) controls or storage node entities, as summarized in Table 1 below.

Table 1 | LID Control or SWMM Entity Used to Model Each GI Technology

GI Type	GI Technology	LID Control or SWMM Entity to Model GI
Surface Infiltration	Bioretention	Bio-Retention Cell LID
	Stormwater Planters	Rain Garden LID
	Bioswales	Bio-Retention Cell LID
	Bumpins and Bumpouts	Infiltration Trench LID
	Infiltration Trenches	Infiltration Trench LID
Naturalized Areas	Native Prairie	Rain Garden LID
Permeable Pavement	Porous Asphalt	Permeable Pavement LID
	Pervious Concrete	Permeable Pavement LID
	Permeable Pavers	Permeable Pavement LID
Subsurface Infiltration Cell	Unvegetated Subsurface Infiltration	Infiltration Trench LID
	Dry Well	Storage Node
	Tree Cells	Rain Garden LID
Stormwater Retention	Constructed Wetland	Storage Node
	Detention Storage	Storage Node
	Green Roof	Green Roof LID

LID controls are infrastructure distributed throughout the watershed that are designed to capture, retain, and/or infiltrate stormwater. LID controls are modeled in SWMM on an area basis and consist of two primary elements, the LID Control Editor and LID Usage Editor. The LID Control Editor describes the characteristics of the GI in the vertical structure on a unit-area basis. The LID Usage Editor defines how the GI is represented within the subcatchment. The LID control is added to the subcatchment based on its physical location. For example, LID controls for GI facilities constructed the right-of-way are added to the directly connected impervious area (DCIA) subcatchment in Peoria's SWMM model, while green roof LID controls are added to the modeled roof subcatchments. The process for defining parameters in the LID Usage Editor and LID Control Editor are described in Sections 2.0 and 3.0, respectively.

Some GI technologies, specifically dry wells, detention storage, and constructed wetlands, are modeled in SWMM using storage nodes with the outlet structures represented with orifices, weirs, and/or conduits. The storage node parameters are based on the design of the GI facility as described in Section 4.0.

2.0 LID Usage Editor

The parameters for LID Usage are defined as described below.

- The area of each unit is defined based on the design of the GI facility.
- The number of replicate units is defined based on the design and is typically 1.
- The surface width per unit is typically set to the width at the downstream end of the GI facility. The surface width can be set to 0 for other LID processes, such as bio-retention cells, rain gardens, and rain barrels that simply spill any excess captured runoff over their berms.
- The percent initial saturation is set to 0.
- The percent of impervious area treated is defined based on the modeled subcatchment impervious area tributary to the GI facility. For GI facilities added to DCIA subcatchments, this is the percent of the DCIA subcatchment tributary to the GI.
- The percent of pervious area treated is defined based on the modeled subcatchment pervious area tributary to the GI facility. For GI facilities added to DCIA subcatchments, the percent of pervious area treated is 0 since the pervious area subcatchment is routed to the DCIA subcatchment Peoria's SWMM model. The routing between modeled subcatchments results in pervious subcatchment runoff becoming run-on to the DCIA subcatchment. More detail about modeled subcatchments and subcatchment routing is available in Section 4.1.2 of the Updated Starting Conditions H&H Model Report.
- The drain to attribute is used to represent the underdrain routing. The field is used to specify the location where the underdrain outlets, or left blank, to use the outlet of the subcatchment.
- The return all outflow to pervious area box is checked when the LID control outflow is directed to the pervious area of the subcatchment it is located in; this field is blank when the outflow is sent to the outlet of the subcatchment. This field will be left blank as this option is not currently intended to be used as part of Peoria's CSO Remedial Measures Program.

An example of the LID Usage Editor is shown in Figure 1 below.

LID control name:
Porous_Asphalt ▼

☐ LID occupies full subcatchment

Area of each unit (ft²) 520

Number of replicate units 1

% of subcatchment occupied 6.2

Surface width per unit (ft) 0

% initially saturated 0

% of impervious area treated 100

% of pervious area treated 0

Send drain flow to:
(Leave blank to use outlet of current subcatchment)

☐ Return all outflow to pervious area

Detailed report file (optional)

Figure 1 | Parameters for LID Usage Editor

3.0 LID Control Editor

3.1 Typical LID Parameters

The typical LID control parameters used to represent different GI technologies are defined as follows.

- Surface – applicable for all LID controls
 - ♦ The berm height is based on the berm height of the GI facility; if there is no berm then the berm height is set to 0. The berm height is typically between 6 and 12 inches for bioretention and other vegetated GI technologies and typically 0 for permeable pavement and other non-vegetated GI technologies.
 - ♦ The vegetation volume fraction represents the volume of the ponding area that is occupied by vegetation and therefore not available for stormwater. Typical values range from 0 for unvegetated surfaces but may be as high as 0.1 to 0.2 for very dense vegetative growth per the SWMM Help Manual. A typical value of 0.05 is used for bioretention and vegetated GI facilities to represent moderate to dense vegetation coverage. A typical value of 0 is used for unvegetated surfaces, such as an infiltration trench and permeable pavement.
 - ♦ The surface roughness is set according to the surface texture and values in the SWMM Help Manual, shown below in Table 2.
 - ♦ The surface slope is set to the longitudinal slope of the GI facility.

Table 2 | Manning's Roughness Coefficient for Overland Flow from the SWMM Help Manual

Surface	Manning's n
Smooth asphalt	0.011
Smooth concrete	0.012
Ordinary concrete lining	0.013
Good wood	0.014
Brick with cement mortar	0.014
Vitrified clay	0.015
Cast iron	0.015
Corrugated metal pipes	0.024
Cement rubble surface	0.024
Fallow soils (no residue)	0.05
Cultivated soils	
Residue cover < 20%	0.06
Residue cover > 20%	0.17
Range (natural)	0.13
Grass	
Short, prairie	0.15
Dense	0.24
Bermuda grass	0.41
Woods	
Light underbrush	0.40
Dense underbrush	0.80

- Pavement – applicable for permeable pavement LID control
 - ♦ The pavement thickness is based on the GI facility pavement thickness. This is typically 6 inches but may vary between 3 and 8 inches based on the design and type of pavement.
 - ♦ The pavement void ratio is based on the design specification or information from the manufacturer. The void ratio is typically between 0.12 and 0.21 according to the SWMM Help Manual. The SWMM Help Manual does not provide guidance on the different void ratios for different types of permeable pavement systems.

- The void ratio for continuous paver systems is typically between 0.18 and 0.33 according to Table 6-6 in SWMM Reference Manual Volume III – Water Quality dated July 2016.
- The void ratio for block paver systems with aggregate between the joints is typically between 0.11 and 0.67 according to Table 6-6 in SWMM Reference Manual Volume III – Water Quality dated July 2016. Note the values in Table 6-6 are for porosity, so the following equation was used to convert to void ratio: $\text{void ratio} = \text{porosity} / (1 - \text{porosity})$.
- The void ratio for block paver systems with open joints is an area-weighted average of the open joint space (representative of the volume of voids) divided by the impervious paver block area (representative of the volume of solids). Note that SWMM does not presently allow a void ratio greater than 1, and an open joint has a void ratio that approaches infinity (void ratio = volume of voids / volume of solids, where the volume of solids in an open joint is 0). Therefore, paver block systems with open joints are modeled as continuous systems and an area weighted average of the open space is used to properly represent the void ratio.
- ◆ The impervious surface fraction is set to 0 for continuous systems. For block paver systems with aggregate in the joints, the impervious surface fraction is the ratio of impervious paver block to the total area. For block paver systems with open joints, the impervious surface fraction is set to 0 as the void ratio and pavement permeability are calculated as an area weighted average of the open joint and impervious block paver areas.
- ◆ The pavement permeability is typically set based on values from the manufacturer and performance testing results. The permeability of new porous concrete or asphalt can be hundreds of inches per hour according to the SWMM Help Manual. For block paver systems with aggregate in the joints, the permeability refers to the permeability of the aggregate material filling the joints. For block paver systems with open joints, the permeability is an area weighted average of the open joint space and impervious paver block.
- ◆ The clogging factor is typically set to 1960 based on typical permeable pavement clogging. The clogging factor may be adjusted based on GI inspections and performance testing results. The SWMM Help Manual does not provide a typical range for the clogging factor. The typical value of 1960 is calculated using the equation in the SWMM Help Manual, assuming a typical permeable pavement with a capture ratio of 3 will have the surface infiltration rate degrade from 100 in/hr to 10 in/hr over 10 years based on Wisconsin DNR guidance.
- ◆ The regeneration interval is typically set to 182.5 days to represent maintenance twice a year. The regeneration interval may be varied based on the actual maintenance frequency. The SWMM Help Manual guidance on the regeneration interval states it is the number of days that the pavement layer is allowed to clog before its permeability is restored, but does not provide guidance on the typical range of values or recommended number of days between maintenance activities. The typical value of 182.5 days is selected to represent the minimum maintenance frequency anticipated for green infrastructure in Peoria.

- ♦ The regeneration fraction is typically set to be 0.75. The regeneration fraction may be varied based on performance testing results. The SWMM Help Manual does not provide a typical range for the regeneration fraction. The PaveDrain Maintenance Manual and Peoria's performance testing completed to date indicate a regeneration fraction greater than 0.9 can be achieved. A typical regeneration fraction of 0.75 was selected to be conservative.
- Soil – applicable for bio-retention cell, rain garden, permeable pavement, and green roof LID controls
 - ♦ The soil thickness is based on the design of the GI facility. For bioretention and other vegetated GI facilities, this is typically between 18 and 36 inches according to the SWMM Help Manual. For green roofs, a typical thickness is between 3 and 6 inches according to the SWMM Help Manual. For permeable pavement, the thickness is typically 0.
 - ♦ The soil porosity is based on the soil texture and the Soil Characteristics Table in the SWMM Help Manual, shown as Table 3, unless site specific testing supports an alternative value.
 - ♦ The field capacity is based on the soil texture and the Soil Characteristics Table in the SWMM Help Manual, shown as Table 3, unless site specific testing supports an alternative value.
 - ♦ The wilting point is based on the soil texture and the Soil Characteristics Table in the SWMM Help Manual, shown as Table 3, unless site-specific testing supports an alternative value.
 - ♦ The conductivity is based on the soil texture and the Soil Characteristics Table in the SWMM Help Manual, shown as Table 3, unless site-specific testing supports an alternative value.
 - ♦ The conductivity slope is typically in the range of 30 to 60 and may be estimated from a standard soil grain size analysis as $0.48(\% \text{ Sand}) + 0.85(\% \text{ Clay})$ following guidance in the SWMM Help Manual. Alternatively, site-specific testing may be used to calculate the conductivity slope using the following equation.
 - $K = K_{sat} * \exp(-HCO * (porosity - moisture\ content))$
 - where K is the hydraulic conductivity at a given moisture content,
 - and K_{sat} is the saturated hydraulic conductivity,
 - and HCO is the conductivity slope.
 - ♦ The suction head is based on the soil texture and the Soil Characteristics Table in the SWMM Help Manual, shown as Table 3, unless site-specific testing supports an alternative value.

Table 3 | Soil Characteristics from the SWMM Help Manual

Soil Texture Class	K	Ψ	ϕ	FC	WP
Sand	4.74	1.93	0.437	0.062	0.024
Loamy Sand	1.18	2.40	0.437	0.105	0.047
Sandy Loam	0.43	4.33	0.453	0.190	0.085
Loam	0.13	3.50	0.463	0.232	0.116
Silt Loam	0.26	6.69	0.501	0.284	0.135
Sandy Clay Loam	0.06	8.66	0.398	0.244	0.136
Clay Loam	0.04	8.27	0.464	0.310	0.187
Silty Clay Loam	0.04	10.63	0.471	0.342	0.210
Sandy Clay	0.02	9.45	0.430	0.321	0.221
Silty Clay	0.02	11.42	0.479	0.371	0.251
Clay	0.01	12.60	0.475	0.378	0.265

K = hydraulic conductivity, in/hr

Ψ = suction head, in.

ϕ = porosity, fraction

FC = field capacity, fraction

WP = wilting point, fraction

- Storage – applicable for bio-retention cell, rain garden, infiltration trench, and permeable pavement LID controls
 - ♦ The storage thickness is based on the design. The storage thickness is typically 48 inches or less to minimize utility conflicts.
 - ♦ A void ratio (volume of voids over volume of solids) of 0.6667, representing a 40% aggregate porosity (volume of voids over total volume), is typically used. This may be varied between 0.5 and 0.75, typical of gravel beds, following guidance in the SWMM Help Manual. The void ratio for a storage chamber or storage pipe is based on manufacturer-recommended values. Note that porosity = void ratio / (1+ void ratio).
 - ♦ The seepage rate is based on site-specific testing performed at the native soil interface. A factor of safety of 2 is applied to the site-specific testing to determine the design seepage rate.
 - ♦ The clogging factor, which is assumed to be zero as the GI facilities, will be routinely inspected and any observed clogging will be remediated through maintenance.

- Underdrain – applicable for bio-retention cell, infiltration trench, and permeable pavement LID controls
 - ♦ The drain coefficient is typically set to 0 as most of Peoria’s GI facilities do not have an underdrain. If a GI facility is designed with an underdrain, the drain coefficient will be calculated following guidance in the SWMM Help Manual.
 - ♦ The drain exponent is typically set to 0.5 such that the drain flow is calculated using the orifice equation following guidance in the SWMM Help Manual.
 - ♦ The drain offset height is based on the design drain offset above the bottom of the storage layer.
 - ♦ The open level describes when the underdrain is active. This is typically set to 0 as the underdrains do not typically have controls.
 - ♦ The closed level describes when the underdrain is closed. This is typically set to 0 as the underdrains do not typically have controls.
 - ♦ The control curve describes the relationship between depth and flow. This is typically blank as the depth and flow relationship is defined based on the drain coefficient and drain exponent.
- Drainage Mat – applicable to green roof LID control
 - ♦ The drainage mat thickness is based on the GI facility drainage mat thickness.
 - ♦ The drainage mat void fraction will use manufacturer-recommended values. If manufacturer-recommended values are not available, the drainage mat void fraction will follow the guidance in the SWMM Help Manual and range from 0.5 to 0.6.
 - ♦ The drainage mat roughness will use manufacturer-recommended values. If manufacturer-recommended values are not available, the drainage mat roughness will follow the guidance in the SWMM Help Manual and range from 0.1 to 0.4.

3.2 Bio-Retention Cell LID Control

Bioretention is modeled in SWMM using the Bio-Retention Cell LID Control. An example of the parameters for bioretention is shown in Figures 2 through 5. Actual parameters are based on the design of the specific GI facility.

Bioswales are modeled similar to bioretention. The surface slope parameter is set to the longitudinal slope of the swale.

Name:

LID type:

Berm height (in)	6
Vegetation volume (fraction)	0.05
Surface roughness (Manning's n)	0.17
Surface slope (percent)	0

Figure 2 | Surface Parameters for Bioretention in LID Control Editor

Name:

LID type:

Thickness (in)	18
Porosity (volume fraction)	0.437
Field capacity (volume fraction)	0.062
Wilting point (volume fraction)	0.024
Conductivity (in/hr)	4.74
Conductivity slope	43.2
Suction head (in)	1.93

Figure 3 | Soil Parameters for Bioretention in LID Control Editor

Name:

LID type:

Thickness (in)	30
Void ratio (voids/solids)	0.6667
Seepage rate (in/hr)	2
Clogging factor	0

Figure 4 | Storage Parameters for Bioretention LID Control Editor

Name:

LID type:

Drain coefficient (in/hr)	0
Drain exponent	0.5
Drain offset height (in)	6
Open level (in)	0
Closed level (in)	0
Control curve	

Note: Use a drain coefficient of 0 if the LID unit has no underdrain.

Figure 5 | Underdrain Parameters for Bioretention in LID Control Editor

3.3 Rain Garden LID Control

Stormwater planters are modeled in SWMM using the Rain Garden LID Control. An example of the parameters for stormwater planters is shown in Figures 6 through 8. Actual parameters are based on the design of the specific GI facility.

Native prairie is also modeled similar to stormwater planters. The soil thickness parameter is set very small, e.g., 0.1 inches, such that the native prairie only takes volume credit for surface ponding. The surface berm height is set to the height of the check dam or furrow used to force ponding.

Name:
Stormwater_Planter

LID type:
Rain Garden ▼

Surface Soil Storage

Berm height (in)	6
Vegetation volume (fraction)	0.05
Surface roughness (Manning's n)	0.17
Surface slope (percent)	0

Figure 6 | Surface Parameters for Stormwater Planter in LID Control Editor

Name:
Stormwater_Planter

LID type:
Rain Garden ▼

Surface Soil Storage

Thickness (in)	18
Porosity (volume fraction)	0.437
Field capacity (volume fraction)	0.062
Wilting point (volume fraction)	0.0024
Conductivity (in/hr)	4.74
Conductivity slope	43.2
Suction head (in)	1.93

Figure 7 | Soil Parameters for Stormwater Planter in LID Control Editor

The screenshot shows the 'Storage' tab selected in the LID Control Editor. The 'Name' field is 'Stormwater_Planter' and the 'LID type' is 'Rain Garden'. The 'Storage' tab is active, showing the following parameters:

Parameter	Value
Thickness (in)	0
Void ratio (voids/solids)	0.75
Seepage rate (in/hr)	2
Clogging factor	0

Figure 8 | Storage Parameters for Stormwater Planter in LID Control Editor

3.3.1 Tree Cells

Tree cells are modeled in SWMM using the Rain Garden LID Control. An example of the parameters for tree cells are shown in Figures 9 through 11. Actual parameters are based on manufacturer recommendations and the design of the specific GI facility. Tree canopy interception is not represented in the model. The surface vegetation volume fraction is set to 0 since the area occupied by the tree and root ball is not included in the Area of Each Unit in the LID Usage Editor. The tree and root ball are excluded from the Area of Each Unit since the soil characteristics vary between the higher infiltrating engineered media in the tree cells and the planting soil that is typically present in the root ball.

The screenshot shows the 'Surface' tab selected in the LID Control Editor. The 'Name' field is 'Tree_Cell' and the 'LID type' is 'Rain Garden'. The 'Surface' tab is active, showing the following parameters:

Parameter	Value
Berm height (in)	6
Vegetation volume (fraction)	0.0
Surface roughness (Manning's n)	0.05
Surface slope (percent)	0.5

Figure 9 | Surface Parameters for Tree Cell in LID Control Editor

Name: Tree_Cell

LID type: Rain Garden

Surface Soil Storage

Thickness (in)	24
Porosity (volume fraction)	0.437
Field capacity (volume fraction)	0.105
Wilting point (volume fraction)	0.047
Conductivity (in/hr)	1.18
Conductivity slope	47
Suction head (in)	2.4

Figure 10 | Soil Parameters for Tree Cell in LID Control Editor

Name: Tree_Cell

LID type: Rain Garden

Surface Soil Storage

Thickness (in)	0
Void ratio (voids/solids)	0.75
Seepage rate (in/hr)	2
Clogging factor	0

Figure 11 | Storage Parameters for Tree Cell in LID Control Editor

3.4 Infiltration Trench LID Control

Infiltration trenches are modeled in SWMM using the Infiltration Trench LID Control. An example of the parameters is shown in Figures 12 through 14. Actual parameters are based on the design of the specific GI facility.

Stormwater bumpins and bumpouts are modeled as infiltration trenches with stormwater entering the aggregate storage through an inlet. The design and modeling of stormwater bumpins and bumpouts conservatively assumes no storage volume in the soil layer.

Unvegetated subsurface infiltration is also modeled as an infiltration trench.

The screenshot displays the 'Surface' tab of the LID Control Editor for an 'Infiltration Trench'. The 'Name' field is 'Infiltration_Trench' and the 'LID type' is 'Infiltration Trench'. The 'Surface' tab is selected, showing the following parameters:

Parameter	Value
Berm height (in)	0.0
Vegetation volume (fraction)	0.0
Surface roughness (Manning's n)	0.024
Surface slope (percent)	1.0

Figure 12 | Surface Parameters for Infiltration Trench in LID Control Editor

The screenshot displays the 'Storage' tab of the LID Control Editor for an 'Infiltration Trench'. The 'Name' field is 'Infiltration_Trench' and the 'LID type' is 'Infiltration Trench'. The 'Storage' tab is selected, showing the following parameters:

Parameter	Value
Thickness (in)	48
Void ratio (voids/solids)	0.6667
Seepage rate (in/hr)	2
Clogging factor	0

Figure 13 | Storage Parameters for Infiltration Trench in LID Control Editor

The screenshot shows the 'Underdrain' tab selected in the LID Control Editor. The 'Name' field is 'Infiltration_Trench' and the 'LID type' is 'Infiltration Trench'. The 'Underdrain' tab is active, showing parameters for the underdrain system. The 'Surface' tab is also visible. The parameters are as follows:

Parameter	Value
Drain coefficient (in/hr)	0
Drain exponent	0.5
Drain offset height (in)	6
Open level (in)	0
Closed level (in)	0
Control curve	[Dropdown menu]

Note: Use a drain coefficient of 0 if the LID unit has no underdrain.

Figure 14 | Underdrain Parameters for Infiltration Trench in LID Control Editor

3.5 Permeable Pavement LID Control

Porous asphalt, pervious concrete, and permeable pavers are modeled in SWMM using the Permeable Pavement LID Control. An example of the parameters for permeable pavers is shown in Figures 15 through 19. Actual parameters are based on the design of the specific GI facility.

The screenshot shows the 'Surface' tab selected in the LID Control Editor. The 'Name' field is 'Porous_Asphalt' and the 'LID type' is 'Permeable Pavement'. The 'Surface' tab is active, showing parameters for the surface. The 'Pavement' tab is also visible. The parameters are as follows:

Parameter	Value
Berm height (in)	0.0
Vegetation volume (fraction)	0.0
Surface roughness (Manning's n)	0.013
Surface slope (percent)	2

Figure 15 | Surface Parameters for Porous Asphalt in LID Control Editor

Name:
Porous_Aspphalt

LID type:
Pemeable Pavement ▼

Surface Pavement Soil Storage Underdrain Pollutant Removals

Thickness (in)	4
Void ratio (voids/solids)	0.15
Impervious surface (fraction)	0
Permeability (in/hr)	25
Clogging factor	1960
Regeneration interval (days)	182.5
Regeneration fraction	0.75

Figure 16 | Pavement Parameters for Porous Asphalt in LID Control Editor

Name:
Porous_Aspphalt

LID type:
Pemeable Pavement ▼

Surface Pavement Soil Storage Underdrain Pollutant Removals

Thickness (in)	0
Porosity (volume fraction)	0.25
Field capacity (volume fraction)	0.15
Wilting point (volume fraction)	0.08
Conductivity (in/hr)	4.7
Conductivity slope	39.3
Suction head (in)	1.9

Figure 17 | Soil Parameters for Porous Asphalt in LID Control Editor

Name: Porous_Ashphalt

LID type: Pemeable Pavement

Surface | Pavement | Soil | **Storage** | Underdrain | Pollutant Removals

Thickness (in) 42

Void ratio (voids/solids) 0.6667

Seepage rate (in/hr) 2

Clogging factor 0

Figure 18 | Storage Parameters for Porous Asphalt in LID Control Editor

Name: Porous_Ashphalt

LID type: Pemeable Pavement

Surface | Pavement | Soil | **Storage** | **Underdrain** | Pollutant Removals

Drain coefficient (in/hr) 0

Drain exponent 0.5

Drain offset height (in) 6

Open level (in) 0

Closed level (in) 0

Control curve

Note: Use a drain coefficient of 0 if the LID unit has no underdrain.

Figure 19 | Underdrain Parameters for Porous Asphalt in LID Control Editor

3.6 Green Roof LID Control

Green roofs are modeled in SWMM using the Green Roof LID Control. An example of the parameters is shown in Figures 20 through 22. Actual parameters are based on the design of the specific GI facility.

Name:

LID type:

Berm height (in)	0
Vegetation volume (fraction)	0.0
Surface roughness (Manning's n)	0.15
Surface slope (percent)	10.0

Figure 20 | Surface Parameters for Green Roofs in LID Control Editor

Name:

LID type:

Thickness (in)	4
Porosity (volume fraction)	0.437
Field capacity (volume fraction)	0.062
Wilting point (volume fraction)	0.024
Conductivity (in/hr)	4.73
Conductivity slope	43.2
Suction head (in)	1.93

Figure 21 | Soil Parameters for Green Roofs in LID Control Editor

The screenshot displays the 'LID Control Editor' interface. At the top, the 'Name' field is set to 'Green_Roof'. Below it, the 'LID type' dropdown menu is set to 'Green Roof'. There are three tabs: 'Surface', 'Soil', and 'Drainage Mat', with 'Drainage Mat' being the active tab. Under the 'Drainage Mat' tab, there are three input fields: 'Thickness (in)' with a value of '2', 'Void fraction' with a value of '0.5', and 'Roughness (Manning's n)' with a value of '0.2'.

Parameter	Value
Thickness (in)	2
Void fraction	0.5
Roughness (Manning's n)	0.2

Figure 22 | Drainage Mat Parameters for Green Roofs in LID Control Editor

4.0 SWMM Storage Node

Dry wells are modeled in SWMM using the storage node entity with a seepage rate based on the site-specific testing performed at the native soil interface. A factor of safety of 2 is applied to the site-specific tests to determine the design seepage rate. The storage curve is defined to reflect the dimensions of the dry well, which typically includes a concrete manhole structure and the surrounding coarse aggregate. The bottom of the storage curve represents the full surface area at the native soil interface. The storage curve above the bottom is adjusted by an area weighted average to represent the available storage in the concrete manhole structure and the void space of the coarse aggregate. A manhole riser is represented at the top of the dry well storage curve. An example of the dry well parameters is shown in Figure 23. Actual parameters are based on the design of the specific GI facility.

Detention storage is modeled similar to a dry well. The storage curve is defined to reflect the internal dimensions of the detention storage. If the detention storage has a permanent pool of water, the storage curve only includes the available storage volume above the normal water level and the seepage rate is set to 0. Actual parameters are based on the design of the specific GI facility.

Constructed wetlands are modeled similar to dry wells. The storage curve is defined to reflect the available storage volume above the normal water level. The seepage rate is set to 0. Actual parameters are based on the design of the specific GI facility.

Orifices, weirs, and/or conduits are connected to the storage nodes to represent the outlet structures for each GI facility, as applicable. The outlet parameters are based on the design of the specific GI facility.

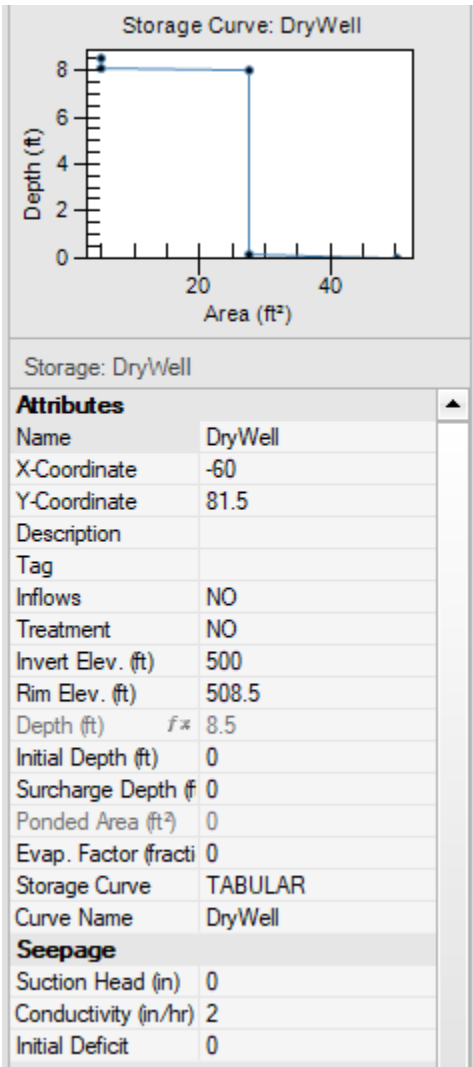


Figure 23 | Storage Node Parameters for a Dry Well

5.0 References

PaveDrain. (2023). Maintenance Manual. Retrieved from <https://www.pavedrain.com/maintenance>

Rossman, L. A., & Huber, W. C. (2016). Storm water management model reference manual volume III – Water Quality. US Environmental Protection Agency.

United States Environmental Protection Agency. (n.d.) EPA SWMM Help. Accessed via EPA SWMM model, version 5.2, December 15, 2023.

Wisconsin Department of Natural Resources. (n.d.) Technical Note for Conducting Pavement Surface Infiltration Rate, Pollutant Load and Runoff Volume Reduction Modeling in Accordance with WDNR Conservation Practice Standard 1008, Permeable Pavement. Retrieved from <https://dnr.wisconsin.gov/sites/default/files/topic/Stormwater/PermeablePavement1008TechNote.pdf>