Green Infrastructure Plan

Unincorporated Contra Costa County

Prepared by Geosyntec Consultants and SCI Consulting Group

FINAL DRAFT FOR REVIEW – JUNE 2019

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Acronyms

ABAG	Association of Bay Area Governments
BASMAA	Bay Area Stormwater Management Agencies Association
CCCWP	Contra Costa Clean Water Program
CCW SWRP	Contra Costa Watersheds Stormwater Resource Plan
FC District	Contra Costa County Flood Control and Water Conservation District
GI	Green Infrastructure
GIS	Geographic Information System
IRWMP	Integrated Regional Water Management Plan
MRP	Municipal Regional Stormwater Permit
MS4	Municipal Separate Storm Sewer System
MTC	Metropolitan Transportation Commission
NPDES	National Pollutant Discharge Elimination System
PCBs	Polychlorinated Biphenyls
TMDL	Total Maximum Daily Load

1 Introduction and Overview

1.1 Regulatory Mandate

Unincorporated Contra Costa County, hereafter "County," is one of 76 local government entities, or permittees, subject to the requirements of the San Francisco Bay Regional Water Quality Control Board (RWQCB) Municipal Regional Stormwater Permit (MRP), which was last reissued in November 2015[1]. The MRP mandates implementation of a comprehensive program of stormwater control measures and actions designed to limit contributions of urban runoff pollutants to San Francisco Bay.

MRP Provision C.3.j.i. requires the County to prepare and implement a Green Infrastructure Plan, to be submitted with its Annual Report to the RWQCB that is due September 30, 2019.

Green Infrastructure (GI) refers to constructing and retrofitting storm drainage systems to mimic natural processes by enabling stormwater to infiltrate the soil rather than to runoff into storm drains and pipes. This relatively new approach is being used to reduce runoff volumes, disperse runoff to vegetated areas, harvest and use runoff where feasible, promote infiltration and evapotranspiration, and use bioretention and other natural systems to detain and treat runoff before it reaches tributary creeks and, ultimately, San Francisco Bay. GI facilities include but are not limited to pervious pavement, infiltration basins, bioretention facilities, green roofs, and rainwater harvesting systems. GI can be incorporated into construction of new and redeveloped parcels, roads, and other infrastructure within the public right-of-way (ROW).

1.2 Background on Mercury and PCBs in San Francisco Bay

Water quality in San Francisco Bay (Bay) is impaired by mercury and polychlorinated biphenyls (PCBs), along with other pollutants. Sources of these pollutants include urban stormwater. By reducing and treating stormwater flows, GI reduces the quantity of these pollutants entering the Bay and will serve to hasten its recovery.

MRP Provisions C.11 and C.12 require Contra Costa County Permittees to regionally reduce estimated PCBs loading by 23 grams/year and estimated mercury loading by 9 grams/year, using GI, by June 30, 2020. Each County Permittee must also project the load reductions achieved via GI by 2020, 2030, and 2040, showing that collectively across the MRP region, reductions will amount to 3 kg/year PCBs and 10 kg/year mercury by 2040.

The MRP pollutant-load reduction requirements are driven by Total Maximum Daily Load (TMDL) requirements adopted by the RWQCB for mercury (Resolution No. R2-2004-0082 and R2-2005-0060) and PCBs (Resolution No. R2-2008-0012). Each TMDL allocates allowable annual loads (waste load allocation, hereafter "WLA") to the Bay from identified sources, including from urban stormwater.

The mercury TMDL addresses two water quality objectives. The first, established to protect people who consume Bay fish, applies to fish large enough to be consumed by humans. The objective is 0.2 milligrams

[1] Order R2-2015-0049

(mg) of mercury per kilogram (kg) of fish tissue (average wet weight concentration measured in the muscle tissue of fish large enough to be consumed by humans). The second objective, established to protect aquatic organisms and wildlife, applies to small fish (3-5 centimeters in length) commonly consumed by the California least tern, an endangered species. This objective is 0.03 mg mercury per kg fish (average wet weight concentration). To achieve the human health and wildlife fish tissue and bird egg monitoring targets and to attain water quality standards, the Bay-wide suspended sediment mercury concentration target is 0.2 mg mercury per kg dry sediment.

A roughly 50% decrease in sediment, fish tissue, and bird egg mercury concentrations is necessary for the Bay to meet water quality standards. Reductions in sediment mercury concentrations are assumed to result in a proportional reduction in the total amount of mercury in the system, which will result in the achievement of target fish tissue and bird egg concentrations.

The PCBs TMDL was developed based on a fish tissue target of 10 nanograms (ng) of PCBs per gram (g) of fish tissue. This target is based on a cancer risk of one case per an exposed population of 100,000 for the 95th percentile San Francisco Bay Area sport and subsistence fisher consumer (32 g fish per day). A food web model was developed by San Francisco Estuary Institute (SFEI) to identify the sediment target concentration that would yield the fish tissue target; this sediment target was found to be 1 microgram (µg) of PCBs per kg of sediment.

Twenty percent of the estimated allowable PCB external load was allocated to urban stormwater runoff. The Bay Area-wide WLA for PCBs for urban stormwater is 2 kg/yr by 2030. This value was developed based on applying the required sediment concentration (1 µg/kg) to the estimated annual sediment load discharged from local tributaries.

1.3 Objectives and Vision

This GI Plan is intended to facilitate efforts to transition from traditional gray to green infrastructure-centric approaches. The MRP sets forth three broad goals for these plans:

1. Ensure each Permittee has established the necessary procedures and practices to require and implement green infrastructure practices in public and private projects as part of its regular course of business.
2. Serve as a reporting guide and implementation tool to provide reasonable assurance that urban runoff TMDL waste-load allocations will be met, including the projected regional goal of controlling 3 kg/year of PCBs via green infrastructure by 2040.
3. Set targets for GI implementation and identify future actions needed to address the adverse water quality impacts of urbanization and urban runoff on receiving waters.

As required by Provisions C.3.a. through C.3.i. in the MRP, these “Low Impact Development” practices are already being implemented on private and public land development projects in the County. Specific methods and design criteria are spelled out in the Contra Costa Clean Water Program (CCCWP) *Stormwater C.3 Guidebook* (7th Edition, 2017), which the County has referenced in County Code Title 10, Division 1014 “Stormwater Management and Discharge Control”.

1.4 Plan Context and Elements

1.4.1 Planning Context

Municipal Geography

Contra Costa County comprises 805 square-miles, of which approximately 732 square-miles are land. The general dimensions of the County are approximately 40 miles from west-to-east and 20 miles north-to-south (General Plan, 2010). From a geographic standpoint, the County is bounded by (in a clockwise direction) the San Francisco Bay-Delta to the north, Delta islands to the east, municipal boundary with Alameda County to the south-southeast, East Bay Hills to the south-southwest, San Francisco Bay to the west.

Throughout the County, there are nineteen incorporated cities/towns and forty-five Special Districts. Unincorporated County areas are spread throughout the greater County, totaling approximately 491 square-miles and include thirteen Municipal Advisory Councils (MACs) that advise the Board of Supervisors.There are MAC's for each of the following communities: Alamo, Bay Point, Bethel Island, Byron, Diablo, Discovery Bay, El Sobrante, Kensington, Knightsen, North Richmond, Pacheco, Contra Costa Centre, and Rodeo. Though unincorporated County includes a variety of urban pockets, the majority the footprint is rural. Figure 1 depicts unincorporated County areas within the urban limit line as dark grey. [2]

[2] http://www.cccounty.us/DocumentCenter/View/30951/Urban-Limit-Line-Map?bidId=, accessed April 1, 2019.

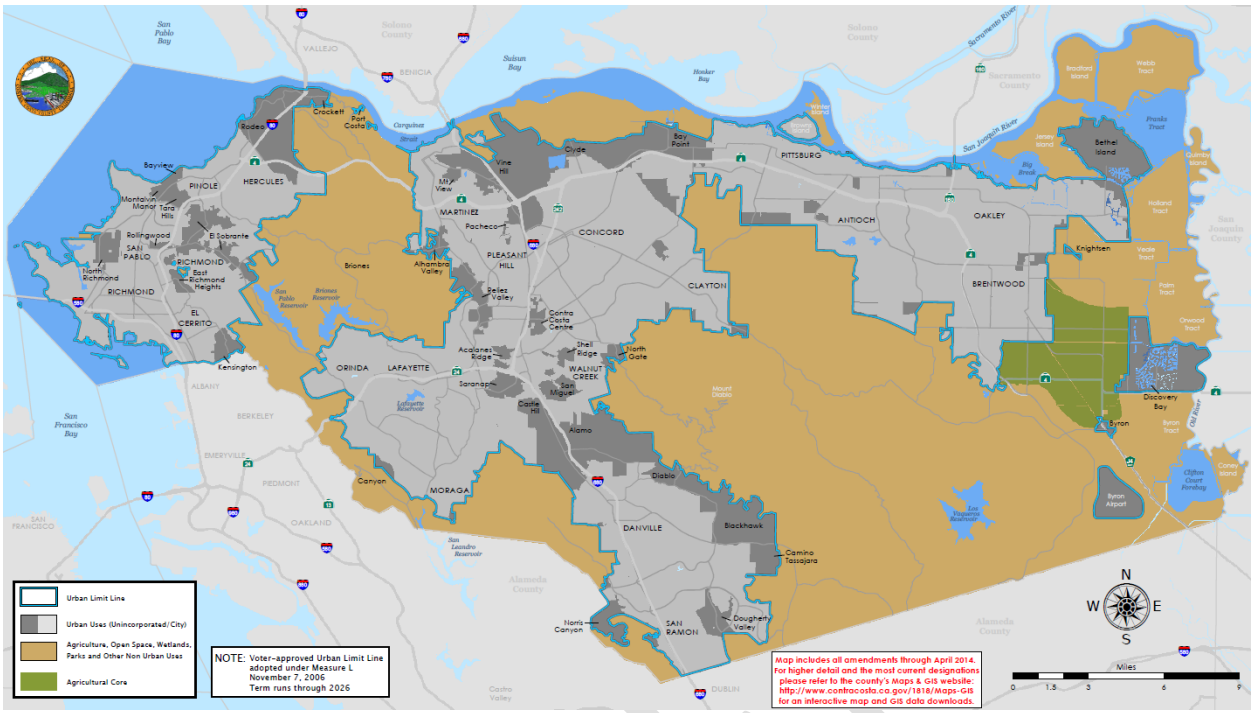


Figure 1. Depiction of Unincorporated Areas within Urban Limit Line (shown as dark grey).

Demographics

The County is comprised of a diverse social environment. The western and central portions of the County comprise urban and suburban environments, while the eastern portion of the unincorporated area is a primarily agricultural environment, resembling that of neighboring San Joaquin County. The County's population is 1,149,393 (2019), per the State of California Department of Finance's *Population Estimates for Cities, Counties, and the State*.[3] For Unincorporated County, the total population is estimated to be 172,513.[4]

From a community economic perspective, household incomes within Unincorporated County are generally higher in the areas along Interstate (I) 680, south of State Route (SR) 24, and lower along the Bay and Bay-Delta lines, as well as to the east.[5]

Development and Redevelopment Trends

Historically, many cities have chosen not to annex particular urban unincorporated pockets. One reason for this is that infrastructure improvements such as sanitary sewers, curbs, gutters, sidewalks, and street lights were not required at the time many of the unincorporated pockets were developed. As a result, cities have been hesitant to annex unincorporated pockets where major capital expenditures were required to bring them up to city standards. This sentiment has persisted, with this factor continuing to

[3] State of California, Department of Finance, E-1 Population Estimates for Cities, Counties and the State with Annual Percent Change — January 1, 2017 and 2018. Sacramento, California, May 2018.
[4] Ibid.
[5] http://ca-contracostacounty2.civicplus.com/5342/Demographics, accessed April 2, 2019.

discourage the annexation of already urbanized unincorporated pockets adjacent to cities, or in the case of North Richmond, surrounded by one, the City of Richmond.

Rural unincorporated areas of the County have remained either undeveloped or has developed at low densities. Public policy has also played a role in discouraging the annexation of the rural unincorporated areas, as most rural lands are located far from the boundaries of cities, often making the provision of urban services from cities impractical and economically unfeasible. In addition, the County's Urban Limit Line, a proposition passed by voters in 1988 ("Measure C"), has discouraged urbanization outside of municipal boundaries.

Concerning the growth of housing throughout the County, since 1984, the trend has been consistent at approximately three-quarters in incorporated cities and one-quarter in Unincorporated County.[6]

Commitment and Actions for Sustainability

The County has established a Sustainability Program, under the Department of Conservation and Development, with the mission to make "communities cleaner and healthier for families, children, and future generations." To help realize this mission, the program has six tenets: Livable Communities; Energy and Water; Planning for our Future; Waste Reduction; Leading by Example; Engage with the County. To further help manifest these efforts, the County has established both a Sustainability Commission and Committee.

Related to sustainability, the County also adopted a Municipal Climate Action Plan and a Countywide Climate Action Plan in 2008 and 2015, respectively. Both of these plans focus on greenhouse gas reduction countywide, including Unincorporated County.

CEQA

This GI Plan is statutorily exempted under Public Resources Code (Contra Costa County CEQA Guidelines and California Administrative Code Sec. 15262 et seq.) because it involves feasibility or planning studies for possible future actions that the Board of Supervisors has not approved or adopted and the County has considered environmental factors and found no potential for significant environmental impacts. Any future projects that are to be constructed as recommended by the Plan will conduct a review of potential environmental impacts as required by CEQA.

1.4.2 Watersheds and Storm Drainage Infrastructure

Watersheds and Watershed Characteristics

As described in the Contra Costa Watersheds Stormwater Resource Plan, hereafter "CCW SWRP", there are thirty-one (31) major watersheds and sub-watersheds throughout the County, which are linked by similar water quality stressors and regional water quality impairments due to urbanization.[7] The CCW SWRP organized the County into five watershed-based planning units: East, Central, North, South, and

[6] Contra Costa County General Plan: 2005-2020, January 18, 2005 (Reprint July 2010), http://www.co.contra-costa.ca.us/DocumentCenter/View/30912/Ch2-Planning-Framework?bidId=, accessed April 1, 2019.
[7] Contra Costa Watersheds Stormwater Resource Plan, August 2018.

West County. Unincorporated areas are located within each of the planning units. The specific watersheds throughout unincorporated areas, by planning unit, are as follows:

- North County Planning Unit: Alhambra Creek, Peyton Slough, Refugio Creek, Rodeo Creek, and various drainages to Carquinez Strait;
- South County Planning Unit: Upper Alameda Creek, Alamo Creek, Tassajara Creek, Upper San Leandro Creek, Moraga Creek, and Cayetano Creek;
- East County Planning Unit: East and West Antioch Creek, Marsh Creek (watershed includes Dry, Deer, and Sand Creeks), Kellogg Creek, Brushy Creek, and East County Delta Drainages;
- West County Planning Unit: Wildcat Creek, San Pablo Creek, Rheem Creek, Pinole Creek, Garrity Creek, Baxter Creek, Cerrito Creek, and West Richmond Creek; and
- Central County Planning Unit: Walnut Creek, San Ramon Creek, Tice Creek, Las Trampas Creek, Green Valley Creek, Pine Creek, Grayson Creek, Galindo Creek, Clayton Valley Drain, Mount Diablo Creek, Willow Creek, and Kirker Creek.

Figures 2 and 3 show the Watershed Planning Units and County jurisdictional boundaries, respectively. These figures illustrate the complexity of the County addressing GI plan implementation in the numerous watersheds shared with other jurisdictions.

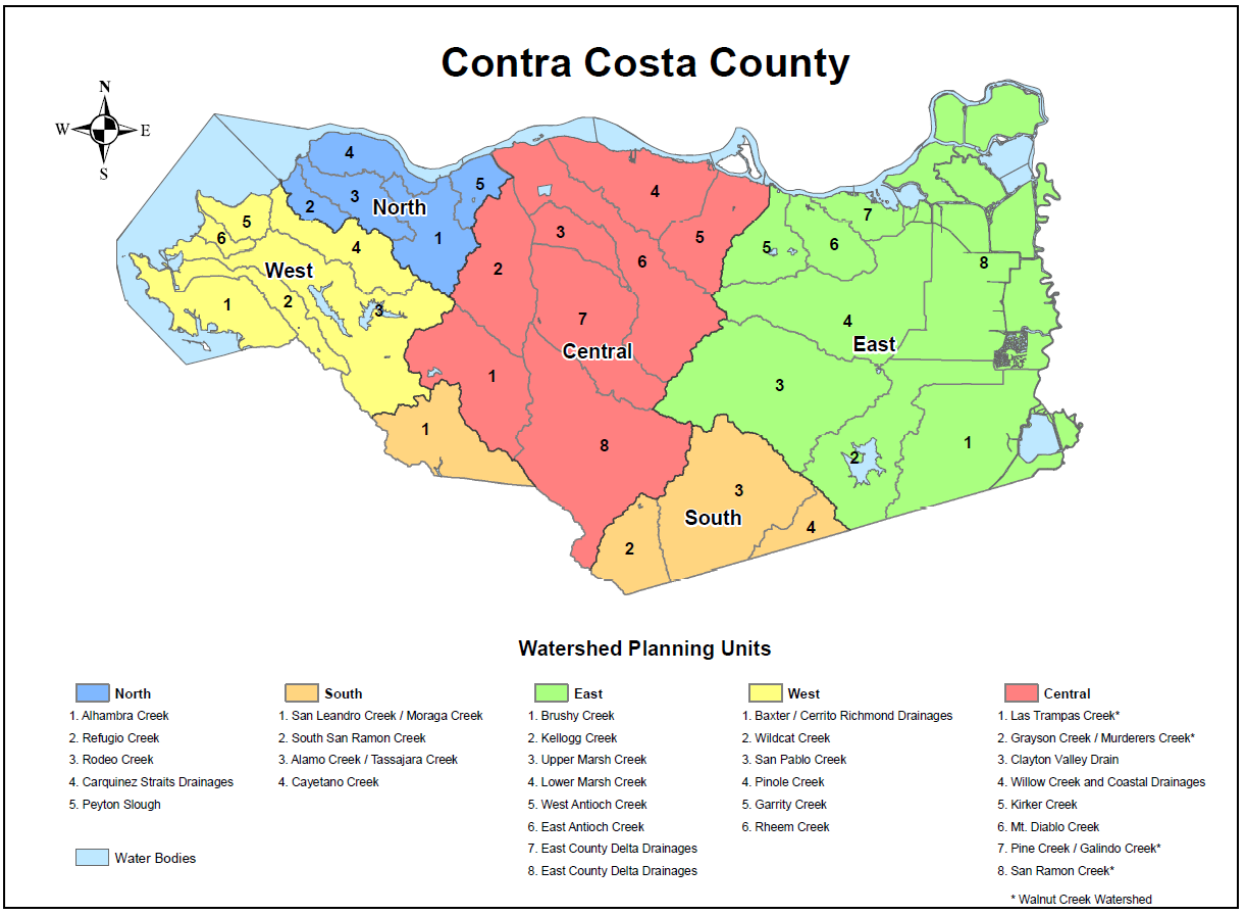


Figure 2. County Watershed Planning Units.

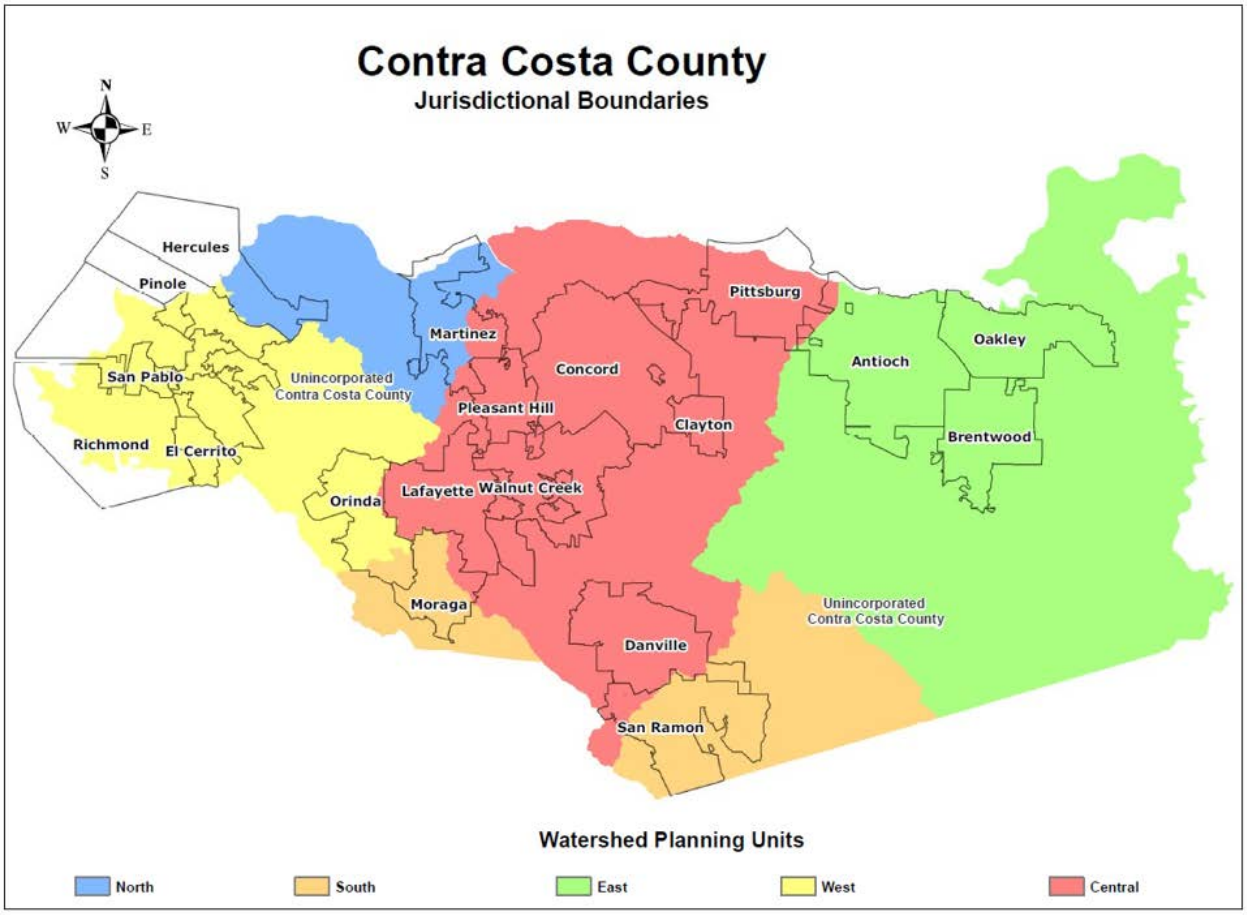


Figure 3. County Jurisdictional Boundaries by Watershed Planning Unit.

Major Drainages and Flood Control

Contra Costa County drainages include headwaters of creeks that drain through other counties before reaching the Bay. The Contra Costa County Watershed Atlas[8] (2003) provides data for all the major and minor watersheds in the county. The Atlas provides statistics for the watersheds including geophysical data, land use data, and some historical data.

Contra Costa County consists of 466,473 acres. The longest creek in the county (Marsh Creek) is 34.6 miles long. Table 1 below lists the major watersheds in order of watershed size and the estimated length of their respective longest creeks.

[8] https://www.cccleanwater.org/watersheds/watersheds-in-contra-costa-county

Table 1: Major Watersheds in Contra Costa County

Name	Area (acres)	Longest Branch of Creek (miles)
Walnut Creek (includes San Ramon, Pine, Grayson and Las Trampas Creeks)	93,556	28.74
Marsh Creek (includes Dry, Deer, and Sand Creeks)	60,066	34.57
San Pablo Creek	27,640	19.65
Mt. Diablo Creek	23,846	17.24
Alhambra Creek	10,735	7.99
Pinole Creek	9,705	10.95
Wildcat Creek	6,848	13.43

Mt Diablo dominates the landscape in Central County, being the headwaters of many of the largest watersheds. Mt Diablo is near the northern terminus of the Diablo Range which separates drainages of Central and East County. The Berkeley and Oakland Hills further define the upper watersheds of West and Central County. Watersheds in Contra Costa are steep at their headwaters and generally flow to flatter valleys or plains.

Volunteer interests are vital to fostering healthy watersheds. The numerous creek and related groups provide the challenge of coordinating multiple local groups, but demonstrate a high level of public interest in the natural and water quality values associated with the County's watersheds . Volunteer watershed groups tend to rally around specific creeks . The Contra Costa Watershed Forum , initiated in 1999, meets bi-monthly, and serves as a catalyst and clearinghouse for sharing information and providing unity and continuity among the varied watershed stewardship groups, as well as providing a medium for coordinating with agencies, including the County and its flood control district

Contra Costa County Flood Control and Water Conservation District (FC District) manages the funding for major flood risk reduction planning and flood control projects. The funding is watershed-based. Divided into Flood Control Zones based on these watershed boundaries, the FC District manages flood control facilities in each Zone using what property tax funding it receives. Due to historic circumstances surrounding Proposition 13 (see Chapter 7), some of these Zones have very low and even zero property tax revenue. The FC District struggles to fund basic maintenance of Corps of Engineer constructed facilities that the FC District is obligated to maintain. The FC District also receives a $1/10^{th}$ of the 1% Ad valorem tax to provide District-wide operational and administrative funding. The FC District is a partner in many ways to the County and is supportive of the GI planning efforts of the County. However, it should be clearly understood that the FC District funds are separate from the County general drainage funds and road funds.

Major Watersheds with Facilities in Unincorporated County

The County Public Works Department maintains 150 miles of streams, channels, and other drainage facilities in unincorporated areas of the County. The FC District also manages and maintains large drainage infrastructure both in unincorporated areas and in most of the 19 cities in the County. As the focus of this GI plan is on unincorporated areas, the facility discussion below is exclusive to those drainage facilities.

In the community of North Richmond, three channelized streams are present: Wildcat Creek, San Pablo Creek, and Rheem Creek. All were 'improved' by the US Army Corps of Engineers to reduce flood risk for the surrounding community. Wildcat and San Pablo Creeks are of a newer, more environmentally sensitive design. Rheem Creek has a typical trapezoidal rock lined channel which has limited riparian vegetation.

Garrity Creek has a minor flood control facility that receives stormwater from the unincorporated community of Montalvin Manor.

Rodeo Creek is the major stream that serves the unincorporated community of Rodeo and has its headwaters in the John Muir Land Trust-owned Fernandez Ranch Open Space. These upper reaches have significant instability, and this produces a heavy sediment and debris load in the creek. The Corps of Engineers improved the reach of the creek in the urban area of Rodeo in the 1960s and the lowest portion (near where it drains into San Pablo Bay) is a rectangular concrete channel.

Along the "north" Watershed Planning Unit (see Figure 2 above), there are a number of smaller drainages that serve the communities of Crockett and Port Costa.

The Walnut Creek Watershed is the main feature of the Central Watershed Planning Unit (Figure 2), and drains many unincorporated communities such as Saranap, Alamo, Blackhawk, and Diablo. Walnut Creek is the largest watershed in the County and consists of a number of important tributaries such as Tice, San Ramon, Las Trampas, Pine, and Pacheco.

The unincorporated community of Clyde drains to Mt. Diablo Creek, which passes nearby before entering Suisun Bay.

Further east, the unincorporated community of Bay Point is served by a number of smaller drainages that discharge into or through the marshlands along the edge of Suisun Bay.

In the eastern portion of the County, the communities of Knightsen and Byron are in an area of poor drainage, and much of their stormwater needs to be pumped over levees to reach the delta. Other areas, including the community of Discovery Bay, rely on Brushy and Kellogg Creeks to handle their stormwater requirements.

Finally, the portion of Marsh Creek at, and upstream of, the Marsh Creek Reservoir, serves the unincorporated lands in this watershed. Marsh Creek is the second largest watershed in the County, and is also notable for mercury contamination due to legacy mining activities in the upper watershed on the sides of Mt. Diablo.

Storm Sewer System, Challenges, and Opportunities

Similar to other facets of infrastructure, the age and state of repair of the storm drain system pose a challenge to the County. As indicated in Section 1.4.1 above, infrastructure in urban and rural unincorporated areas have had a lack of investment. Not only is there a need to rehabilitate or replace existing infrastructure, but there is only a need to maintain existing features.

The County maintains maps that depict the road, countywide, and Flood Control District drainage systems. Much of this data has been transferred into geographic information system (GIS) format and the County is in the planning phases of collecting and correcting the GIS drainage inventory data for use in developing an asset management program for maintenance, planning, and administrative purposes. This GIS database also serves as a valuable resourcefor investigating potential locations of GI implementation.

Recent and Planned Drainage Improvements

There are a number of planned and/or current drainage improvement projects in the incorporated county, including the following:

- Wildcat and San Pablo Creeks Levee Remediation Project
- Marsh Creek Reservoir Capacity and Habitat Restoration
- Sustainable Capacity Improvement at Rodeo Creek

Funding for Maintenance and for Capital Improvements

The County has varying sources for drainage related capital improvements and maintenance of those drainage facilities. Through the FC District, a portion of property tax with the boundaries of some Flood Control Zones for design, construction, and maintenance of regional storm drainage facilities within the Zone. Development projects within some Drainage Areas are charged impact fees that fund construction of planned drainage facilities required to mitigate the increased runoff from development. The FC District has also established special assessments in some Drainage Areas to fund ongoing maintenance.

Proposition 13 has hindered the ability of public agencies to raise requisite funds for infrastructure projects and maintenance. A ballot initiative was attempted in late-2015 to amend the state Constitution in order to create an optional method for local agencies to raise funds for stormwater and major drainage projects. After polling in early-2016, it was determined that there was not sufficient public support to move forward with the initiative. Potential strategies to secure future GI funding are presented in Section 7 of this GI Plan.

1.4.3 Related Regional and Countywide Plans and Planning Documents

This GI Plan has been coordinated with the following regional stormwater documents:

- The CCW SWRP. The CCW SWRP was funded by State Water Resources Control Board under a Proposition 1 Grant, with matching contributions provided by Contra Costa municipalities individually and collectively through the CCCWP. The CCW SWRP identifies and prioritizes potential multi-benefit stormwater management projects, including green infrastructure projects, in watersheds and jurisdictions throughout Contra Costa County. Projects identified

within the CCW SWRP are eligible to apply for future state funding. Many of the projects included in this GI Plan were drawn from the CCW SWRP project opportunity lists.

- The Contra Costa Countywide Reasonable Assurance Analysis (RAA). The RAA for Green Infrastructure is being prepared by Contra Costa municipalities collectively through the CCCWP and is consistent with guidance prepared by the Bay Area Stormwater Management Agencies Association (BASMAA). The RAA for Green Infrastructure uses a water quality model coupled with continuous simulation hydrologic output to estimate baseline loadings of pollutants and the reductions that might be achieved through green infrastructure implementation in 2020, 2030, and 2040 under various scenarios, which include implementation of potential project locations identified in this Plan. RAA findings will be within the TMDL Implementation Plan, as part of the 2020 Annual Report submitted to the San Francisco Bay RWQCB.

1.4.4 Related Local Planning Documents

Green infrastructure can be integrated into a wide diversity of public and private projects. Public projects can incorporate green infrastructure in streets, parks, schools, and other civic properties. In order to ensure that green infrastructure is considered and supported in the range of planning and design processes for these projects, the County will be reviewing and updating the planning documents listed in Table 2 to appropriately incorporate green infrastructure requirements as these plans are updated.

Table 2. County Planning Documents to Align with GI Plan

Document	Responsible Department	Summary of Updates	Next Projected Update
General Plan	Department of Conservation and Development	GI Plan to be integrated into the Public Facilities/ Services Element	2020
Climate Action Plan	Department of Conservation and Development	Entire document to be updated to reflect the GI plan	2020
Complete Streets	Department of Conservation and Development	The County's Complete Streets Policy allows for the inclusion of some GI features, but it's advisable to incorporate GI explicitly into it so that, when feasible, "Complete streets" can be designed/function as "Sustainable Streets"	2020

In 2019 and 2020, the County will be updating its Climate Action Plan (CAP). The CAP identifies greenhouse gas emissions, both countywide and for County operations, and names strategies the County will take to reduce those emissions. In the 2015 CAP, actions were grouped into six categories: energy efficiency, renewable energy, land use and transportation, solid waste, water, and county operations. Green

infrastructure falls into the land use and transportation categories. At the time of this writing, we anticipate the same categories will be used in the 2020 CAP Update.

In 2019, the County will update the emissions profile and identify emissions reductions targets and measures to reach those targets. The County's Sustainability Commission is advising staff in this work. In 2020, the work will shift to the hearing and adoption process. The CAP is being developed and adopted in conjunction.

Complete Streets improves mobility, safety, public health, and environmental sustainability. Where feasible and in context with local conditions, Complete Streets allows for green infrastructure elements, such as street trees and landscaping and planting strips. The County adopted a Complete Streets Policy in 2016 to ensure its commitment to maintaining and building streets that provide safe, comfortable, and convenient travel for all users, including pedestrians, bicyclists, seniors, people with disabilities, children, and users and operators of public transportation. The Complete Street Policy helps the County meet local and state-level safety and sustainability goals and policies. The Complete Streets Policy will be subsumed into the Transportation & Circulation Element in the 2020 County General Plan Update.

1.4.5 Outreach and Education

Outreach and education of County stakeholders has occurred in a limited way through the Contra Costa Watershed Forum presentations in January and March 2019. In addition, the Watershed Program will engage with stakeholders in the coming months through presentations to and feedback from the Municipal Advisory Committees (MACs), which function as guidance bodies for the County Board of Supervisors.

1.4.6 Policies, Ordinances, and Legal Mechanisms

The following policies, ordinances, and legal mechanisms are in place relating to the implementation of goals put forth in this GI Plan:

The County uses its planning, zoning, and building authorities to require proposed new development and redevelopment projects to incorporate LID features and facilities in accordance with the Provision C.3, and the current edition of the Contra Costa Clean Water Program's *Stormwater C.3 Guidebook* (7th Edition, June 2017).

For streetscape improvements and "complete streets" projects, the National Association of City Transportation Officials (NACTO) *Urban Street Stormwater Guide*, the San Mateo County *Sustainable Green Streets and Parking Lots Design Guidebook*, and other resources available on the CCCWP website, may be consulted.

LID features and facilities will be designed and constructed in accordance with the applicable specifications and criteria in the *Stormwater C.3 Guidebook.* Additional details and specifications, as may be needed for design of street retrofit projects, may be adapted from the *San Francisco Public Utilities Commission Stormwater Requirements and Design Guidelines Appendix B* (Green Infrastructure Details),

the *Central Coast Low Impact Development Institute Bioretention Standard Details and Specifications*, or other resources compiled by the CCCWP and available through their website.

Participation in a countywide interagency process, convened by the CCCWP, will facilitate excellence and consistency in the design and construction of Green Infrastructure features and facilities. The County will:

- Share with other Contra Costa municipalities, through the CCCWP, conceptual, preliminary, and final plans and specifications developed for Green Infrastructure projects;
- Identify significant GI projects and issues encountered during design and construction of those projects and bring those projects and issues forth in online forums and in-person interagency workshops and meetings;
- Participate in evaluation and recommendation of design details and specifications for GI, where doing so furthers the purposes of countywide consistency and cost-efficiency, and quality of the built facilities;
- Participate, as a reviewer, in the drafting and updating of a "GI Design Guide," the purpose of which will be to assist CIP staff in Contra Costa municipalities through the steps of project identification, evaluation, design, and construction.

2 Green Infrastructure Targets

MRP Provision C.3.j.i.(2)(c) requires that the Green Infrastructure Plan include "targets for the amount of impervious surface, from public and private projects, within the Permittee's jurisdiction to be retrofitted over the following time schedules… (i) By 2020, (ii) By 2030; and (iii) By 2040." This section describes the process used to develop projections for the impervious surface area to be retrofitted and treated with GI from private and public projects within County jurisdiction and presents the results.

2.1 Private Development Projections

Table 3 presents an estimate of the impervious area to be treated by GI via private development projects for 2020, 2030, and 2040. The impervious area treated by private development presented in Table 3 includes actual projects constructed through 2018 and projected private development project area for 2019/2020, 2021 through 2030, and 2031 through 2040.

To forecast future private development area, the County participated in a process coordinated through the CCCWP that used the output of UrbanSim, a model developed by the Urban Analytics Lab at the University of California under contract to the Bay Area Metropolitan Transportation Commission (MTC). The UrbanSim modeling system was developed to support the need for analyzing the potential effects of land use policies and infrastructure investments on the development and character of cities and regions. The Bay Area's application of UrbanSim was developed specifically to support the development of Plan Bay Area, the Bay Area's Sustainable Communities planning effort.

MTC forecasts growth in households and jobs and uses the UrbanSim model to identify development and redevelopment sites to satisfy future demand. Model inputs include parcel-specific zoning and real estate data; model outputs show increases in households or jobs attributable to specific parcels. The methods and results of the Bay Area UrbanSim model have been approved by both MTC and ABAG Committees for use in transportation projections and the regional Plan Bay Area development process.

The CCCWP process used outputs from the Bay Area UrbanSim model to map parcels predicted to undergo development or redevelopment in each Contra Costa jurisdiction at each time increment specified in the MRP (2020, 2030, and 2040).[9] The resulting maps were reviewed by County staff for consistency with local knowledge, and local planning and economic development initiatives and revised as needed.

It is assumed that multifamily residential and commercial/industrial new development and redevelopment projects will incorporate stormwater treatment facilities, in accordance with MRP Provisions C.3.b., C.3.c., and C.3.d. It is also expected that more than 50% of the existing impervious area

[9] The UrbanSim model effectively translates Bay Area-wide growth assumptions (reflecting new development and redevelopment) into specific projects by acting as a "rational" developer looking to maximize the difference between pre- and post-redevelopment property values based on a series of algorithms relying on resources such as property value estimates produced by online resources such as Zillow or Redfin. Thus, the actual parcels projected to be redeveloped are approximate, but the MTC UrbanSim model outputs provided the Contra Costa Permittees with a common, defensible basis for projecting impervious area to be treated with LID due to private new development and redevelopment projects in the future.

in each parcel will be replaced if a parcel is redeveloped, and therefore the entire parcel will be subject to Provision C.3 requirements (that is, will be retrofit with GI), consistent with the "50% rule" requirements of MRP Provision C.3.b.

Existing impervious surface for each affected parcel was estimated using the 2011 National Land Cover Database. Estimates were spot-checked and revised based on local knowledge and available satellite imagery. The amounts of existing impervious surface retrofitted or forecasted to be retrofit with GI via private development shown in Table 3 were developed using these assumptions.

Table 3: Estimate of Impervious Surface Treated or Retrofit via Private Development

Year	Total Impervious Area (Acres)[1]	Comments
2003 - 2020	11	Includes private development projects constructed from 2003 – 2019 from the AGOL database[2] and UrbanSim projections for 2019 - 2020.
2021 - 2030	49	Predicted by UrbanSim
2031 - 2040	69	
2003 – 2040	129	Total Impervious Area Retrofit via Private Development

1. Total impervious area reported to nearest whole acre.
2. Refers to City's GI tracking system, see Section 5.

2.2 Public GI Implemented and Future Targets

Table 4, below, presents an estimate of the impervious area to be retrofit via public GI projects for 2020, 2030, and 2040. For the period 2021 - 2040, Unincorporated County's GI project implementation goal is to plan and then construct on average, one retrofit project per year, provided that funds are procured (see Chapter 7). This strategy does not specify which potential project locations might be implemented by a certain date. Potential project locations have been identified through a prioritization analysis described in Section 3.1; the list of potential project locations is included as Appendix A. Though the County's goal is to implement one project per year, the list includes thirty potential project locations in order to provide flexibility in project selection. Given the unknown of which locations may move forward to be actual projects within the specified timeframes, the impervious surface area per project was normalized. That is, the total impervious surface area for the thirty potential GI project locations that are shown in Appendix A is 42 acres, with an average of 1.4 acres per project). As a result, if one project is programmed per year, then 1.4 acres of impervious surface would be retrofit per year on average and a total of approximately 28 acres of impervious area would be retrofit from 2021 to 2040. Approximately 15 acres of public GI retrofit will have been constructed from 2003 to 2020, for a total of 43 acres by 2040. Table 4 below presents the impervious area retrofit targets for public projects for 2020, 2030, and 2040.

Table 4: Estimate of Impervious Surface Retrofit via Public Project

Year	Total Impervious Area (Acres)[1]
2003 - 2020	15[2]
2021 - 2030	14
2031 - 2040	14

1. Total impervious area reported to nearest whole acre.
2. Total impervious area retrofit through existing public GI projects.

2.3 Projected Load Reductions

MRP Provisions C.11 and C.12 require the Contra Costa Permittees within San Francisco Bay RWQCB jurisdiction to collectively reduce estimated PCBs loading by 23 g/year and estimated mercury loading by 9 g/year using GI by June 30, 2020. Regionally, MRP Permittees must project the load reductions achieved via GI by 2020, 2030, and 2040 as part of the TMDL Implementation Plans due in 2020, showing that collectively, reductions will amount to 3 kg/year of PCBs and 10 kg/year of total mercury by 2040. A "Countywide Attainment Scenario Report" will be completed in 2020, which will provides a preliminary projection for load reductions achieved via GI by 2020, 2030, and 2040 at the Countywide level using the RAA model. The GI projects and project opportunities included in this Plan will be accounted for in the Countywide Attainment Scenario Report.

As part of the RAA process, the estimates of projected private development (described in Section 2.1) and the general and specific locations of public GI projects (summarized in Section 2.2 and detailed in Chapter 3) will be incorporated into a final water quality model and projected pollutant load reductions will be developed for 2020, 2030, and 2040. Details of methods, inputs, and model outputs will be included in the TMDL Implementation Plan and RAA Technical Report, which will be submitted to the RWQCB with the 2020 Annual Report.

3 Public Project Identification, Prioritization, and Mapping

3.1 Tools for Public Project Identification and Prioritization

Publicly-owned parcels and ROWs that could potentially be retrofit to include multi-benefit stormwater capture facilities were identified in the CCW SWRP. These potential project locations were used as the basis for identifying future public retrofit opportunities within the County for this GI Plan. A summary of the project identification and prioritization process conducted for the CCW SWRP is described below; additional details may be found in the CCW SWRP.

3.1.1 SWRP Project Opportunity Identification

The CCW SWRP identified public retrofit opportunities through a request for planned projects, sent to the Contra Costa County Permittees, along with a geographic information system (GIS)-based project opportunity analysis, conducted using data received from the Permittees through a data request. Information related to the identification of potential project locations was received from 25 jurisdictions, government agencies, non-governmental organizations, and watershed groups.

The desktop GIS analysis entailed screening for publicly-owned parcels and ROW without physical feasibility constraints that would preclude implementation of a stormwater capture measure. The project opportunity analysis consisted of the following steps:

1. Identify publicly-owned parcels through parcel ownership and/or tax-exempt status.
2. Screen identified publicly-owned parcels to identify those at least 0.1 acres in size; and with average slopes less than 10%.
3. Identify ROW using the county-wide roadway data layer. Roadways considered were state and county highways and connecting roads, as well as local, neighborhood, and rural roads.
4. Identify land uses associated with identified parcels and surrounding identified ROW with a combination of ABAG land use categories and use codes provided by the Contra Costa County Assessor.
5. Screen all identified locations for physical feasibility. The following screening relating to physical constraints was applied to identified sites (to the extent that the necessary data had been provided or obtained):
    a. Regional facilities were not considered for parcels that were greater than 500 feet from a storm drain, due to limited feasibility in treating runoff from a larger drainage area;
    b. Parcel-based facilities were not considered for sites that were more than 50% undeveloped land uses, due to the limited potential for pollutant of concern load reduction;
    c. Parcels with significant drainage area outside of urbanized areas were removed, as these sites would not provide opportunity for significant pollutant of concern load reduction;

d. Sites more than 50% within environmentally sensitive areas (ESAs) (designated wetlands, biologically sensitive areas) were removed so as not to disturb these habitats;

e. Sites with more than 50% overlying landslide hazard zones were removed to avoid the potential for increasing landslide risk.

The remaining identified public parcels and ROW were considered preliminarily feasible for implementation of stormwater capture measures and were analyzed using a metrics-based multi-benefit analysis. The results of the metrics-based multi-benefit analysis provided some information helpful for consideration of GI priorities within Unincorporated County. A summary of the project opportunity classification and scoring conducted for the SWRP is provided in the following section.

3.1.2 SWRP Project Opportunity Metrics-Based Multi-Benefit Analysis

To conduct the project opportunity metrics-based multi-benefit analysis required as part of the SWRP, additional data was analyzed, and classifications were made regarding the project opportunities. First, project opportunities were classified using the following information:

1. Stormwater capture project type;
2. Infiltration feasibility;
3. Facility type;
4. Drainage area information.

Details regarding each of these classifications are provided below.

Stormwater Capture Project Type

All physically feasible project opportunities that did not include a previously defined non-GI stormwater capture facility (e.g. stream restoration projects provided by Stakeholders as part of the SWRP project request), were assumed to be feasible for GI implementation as part of the SWRP project opportunity classification. The projects identified through the GIS opportunity analysis and stakeholder stormwater capture projects process were categorized as parcel-based, regional, or ROW/green street projects; see Table 5 below.

Table 5: Green Infrastructure Project Types and Categorization Criteria

GI Project Type	Definition	Description
ROW/green street projects	Treating the road and portions of adjacent parcels	• All street-based projects.
Regional Projects	Treating a large area draining to the parcel	• The parcel contains at least 0.5 acre of undeveloped or pervious area (as identified through the land use class); and • The drainage area is larger than the parcel itself and the location is sufficiently close to a storm drain (i.e., within 500 feet, where storm drain pipe data is available).
Parcel-based projects	Treating the drainage area only on the identified parcel	• All other parcel locations.

Infiltration Feasibility

All SWRP project opportunity locations were categorized as feasible, infeasible, or partially feasible for infiltration, based on underlying hydrologic soil group, depth to groundwater (as data available), nearby soil or groundwater contamination, and presence of underlying geotechnical hazards; see Table 6 below.

Table 6: SWRP Project Opportunity Infiltration Feasibility Categorization Criteria

Infiltration Feasibility Category	Description
Hazardous/infeasible for infiltration	Projects that are located: • More than 50% overlying liquefaction hazards; • Within 100 feet of a site with soil or groundwater contamination (e.g., based on proximity to active GeoTracker[1] or EnviroStor[2] sites).
Infiltration safe but only partially feasible	None of the above constraints exist, but the soil underlying the facility is relatively poorly draining (identified as hydrologic soil group [HSG] C or D).
Infiltration feasible	The site has none of the infiltration hazards present and the soil underlying the facility is relatively well draining (identified as HSG A or B).

[1] GeoTracker is a California State Water Resources Control Board website which tracks sites with the potential to impact water quality in California, including contaminated sites (https://geotracker.waterboards.ca.gov/).

[2] EnviroStor is the Department of Toxic Substances Control's data management system for tracking cleanup, permitting, enforcement and investigation efforts at hazardous waste facilities and sites with known contamination or sites where there may be reasons to investigate further (https://www.envirostor.dtsc.ca.gov/public/).

For the purpose of SWRP project opportunity multi-benefit scoring, locations feasible for infiltration were assumed to retain the full water quality volume. At locations that are partially feasible for infiltration, it was assumed that infiltration would be promoted in the facility, but the full water quality volume would not be infiltrated due to poor drainage. These areas were assumed to infiltrate to the extent possible using a raised underdrain. Locations that are hazardous for infiltration were assumed to implement non-infiltrating GI projects (i.e., lined bioretention) and were assumed to retain no volume.

SWRP Project Opportunity Facility Type

Each SWRP project opportunity location was assigned a facility type. For potential projects identified by the Permittees and/or stakeholders, a facility type was assigned based on the description or classification provided by the agency or project proponent. For project opportunities identified through GIS analysis, the facility type was assumed to be GI, with infiltration capability defined based on the infiltration feasibility screening. The resulting SWRP multi-benefit stormwater capture project types, considered for the GI Plan, included:

- Capture and Reuse
- Constructed Wetland
- Lined Bioretention
- Unlined Bioretention
- Unlined Swale
- Water Quality Basin

Flood control facilities and habitat restoration project opportunities were open for consideration by Unincorporated County, if feasible to include GI.

SWRP Project Opportunity Drainage Area

For each identified project opportunity, the drainage area was identified and characterized as follows:

1. All project opportunities with identified drainage areas were characterized as provided by project proponents.
2. For ROW opportunities for which the drainage area had not been characterized, the roadway and an assumed tributary width (i.e. 50 feet per side) that extends into the adjacent parcels was considered the drainage area.
3. For parcel-based project opportunities for which the drainage area had not been characterized, the entire parcel was assumed to make up the drainage area.
4. For regional project opportunities for which the drainage area had not been characterized, the drainage area characterization (i.e., slope and land use) was approximated.

The drainage areas defined as part of the SWRP were applied to the project opportunities associated with the geographic areas found potentially feasible for retrofit that the County identified through this GI Plan. As such, these drainage areas could change, if and when facilities are identified and located for capture of these geographic areas.

SWRP Project Opportunity Metrics-Based Multi-Benefit Analysis Scoring

Using the information compiled in the identified project opportunity database, each SWRP identified project received a score using a metrics-based multi benefit analysis. A description of each project criteria that was used to analyze and score projects is provided below:

- **Parcel area** (regional and parcel-based GI opportunities only) - This scoring component awarded more points for larger parcels.
- **Slope** – This scoring component awarded more points to flatter slopes and is related to ease of construction and implementation.
- **Infiltration feasibility** – More points were awarded to projects that overlie infiltrating soils.
- **PCBs/mercury yield classification in project drainage area** – This scoring component is related to the influent TMDL pollutant loads; higher potential load reduction achieved higher points.
- **Removes pollutant loads from stormwater** – Points were awarded to facilities designed as GI or treatment control facilities for this scoring component.
- **Augments water supply** – Increasing points were awarded based on potential water supply provided for this scoring component.
- **Provides flood control benefits** – Flood control facilities received points specific to providing flood control benefits for this scoring component.
- **Re-establishes natural water drainage systems** or develops, restores, or enhances habitat and open space – Hydromodification control, stream restoration, and habitat restoration projects received points specific to providing these environmental benefits, for this scoring component.
- **Provides community enhancement and engagement** – Projects that specifically provide public use areas or public education components with potential opportunities for community engagement and involvement were given points specific to providing community benefits, for this scoring component.

All classified and scored projects were compiled into a master database as part of the CCW SWRP and organized by Permittee. The CCW SWRP-identified project opportunities located within County jurisdiction were provided for review. The project classification information and SWRP score were provided for informational purposes.

3.1.3 Additional Criteria Used by Municipal Staff

This section presents the methodology used by the County to identify potential public project locations included in this GI Plan. From the CCW SWRP analysis described in section 3.1, approximately 3,800 potential project locations were identified throughout the County. The County screened this list to eliminate infeasible and low priority potential project locations. The initial screening excluded the following from the CCW SWRP locations:

- Those located in new urban/open space land uses;
- Old urban ROW locations that were not prioritized; and
- Low priority locations.

The initial screening resulted in a list of 856 potential public project locations for further consideration. These 856 locations were then categorized using the following criteria:

- Adjacent to PCBs source property;
- Old industrial;
- Old urban;
- County-identified opportunities; and
- Outside the Urban Limit Line.

After further refinement, 206 potential public project locations were presented to the County GI Plan Technical Advisory Group (TAG) for vetting. The County GI Plan TAG consisted of personnel from several County departments notably : the Public Works Department and its divisions, i.e., Transportation Engineering, Capital Projects, Engineering Services, Design and Construction, and IT; the department of , Conservation and Development, and the Flood Control and Water Conservation district; and the Watershed Program. Members of the TAG reviewed early drafts of the GI plan to evaluate and vet potential GI project locations and to confirm the priority of identified locations that may remain as potentially feasible, based on their knowledge of the Unincorporated County areas and GI implementation goals and objectives. As a result of the TAG's review, 109 GI project locations were identified as potentially feasible.

3.2 Maps and Project Lists

This project location evaluation effort, combined with additional discussions among TAG members, desktop feasibility analyses, and visits to selected locations, resulted in the when winnowing down these 109 locations to the 30 locations included in the Final Draft GI Plan (see Appendix A). The geographic distribution of these 30 potential GI locations is shown in Figure 4, on the following page.

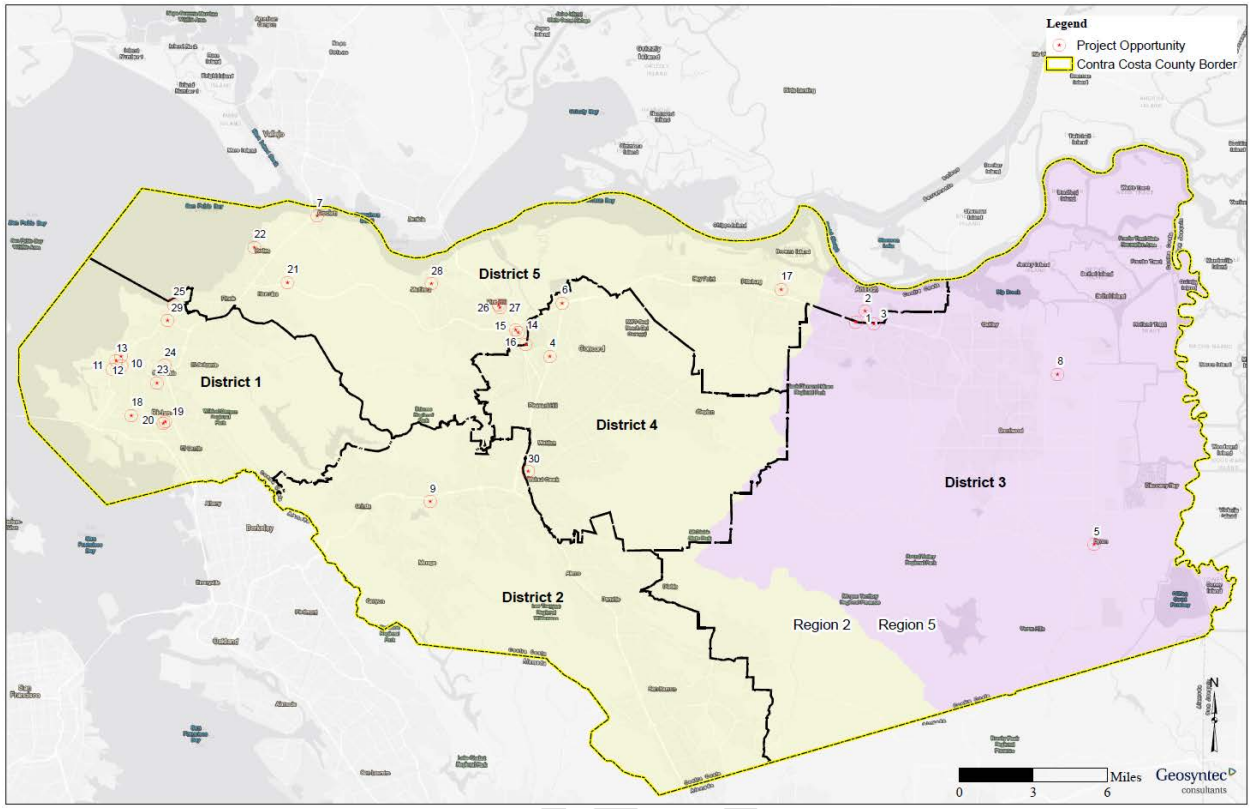


Figure 4. Geographic Distribution of the Potential GI Project Locations.

These potential project locations will be further assessed and subsequently eliminated or identified as public project opportunities as the County implements this GI Plan.

The County intends to design and implement, on average, one GI project per year between 2021 and 2040. While this level amounts to twenty total projects implemented by 2040, thirty have been identified as priority GI locations in order to allow the County substitute GI project locations for those that are deemed infeasible during the conceptual design phase. As this is a "living" plan, potential project locations may be added over time. The list and maps of the thirty potential project locations are provided in Appendix A.

4 Early Implementation Projects

4.1 Review of Capital Improvement Projects

MRP Provision C.3.j.ii. requires that Permittees prepare and maintain a list of public and private green infrastructure projects planned for implementation during the current permit term, and public projects that have potential for green infrastructure measures. The County submitted an initial list with the FY 15-16 Annual Report to the RWQCB and updated the list in the FY 16-17 and FY 17-18 Annual Reports. The creation and maintenance of this list was supported by guidance developed by BASMAA: "Guidance for Identifying Green Infrastructure Potential in Municipal Capital Improvement Projects" (CIP), May 6, 2016.

4.2 List of Projects Identified

The County Watershed Program staff have been in regular contact and coordination with the County's Transportation Engineering, Design/Construction, and Capital Projects (CP) Divisions of the Public Works Department to identify potential GI facilities for new or redeveloped County buildings and parking lots, in the effort to fulfill the expectation of the MRP's C.3.j provision of "no missed opportunities" with respect to GI for County projects that are regulated by C.3. As a result, staff from the County Watershed Program and CP Division have been cooperating in the determining C.3 responses to and/or the development of stormwater control plans for the following capital projects:

- County Administration Building, 651 Pine St., Martinez – additional GI facilities in addition to C.3 requirements
- Office of Emergency Services (OES) 50 Glacier Drive, Martinez – additional GI facilities in addition to C.3 requirements
- Contra Costa County Surface Parking Lot (651 Pine St., Martinez – Exploring additional GI facilities in addition to C.3 requirements
- Surplus Storage Yard Parking Lot (adjacent to OES) - Exploring additional GI facilities in addition to C.3 requirements
- Animal Services Facility Parking Lot and play area expansion - Exploring additional GI facilities in addition to C.3 requirements
- MDF parking deck, Willow Street, Martinez

One example of a public ROW project that has implemented GI is the Rio Vista Sidewalk Project, which was constructed in 2018 and incorporates permeable pavement.

In addition, a non-C.3 "complete streets "project in North Richmond, "Fred Jackson Way First Mile/Last Mile", has been adapted to include urban greening and potentially GI features.

CIP Projects with Green Infrastructure potential that were identified during 2015-2019 are listed in Table 7, along with their status.

Table 7: Capital Improvement Projects with Green Infrastructure Potential (identified 2015-2019)

Project Name	Description	Potential Tributary Impervious Area (SF)	Project Status
County Administration Building	Office building replacement and new parking structure.	36,086 SF	In progress – scheduled to complete April 2020
Office of Emergency Services	Replacement of two County buildings	110,704 SF	In progress – scheduled to complete Jan. 2020
Contra Costa County Surface Parking Lot	New Administration Parking Lot	61,458 SF	Complete
Animal Services Facility Parking Lot and Play Area Expansion	New 26 stall parking expansion and dog play area	13,555 SF	In planning
MDF Parking Deck	New Elevated Parking Deck located at Martinez Detention Facility	26,900 SF	In progress – scheduled to complete Oct. 2019
Fred Jackson Way "First Mile/Last Mile"	Construct sidewalk and bike lanes on Fred Jackson Way from Grove Avenue to Brookside Drive	84,000 SF = 1.9 acres	In Design – construction 2021
Rio Vista Sidewalk	Sidewalk improvements, including permeable pavement	*(County Input)*	Complete
Rodeo Downtown Sidewalk	Sidewalk improvements, including bioretention area	*(County Input)*	Complete

4.3 Workplan for Completion

Tasks and timeframes for constructing the projects identified in Section 4.2

Note: County to provide input to this section.

5 Tracking and Mapping Public and Private Projects Over Time

5.1 Tools and Process

The CCCWP has developed a county-wide GIS platform for maintaining, analyzing, displaying, and reporting relevant municipal stormwater program data and information related to MRP Provisions C.10 (trash load reduction activities) and C.11/C.12 (mercury and PCBs source property identification and abatement screening activities). This tool is also used to track and report on GI project implementation.

The CCCWP's stormwater GIS platform features web maps and applications created using ESRI's ArcGIS Online (AGOL) for Organizations environment, which accesses GIS data, custom web services and reports that are hosted within an Amazon cloud service running ESRI's ArcGIS Server technology.

The *C.3 Project Tracking and Load Reduction Accounting Tool* within the CCCWP AGOL system is used to track and report on GI project implementation. It is currently used to track and map existing private and public projects incorporating GI. In the future, it may also be used to map planned GI projects and will allow for ongoing review of opportunities for incorporating GI into existing and planned CIPs. The AGOL system can be used to develop maps that can be displayed on public websites and/ or distributed to the public. These maps can be developed to contain information regarding the GI project data input into the AGOL system.

The *C.3 Project Tracking and Load Reduction Accounting Tool* is intended to be used to allow for estimates of potential project load reduction for PCBs and mercury and presently supports the BASMAA Interim Accounting Methodology for certain load reduction activities. In the future, the tool is planned to be updated with the RAA methodology that is being developed for the County. That functionality is planned to be active by the end of the current Permit term (December 2020).

The County already actively engages with the AGOL tool and maintains up-to-date C.3 and public GI retrofit project data to add new projects and/or provide project status updates.

6 Design Guidelines and Specifications

6.1 Guidelines for Streetscape and Project Design

When determining design elements to be included in streetscape improvements and complete streets projects, it is recommended that project managers and designers consult the National Association of City Transportation Officials (NACTO) *Urban Street Stormwater Guide*, the San Mateo County *Sustainable Green Streets and Parking Lots Design Guidebook* (specifically Chapter 5: Key Design and Construction Details), and other streetscape resources available on the CCCWP website. Additionally, the BASMAA *Guidance for Identifying Green Infrastructure Potential in Municipal Capital Improvement Projects* (BASMAA, 2016) during CIP project review for GI potential, is a valuable resource. All of these references are provided in Appendix B.

6.2 Specifications and Typical Design Details

GI features and facilities will be designed and constructed in accordance with the applicable specifications and criteria in the *CCCWP Stormwater C.3 Guidebook*. Additional details and specifications, as may be needed for design of street retrofit projects, can be adapted from Appendix B ("Green Infrastructure Details") of the *San Francisco Public Utilities Commission Stormwater Requirements and Design Guidelines* (SFPUC, 2016), the *Central Coast Low Impact Development Institute Bioretention Standard Details and Specifications* (CASQA and LIDI, 2017), the BASMAA Urban Greening details (BASMAA, 2017), or other resources compiled by the CCCWP and available through their website. These references are provided in Appendix C.

6.3 Sizing Requirements

For public GI retrofit projects, regional and parcel-based projects should be sized, to the extent possible, to meet the "Volume Hydraulic Design Basis"[10] that is included in MRP Provision C.3.d.i.(1). For regional projects, as defined in Table 5, sizing will be conducted on a project-specific basis and may include consideration of treatment facilities, other pollutant priorities (e.g. trash), or other factors present in the watershed.

For public GI retrofit projects located in the ROW, it is recommended to follow the BASMAA-released *Guidance for Sizing Green Infrastructure Facilities in Street Projects* (BASMAA, 2018), pending any subsequent guidance released by the RWQCB.

These references are also included in Appendix D.

[10] From MRP Provision C.3.d.i.(1): Treatment systems whose primary mode of action depends on volume capacity shall be designed to treat runoff equal to:

(a) The maximum stormwater capture volume based historical rainfall records, essentially runoff from the 85th percentile 24-hour storm event; or

(b) The volume of annual runoff required to achieve greater-than or equal to 80 percent capture using local rainfall data; in accordance to Section 5 of CASQA's *Stormwater Best Practice Handbook, New Development and Redevelopment* (2003).

7 Funding Options

7.1 Funding Strategies Developed Regionally

Provision C.3.j.i(2)(k) of the MRP states that the green infrastructure (GI) plans are to include "an evaluation of prioritized project funding options, including, but not limited to: Alternative Compliance funds; grant monies, including transportation project grants from federal, State, and local agencies; existing Permittee resources; new tax or other levies; and other sources of funds." This Section provides an evaluation of funding sources to help facilitate implementation.

7.1.1 Funding Context

GI falls generally under the umbrella of stormwater management, but it also expands the meaning of stormwater management as municipalities have long conceived it, as GI can be associated with or be inclusive of urban greening," sustainable streets," and place-making features. Over the past century of urban expansion, stormwater management has meant collecting and conveying "nuisance" runoff to receiving waters. The revisions to the Clean Water Act in the late 1980s and the first NPDES permits in the following decade for municipal separate storm sewer systems (which are known as "**MS4s**"), have served to redefine stormwater management profoundly. Over the past three decades, the trend in MS4 permits has become clear: municipalities must change how they view their roles as stormwater managers; to regard their roles as stormwater stewards, by enabling stormwater to be infiltrated into the soil or captured for reuse and/or recycling. Where they had once focused strictly on traditional public infrastructure, MS4 permits now induce them to re-focus on other more "environmentally friendly" best management practices (public and private), such as integrated pest management, controlling commercial and industrial discharges, managing construction sites, and requiring permanent controls on new development (including low impact development and hydrograph modification (hydromodification) management), trash capture, and implementation of GI for existing developed areas (i.e., GI retrofit).

Just as more municipalities are realizing that stormwater management should be considered an enterprise or utility on par with water and sewer utilities, others are beginning to realize that stormwater management may have already outgrown its "utility" status. Stormwater management does not fit neatly into public works functions but has a range of purposes that must be integrated into municipal planning and land use responsibilities, as well. It is also pushing the limits of what a municipality is empowered to do regarding behavior and practices on private property. This is manifest in the range of documents that make up the GI Plans.

Funding for GI is no less vexing. Under the old "gray infrastructure" model, stormwater funding was used for management and upgrade/expansion of traditional public stormwater infrastructure (inlets, pipes, pump stations, creeks, channels, and levees). Under the new model of green infrastructure, GI serves to extend the benefits of stormwater management, though the funding framework for GI/low impact development (LID) is not well developed.

Traditional stormwater funding has always been a challenging field with many hurdles that are changing as rapidly as the regulations pertaining to stormwater quality. Dedicated and sustainable stormwater funding is usually found in the form of a property-related fee (similar to water and sewer fees). Proposition

218 requires these to be focused around services provided and each property's share of the cost of those services. GI expands the universe of infrastructure beyond the traditional drainage facilities to roads, landscaped areas, and other features not traditionally thought of as MS4 facilities. As a result, great care must be taken as traditional stormwater funding sources are applied to the GI goals.

Proposition 218 was a constitutional amendment approved by California voters in 1996 and was intended to make it more difficult for municipalities to raise taxes, assessments, and fees, (including property-related fees). As currently interpreted by the courts, Proposition 218 requires that stormwater fees must be approved through a ballot measure – a much higher threshold than for the sister utilities of water, sewer, and refuse collection, which must only conduct a public hearing. The result is that in the past two decades, only a handful of municipalities have been able to put any new stormwater revenue mechanisms in place. This has been detrimental to achieving the "One Water" goals that are so important in resolving water supply shortages and pollution, and other water resources challenges.

7.1.2 Regionally Developed Planning/Funding Resources

This Section builds on several foundational documents that offer general background information and guidance on formulating funding strategies for GI.

BASMAA – Roadmap for Funding Solutions for Sustainable Streets

BASMAA published the "Roadmap for Funding Solutions for Sustainable Streets" in April 2018. That report was "developed to identify and remedy obstacles to funding for Sustainable Street projects, which are defined as projects that include both Complete Street improvements and green stormwater infrastructure." The actions contained in the report "are designed to improve the capacity…to fund Sustainable Streets projects that support compliance with regional permit requirements to reduce pollutant loading…while also helping to achieve the region's greenhouse gas reduction targets." Those actions include maximizing available resources and as well as identifying new funding streams.

Although municipal ROW represents only a fraction of the acreage within its boundaries, roadways present some of the best opportunities for GI implementation. Roadways tend to be the first opportunity to grab concentrated, untreated storm flows and route them to (or become) GI facilities.

The BASMAA "Roadmap" provides excellent guidance on making the most of these benefits.

CASQA – Stormwater Funding Resource Website

The California Stormwater Quality Association ("CASQA") has developed a Stormwater Funding Resource webpage. Although it does not focus specifically on GI funding, much of its content is applicable to various aspects of GI funding. It can be found at the following url: https://www.casqa.org/resources/funding-resources. It contains sections that examine sustainable funding, creating a stormwater utility, project funding, and examples of regional funding efforts.

7.2 Local Funding Strategies

It has become evident that downstream funding needs will be substantial and varied in scope. GI, by its very nature, is a flexible and variable approach to reducing stormwater pollutants, and therefore will continue to evolve in the coming years in its efficacy, costs, and approaches.

There are several ways to categorize funding. This Section looks at whether funding is either ongoing or one-time funding, or debt financing (one-time funds that are repaid in an ongoing manner). This report also distinguishes between balloted and non-balloted, as any funding source that requires a ballot measure will bring more challenges. Figure 5 below helps to visualize these two axes and illustrates a few examples of each.

Figure 5. General Funding Category Matrix.

	Sustainable / Ongoing	One-Time	Long-Term Debt
Balloted	Taxes, Fees & Assessments		GO Bonds *
Non-Balloted	Regulatory Fees Re-Alignment Developer Fees	Grants	COPs ** Revolving Fund

** General Obligation Bonds; ** Certificates of Participation*

GI costs can be divided into three primary elements: planning, design and construction, and operation and maintenance. However, it is worth noting that not all of these elements can be funded by all funding sources. For example, bond funding is typically only applicable to capital improvement projects and cannot fund early planning or future maintenance. Appendix E contains a matrix of funding sources that cross-reference each source against the types of activity to which it does or does not apply.

7.2.1 Traditional Funding Mechanisms

This section discusses common existing funding mechanisms such as fees, taxes, grants and debt issuance. As indicated in the matrix above, some of these mechanisms require a ballot proceeding for approval, which are discussed separately.

Balloted Mechanisms

There are two basic types of balloted measures appropriate for stormwater funding, namely, property-related fees and special taxes. Successfully implemented balloted approaches have the greatest capacity to significantly and reliably fund stormwater management, but they are often very challenging to enact. Generally, the most important key to a successful ballot measure is to propose a project or program that is seen by the voting community to have a value commensurate with the tax or fee. The two greatest challenges are to craft a measure that meets this threshold, and then to effectively communicate the information to the community.

Since balloted funding mechanisms tend to be the most flexible and sustainable, they are often seen as underpinning an agency's entire program. Not only can they pay directly for services or projects, but a dedicated and sustainable revenue stream can also be leveraged to help secure grants, loans, partnerships, and many other opportunities that present themselves. Without such a dedicated revenue stream, those opportunities must often be missed. Examples of balloted mechanisms include:

- Property-related fees. These are similar to fees imposed for water, sewer, and solid waste services. The primary difference between those fees and fees for stormwater services are that stormwater fees are required to be approved through a ballot measure in accordance with Proposition 218 where a simple 50% majority is required for passage (where one parcel equals one vote). In all other ways they are identical to the other utility fees: they require a fair-share apportionment of costs to rate payers as detailed in a rate study or other cost of service analysis; they cannot charge more than the proportionate cost of service (e.g., discounts or exemptions cannot be subsidized by other ratepayers); and all revenues must be spent only on the stormwater services. Property-related fees are the most common sustainable revenue mechanism employed by municipalities for stormwater management services. However, as GI stretches the traditional definition of stormwater management (reaching into transportation, watershed management, and water resources), so, too, must a GI-related fee mechanism be "stretched" to encompass the scope of GI.
- Special taxes. These are decided by registered voters and require a two-thirds majority for approval. Special taxes are well known to Californians and are utilized for all manner of services, projects, and programs. They are usually legally very stout and flexible and can support an issuance of debt such as loans or bonds in most cases. There are several types of special taxes, but the most common for stormwater services are parcel taxes. Other types of special taxes include sales, business license, vehicle license, utility users, and transient occupancy taxes. These types can also be implemented as a general (not special) tax, where they would only require a simple 50% majority for passage. But to qualify as a general tax, it must be pledged only for an agency's general fund with no strings attached, in which case any GI or stormwater services must compete with other general funded services such as police, fire and parks. Although a general tax requires only a simple majority, voters tend to show better support for special taxes where the purpose of the tax is explicitly identified.
- General obligation bonds. These are familiar to the voting public. Such bond measures require a two-thirds majority for passage. Bonds are issued to raise funding up front and are repaid through a tax levied against property on the annual property tax bill. One primary restriction on these bonds is that they can only be used for capital projects. While that includes land acquisition, planning, design and construction, the costs for maintenance and operations cannot be paid from the bond proceeds.

Challenges with balloted approaches extend beyond the requirement for voter approval; they include a lack of familiarity by stormwater and GI professionals, the need for extensive community engagement and education, as well as political strategizing. Over the past 15 years, there have been fewer than thirty community-wide measures attempted for stormwater throughout California, and the success rate is just over 50%. Though that has generally been the case, during the most-recent election cycle (November

2018), in both the City of Berkeley and the County of Los Angeles County, voters approved funding measures. Los Angeles' bond, "Measure W," was approved with 69% of the vote; this measure enacts a parcel tax of 2.5 cents per square-foot of impermeable surface.

Though challenging, keys to a successful balloted approach include:

- Evaluate your community's needs and develop a plan for meeting them. This often will come from a needs analysis or a master plan. The more popular projects are ones that the community sees as fixing a problem they know about.
- Know your community's priorities. If agency needs are not seen as priorities by the community, a ballot measure will likely fail. Priorities are usually measured by a public opinion survey, which would identify priorities as well as willingness to pay for the proposed program. Top priorities identified in the survey should be folded-back into the proposed measure to demonstrate that the agency is responsive to the community's input.
- Communicate with the voters. Community engagement must be tailored to fit the measure. It can range from a brief set of outreach materials (i.e. website and/or flyer) to a comprehensive branding and information effort that can take several months or longer, complete with town hall meetings and media coverage. Knowing your stakeholders and opinion leaders is a must, and special efforts with those groups are always recommended. Note that advocacy by a public agency is strictly forbidden by law, so legal counsel should be involved at some point to help distinguish between outreach and advocacy.
- Know where you stand with the voters. Questions to raise internally include: do voters trust the agency; do they believe that it will deliver on it promises; and how have past ballot measures worked out? If you know the answers to questions like these, and if your answers are not positive or supportive of advancing the measure, then it will be important to develop some corrective strategies before embarking on it.
- Plan for the needed resources. Many public agencies hire professional consultants for critical elements of this process from needs analysis to surveys and community engagement. While these consultants can be costly, it is usually well worth the expense if they can deliver a successful measure. Considerable agency staff time may also be required, since this is a very iterative process that must be presented to the public by agency representatives, not consultants.

Senate Bill 231, passed by the California State legislature and signed by the Governor in October 2017, modified the Proposition 218 Omnibus Act, by adding a definition of sewer that included storm drainage. By doing this, stormwater fees can be enacted, or increased without a ballot measure. However, the legality of the statute will be tested by the authors of Prop 218 (Howard Jarvis Taxpayers Association) who have promised to sue any municipality that takes advantage of SB 231 by enacting or increasing stormwater fees. So, unless municipalities wish to have this law tested against Prop 218 judicially, or wish to coordinate among each other in doing so, they should continue to submit stormwater fees to a ballot

Non-Balloted Mechanisms

Non-balloted funding mechanisms include regulatory fees, developer impact fees, and other opportunistic approaches to funding. Table 10 lists a few of the more common approaches. While these funding approaches do not require voter approval, they still impact various segments of the community and therefore will feel the effects of local politics.

Table 8: Common Approaches to Non-Balloted Funding Mechanisms

Type of Approach	Examples	Comments
Regulatory Fees	• Plan Check Fees • Inspection Fees	Proposition 26 (2010) has significantly limited the applicability.
Realignment of Services	• Water Supply • Sewer • Refuse Collection	Leverage and integrate stormwater elements that qualify under water, sewer, and/or refuse collection categories.
Business License Fees	• Business License Fee	Applies to commercial operations with clear impacts on stormwater such as restaurants and vehicle repairs.
AB 1600 Fees	• Developer Impact Fees	Similar to impact fees aimed at improving water and sewer systems, or parks and schools.
Integration into Projects with Existing Funding	• Transportation or Utility Projects	Takes advantage of multi-benefit projects that also further stormwater goals.

Two of the more applicable approaches for the County are discussed in greater detail, developer impact fees and realignment:

- Developer impact fees. These fees are monetary exactions placed on the conditions of approval for a new development. These are also called AB 1600 fees and must be identified in a nexus study of some sort. One of the challenges of utilizing developer impact fees for GI is demonstrating the nexus of the development to impacts on stormwater quality. Most new development is already subject to Provision C.3, which may be considered adequate to cover those impacts. Therefore, care must be taken before charging additional impact fees.

- Realignment. This term is applied to reorganizing the internal work flow and/or financial tracking of revenues and expenditures of certain stormwater management activities that support other non-balloted fee structures (i.e. water, sewer, and refuse collection). The most common example is that of trash capture. The MRP, where it is functioning as a stormwater pollutant reduction permit, requires the County to implement a trash capture plan. Collecting trash, however, is a function of the community's trash collection system, which does not require voter approval for fee increases. Therefore, the County could charge all of its trash capture expenses (capital, operations and maintenance, and administrative) directly to properties that contribute to the trash burden.

Grants and Loans

Grants and loans are typically one-time funds from an outside source. Because of their one-time nature, they are best suited for finite projects or programs (rather than ongoing and recurring operational and maintenance programs). Grants do not have to be repaid whereas loans do require repayment (usually with interest). Both require an agency to apply and are usually competitive. Most grants are targeted to specific programs or features, so crafting a project to fit with the grant goals and objectives is challenging. Federal, state and regional grant programs have funding available to local governments to support GI efforts. Several current grant programs are listed in Appendix E. Below are listed some benefits and challenges with both types of funding:

Benefits:

- Grants can fund programs or systems that would otherwise take up significant general fund revenues
- Grants often fund new and innovative ideas that a local agency might otherwise be reluctant to take on using general funds
- Grants can be leveraged with other sources of funding, which can serve to increase the viability, benefits, and/or size of a GI project
- Successful implementation of a grant-funded project can establish a positive precedent that can lead to receipt of other grants
- Certain loan programs such as the State Revolving Fund can offer lower-than-market interest rates and less security requirements.

Challenges:

- Timelines for grants often do not fit with an agency's timelines for project implementation;
- Coordinating multiple grants for a single project can be particularly challenging as timelines and matching fund requirements may not align;
- Most grants require an agency to furnish matching funds from outside of the grant, so they cannot generally be considered as stand-alone sources of funding
- Grants and some loans are competitive in nature, and have limited funding levels

- Grants are often limited to specific goal and objectives that may not fit with those of the agency (such as GI goals)
- Alternatively, some grants may require multiple objectives be fulfilled as part of a project, some of which may not be consistent with, or applicable to the mission of the agency
- Grant applications can require considerable staff time and coordination resources, with no guaranty of success
- Most grants require that the agency commit to providing post-project maintenance without providing the associated funding for it
- Loans and bond programs require ongoing, dedicated funding to make debt payments

While grants and loans can (and should) be sought for funding critical projects such as GI, they are best when underwritten by some sort of ongoing revenue source that can provide matching funds, post-project operation and maintenance funds, or debt payments. The California Clean Water State Revolving Fund is one type of revolving fund loan may be a good option.

7.2.2 Special Financing Districts

Special financing districts are financial structures created by local agencies for the purpose of levying taxes, fees or assessment for specific improvements and/or services provided. While most special financing districts require a ballot process, they are often employed with new development projects when all the property(ies) are owned by one entity. As such, the balloting is an administrative function with an assured outcome.

There are four basic types of special financing districts that apply to GI: benefit assessments; community financing districts (CFD, or Mello-Roos); business improvement districts (BID); and enhanced infrastructure financing districts (EIFD). Each of these can be used to support debt service. Further detail regarding each is provided below:

- Benefit assessments. These are relatively restrictive in that they must account for any general benefit to property not within the district, which in turn cannot be included in the assessment calculation for the properties. With GI, the general benefits could be considerable thereby diluting the funding potential for this option. This option requires a simple 50% majority (with ballots weighted by the amount of the assessment), and public or tax-exempt properties cannot be exempted.
- CFDs. These districts utilize a tax (not an assessment) and are the most flexible. There is no "general benefit" restriction, and there is flexibility in exempting various types of properties (government, tax exempt, etc.). As a special tax, a two-thirds majority is required for approval.
- BIDs are limited to business districts, which can be inclusive of a specified residential area/district; they can be used to assess property owners and/or business owners for certain improvements and services. GI features can function as aesthetic improvements that are popular with business districts (e.g., permeable pavers on streets, GI bulb-outs, and rain gardens). The most applicable

version of a BID that is applicable to GI implementation and maintenance is a "Green Benefits District" that has been successfully pioneered by the City of San Francisco/SF PUC.

- EIFDs. These are a form of tax increment financing that captures the increase in property tax as properties within the district are developed to a higher assessed value. This is a relatively new mechanism (signed into law in 2014) and has only been implemented a handful of times around the state. The proceeds are intended to be used to enhance the properties within the district, usually through infrastructure improvements, which, in turn, fuels the property assessment increase. The most common infrastructure enhancements have been in the areas of transportation and parks, but utilities have also benefited. There is a potential for using this mechanism for GI, although there hasn't been a successful implementation along those lines yet.

7.2.3 Alternative Compliance

The MRP contains a vast array of elements for which compliance is required. In some cases, straightforward compliance may be impractical or impossible, and the RWQCB has shown a willingness to consider alternate compliance in one form or another. Provision C.2.e.i allows the following alternative compliance options:

- Construction of a joint stormwater treatment facility;
- Construction of a stormwater treatment system off-site (on public or private property); and
- Payment of an in-lieu fee toward the cost of a regional project.

The first two options do not generate revenue for use on a regional GI project, but they could deliver GI facilities that further the goals of this GI plan. The in-lieu fees option can be cultivated into a source of revenue to be used in pursuit of the GI plan. This can be particularly useful in cases where a GI project, whether regional in scope or smaller, can deliver "more bang for the buck." In other words, a well-designed regional project can often deliver more GI benefit per dollar than distributed GI facilities. It is in those cases where an in-lieu fee program can be useful.

A subset of in-lieu fees is to use a mitigation approach for developments or other properties that need to offset impacts to the community and/or environment. This can be implemented on an ad hoc basis and negotiated on a case-by-case basis both in terms of the mitigation contribution and how the funds are to be used by the County.

Another type of alternative compliance program is a credit trading program. Credits created by one project are traded to another project that may not be able to meet MRP requirements. Such a program is typically managed by a governmental agency and can create incentives to treat stormwater in excess of the MRP requirements on regulated sites, while also creating incentives to install systems that treat stormwater on non-regulated sites.

7.2.4 Partnerships

By teaming up with other entities or agencies may not generate additional funding directly, but partnerships offer many other benefits that can aid in the overall resources needed to deliver GI projects.

These can come in the form of economy-of-scale savings or multi-benefit projects that can achieve multiple goals for a single price. Several such strategies, as well as some other beneficial strategies, are discussed below.

- Multi-agency partnerships. Such partnerships are the most common. Large or regional projects may not fit easily within a city limit line, so a partnership between cities can overcome that. GI works best on a watershed basis – another way geography transcends city limit lines. Another benefit is the resource sharing that comes along with a multi-agency partnership, helping projects to cost less overall.
- Transportation opportunities. These are also a common way for GI features to be implemented. Complete streets and green streets movements, as well as the MRP requirements for transportation projects, have all helped promote GI as a standard design feature for transportation projects. Agencies may consider providing additional treatment capacity when conditions are favorable. In these situations, the additional investment could result in a higher quality treatment and a cost savings for the agency by providing GI credits beyond the subject project and extend these credits for a second capital project site where conditions are more restrictive.
- Caltrans mitigation. Caltrans, which has its own MS4 permit, is allowed to meet requirements outside of their own ROW, when onsite opportunities are not sufficient. As a result, Caltrans looks for opportunities to collaborate with local agencies to find off-site GI solutions while bringing their own funding sources. This is similar to the alternative compliance model mentioned in Section 7.2.3 above.
- Public-Private Partnerships (P3s). This strategy has the potential to help many communities optimize their limited resources through agreements with private parties to help build and maintain public infrastructure. The state enacted legislation in 2007 that enabled the P3 model, and since then agencies have use P3s for public infrastructure projects.
- Not-for-profit (NFP). These types of work forces can be a valuable resource to help make scarce resources stretch further. This strategy is based on a “community-based” habitat stewardship and protection approach and has been incorporated into the missions of numerous environmental NFPs. This approach is widely supported by the public, as the passage of recent water, park and open space ballot measures in the SF Bay Area and California have demonstrated. This approach has also been used for both GI construction and post-project maintenance. Some NFPs have been training “green collar” workers to both build and to maintain GI features on behalf of municipalities, as is occurring in Richmond (California). This kind of community-based model can serve to foster a public/nonprofit partnership where NFP’s perform “fee-for-service” contracts with agencies to help plant/construct and/or maintain GI features. This is a relatively new and innovative variation to the public–private partnerships approach just described. Benefits of a NFP collaboration include public education and building community support for the agency’s clean water programs.
- Volunteers. Volunteer work forces can also be a resource for GI projects. Relying on work performed by a strictly volunteer workforce has drawbacks including recruiting, overseeing,

training and managing volunteers as well as the reliability and quality of work. In some cases, volunteer work forces are sponsored or managed by a NFP, which may offset some the drawbacks. Benefits of a volunteer program include public education and building community support for the agency's clean water programs.

- Philanthropy. This is an option that could have some potential for attracting funding or other resources. Many large corporations often look for ways to benefit the communities in which they reside, and GI facilities can provide them beneficial visibility while they help move projects forward.

7.3 Optimal Strategies for Contra Costa County

The GI Plan and the projects identified within are wide ranging and cover a variety scopes, locations, sizes, impacts, benefits and costs. Likewise, the options of funding those projects are also varied (as shown above). To assist the County in the task of pairing projects with funding, it is useful to begin by focusing on the most promising funding strategies. Nine funding strategies have been identified, with the advantages and disadvantages of and the "best applications" for each strategy compared in a GI funding summary matrix shown on the following pages.

Table 9: Optimal GI Funding Strategies for Contra Costa County

Strategy		Requirements	Pros	Cons	Best Applications	Planning / Design	Capital	O & M
1	Stormwater Fee	* Define services and service area(s); * Rate study; * Ballot Approval	* Excellent financial foundation for stormwater and GI; * Flexible and legally stout; * Can be used for matching funds for grants; * Debt can be issued in most cases; * SB 231 may open the way for no balloting	* Ballot measure required; * Significant public outreach recommended	* Should be considered for all applications; * May work best in subregional or watershed areas; * Revenue can be used flexibly; * Excellent for maintenance costs	X	X	X
2	Green Benefits District	* Usually used in small areas such as business districts or neighborhoods; * Define services and service area; * Weighted ballot Approval	* Services can be narrowly defined for GI; * Can include both residential and commercial; * Can fund both construction and maintenance; * Local control over services and finances; * Opportunity for volunteerism to control costs; * Provides enhancements over baseline services	* Ballot measure required; * Cannot use debt financing; * Local consensus can be disrupted by dissenting businesses	Best in: * New developments; Also good in: * Existing areas; or * Mixed development; Excellent for maintenance costs	X	X	X
3	Enhanced Infrastructure Financing District	<u>With No Debt</u>: * Establish a Public Finance Authority; * Adopt a Financing Plan; * Resolution(s) from participating agencies <u>With Debt</u>: * All of the above; * Get approval from at least 55% of voters in District	* Can fund many types of projects; * Does not require a vote (unless debt is part of the plan, then a 55% majority is required); * Can include multiple municipalities and special districts, so area can be tailored to needs (e.g. watersheds, high legacy pollutant areas, countywide)	* Has not been applied to GI; * Cannot be used for operations, maintenance or repairs; * Education districts are not permitted to participate; * GI is only a small piece of what an EIFD can do - it may take a back seat to other, larger community concerns	* Best in a redeveloping area; * Only eligible for CIP (not O&M); * Most likely to work when incorporated into a full EIFD scope	X	X	

Strategy		Requirements	Pros	Cons	Best Applications	Planning / Design	Capital	O & M
4	Not-for-Profit (NFP) Partnership	* Contract or MOU; * Based on qualifications	* Provide expertise for GI or related services; * Costs may be greatly reduced from market rate; * Usually community-based and sometimes local; * Can be applied to both construction and maintenance; * Can Increase community interest	* May be restricted to certain scope or locations; * May need to meet prevailing wage requirements; * Limited competition may drive costs up	* Applicable to most GI projects; * Best when incorporated into design and buld processes; * Excellent for maintenance activities	X	X	X
5	Community Development Corporation	* Contract or MOU; *Determined by mission statement	* Provide expertise for GI or related services; * Works at the neighborhood level; * Can be applied to both construction and maintenance; * Can Increase community interest	* May be restricted to certain scope or locations; * May need to meet prevailing wage requirements; * Limited competition may drive costs up	* Applicable to most GI projects; * Best when incorporated into design and buld processes; * Excellent for maintenance activities	X	X	X
6	Volunteers	* To be effictive, volunteers need organization and oversight; * Can be used to supplement paid contractors, or perform entire projects	* "Free" labor; * Some volunteers provide needed expertise; * Increases awareness of GI program; * Some non-profit organizations have ready-made volunteer groups that are trained and organized; * Can build public support for dedicated revenue mechanism such as a fee; * Education program for community	* Requires significant staff resources to recruit, organize, train and plan & supervise the work; * Can be unreliable - hard to build schedule and cost forecasts around volunteer work force; * Can create conflict with prevailing wage requirements; * Difficult to incorporate into project construction work	* Can be used to reduce maintenance costs for most projects; * May be applicable to certain construction projects as well	X	X	X
7	Developer Fees, In-Lieu Fees & Credit Trading Program	Develop program of regional projects and costs apportioned to development (nexus study per AB 1600)	* Collective funding can help fund regional projects where best return on GI investment occurs; * Helps struggling development meet GI requirements	* Nexus study must demonstrate connection between development and GI need; * Administration of funds requires resources; * Credit Trading will require program creation	* Best when utilized to fund regional projects; * Can apply to development anywhere within jurisdiction	X	X	X

Strategy		Requirements	Pros	Cons	Best Applications	Planning / Design	Capital	O & M
8	Mitigation Fees Fund	Local mitigation funds from polluters or other entities needing to offset impacts to a community and or the environment.	* Be aware of opportunities & apply when practical * Flexible in how applied (ad hoc basis)	* Projecting revenue is diffucult; * May need to comply with Prop 26	Be aware of opportunities & apply when practical	X	X	X
9	Other Opportunistic Strategies	* Grants; * Transportation; * Caltrans Mitigation; * Realignment	Be aware of opportunities & apply when practical	Requires diligence and awareness of candidate programs and projects	Be aware of opportunities & apply when practical	varies		

8 Adaptive Management

8.1 Process for Plan Updates

Unincorporated County will amend or update this GI Plan as required by the RWQCB. Plan revisions may include updates of public and private GI projects implemented and public GI projects identified for future implementation. Components of this GI Plan will also be included in other future County planning documents, as indicated in Section 1.3.4.

8.2 Pursuing Future Funding Sources

Unincorporated County is pursuing a number of funding strategies, as described in Chapter 7 and further evaluated in Appendix E, to support implementation of GI projects. For strategies deemed viable for Unincorporated County, a process will be developed to allow for a consistent, clear methodology to enact any appropriate strategy when needed for future GI implementation.

8.3 Alternative Compliance and Credit Trading Investigations

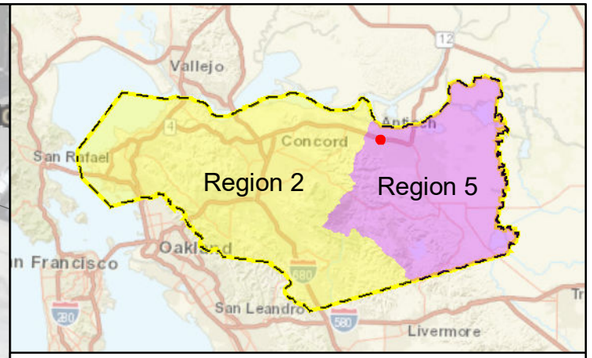
The cities of San Pablo, Walnut Creek, and Richmond (in conjunction with cities across the Bay Area) are proposing to establish a water quality trading/banking system for Contra Costa County to address the countywide load reduction requirements of the PCBs and mercury TMDLs. A water quality trading system has the ability to more efficiently and affordably improve water quality, reduce compliance pressures on Permittees, and decrease the overall costs of water quality improvements. In pursuit of such a system, these three cities have applied for an EPA grant. Additional information regarding how such a program could be used to achieve the requirements in MRP Provisions C.11/C.12 for PCBs and mercury load reductions through GI is provided in Appendix F of this Plan.

Appendix A. Potential Public Project Locations

Note: Resulting from prioritization, TAG review, site visits, and addtitional feedback from County

No.	Location	SWRP ID	Project Type	Project Area (acre)[a]	Impervious Surface (acre)[a]
1	Antioch	planned_705	Planned Unlined Bioretention	0.7	0.4
2	Antioch	planned_699	Planned Unlined Bioretention	0.9	0.7
3	Antioch	planned_712	Planned Unlined Bioretention	0.2	0.2
4	Concord	planned_836; planned_837	Planned Unlined Bioretention	0.9	0.6
5	Byron	planned_600	Planned Unlined Swale	2.9	1.7
6	Concord	planned_930	Planned Unlined Bioretention	1.3	0.9
7	Crockett-Port Costa	ROW_6054	ROW Opportunity	0.7[b]	0.7[b]
8	Knightsen	planned_360	Planned Water Quality Basin	0.7[b]	0.4[b]
9	Lafayette	planned_1079	Planned Unlined Bioretention	1.1	0.5
10	North Richmond	ROW_2768	ROW Opportunity	8.1	4.7
11	North Richmond	ROW_14957	ROW Opportunity	6.4[b]	2.2[b]
12	North Richmond	ROW_8096	ROW Opportunity	3.3[b]	2.1[b]
13	North Richmond	ROW_14519	ROW Opportunity	13.6[b]	8.6[b]
14	Pacheco	ROW_16577	ROW Opportunity	2.5	1.7
15	Pacheco	ROW_13183	ROW Opportunity	1.7	1.1
16	Pacheco	ROW_224	ROW Opportunity	1.3	0.9
17	Pittsburg	planned_713	Planned Unlined Bioretention	1.8	1.2
18	Richmond	planned_1292	Planned Unlined Bioretention	1.4	1.0
19	Richmond	planned_1284	Planned Unlined Bioretention	0.1	0.1
20	Richmond	planned_1290	Planned Unlined Bioretention	2.9	2.2
21	Rodeo	Parcel_256018	Parcel-Based Opportunity	2.3[b]	2.3[b]
22	Rodeo	planned_1097	Planned Unlined Bioretention	0.3	0.2
23	San Pablo	planned_1272	Planned Unlined Bioretention	3.8	3.3
24	San Pablo (Greenwood and Fordham)	N/A	ROW Opportunity	0.4[b]	0.4[b]
25	San Pablo (Montarabay)	planned_1177	County Requested	1.9[b]	1.9[b]
26	Unincorporated Martinez Neighborhoods	Parcel_243602	Parcel-Based Opportunity	2.0	1.3
27	Unincorporated Martinez Neighborhoods	planned_943	Planned Unlined Bioretention	0.3	0.1
28	Martinez	planned_1139; planned_1140	Planned Unlined Bioretention	0.4	0.4
29	Unincorporated Richmond Neighborhoods	planned_1182	Planned Unlined Bioretention	0.2	0.1
30	Walnut Creek	planned_966	Planned Unlined Bioretention	0.6	0.5
			Total =	65 acres	42 acres

[a] Project area and Impervious Surface quantities from Countywide Attainment Tool, else GIS (denoted [b])



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 1

APN 067342002

Street Name

Project Name CCC_067342002

Location Antioch

N

Feet

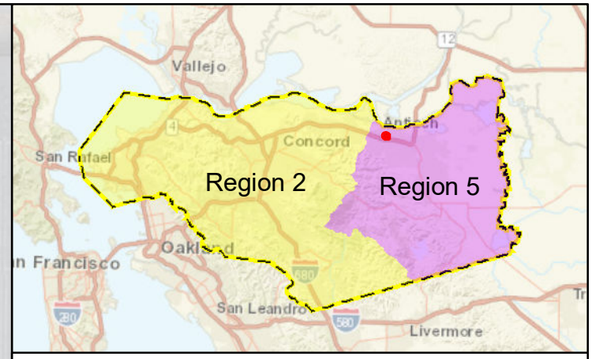
0 30 60

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

WW2048A | June 2019

Figure 1



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 2

APN 067221014

Street Name

Project Name CCC_067221014

Location Antioch

N

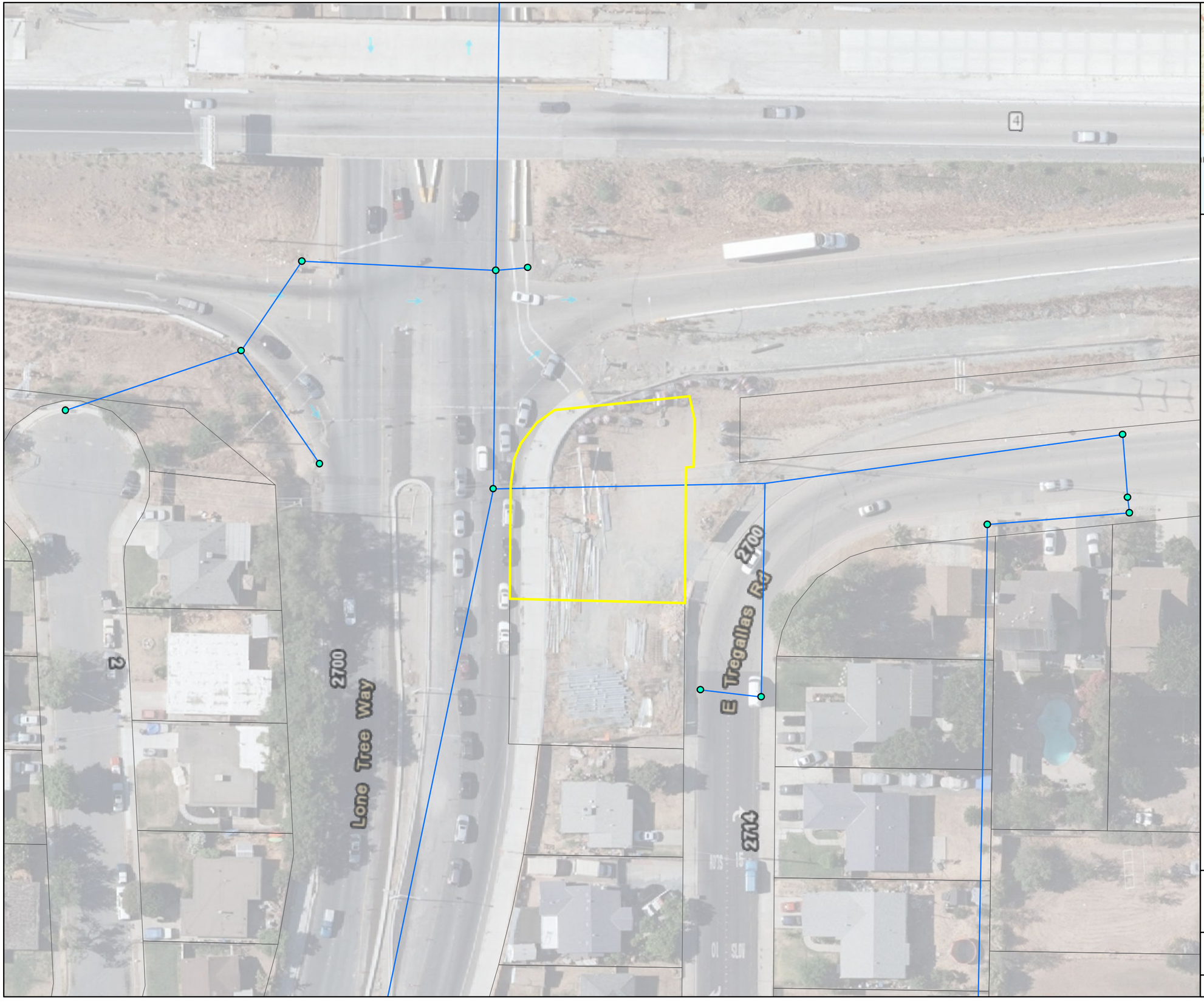
0 30 60 Feet

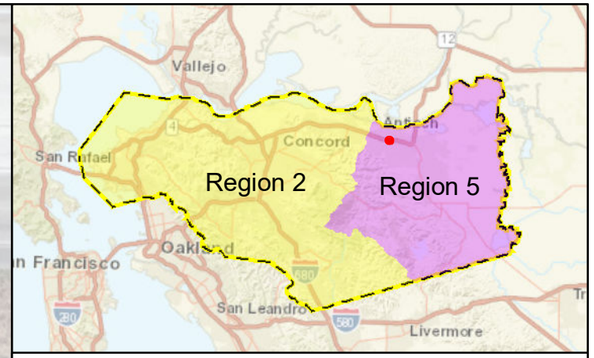
Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

WW2048A | June 2019

Figure 2





Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No	3
APN	068151017
Street Name	
Project Name	CCC_068151017
Location	Antioch

N

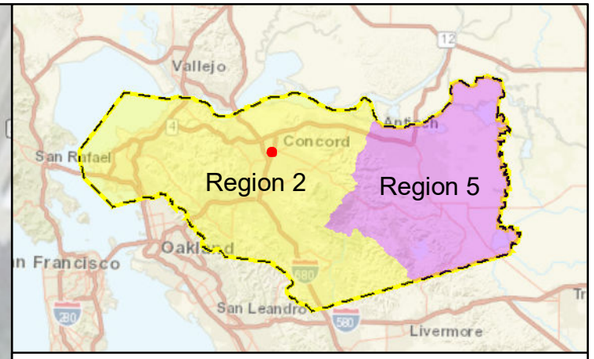
0 30 60 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

WW2048A | June 2019

Figure 3



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 4

APN 126020106 and 126020101

Street Name

Project Name CCC_126020106 and CCC_126020101

Location Concord

N

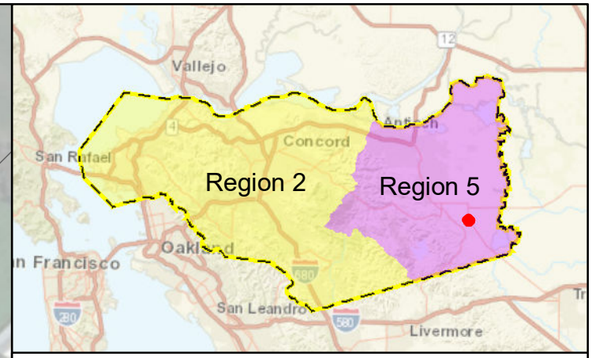
0 50 100 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

WW2048A | June 2019

Figure 4



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 5

APN

Street Name

Project Name Byron old industrial bioswale

Location Byron

0 110 220 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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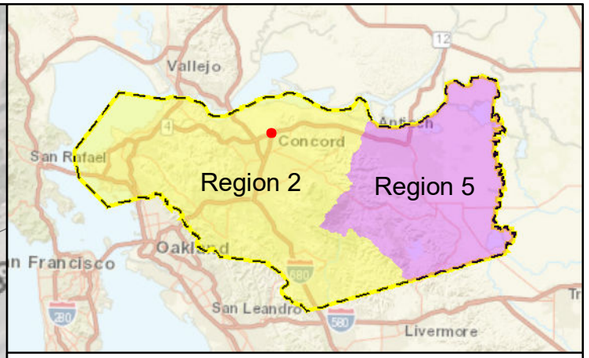
Figure 5



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 6

APN 159080036

Street Name

Project Name CCC_159080036

Location Concord

N

0 30 60 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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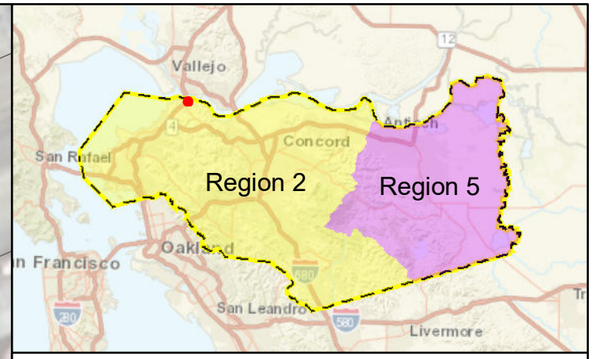
Figure 6



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 7

APN

Street Name DOWRELIO DR

Project Name

Location Crockett-Port Costa

N

0 50 100 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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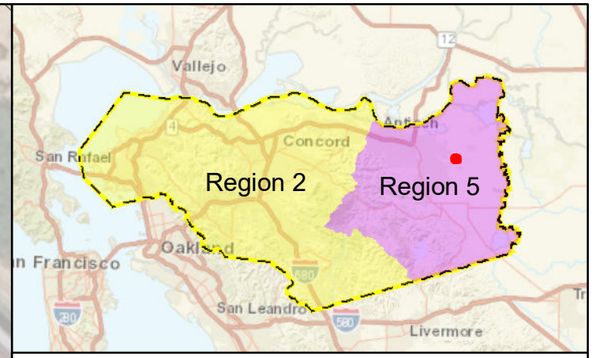
Figure 7



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 8

APN

Street Name

Project Name Curlew Connex/Delta Road Drainage Improvements

Location Knightsen

N

0 80 160 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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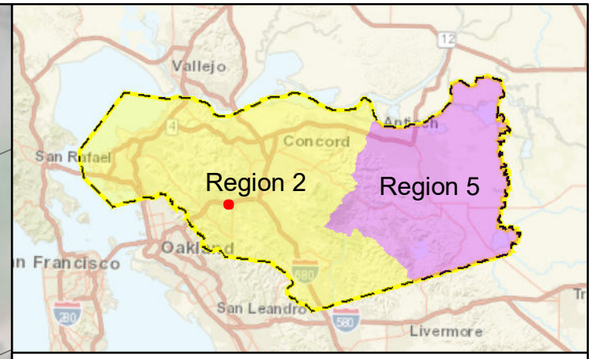
Figure 8



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 9

APN 241010049

Street Name

Project Name CCC_241010049

Location Lafayette

N

0 50 100 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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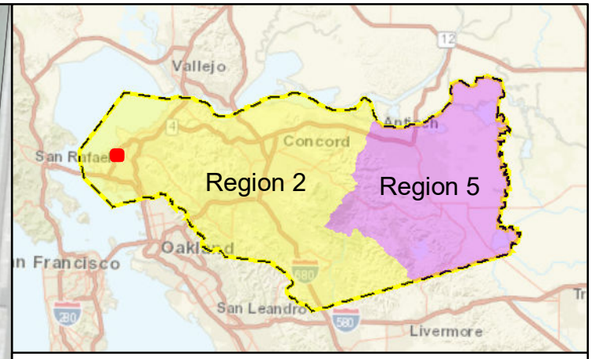
Figure 9



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 10

APN

Street Name BROOKSIDE DR

Project Name

Location North Richmond

N

0 190 380 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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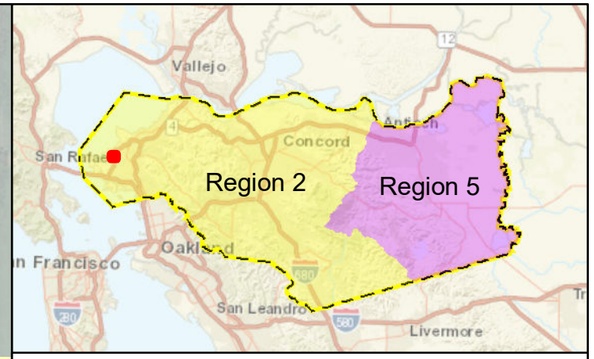
Figure 10



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 11

APN

Street Name PITTSBURG AVE

Project Name

Location North Richmond

N

0 160 320 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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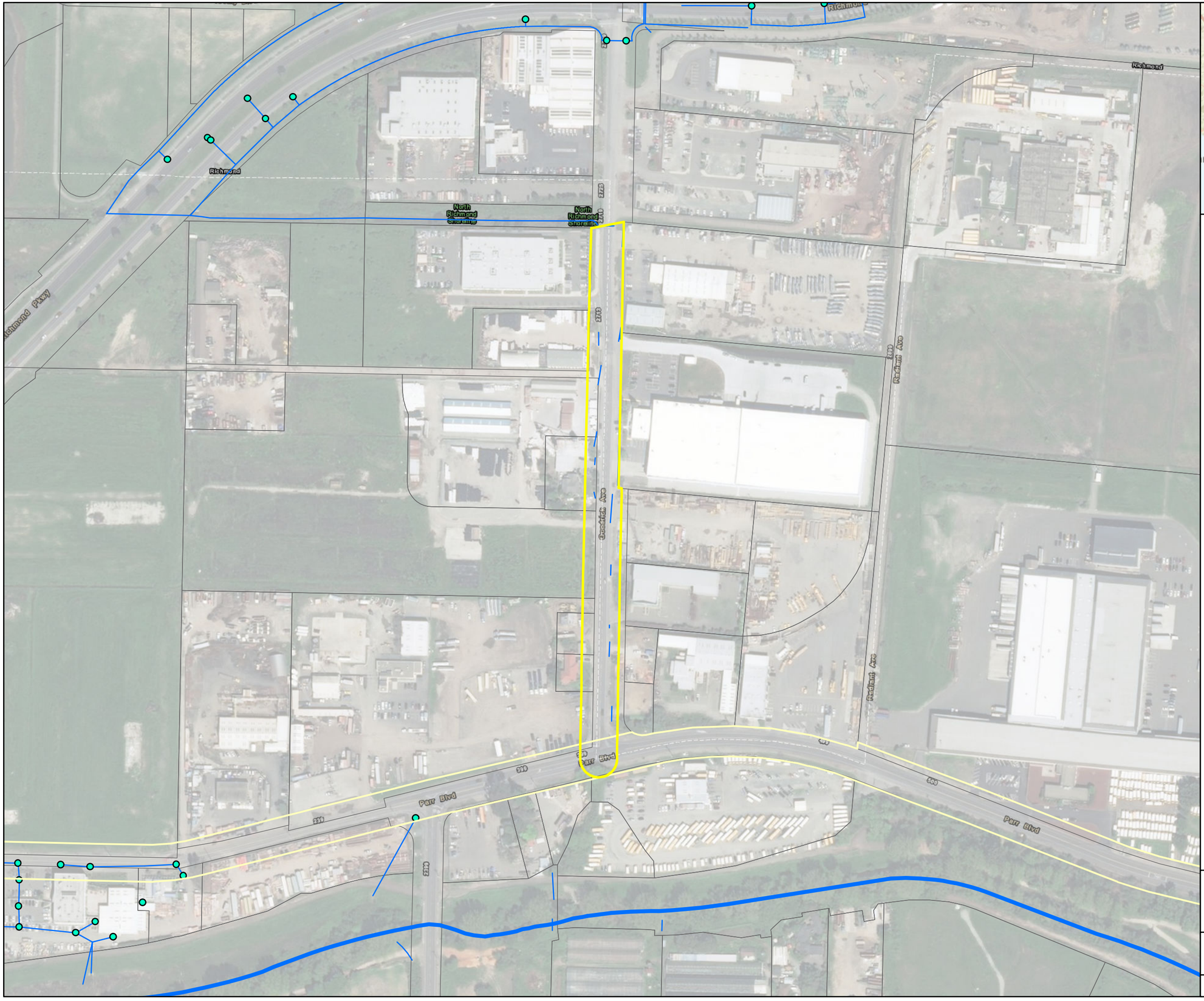
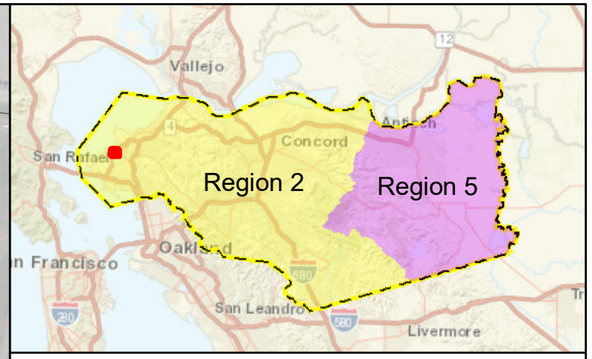
Figure 11





Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 12

APN

Street Name GOODRICK AVE

Project Name

Location North Richmond

N

0 160 320 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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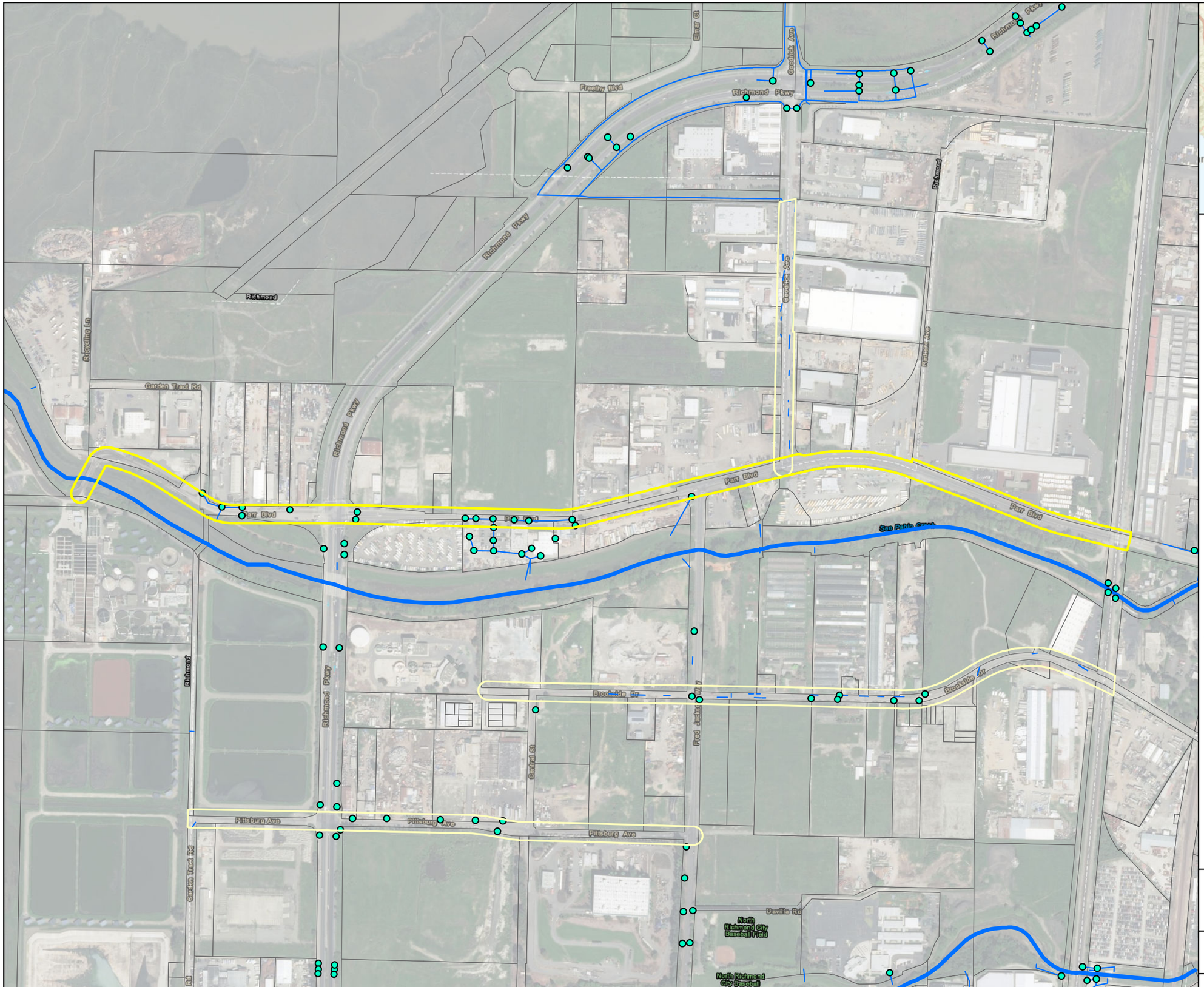
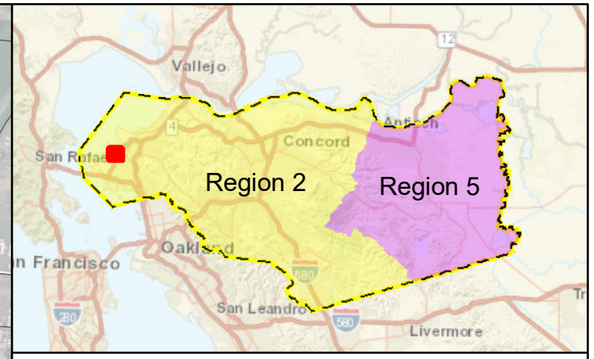
Figure 12





Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 13

APN

Street Name PARR BLVD

Project Name

Location North Richmond

N

0 330 660 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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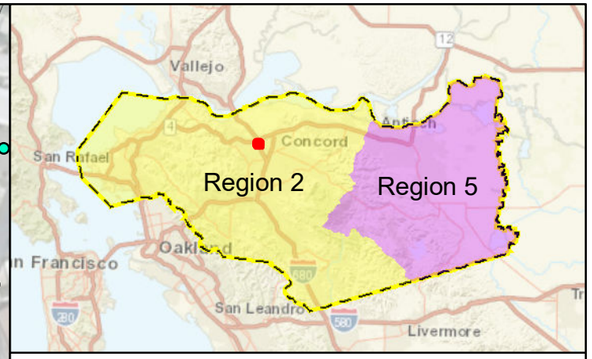
Figure 13



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 14

APN

Street Name S BUCHANAN CIR

Project Name

Location Pacheco

N

0 110 220 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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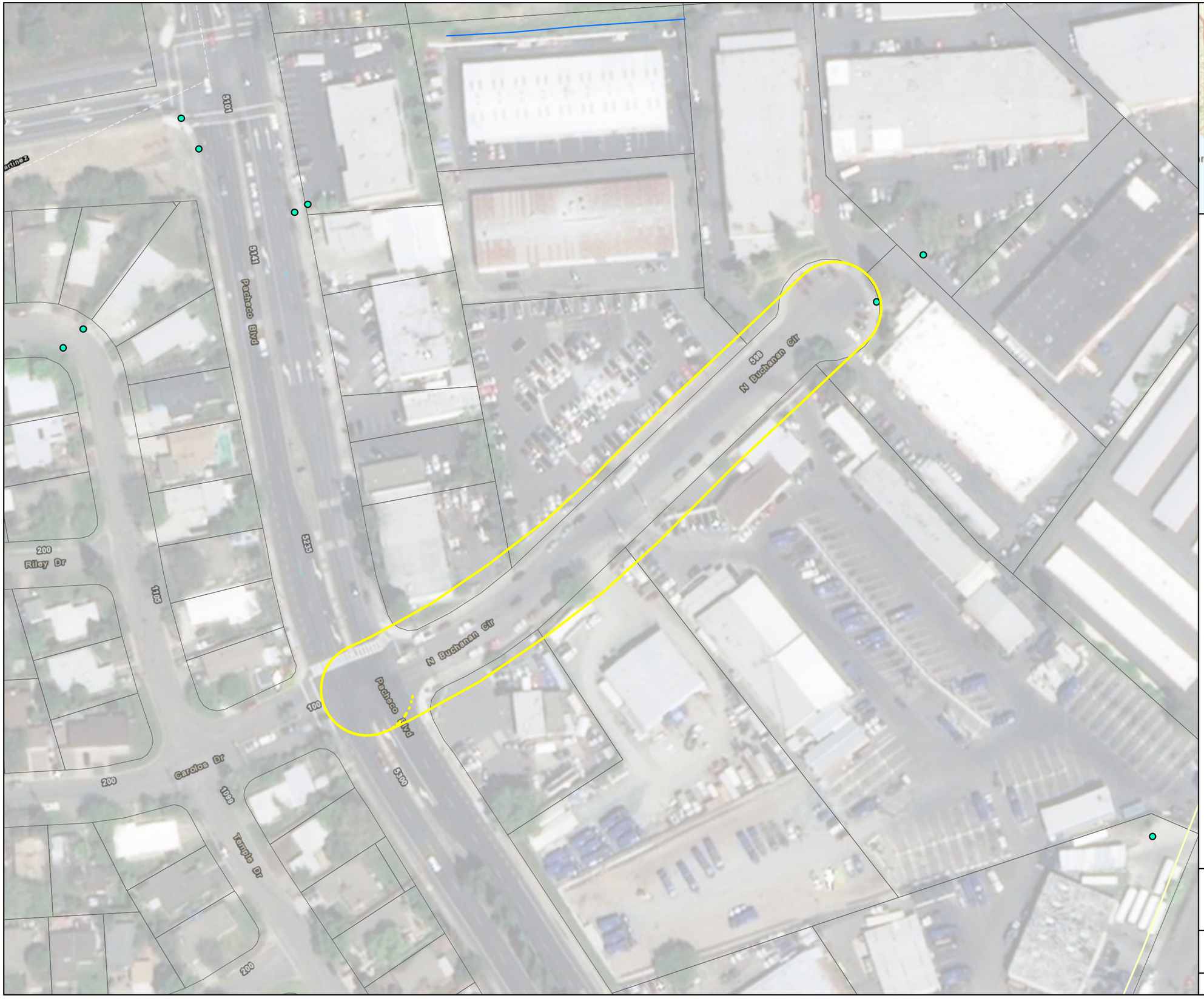
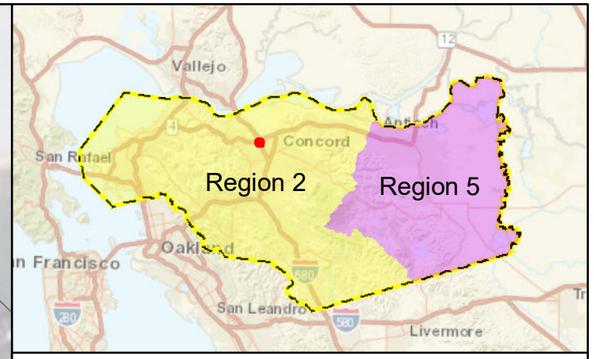
Figure 14





Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 15

APN

Street Name N BUCHANAN CIR

Project Name

Location Pacheco

N

0 60 120 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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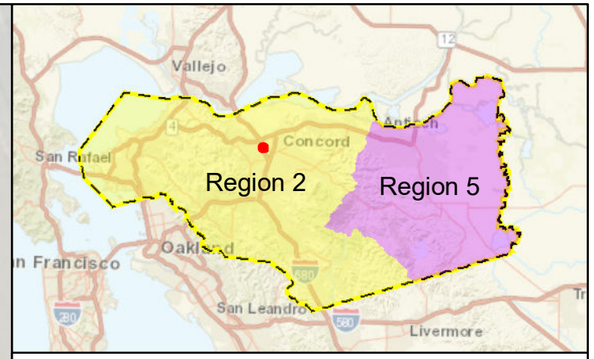
Figure 15



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 16

APN

Street Name 2ND AVE S

Project Name

Location Pacheco

N

0 60 120 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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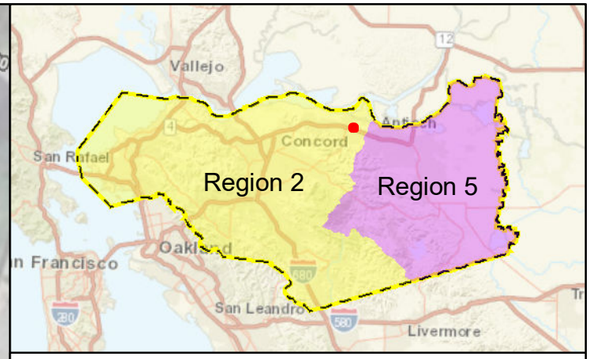
Figure 16



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 17

APN 073140018

Street Name

Project Name CCC_073140018

Location Pittsburg

N

0 50 100 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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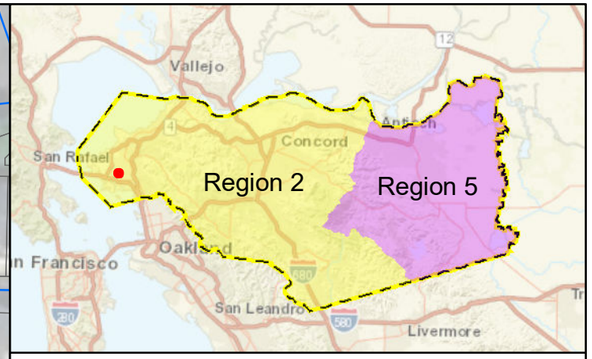
Figure 17



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No	18
APN	540082033
Street Name	
Project Name	CCC_540082033
Location	Richmond

N

0 50 100 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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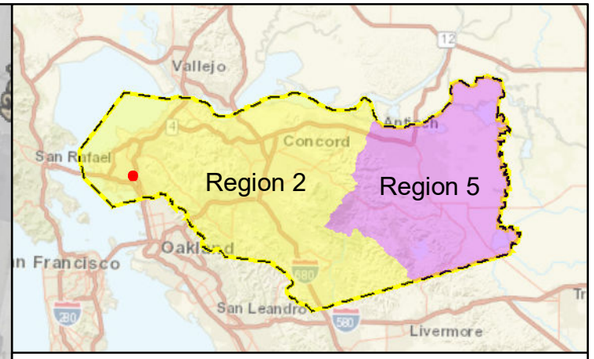
Figure 18



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 19

APN 517320017

Street Name

Project Name CCC_517320017

Location Richmond

N

0 40 80 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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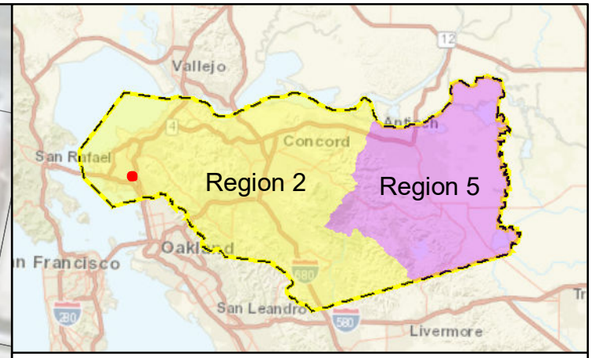
Figure 19



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No	20
APN	517340004
Street Name	
Project Name	CCC_517340004
Location	Richmond

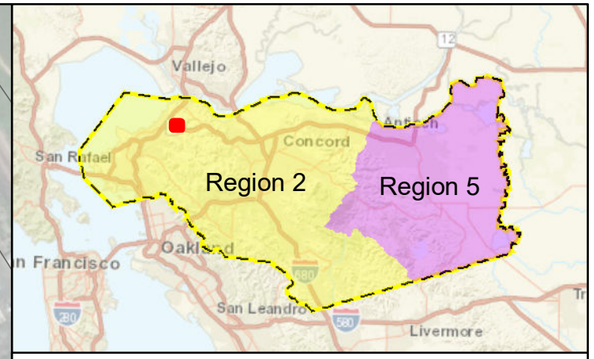
N

0 50 100 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

WW2048A	June 2019	**Figure** 20



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 21

APN

Street Name

Project Name Contra Costa Goldfields GI

Location Rodeo

N

0 220 440 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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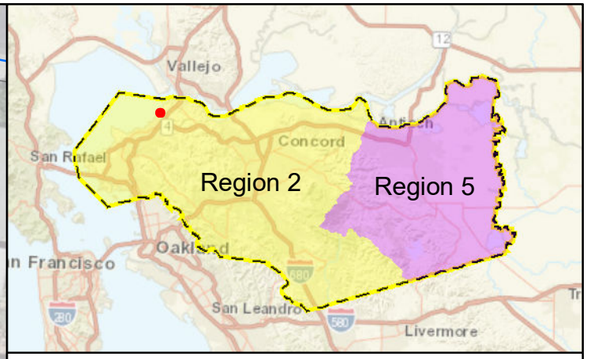
Figure 21



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 22

APN 357171006

Street Name

Project Name CCC_357171006

Location Rodeo

N

0 40 80 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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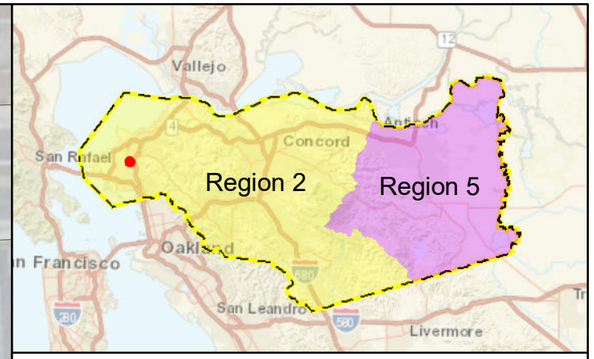
Figure 22



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No	23
APN	417310008
Street Name	
Project Name	CCC_417310008
Location	San Pablo

N

0 60 120 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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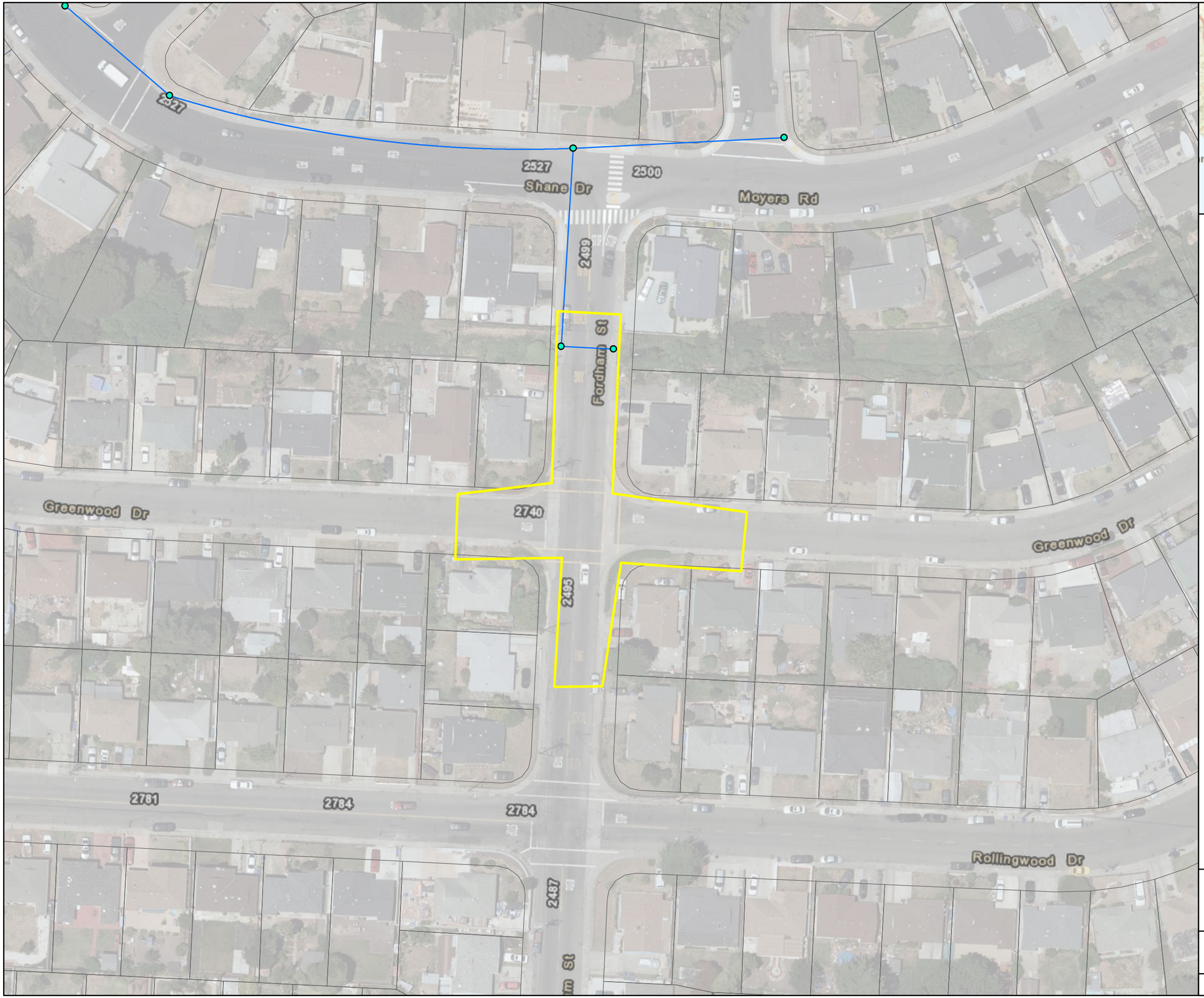
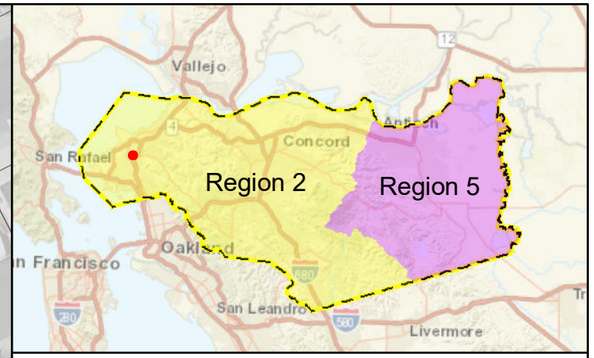
Figure 23





Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 24

APN

Street Name Greenwood Dr.

Project Name Greenwood Dr. at Fordham St.

Location San Pablo

N

0 40 80 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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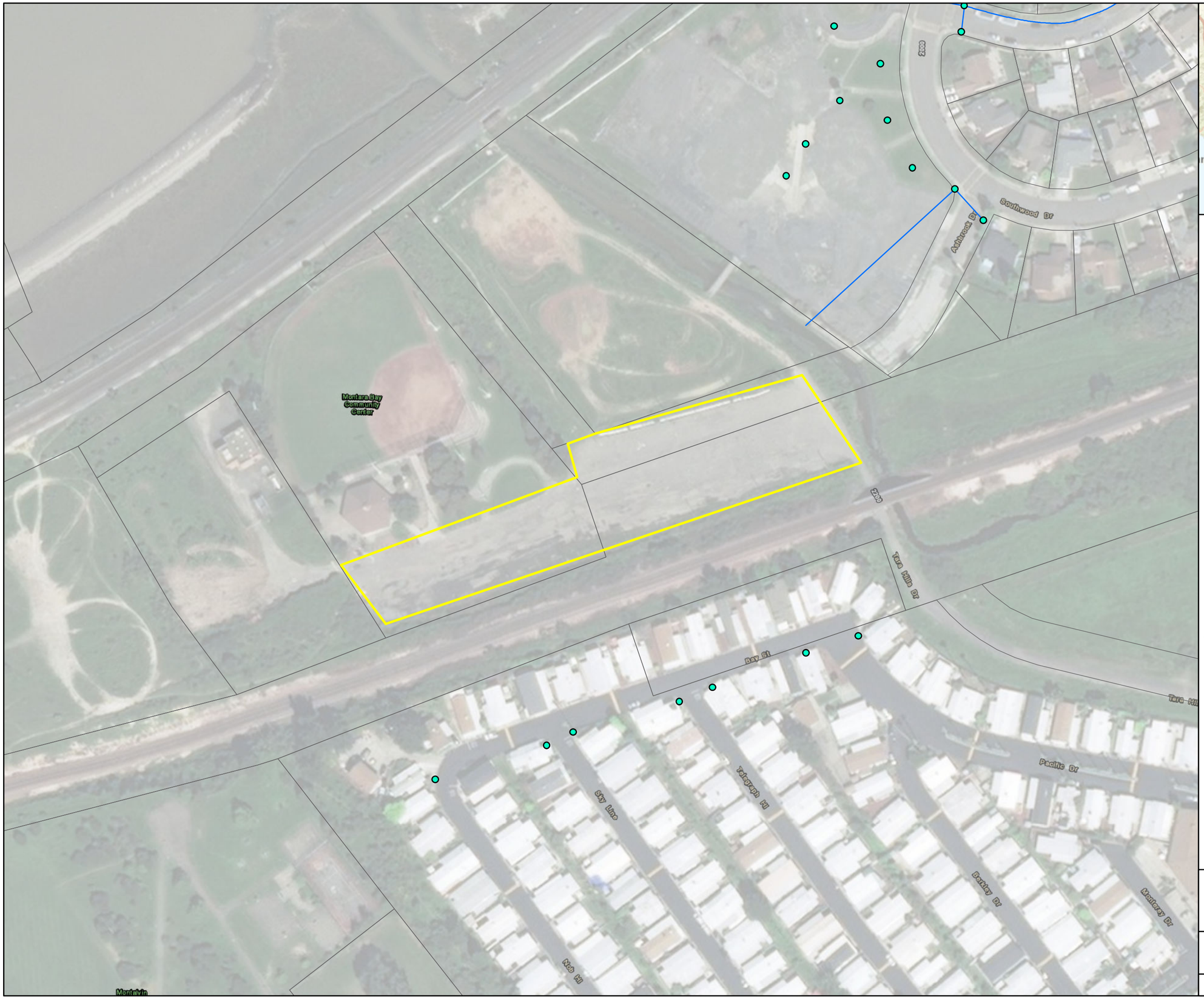
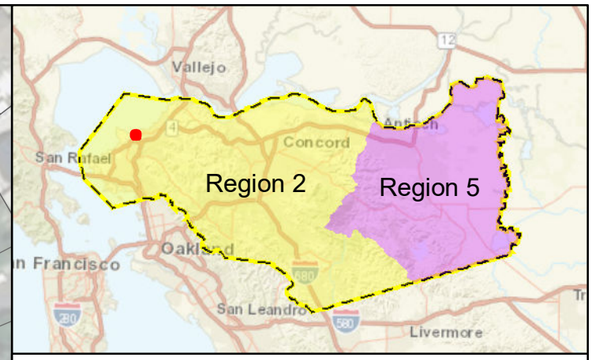
Figure 24





Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 25

APN 403020013

Street Name

Project Name CCC_403020013

Location San Pablo

N

0 80 160 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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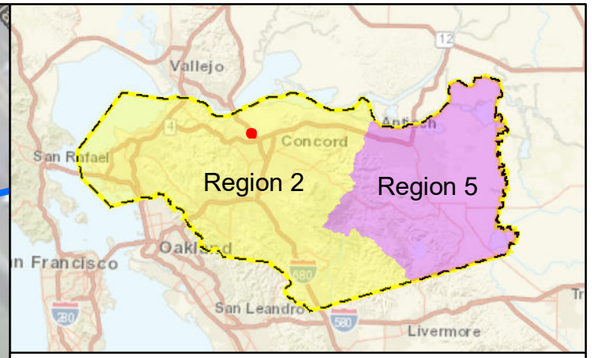
Figure 25



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 26

APN 380260002

Street Name

Project Name

Location Unincorporated Martinez Neighborhoods

N

0 50 100 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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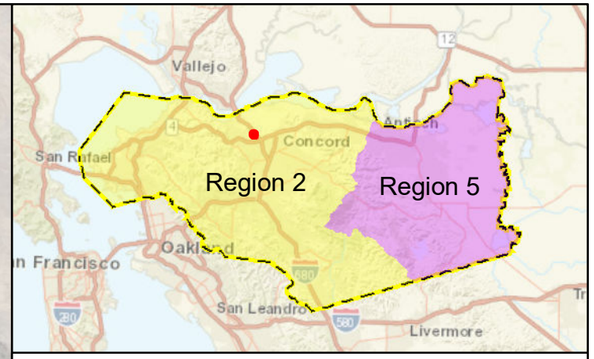
Figure 26



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No	27
APN	161261004
Street Name	
Project Name	CCC_161261004
Location	Unincorporated Martinez Neighborhoods

N

0 40 80 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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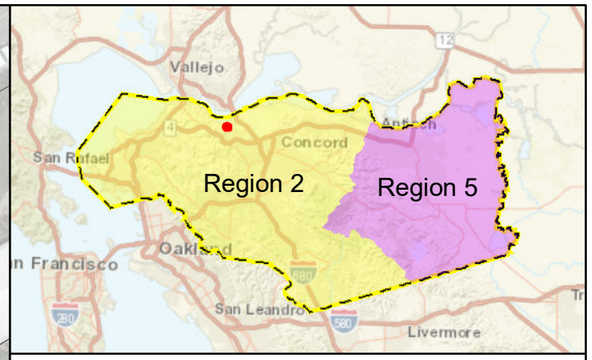
Figure 27



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 28

APN 373202002 and 373202003

Street Name

Project Name CCC_373202002

Location Martinez

N

0 40 80 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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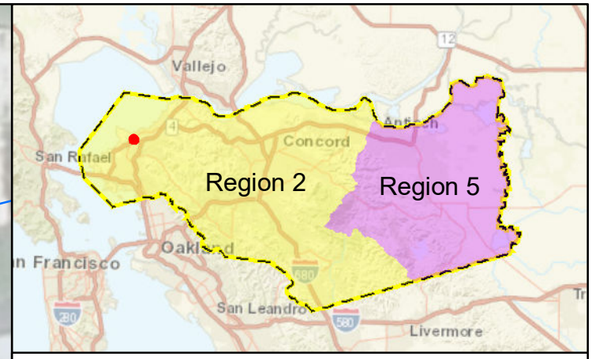
Figure 28



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No	29
APN	405121002
Street Name	
Project Name	CCC_405121002
Location	Unincorporated Richmond Neighborhoods

0 50 100 Feet

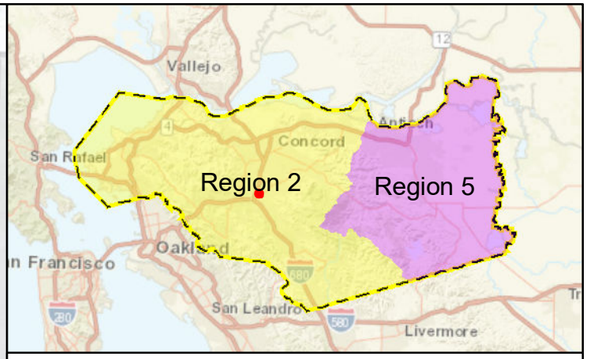
N

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

WW2048A | June 2019

Figure 29



Legend

- Project Opportunity
- Other Project Opportunity
- Parcel Boundary
- Storm Drain Line
- Channel
- Storm Drain Inlet

Proj. No 30

APN 173142016

Street Name

Project Name CCC_173142016

Location Walnut Creek

N

0 40 80 Feet

Contra Costa Public Works GI Plan
Project Opportunities

Geosyntec consultants

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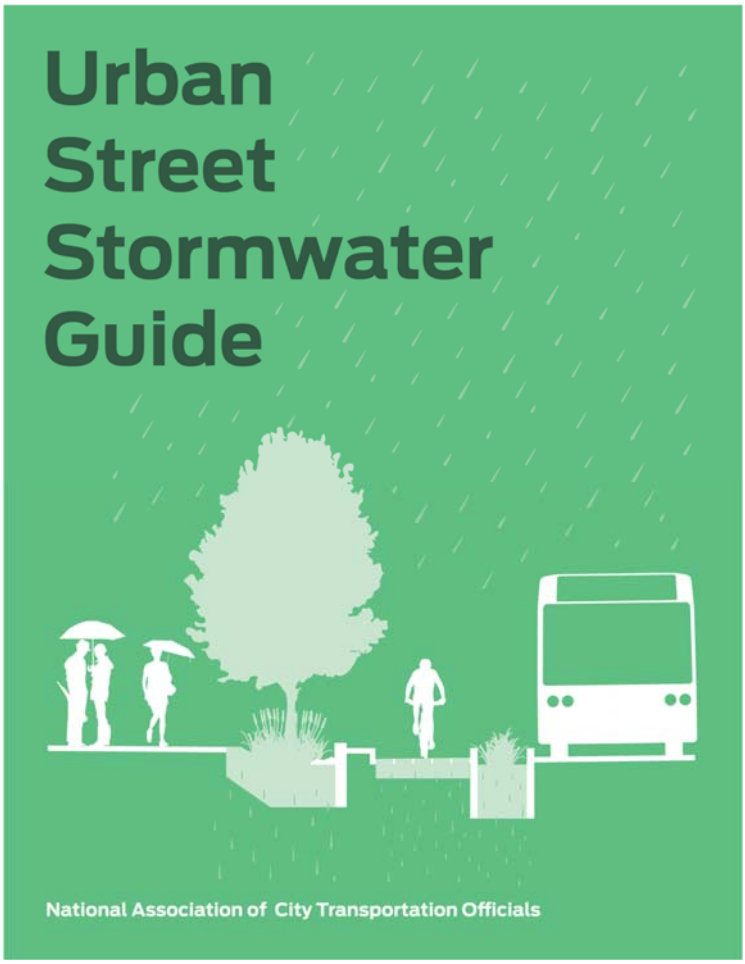
Figure 30

Appendix B. Green Infrastructure Guidelines for Streetscapes and Project Design

Included in this appendix:

1. National Association of City Transportation Officials, *Urban Street Stormwater Guide*, 2017.

2. San Mateo Countywide Water Pollution Prevention Program, *San Mateo County Sustainable Green Streets and Parking Lots Design Guidebook*, First Edition, 2009.



Access via: https://nacto.org/publication/urban-street-stormwater-guide/

San Mateo County Sustainable Green Streets and Parking Lots Design Guidebook

First Edition ~ January 2009

SAN MATEO COUNTYWIDE
Water Pollution Prevention Program
Clean Water. Healthy Community.

Prepared by:

Nevue Ngan Associates
Sherwood Design Engineers

<< *El Camino Real*
Green Street Concept Sketch
San Mateo County, California

Access via:
https://www.flowstobay.org/documents/municipalities/sustainable%20streets/San%20Mateo%20Guidebook.pdf

Appendix C. Green Infrastructure Specifications and Typical Design Details

Included in this appendix:

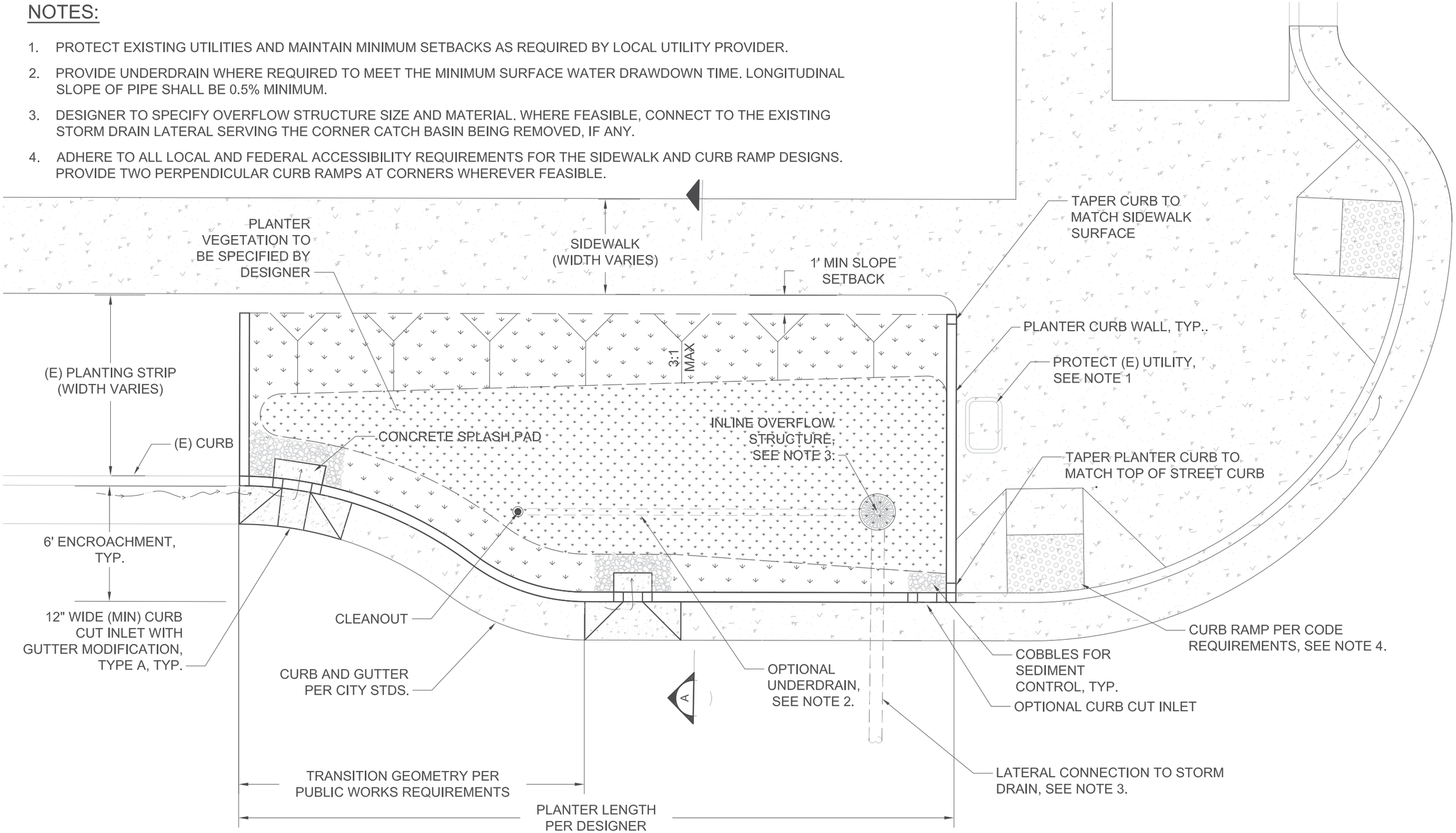
1. BASMAA, *Urban Greening Typical GI Details*, 2017.

2. CASQA and LIDI, *Bioretention Details*, 2017.

3. SFPUC, *San Francisco Stormwater Management Requirements and Design Guidelines*, Appendix B, 2016.

NOTES:

1. PROTECT EXISTING UTILITIES AND MAINTAIN MINIMUM SETBACKS AS REQUIRED BY LOCAL UTILITY PROVIDER.
2. PROVIDE UNDERDRAIN WHERE REQUIRED TO MEET THE MINIMUM SURFACE WATER DRAWDOWN TIME. LONGITUDINAL SLOPE OF PIPE SHALL BE 0.5% MINIMUM.
3. DESIGNER TO SPECIFY OVERFLOW STRUCTURE SIZE AND MATERIAL. WHERE FEASIBLE, CONNECT TO THE EXISTING STORM DRAIN LATERAL SERVING THE CORNER CATCH BASIN BEING REMOVED, IF ANY.
4. ADHERE TO ALL LOCAL AND FEDERAL ACCESSIBILITY REQUIREMENTS FOR THE SIDEWALK AND CURB RAMP DESIGNS. PROVIDE TWO PERPENDICULAR CURB RAMPS AT CORNERS WHEREVER FEASIBLE.



BASMAA URBAN GREENING TYPICAL GI DETAILS
BULBOUT ALTERNATIVE 1
SLOPED SIDES, INLINE OVERFLOW STRUCTURE, CURB CUT INLET TYPE A

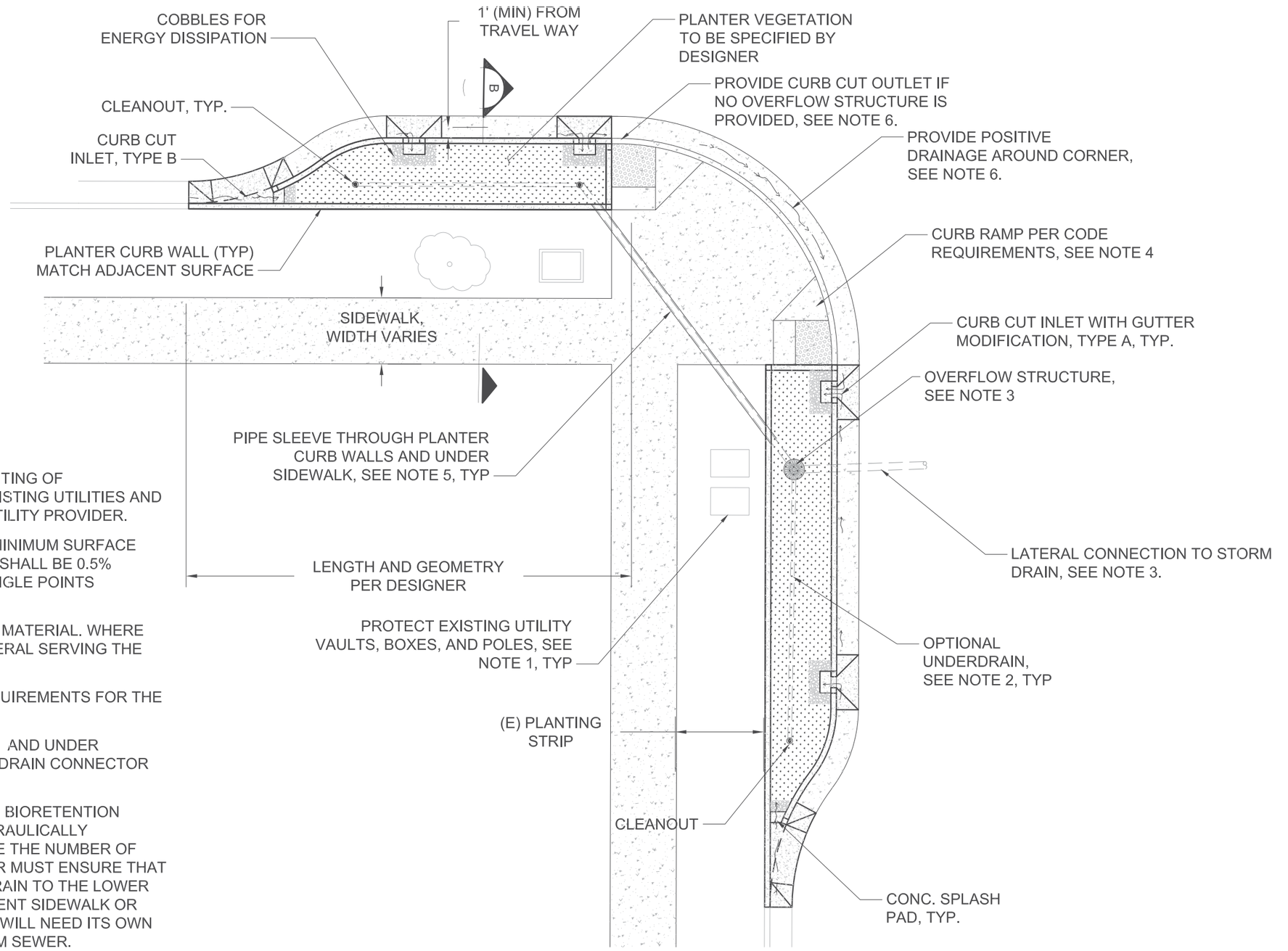
SCALE: 1"=5'

DRAWN BY: BF

CHECKED BY: SD

DATE : APRIL 14, 2017

SHEET NUMBER C-1.1



NOTES:

1. AVOID UTILITY CONFLICTS WHEREVER FEASIBLE IN THE SITING OF BIORETENTION PLANTERS. IF UNAVOIDABLE, PROTECT EXISTING UTILITIES AND MAINTAIN MINIMUM SETBACKS AS REQUIRED BY LOCAL UTILITY PROVIDER.
2. PROVIDE UNDERDRAIN WHERE REQUIRED TO MEET THE MINIMUM SURFACE WATER DRAWDOWN TIME. LONGITUDINAL SLOPE OF PIPE SHALL BE 0.5% MINIMUM. PROVIDE CLEANOUT AT UPSTREAM END AND ANGLE POINTS EXCEEDING 45 DECREES.
3. DESIGNER TO SPECIFY OVERFLOW STRUCTURE SIZE AND MATERIAL. WHERE FEASIBLE, CONNECT TO THE EXISTING STORM DRAIN LATERAL SERVING THE CORNER CATCH BASIN BEING REMOVED, IF ANY.
4. ADHERE TO ALL LOCAL AND FEDERAL ACCESSIBILITY REQUIREMENTS FOR THE SIDEWALK AND CURB RAMP DESIGNS.
5. PROVIDE PIPE SLEEVES THROUGH PLANTER CURB WALLS AND UNDER SIDEWALK TO ALLOW FOR THE PASSING OF SOLID UNDERDRAIN CONNECTOR PIPES.
6. IF THE GRADES AND EXISTING SITE CONSTRAINTS ALLOW, BIORETENTION PLANTERS ON EITHER SIDE OF THE CORNER CAN BE HYDRAULICALLY CONNECTED TO OPTIMIZE TREATMENT AREA AND REDUCE THE NUMBER OF CONNECTIONS TO THE STORM SEWER SYSTEM. DESIGNER MUST ENSURE THAT THE HIGHER BIORETENTION PLANTER CAN POSITIVELY DRAIN TO THE LOWER BIORETENTION PLANTER WITHOUT FLOODING THE ADJACENT SIDEWALK OR ROADWAY. IF INFEASIBLE, EACH BIORETENTION PLANTER WILL NEED ITS OWN OVERFLOW STRUCTURE AND CONNECTION TO THE STORM SEWER.

BASMAA URBAN GREENING TYPICAL GI DETAILS
BULBOUT ALTERNATIVE 2
WALLED BIORETENTION ON BOTH SIDES OF CORNER, CURB CUT INLETS TYPE A & B

SCALE: 1"=10'

DRAWN BY: BF

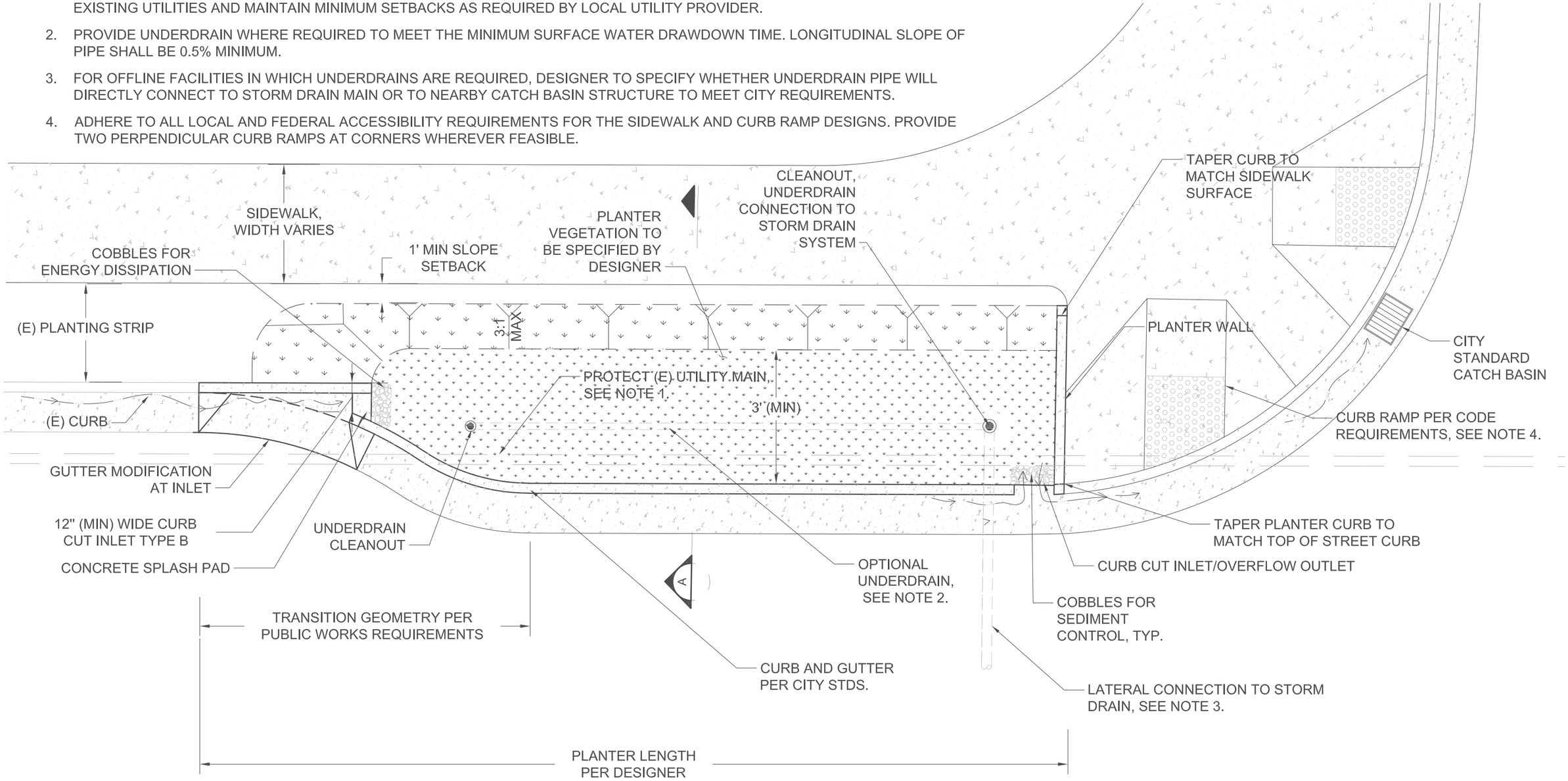
CHECKED BY: SD

DATE : APRIL 14, 2017

SHEET NUMBER C-1.2

NOTES:

1. AVOID UTILITY CONFLICTS WHENEVER POSSIBLE IN THE SITING OF BIORETENTION PLANTERS. IF UNAVOIDABLE, PROTECT EXISTING UTILITIES AND MAINTAIN MINIMUM SETBACKS AS REQUIRED BY LOCAL UTILITY PROVIDER.
2. PROVIDE UNDERDRAIN WHERE REQUIRED TO MEET THE MINIMUM SURFACE WATER DRAWDOWN TIME. LONGITUDINAL SLOPE OF PIPE SHALL BE 0.5% MINIMUM.
3. FOR OFFLINE FACILITIES IN WHICH UNDERDRAINS ARE REQUIRED, DESIGNER TO SPECIFY WHETHER UNDERDRAIN PIPE WILL DIRECTLY CONNECT TO STORM DRAIN MAIN OR TO NEARBY CATCH BASIN STRUCTURE TO MEET CITY REQUIREMENTS.
4. ADHERE TO ALL LOCAL AND FEDERAL ACCESSIBILITY REQUIREMENTS FOR THE SIDEWALK AND CURB RAMP DESIGNS. PROVIDE TWO PERPENDICULAR CURB RAMPS AT CORNERS WHEREVER FEASIBLE.



BASMAA URBAN GREENING TYPICAL GI DETAILS
BULBOUT ALTERNATIVE 3
SLOPED AND WALLED SIDES, CURB CUT INLET TYPE B, CURB CUT OVERFLOW ONLY

SCALE: 1"=5'

DRAWN BY: BF

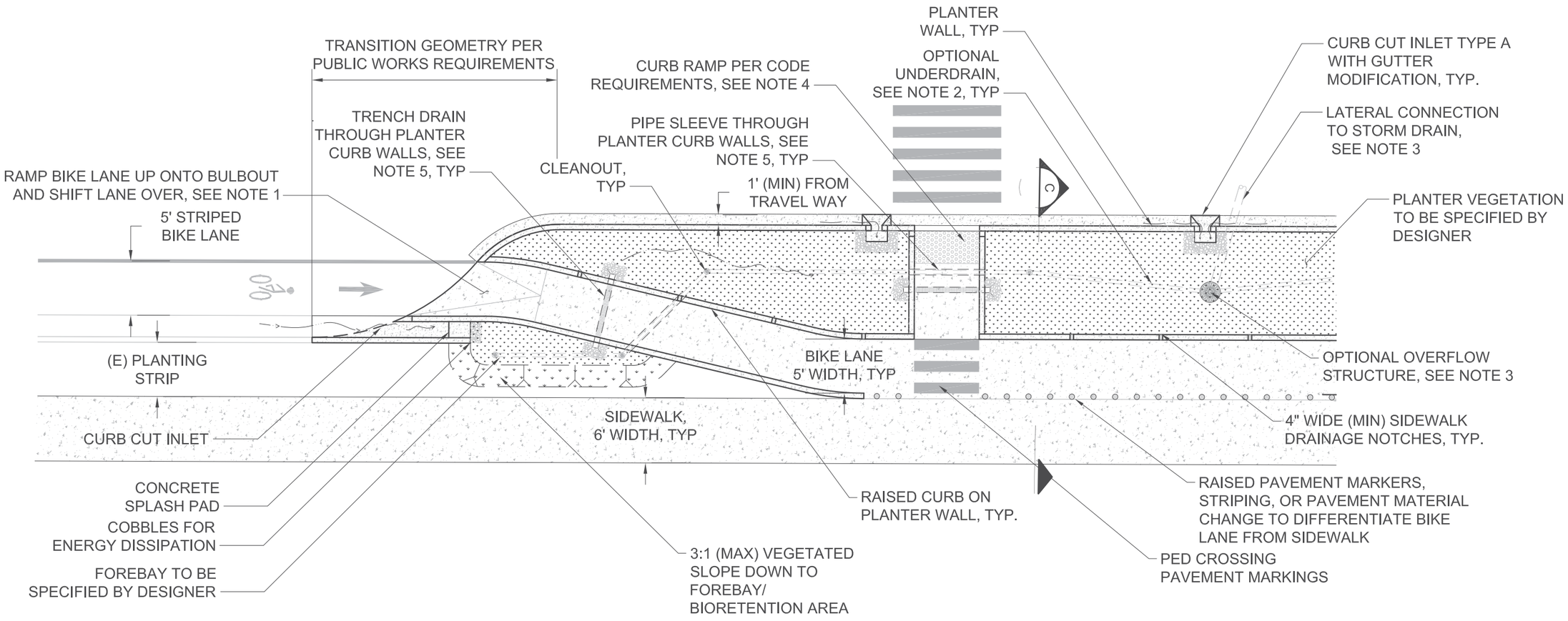
CHECKED BY: SD

DATE : APIRL 14, 2017

SHEET NUMBER C-1.3

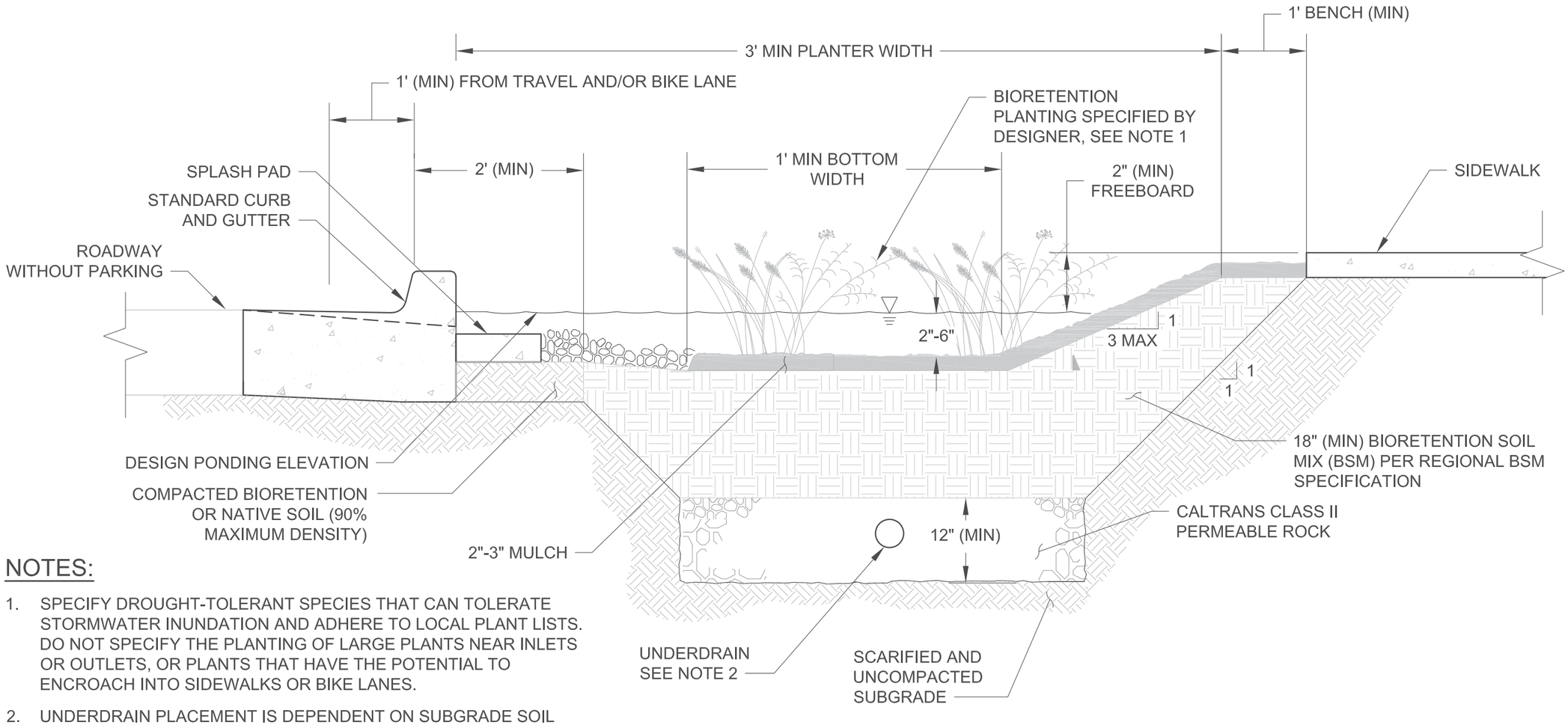
NOTES:

1. FOR HORIZONTAL BIKE LANE SHIFT, PROVIDE MAXIMUM 1:5 TRANSITION RATE.
2. PROVIDE UNDERDRAIN WHERE REQUIRED TO MEET THE MINIMUM SURFACE WATER DRAWDOWN TIME. LONGITUDINAL SLOPE OF PIPE SHALL BE 0.5% MINIMUM. PROVIDE CLEANOUT AT UPSTREAM END AND ANGLE POINTS EXCEEDING 45 DEGREES.
3. DESIGNER TO SPECIFY OVERFLOW STRUCTURE SIZE AND MATERIAL. WHERE FEASIBLE, CONNECT TO THE EXISTING STORM DRAIN LATERAL SERVING THE CORNER CATCH BASIN BEING REMOVED, IF ANY.
4. ADHERE TO ALL LOCAL AND FEDERAL ACCESSIBILITY REQUIREMENTS FOR THE SIDEWALK AND CURB RAMP DESIGNS.
5. PROVIDE TRENCH DRAINS THROUGH PLANTER CURB WALLS TO ALLOW FOR THE HYDRAULIC CONNECTION OF SEPARATED BIORETENTION PLANTERS AND PIPE SLEEVES FOR THE PASSING OF SOLID UNDERDRAIN CONNECTOR PIPES.



BASMAA URBAN GREENING TYPICAL GI DETAILS
BULBOUT ALTERNATIVE 4
MIDBLOCK BULBOUT WITH RAISED BIKE LANE AND PEDESTRIAN CROSSING

SCALE: 1"=10'	DATE : APRIL 14, 2017
DRAWN BY: BF	
CHECKED BY: SD	SHEET NUMBER C-1.4



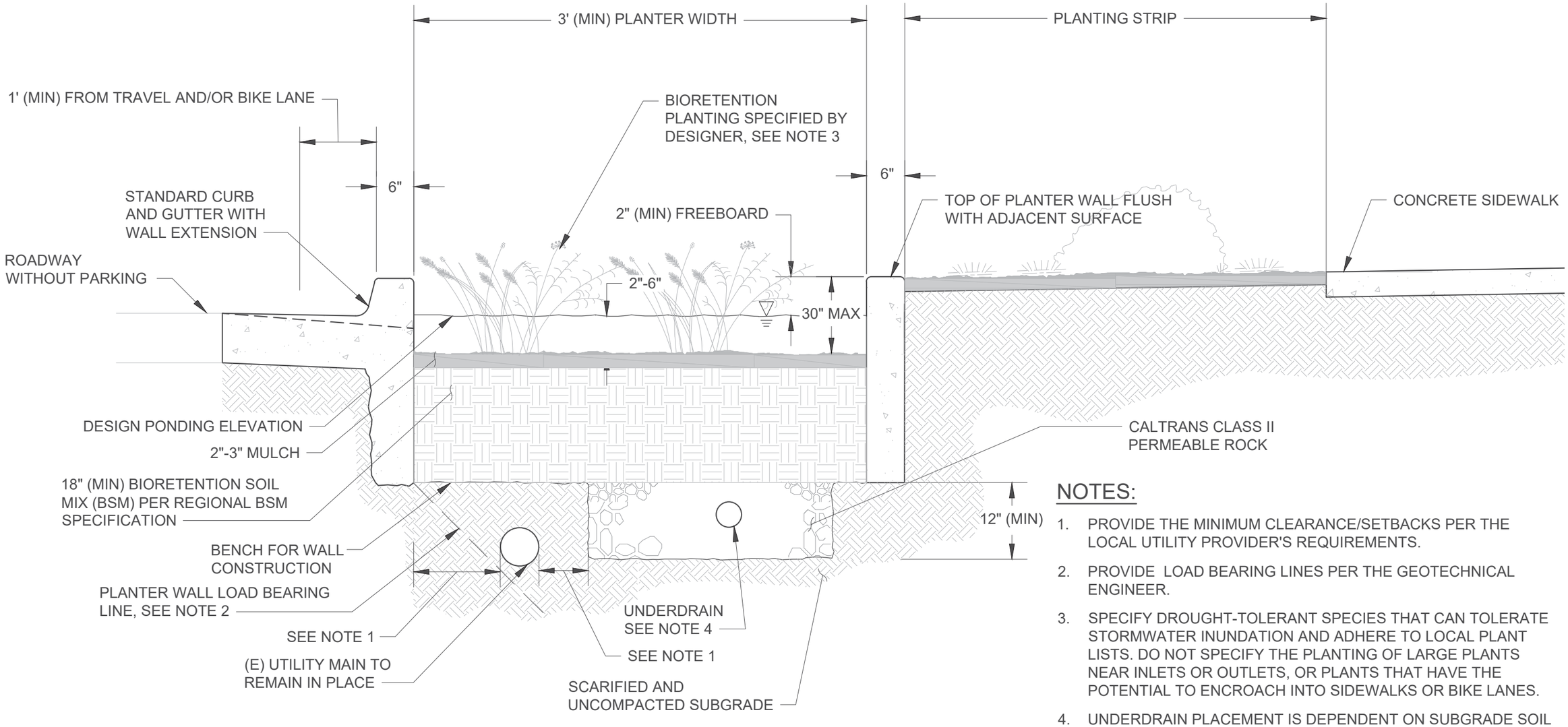
NOTES:

1. SPECIFY DROUGHT-TOLERANT SPECIES THAT CAN TOLERATE STORMWATER INUNDATION AND ADHERE TO LOCAL PLANT LISTS. DO NOT SPECIFY THE PLANTING OF LARGE PLANTS NEAR INLETS OR OUTLETS, OR PLANTS THAT HAVE THE POTENTIAL TO ENCROACH INTO SIDEWALKS OR BIKE LANES.
2. UNDERDRAIN PLACEMENT IS DEPENDENT ON SUBGRADE SOIL CONDITIONS. FOR TYPE B/C SOILS, THE UNDERDRAIN MAY BE ELEVATED TOWARDS THE TOP OF THE AGGREGATE STORAGE LAYER, APPROXIMATELY 3" BELOW BOTTOM OF BIORETENTION SOIL. FOR TYPE D SOILS, THE UNDERDRAIN SHALL BE PLACED 2" ABOVE THE SUBGRADE.

BIORETENTION BULBOUT SECTION A

BASMAA URBAN GREENING TYPICAL GI DETAILS
SECTION A-A
SLOPED SIDES / NO CURB WALLS

SCALE: 3/4"=1'
DRAWN BY: BF
CHECKED BY: SD
DATE : APRIL 14, 2017
SHEET NUMBER S-A-A



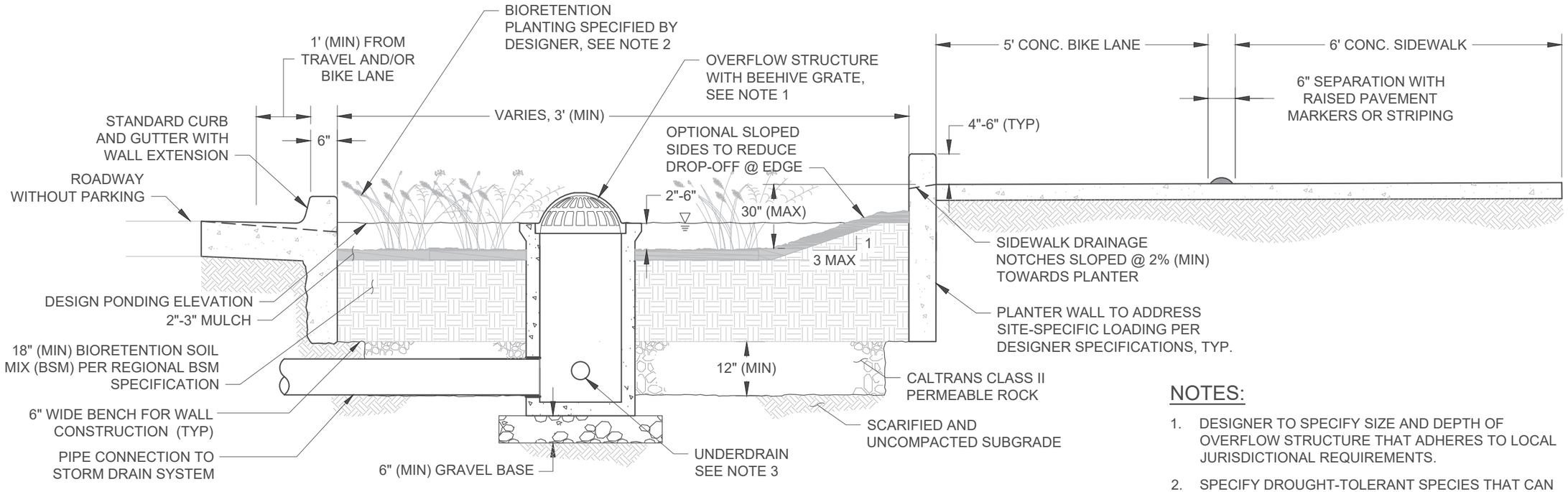
BIORETENTION BULBOUT SECTION B

NOTES:

1. PROVIDE THE MINIMUM CLEARANCE/SETBACKS PER THE LOCAL UTILITY PROVIDER'S REQUIREMENTS.
2. PROVIDE LOAD BEARING LINES PER THE GEOTECHNICAL ENGINEER.
3. SPECIFY DROUGHT-TOLERANT SPECIES THAT CAN TOLERATE STORMWATER INUNDATION AND ADHERE TO LOCAL PLANT LISTS. DO NOT SPECIFY THE PLANTING OF LARGE PLANTS NEAR INLETS OR OUTLETS, OR PLANTS THAT HAVE THE POTENTIAL TO ENCROACH INTO SIDEWALKS OR BIKE LANES.
4. UNDERDRAIN PLACEMENT IS DEPENDENT ON SUBGRADE SOIL CONDITIONS. FOR TYPE B/C SOILS, THE UNDERDRAIN MAY BE ELEVATED TOWARDS THE TOP OF THE AGGREGATE STORAGE LAYER, APPROXIMATELY 3" BELOW BOTTOM OF BIORETENTION SOIL. FOR TYPE D SOILS, THE UNDERDRAIN SHALL BE PLACED 2" ABOVE THE SUBGRADE.

BASMAA URBAN GREENING TYPICAL GI DETAILS
SECTION B-B
WALLS ON BOTH SIDES, UTILITY MAIN PROTECTION

SCALE: 3/4"=1'
DRAWN BY: BF
CHECKED BY: SD
DATE : April 14, 2017
SHEET NUMBER S-B-B



MIDBLOCK BULBOUT SECTION C

NOTES:

1. DESIGNER TO SPECIFY SIZE AND DEPTH OF OVERFLOW STRUCTURE THAT ADHERES TO LOCAL JURISDICTIONAL REQUIREMENTS.
2. SPECIFY DROUGHT-TOLERANT SPECIES THAT CAN TOLERATE STORMWATER INUNDATION AND ADHERE TO LOCAL PLANT LISTS. DO NOT SPECIFY THE PLANTING OF LARGE PLANTS NEAR INLETS OR OUTLETS, OR PLANTS THAT HAVE THE POTENTIAL TO ENCROACH INTO SIDEWALKS OR BIKE LANES.
3. UNDERDRAIN PLACEMENT IS DEPENDENT ON SUBGRADE SOIL CONDITIONS. FOR TYPE B/C SOILS, THE UNDERDRAIN MAY BE ELEVATED TOWARDS THE TOP OF THE AGGREGATE STORAGE LAYER, APPROXIMATELY 3" BELOW BOTTOM OF BIORETENTION SOIL. FOR TYPE D SOILS, THE UNDERDRAIN SHALL BE PLACED 2" ABOVE THE SUBGRADE.

BASMAA URBAN GREENING TYPICAL GI DETAILS
SECTION C-C
RAISED BIKE LANE, OVERFLOW STRUCTURE

SCALE: 1"=2'

DRAWN BY: BF

CHECKED BY: SD

DATE : April 14, 2017

SHEET NUMBER S-C-C

CASQA-LIDI BIORETENTION DETAILS

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CASQA-LIDI BIORETENTION DETAILS

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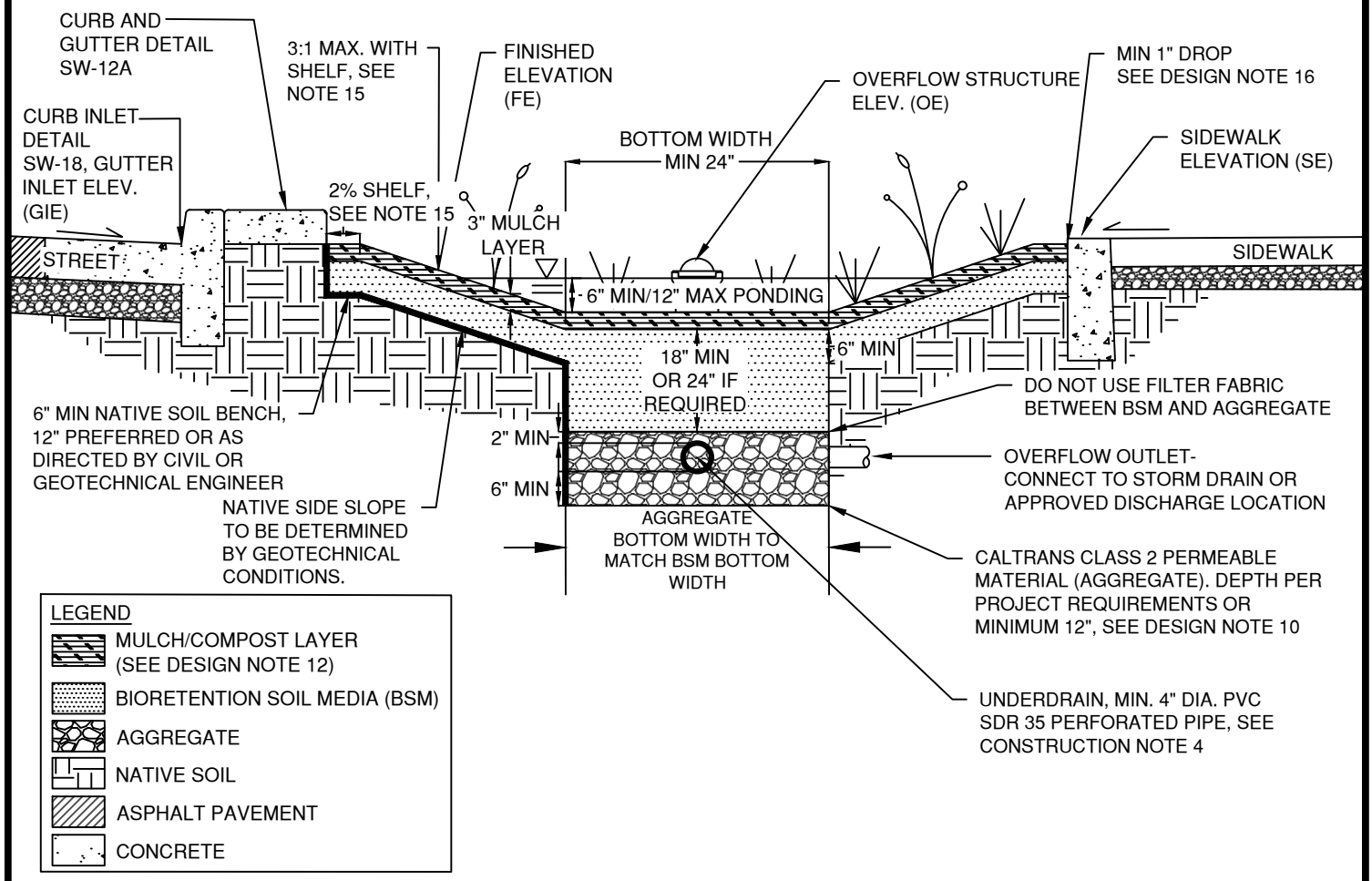
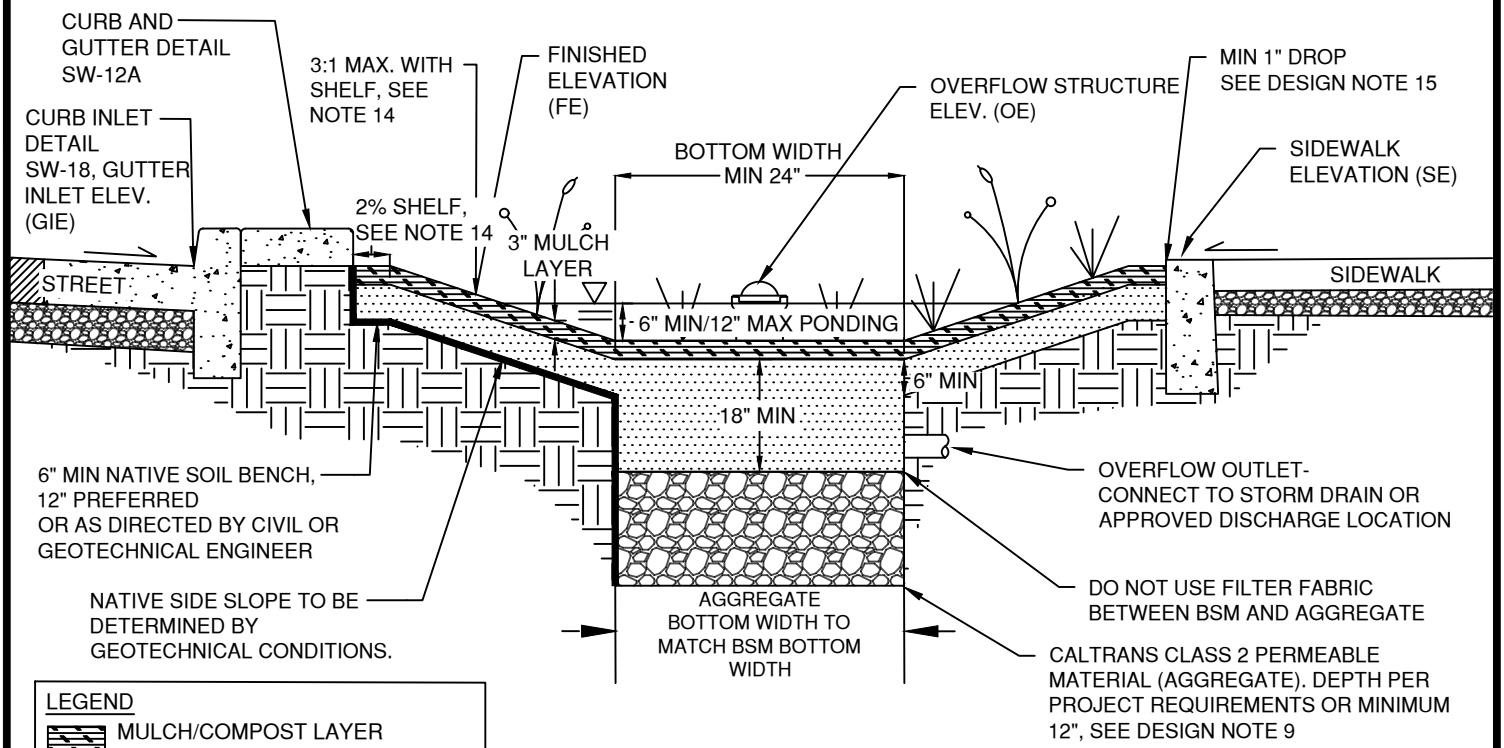


CONSTRUCTION NOTES

1. MAINTAIN UNDISTURBED NATIVE SOIL BENCH TO SUPPORT ADJACENT SIDEWALK/ROAD. SEQUENCE WORK TO CONSTRUCT CURBS BEFORE EXCAVATING BIORETENTION AREA FOR AGGREGATE AND BSM.
2. SCARIFY SUBGRADE BEFORE INSTALLING BIORETENTION AREA AGGREGATE AND BSM.
3. FACILITY EXCAVATION TO ALLOW FOR SPECIFIED AGGREGATE, BSM, AND MULCH DEPTHS TO ACHIEVE FINISHED ELEVATIONS ON CIVIL PLANS.
4. INSTALL UNDERDRAIN WITH HOLES FACING DOWN. TOP OF UNDERDRAIN 6" BELOW TOP OF AGGREGATE LAYER. UNDERDRAIN SLOPE MAY BE FLAT.
5. PLACE BSM IN 6" LIFTS. COMPACT EACH 6" LIFT OF BSM WITH LANDSCAPE ROLLER OR BY LIGHTLY WETTING. IF WETTING, LET DRY OVERNIGHT BEFORE PLANTING.
6. DO NOT WORK WITHIN BIORETENTION AREA DURING RAIN OR UNDER WET CONDITIONS.
7. KEEP HEAVY MACHINERY OUTSIDE BIORETENTION AREA LIMITS.
8. STORMWATER SHOULD BE DIRECTED AWAY FROM BIORETENTION UNTIL CONSTRUCTION IS COMPLETE AND DRAINAGE AREA VEGETATION IS STABILIZED.

DESIGN NOTES

1. BIORETENTION FACILITY DESIGN SHOULD OPTIMIZE THE FLAT BOTTOM DIMENSIONS (I.E., WIDTH, LENGTH) TO MAXIMIZE THE FUNCTIONAL AREA OF THE FACILITY.
2. CAPTURE AND CONVEY OVERFLOW TO STORM DRAIN SYSTEM (DETAIL SW-22, SW-23). ALTERNATIVELY, CONVEY OVERFLOW TO APPROVED DISCHARGE LOCATION THROUGH OTHER OVERLAND METHODS (IE. CURB CUTS, SIDEWALK UNDERDRAIN, WEIR, ETC.).
3. PROVIDE SPOT ELEVATIONS AT INLETS AND OVERFLOW STRUCTURES ON CIVIL PLANS (FE, OE, GIE, SIE), PER DETAIL SW-18.
4. DUE TO SITE VARIABILITY, TO ENSURE THE LONG-TERM STRUCTURAL STABILITY OF THE BIORETENTION FACILITY AND ANY ADJACENT INFRASTRUCTURE CONSULT WITH A GEOTECHNICAL ENGINEER.
5. A VERTICAL LINER MAY BE USED FOR BIORETENTION FACILITIES TO PREVENT LATERAL FLOW AND TO SEPARATE THE NATIVE SOIL FROM THE BSM AND THE AGGREGATE, HOWEVER A HORIZONTAL LINER SHALL NOT BE USED.
6. DO NOT USE FILTER FABRIC BETWEEN BSM AND AGGREGATE.
7. PROVIDE CAPPED, THREADED PVC CLEANOUT FOR UNDERDRAIN, 4" MIN. DIA. WITH SWEEP BEND.
8. PROVIDE A CLEAN-OUT/OBSERVATION PORT IN EACH FACILITY, PER BIORETENTION TECHNICAL SPECIFICATIONS.
9. ON LONGITUDINAL SLOPE, USE CHECK DAMS (DETAILS SW-20, SW-21)
10. DEPTH OF AGGREGATE DETERMINED BY FACILITY SIZING. IF CALTRANS CLASS 2 PERMEABLE IS NOT AVAILABLE, SUBSTITUTE CLASS 3 PERMEABLE WITH AN OVERLYING 3" DEEP CHOKING LAYER OF EITHER CALTRANS COURSE AGGREGATE 1/2" (NO. 4) OR 3/4" X (NO.4) OPEN-GRADED AGGREGATE.
11. BIORETENTION SOIL MEDIA (BSM) SPECIFICATION PER BIORETENTION TECHNICAL SPECIFICATIONS.
12. PLANT SELECTION PER BIORETENTION TECHNICAL SPECIFICATIONS.
13. MULCH PER BIORETENTION TECHNICAL SPECIFICATIONS.
14. LOCATE ENERGY DISSIPATION AS SPECIFIED IN INLET DETAILS.
15. NATIVE SIDE SLOPE 4:1 (H:V) PREFERRED, 3:1 WITH SHELF. 6" MINIMUM SHELF WITH 2% SLOPE TOWARDS FACILITY ADJACENT TO PEDESTRIAN USE OR CURB UNLESS 4:1 SLOPE PROVIDED.
16. INCLUDE AT LEAST 1" DROP FROM CURB ABOVE MULCH LAYER.
17. AVOID DECORATIVE USE OF COBBLE THAT CAN INTERFERE WITH WITH INFILTRATION.



CONSTRUCTION NOTES

1. MAINTAIN UNDISTURBED NATIVE SOIL BENCH TO SUPPORT ADJACENT SIDEWALK/ROAD. SEQUENCE WORK TO CONSTRUCT CURBS BEFORE EXCAVATING BIORETENTION AREA FOR AGGREGATE AND BSM.
2. SCARIFY SUBGRADE BEFORE INSTALLING BIORETENTION AREA AGGREGATE AND BSM.
3. FACILITY EXCAVATION TO ALLOW FOR SPECIFIED AGGREGATE, BSM, AND MULCH DEPTHS TO ACHIEVE FINISHED ELEVATIONS ON CIVIL PLANS.
4. PLACE BSM IN 6" LIFTS. COMPACT EACH 6" LIFT OF BSM WITH LANDSCAPE ROLLER OR BY LIGHTLY WETTING. IF WETTING, LET DRY OVERNIGHT BEFORE PLANTING.
5. DO NOT WORK WITHIN BIORETENTION AREA DURING RAIN OR UNDER WET CONDITIONS.
6. KEEP HEAVY MACHINERY OUTSIDE BIORETENTION AREA LIMITS.
7. STORMWATER SHOULD BE DIRECTED AWAY FROM BIORETENTION UNTIL CONSTRUCTION IS COMPLETE AND DRAINAGE AREA VEGETATION IS STABILIZED.

DESIGN NOTES

1. BIORETENTION FACILITY DESIGN SHOULD OPTIMIZE THE FLAT BOTTOM DIMENSIONS (I.E., WIDTH, LENGTH) TO MAXIMIZE THE FUNCTIONAL AREA OF THE FACILITY.

2. CAPTURE AND CONVEY OVERFLOW TO STORM DRAIN SYSTEM (DETAIL SW-22, SW-23). ALTERNATIVELY, CONVEY OVERFLOW TO APPROVED DISCHARGE LOCATION THROUGH OTHER OVERLAND METHODS (IE. CURB CUTS, SIDEWALK UNDERDRAIN, WEIR, ETC.).

3. PROVIDE SPOT ELEVATIONS AT INLETS AND OVERFLOW STRUCTURES ON CIVIL PLANS (FE, OE, GIE, SIE), PER DETAIL SW-18.

4. DUE TO SITE VARIABILITY, TO ENSURE THE LONG-TERM STRUCTURAL STABILITY OF THE BIORETENTION FACILITY AND ANY ADJACENT INFRASTRUCTURE CONSULT WITH A GEOTECHNICAL ENGINEER.

5. A VERTICAL LINER MAY BE USED FOR BIORETENTION FACILITIES TO PREVENT LATERAL FLOW AND TO SEPARATE THE NATIVE SOIL FROM THE BSM AND THE AGGREGATE, HOWEVER A HORIZONTAL LINER SHALL NOT BE USED.

6. DO NOT USE FILTER FABRIC BETWEEN BSM AND AGGREGATE.

7. PROVIDE A CLEAN-OUT/OBSERVATION PORT IN EACH FACILITY, PER BIORETENTION TECHNICAL SPECIFICATIONS.

8. ON LONGITUDINAL SLOPE, USE CHECK DAMS (DETAILS SW-20, SW-21)

9. USE AND DEPTH OF AGGREGATE DETERMINED BY FACILITY SIZING. IF CALTRANS CLASS 2 PERMEABLE IS NOT AVAILABLE, SUBSTITUTE CLASS 3 PERMEABLE WITH AN OVERLYING 3" DEEP CHOKING LAYER OF EITHER CALTRANS COURSE AGGREGATE 1/2" (NO. 4) OR 3/4" X (NO. 4) OPEN-GRADED AGGREGATE.

10. BIORETENTION SOIL MEDIA (BSM) SPECIFICATION PER BIORETENTION TECHNICAL SPECIFICATIONS.

11. PLANT SELECTION PER BIORETENTION TECHNICAL SPECIFICATIONS.

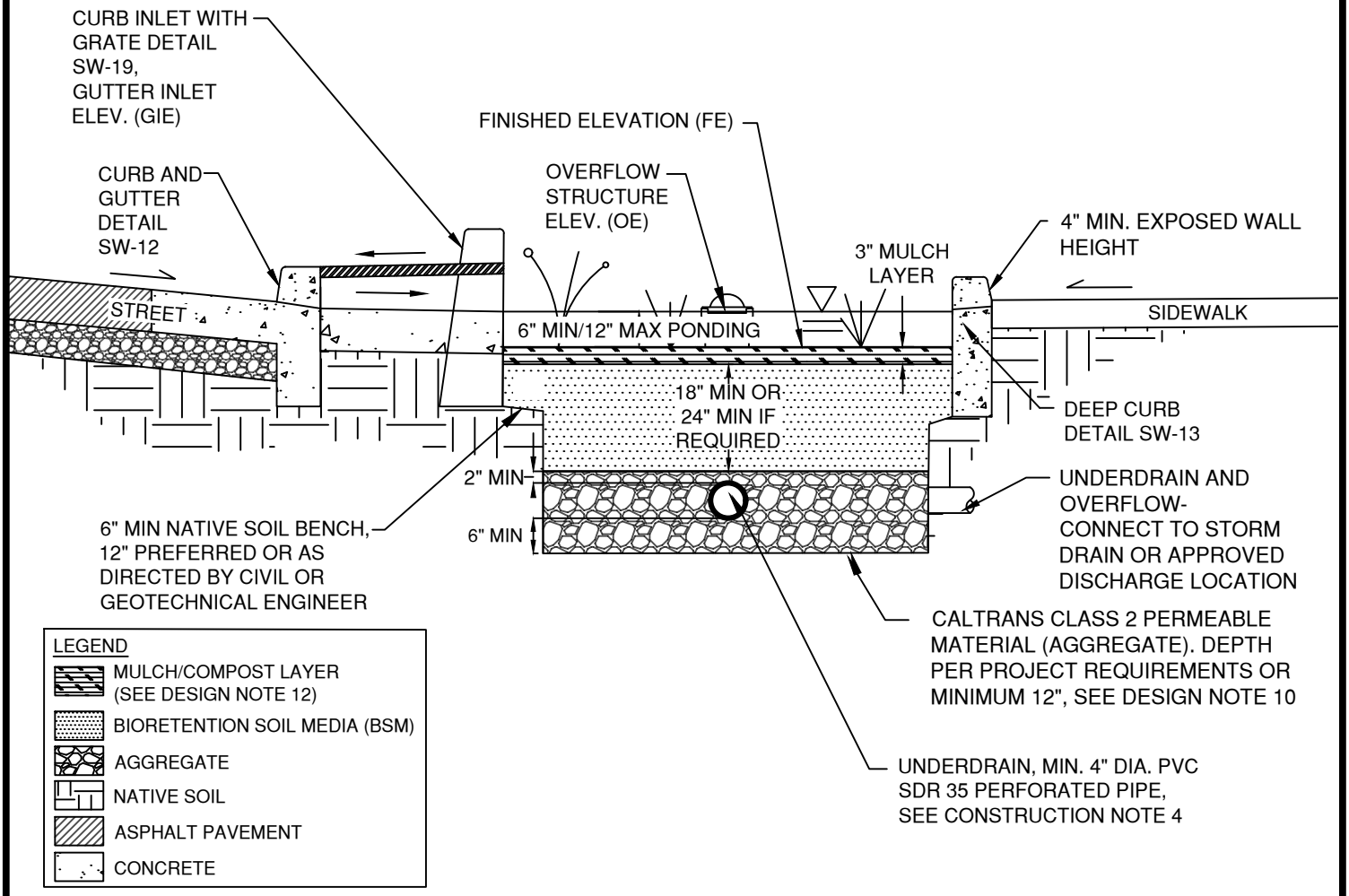
12. MULCH PER BIORETENTION TECHNICAL SPECIFICATIONS.

13. LOCATE ENERGY DISSIPATION AS SPECIFIED IN INLET DETAILS.

14. NATIVE SIDE SLOPE 4:1 (H:V) PREFERRED, 3:1 WITH SHELF. 6" MINIMUM SHELF WITH 2% SLOPE TOWARDS FACILITY ADJACENT TO PEDESTRIAN USE OR CURB UNLESS 4:1 SLOPE PROVIDED.

15. INCLUDE AT LEAST 1" DROP FROM CURB ABOVE MULCH LAYER.

16. AVOID DECORATIVE USE OF COBBLE THAT CAN INTERFERE WITH WITH INFILTRATION.

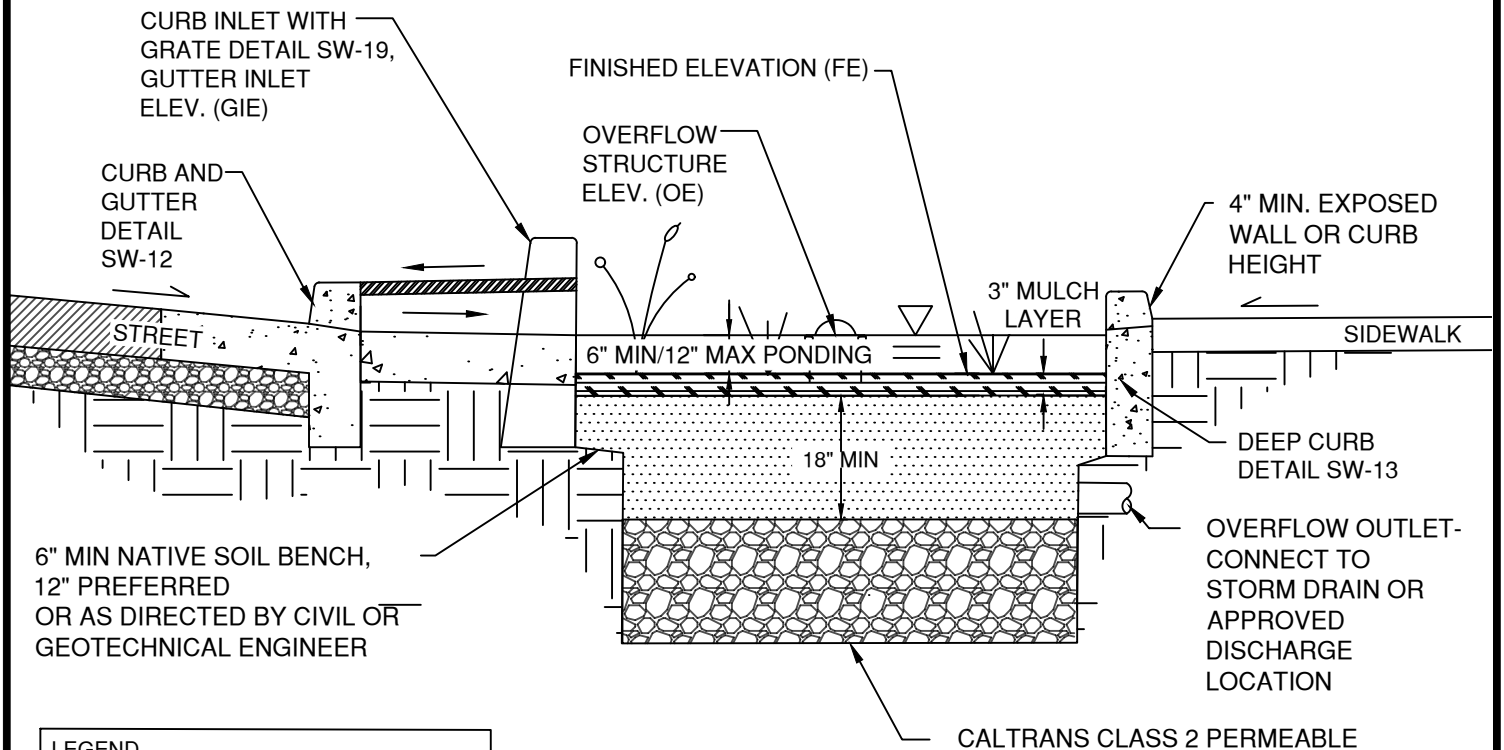


CONSTRUCTION NOTES

1. MAINTAIN UNDISTURBED NATIVE SOIL BENCH TO SUPPORT ADJACENT SIDEWALK/ROAD. SEQUENCE WORK TO CONSTRUCT CURBS BEFORE EXCAVATING BIORETENTION AREA FOR AGGREGATE AND BSM.
2. SCARIFY SUBGRADE BEFORE INSTALLING BIORETENTION AREA AGGREGATE AND BSM.
3. FACILITY EXCAVATION TO ALLOW FOR SPECIFIED AGGREGATE, BSM, AND MULCH DEPTHS TO ACHIEVE FINISHED ELEVATIONS ON CIVIL PLANS.
4. INSTALL UNDERDRAIN WITH HOLES FACING DOWN. TOP OF UNDERDRAIN 6" BELOW TOP OF AGGREGATE LAYER. UNDERDRAIN SLOPE MAY BE FLAT.
5. COMPACT EACH 6" LIFT OF BSM WITH LANDSCAPE ROLLER OR BY LIGHTLY WETTING. IF WETTING, LET DRY OVERNIGHT BEFORE PLANTING.
6. DO NOT WORK WITHIN BIORETENTION AREA DURING RAIN OR UNDER WET CONDITIONS.
7. KEEP HEAVY MACHINERY OUTSIDE BIORETENTION AREA LIMITS.
8. STORMWATER SHOULD BE DIRECTED AWAY FROM BIORETENTION UNTIL CONSTRUCTION IS COMPLETE AND DRAINAGE AREA VEGETATION IS STABILIZED.

DESIGN NOTES

1. BIORETENTIONFACILITY DESIGN SHOULD OPTIMIZE THE FLAT BOTTOM DIMENSIONS (I.E., WIDTH, LENGTH) TO MAXIMIZE THE FUNCTIONAL AREA OF THE FACILITY.
2. CAPTURE AND CONVEY OVERFLOW TO STORM DRAIN SYSTEM (DETAIL SW-22, SW-23). ALTERNATIVELY, CONVEY OVERFLOW TO APPROVED DISCHARGE LOCATION THROUGH OTHER OVERLAND METHODS (IE. CURB CUTS, SIDEWALK UNDERDRAIN, WEIR, ETC.).
3. PROVIDE SPOT ELEVATIONS AT INLETS AND OVERFLOW STRUCTURES ON CIVIL PLANS (FE,OE, GIE, SIE), PER DETAIL SW-18.
4. DUE TO SITE VARIABILITY, TO ENSURE THE LONG-TERM STRUCTURAL STABILITY OF THE BIORETENTION FACILITY AND ANY ADJACENT INFRASTRUCTURE CONSULT WITH A GEOTECHNICAL ENGINEER.
5. A VERTICAL LINER MAY BE USED FOR BIORETENTION FACILITIES TO PREVENT LATERAL FLOW AND TO SEPARATE THE NATIVE SOIL FROM THE BSM AND THE AGGREGATE, HOWEVER A HORIZONTAL LINER SHALL NOT BE USED.
6. DO NOT USE FILTER FABRIC BETWEEN BSM AND AGGREGATE.
7. PROVIDE CAPPED, THREADED PVC CLEANOUT FOR UNDERDRAIN, 4" MIN. DIA. WITH SWEEP BEND.
8. PROVIDE A CLEAN-OUT/OBSERVATION PORT IN EACH FACILITY, PER BIORETENTION TECHNICAL SPECIFICATIONS.
9. ON LONGITUDINAL SLOPE, USE CHECK DAMS (DETAILS SW-20, SW-21)
10. USE AND DEPTH OF AGGREGATE DETERMINED BY FACILITY SIZING. IF CALTRANS CLASS 2 PERMEABLE IS NOT AVAILABLE, SUBSTITUTE CLASS 3 PERMEABLE WITH AN OVERLYING 3" DEEP CHOKING LAYER OF EITHER CALTRANS COURSE AGGREGATE 1/2" (NO. 4) OR 3/4" X (NO. 4) OPEN-GRADED AGGREGATE.
11. BIORETENTION SOIL MEDIA (BSM) SPECIFICATION PER BIORETENTION TECHNICAL SPECIFICATIONS.
12. PLANT SELECTION PER BIORETENTION TECHNICAL SPECIFICATIONS.
13. MULCH PER BIORETENTION TECHNICAL SPECIFICATIONS.
14. LOCATE ENERGY DISSIPATION AS SPECIFIED IN INLET DETAILS.
15. AVOID DECORATIVE USE OF COBBLE THAT CAN INTERFERE WITH WITH INFILTRATION.



LEGEND

- MULCH/COMPOST LAYER (SEE DESIGN NOTE 12)
- BIORETENTION SOIL MEDIA (BSM)
- AGGREGATE
- NATIVE SOIL
- ASPHALT PAVEMENT
- CONCRETE

CONSTRUCTION NOTES

1. MAINTAIN UNDISTURBED NATIVE SOIL BENCH TO SUPPORT ADJACENT SIDEWALK/ROAD. SEQUENCE WORK TO CONSTRUCT CURBS BEFORE EXCAVATING BIORETENTION AREA FOR AGGREGATE AND BSM.
2. SCARIFY SUBGRADE BEFORE INSTALLING BIORETENTION AREA AGGREGATE AND BSM.
3. FACILITY EXCAVATION TO ALLOW FOR SPECIFIED AGGREGATE, BSM, AND MULCH DEPTHS TO ACHIEVE FINISHED ELEVATIONS ON CIVIL PLANS.
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5. DO NOT WORK WITHIN BIORETENTION AREA DURING RAIN OR UNDER WET CONDITIONS.
6. KEEP HEAVY MACHINERY OUTSIDE BIORETENTION AREA LIMITS.
7. STORMWATER SHOULD BE DIRECTED AWAY FROM BIORETENTION UNTIL CONSTRUCTION IS COMPLETE AND DRAINAGE AREA VEGETATION IS STABILIZED.

DESIGN NOTES

1. BIORETENTION FACILITY DESIGN SHOULD OPTIMIZE THE FLAT BOTTOM DIMENSIONS (I.E., WIDTH, LENGTH) TO MAXIMIZE THE FUNCTIONAL AREA OF THE FACILITY.

2. CAPTURE AND CONVEY OVERFLOW TO STORM DRAIN SYSTEM (DETAIL SW-22, SW-23). ALTERNATIVELY, CONVEY OVERFLOW TO APPROVED DISCHARGE LOCATION THROUGH OTHER OVERLAND METHODS (IE. CURB CUTS, SIDEWALK UNDERDRAIN, WEIR, ETC.).

3. PROVIDE SPOT ELEVATIONS AT INLETS AND OVERFLOW STRUCTURES ON CIVIL PLANS (FE, OE, GIE, SIE), PER DETAIL SW-18.

4. DUE TO SITE VARIABILITY, TO ENSURE THE LONG-TERM STRUCTURAL STABILITY OF THE BIORETENTION FACILITY AND ANY ADJACENT INFRASTRUCTURE CONSULT WITH A GEOTECHNICAL ENGINEER.

5. A VERTICAL LINER MAY BE USED FOR BIORETENTION FACILITIES TO PREVENT LATERAL FLOW AND TO SEPARATE THE NATIVE SOIL FROM THE BSM AND THE AGGREGATE, HOWEVER A HORIZONTAL LINER SHALL NOT BE USED.

6. DO NOT USE FILTER FABRIC BETWEEN BSM AND AGGREGATE.

7. PROVIDE A CLEAN-OUT/OBSERVATION PORT IN EACH FACILITY, PER BIORETENTION TECHNICAL SPECIFICATIONS.

8. ON LONGITUDINAL SLOPE, USE CHECK DAMS (DETAILS SW-20, SW-21)

9. USE AND DEPTH OF AGGREGATE DETERMINED BY FACILITY SIZING. IF CALTRANS CLASS 2 PERMEABLE IS NOT AVAILABLE, SUBSTITUTE CLASS 3 PERMEABLE WITH AN OVERLYING 3" DEEP CHOKING LAYER OF EITHER CALTRANS COURSE AGGREGATE 1/2" (NO. 4) OR 3/4" X (NO. 4) OPEN-GRADED AGGREGATE.

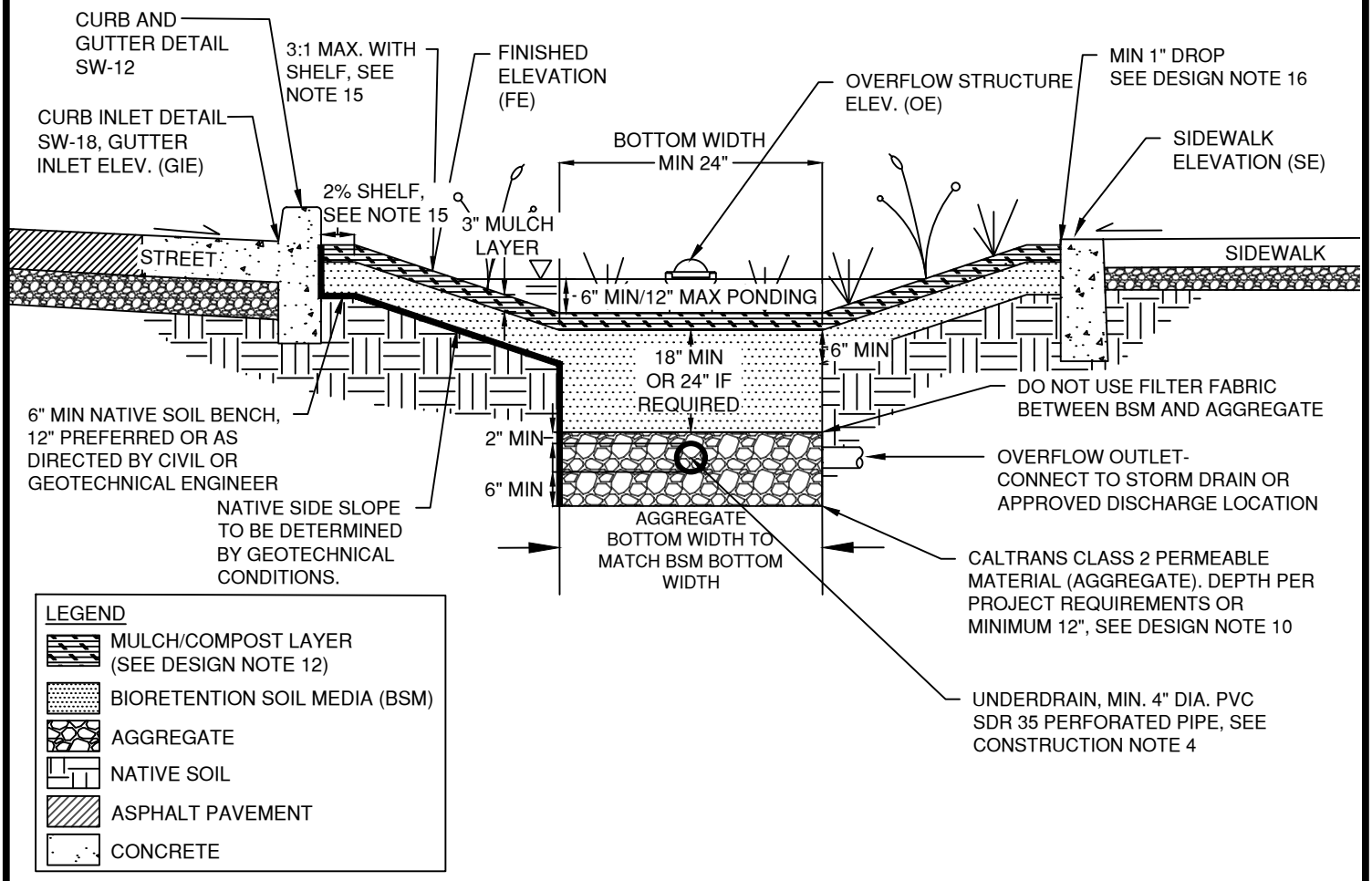
10. BIORETENTION SOIL MEDIA (BSM) SPECIFICATION PER BIORETENTION TECHNICAL SPECIFICATIONS.

11. PLANT SELECTION PER BIORETENTION TECHNICAL SPECIFICATIONS.

12. MULCH PER BIORETENTION TECHNICAL SPECIFICATIONS.

13. LOCATE ENERGY DISSIPATION AS SPECIFIED IN INLET DETAILS.

14. AVOID DECORATIVE USE OF COBBLE THAT CAN INTERFERE WITH WITH INFILTRATION.



CONSTRUCTION NOTES

1. MAINTAIN UNDISTURBED NATIVE SOIL BENCH TO SUPPORT ADJACENT SIDEWALK/ROAD. SEQUENCE WORK TO CONSTRUCT CURBS BEFORE EXCAVATING BIORETENTION AREA FOR AGGREGATE AND BSM.
2. SCARIFY SUBGRADE BEFORE INSTALLING BIORETENTION AREA AGGREGATE AND BSM.
3. FACILITY EXCAVATION TO ALLOW FOR SPECIFIED AGGREGATE, BSM, AND MULCH DEPTHS TO ACHIEVE FINISHED ELEVATIONS ON CIVIL PLANS.
4. INSTALL UNDERDRAIN WITH HOLES FACING DOWN. TOP OF UNDERDRAIN 6" BELOW TOP OF AGGREGATE LAYER. UNDERDRAIN SLOPE MAY BE FLAT.
5. PLACE BSM IN 6" LIFTS. COMPACT EACH 6" LIFT OF BSM WITH LANDSCAPE ROLLER OR BY LIGHTLY WETTING. IF WETTING, LET DRY OVERNIGHT BEFORE PLANTING.
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7. KEEP HEAVY MACHINERY OUTSIDE BIORETENTION AREA LIMITS.
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DESIGN NOTES

1. BIORETENTION FACILITY DESIGN SHOULD OPTIMIZE THE FLAT BOTTOM DIMENSIONS (I.E., WIDTH, LENGTH) TO MAXIMIZE THE FUNCTIONAL AREA OF THE FACILITY.

2. CAPTURE AND CONVEY OVERFLOW TO STORM DRAIN SYSTEM (DETAIL SW-22, SW-23). ALTERNATIVELY, CONVEY OVERFLOW TO APPROVED DISCHARGE LOCATION THROUGH OTHER OVERLAND METHODS (IE. CURB CUTS, SIDEWALK UNDERDRAIN, WEIR, ETC.).

3. PROVIDE SPOT ELEVATIONS AT INLETS AND OVERFLOW STRUCTURES ON CIVIL PLANS (FE, OE, GIE, SIE), PER DETAIL SW-18.

4. DUE TO SITE VARIABILITY, TO ENSURE THE LONG-TERM STRUCTURAL STABILITY OF THE BIORETENTION FACILITY AND ANY ADJACENT INFRASTRUCTURE CONSULT WITH A GEOTECHNICAL ENGINEER.

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9. ON LONGITUDINAL SLOPE, USE CHECK DAMS (DETAILS SW-20, SW-21)

10. DEPTH OF AGGREGATE DETERMINED BY FACILITY SIZING. IF CALTRANS CLASS 2 PERMEABLE IS NOT AVAILABLE, SUBSTITUTE CLASS 3 PERMEABLE WITH AN OVERLYING 3" DEEP CHOKING LAYER OF EITHER CALTRANS COURSE AGGREGATE 1/2" (NO. 4) OR 3/4" X (NO.4) OPEN-GRADED AGGREGATE.

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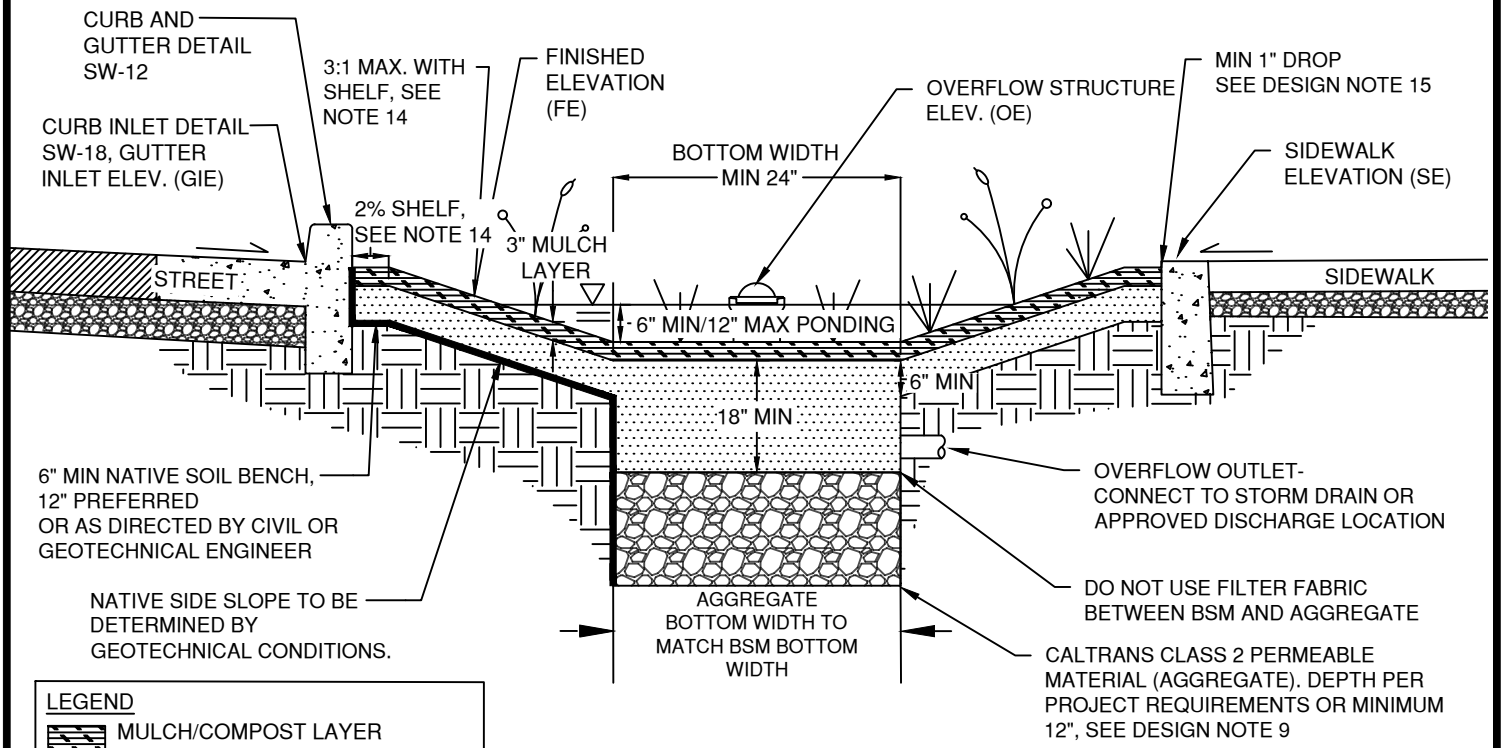

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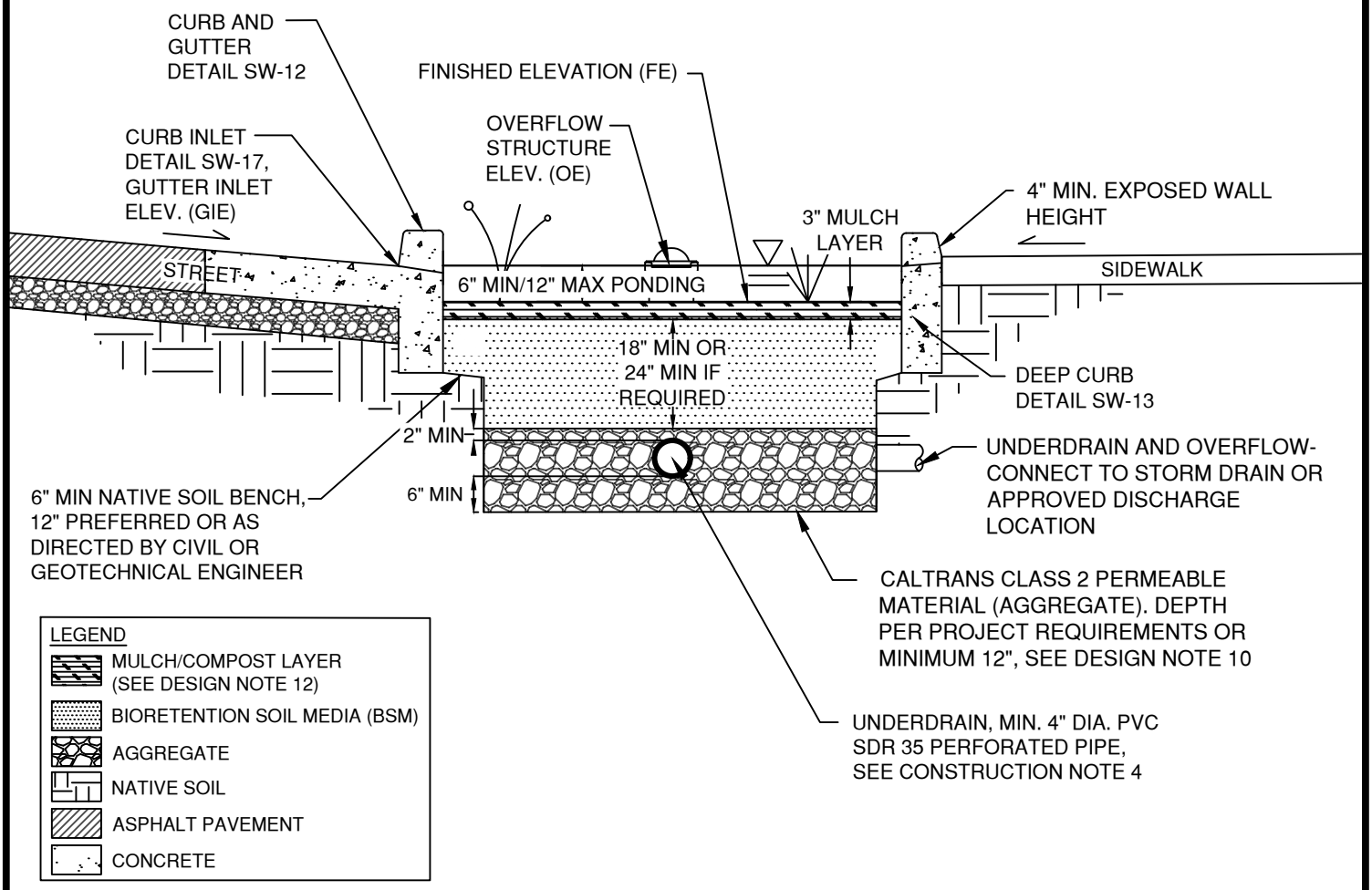

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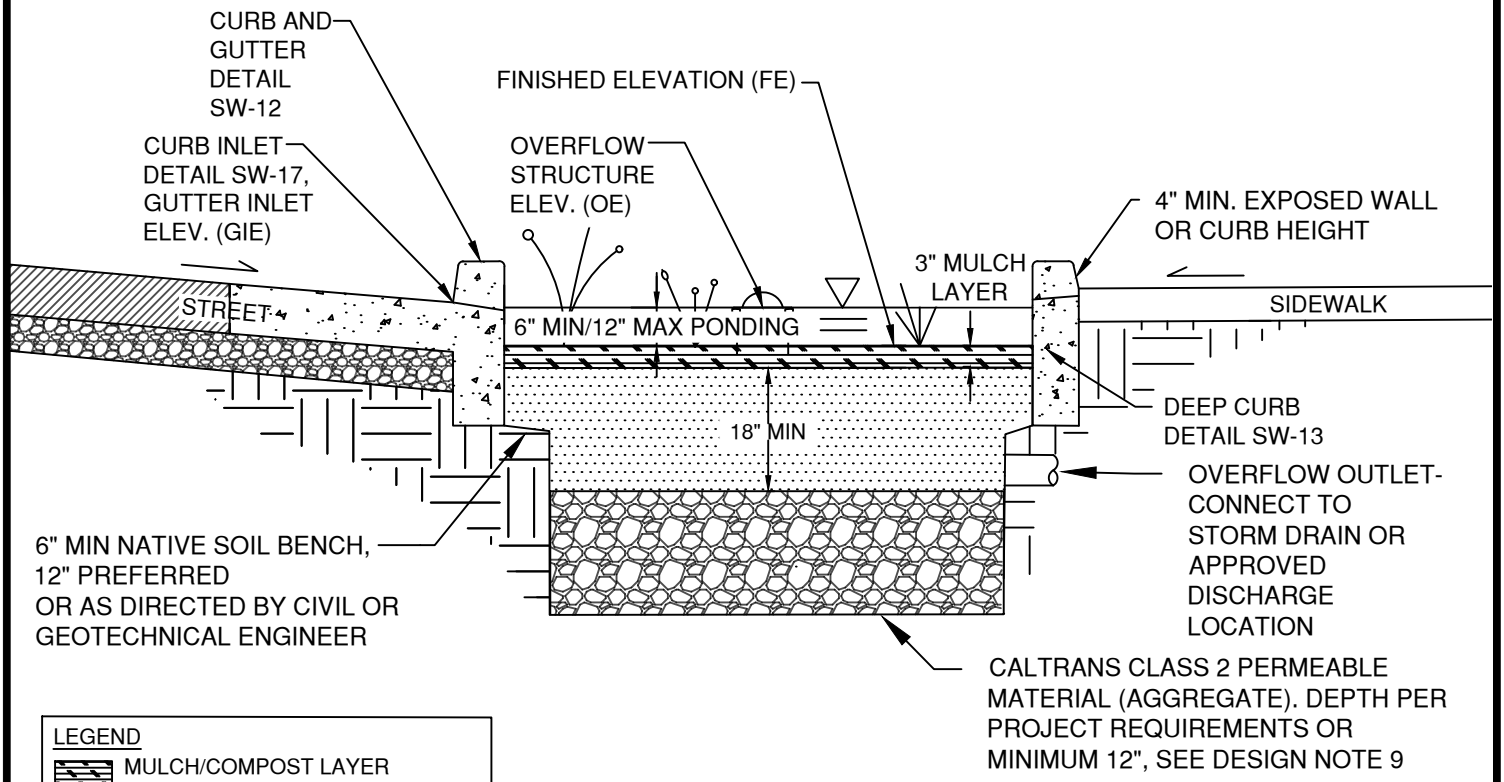

LEGEND

- MULCH/COMPOST LAYER (SEE DESIGN NOTE 12)
- BIORETENTION SOIL MEDIA (BSM)
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- ASPHALT PAVEMENT
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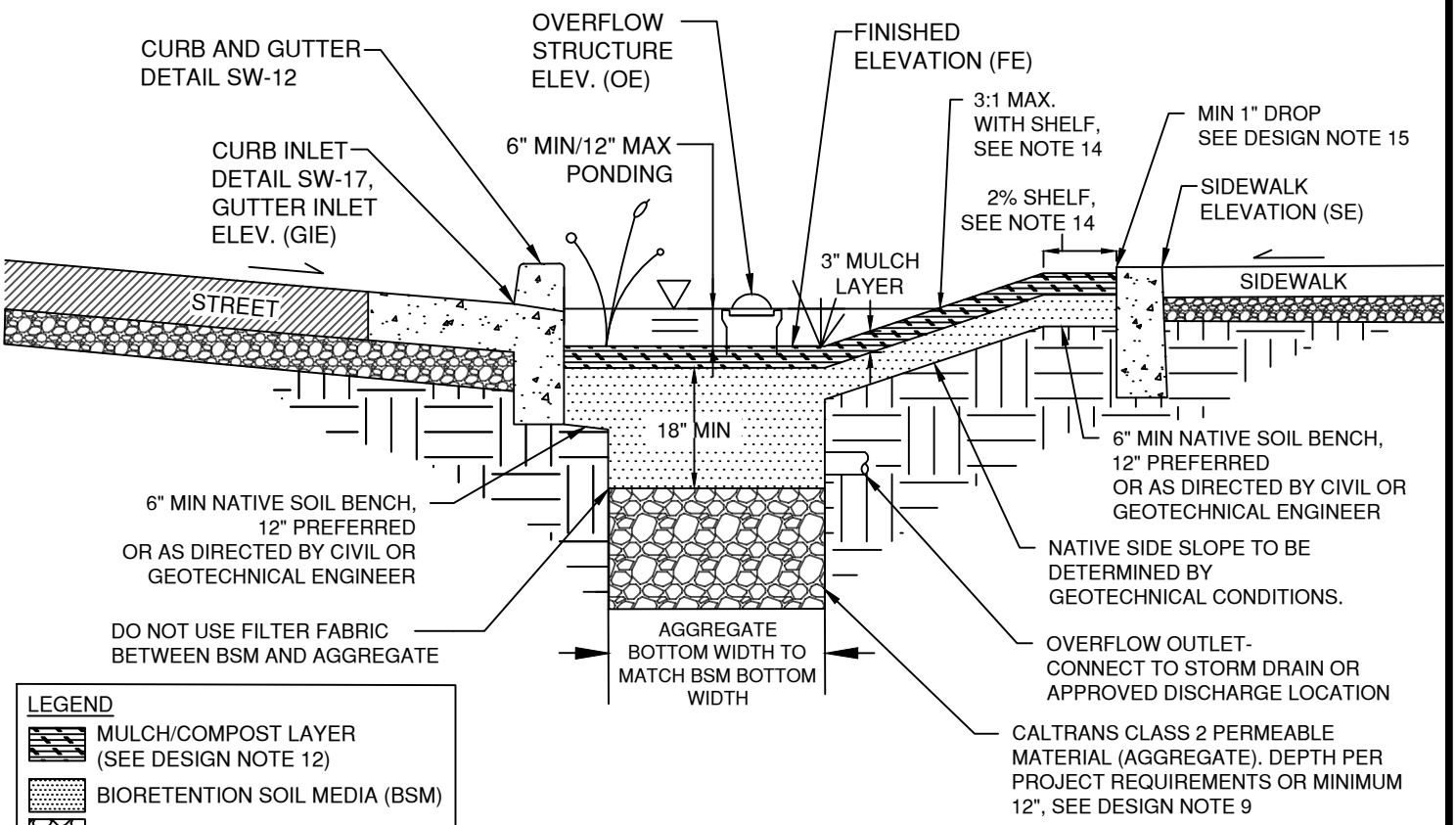

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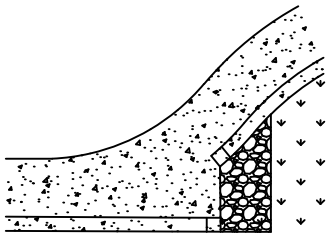
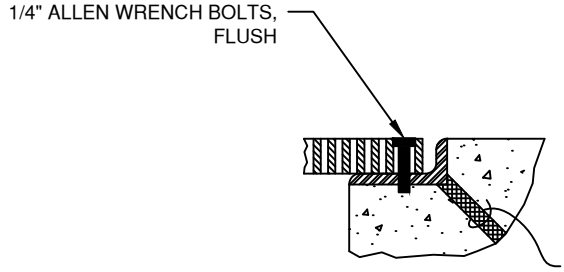
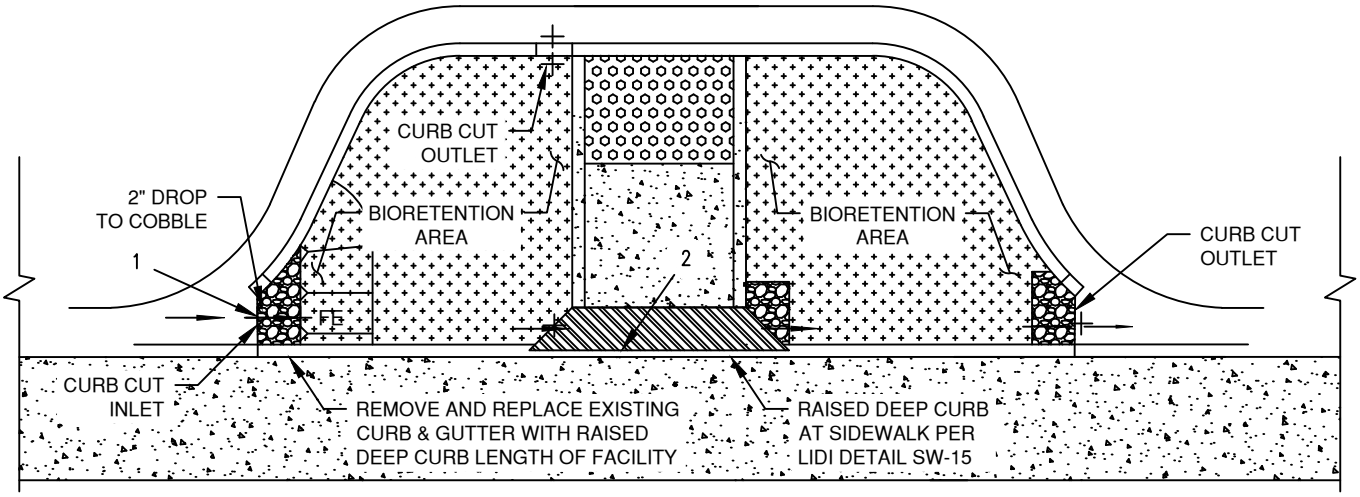


CURB CUT INLET 1



GRATE & FRAME 2

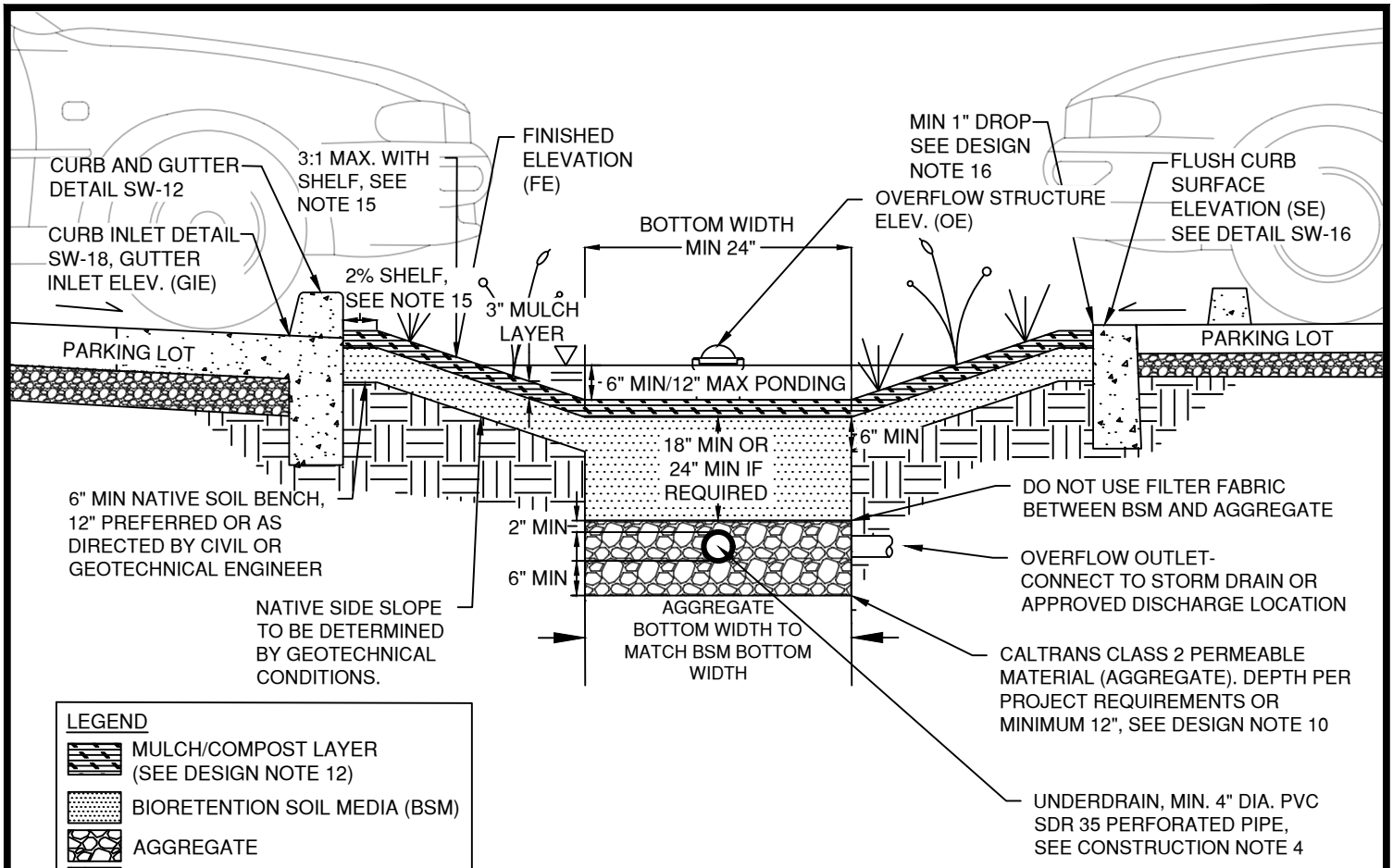


CONSTRUCTION NOTES:

1. INSTALL GRAVEL BAGS AT CURB CUTS TO BLOCK FLOW FROM ENTERING BIORETENTION AREA. CITY TO REMOVE GRAVEL BAGS AT A TIME FOLLOWING CONSTRUCTION COMPLETION.

DESIGN NOTE:

1. THIS STANDARD DETAIL ASSUMES GRADUAL LONGITUDINAL AND CROSS SLOPES OF THE ROADWAY. STEEPER SLOPES IN EITHER DIRECTION WILL IMPACT CONVEYANCE AND ELEVATION DIFFERENCES BETWEEN THE FACILITY AND ADJACENT ROADWAY, CURB, AND SIDEWALK SURFACES. RETROFIT PROJECTS WILL FACE GREATER CONSTRAINTS THAN NEW CONSTRUCTION. SITE SPECIFIC DESIGN IS CRITICAL TO AVOID GRADE CONFLICTS AND MAXIMIZING PONDING AREA. GRADING PLANS THAT PROVIDE SPOT ELEVATIONS ACROSS THE ENTIRE FACILITY AND ALONG ADJACENT SURFACES ARE NECESSARY.



LEGEND

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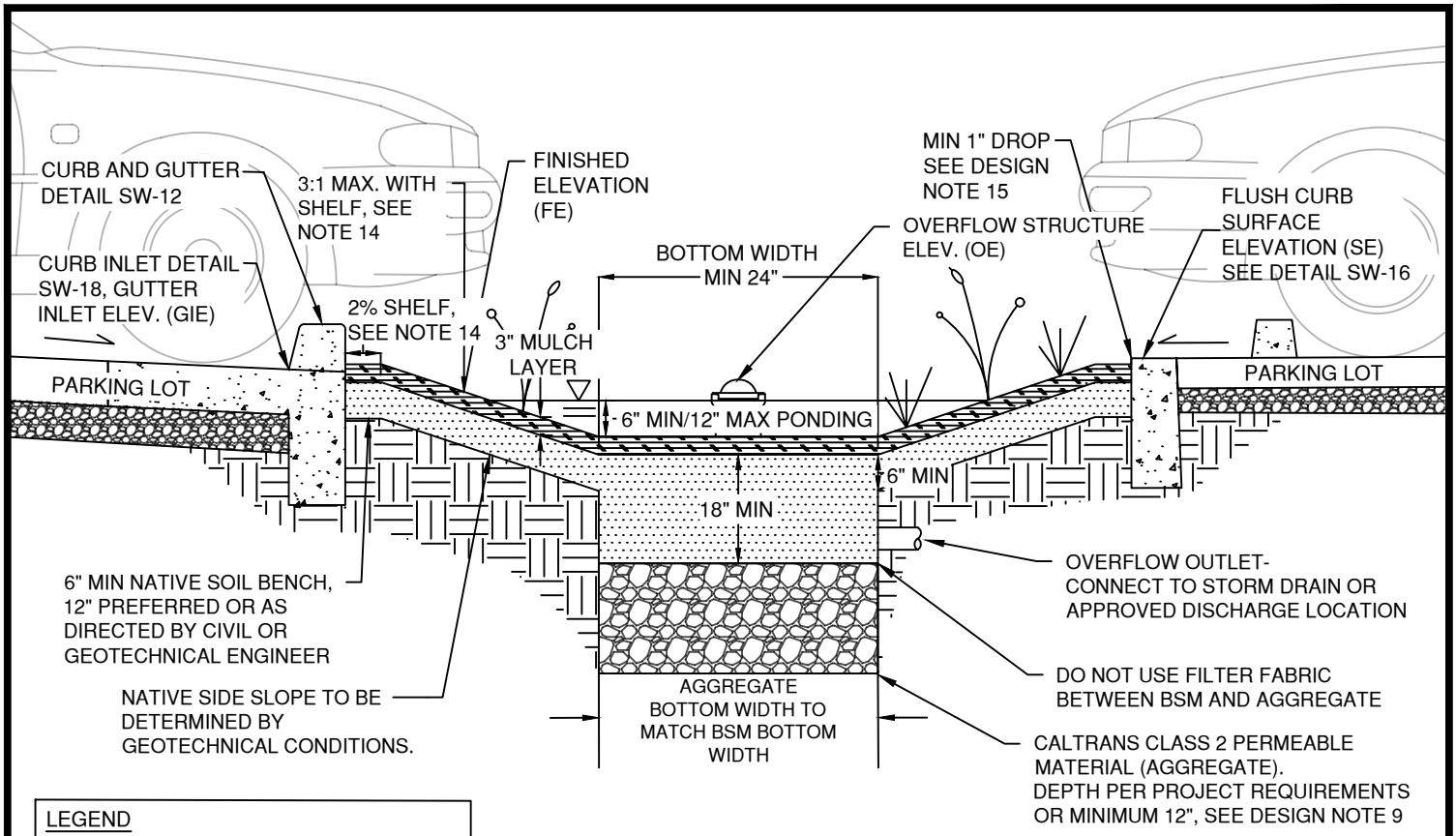

LEGEND

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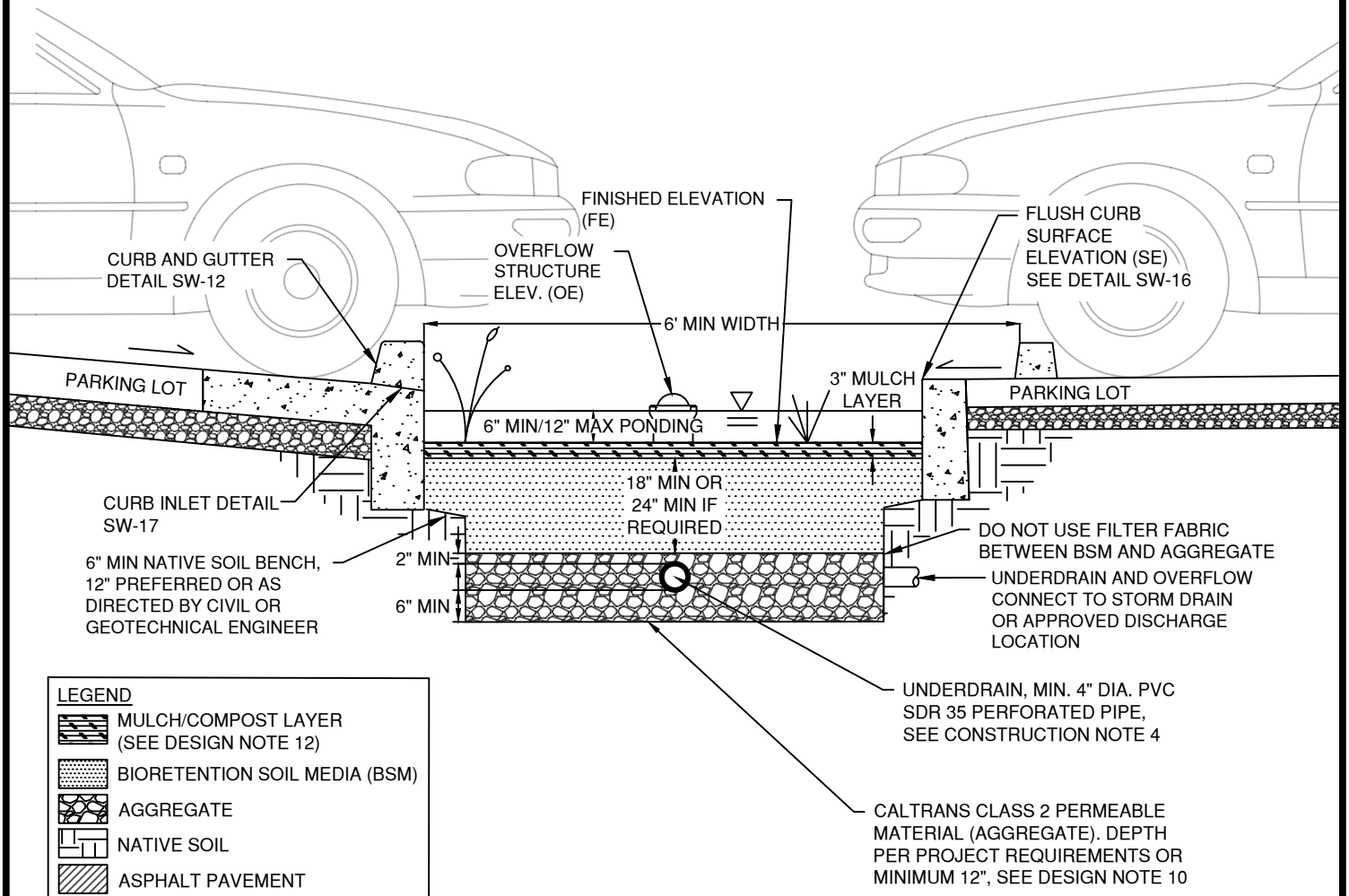
4. PLACE BSM IN 6" LIFTS. COMPACT EACH 6" LIFT OF BSM WITH LANDSCAPE ROLLER OR BY LIGHTLY WETTING. IF WETTING, LET DRY OVERNIGHT BEFORE PLANTING.
5. DO NOT WORK WITHIN BIORETENTION AREA DURING RAIN OR UNDER WET CONDITIONS.
6. KEEP HEAVY MACHINERY OUTSIDE BIORETENTION AREA LIMITS.
7. STORMWATER SHOULD BE DIRECTED AWAY FROM BIORETENTION UNTIL CONSTRUCTION IS COMPLETE AND DRAINAGE AREA VEGETATION IS STABILIZED.

DESIGN NOTES

1. BIORETENTION FACILITY DESIGN SHOULD OPTIMIZE THE FLAT BOTTOM DIMENSIONS (I.E., WIDTH, LENGTH) TO MAXIMIZE THE FUNCTIONAL AREA OF THE FACILITY.
2. CAPTURE AND CONVEY OVERFLOW TO STORM DRAIN SYSTEM (DETAIL SW-22, SW-23). ALTERNATIVELY, CONVEY OVERFLOW TO APPROVED DISCHARGE LOCATION THROUGH OTHER OVERLAND METHODS (IE. CURB CUTS, SIDEWALK UNDERDRAIN, WEIR, ETC.).
3. PROVIDE SPOT ELEVATIONS AT INLETS AND OVERFLOW STRUCTURE ON CIVIL PLANS (FE,OE, GIE, SIE), PER DETAIL SW-18.
4. DUE TO SITE VARIABILITY, TO ENSURE THE LONG-TERM STRUCTURAL STABILITY OF THE BIORETENTION FACILITY AND ANY ADJACENT INFRASTRUCTURE CONSULT WITH A GEOTECHNICAL ENGINEER.
5. A VERTICAL LINER MAY BE USED FOR BIORETENTION FACILITIES TO PREVENT LATERAL FLOW AND TO SEPARATE THE NATIVE SOIL FROM THE BSM AND THE AGGREGATE, HOWEVER A HORIZONTAL LINER SHALL NOT BE USED.
6. DO NOT USE FILTER FABRIC BETWEEN BSM AND AGGREGATE.
7. PROVIDE A CLEAN-OUT/OBSERVATION PORT IN EACH FACILITY, PER BIORETENTION TECHNICAL SPECIFICATIONS.
8. ON LONGITUDINAL SLOPE, USE CHECK DAMS (DETAILS SW-20, SW-21)
9. USE AND DEPTH OF AGGREGATE DETERMINED BY FACILITY SIZING. IF CALTRANS CLASS 2 PERMEABLE IS NOT AVAILABLE, SUBSTITUTE CLASS 3 PERMEABLE WITH AN OVERLYING 3" DEEP CHOKING LAYER OF EITHER CALTRANS COURSE AGGREGATE 1/2" (NO. 4) OR 3/4" X (NO. 4) OPEN-GRADED AGGREGATE.
10. BIORETENTION SOIL MEDIA (BSM) SPECIFICATION PER BIORETENTION TECHNICAL SPECIFICATIONS.
11. PLANT SELECTION PER BIORETENTION TECHNICAL SPECIFICATIONS.
12. MULCH PER BIORETENTION TECHNICAL SPECIFICATIONS.
13. LOCATE ENERGY DISSIPATION AS SPECIFIED IN INLET DETAILS.
14. NATIVE SIDE SLOPE 4:1 (H:V) PREFERRED, 3:1 WITH SHELF. 6" MINIMUM SHELF WITH 2% SLOPE TOWARDS FACILITY ADJACENT TO PEDESTRIAN USE OR CURB UNLESS 4:1 SLOPE PROVIDED.
15. INCLUDE AT LEAST 1" DROP FROM CURB ABOVE MULCH LAYER.
16. AVOID DECORATIVE USE OF COBBLE THAT CAN INTERFERE WITH WITH INFILTRATION.



CONSTRUCTION NOTES

1. MAINTAIN UNDISTURBED NATIVE SOIL BENCH TO SUPPORT ADJACENT SIDEWALK/ROAD. SEQUENCE WORK TO CONSTRUCT CURBS BEFORE EXCAVATING BIORETENTION AREA FOR AGGREGATE AND BSM.
2. SCARIFY SUBGRADE BEFORE INSTALLING BIORETENTION AREA AGGREGATE AND BSM.
3. FACILITY EXCAVATION TO ALLOW FOR SPECIFIED AGGREGATE, BSM, AND MULCH DEPTHS TO ACHIEVE FINISHED ELEVATIONS ON CIVIL PLANS.
4. INSTALL UNDERDRAIN WITH HOLES FACING DOWN. TOP OF UNDERDRAIN 6" BELOW TOP OF AGGREGATE LAYER. UNDERDRAIN SLOPE MAY BE FLAT.
5. COMPACT EACH 6" LIFT OF BSM WITH LANDSCAPE ROLLER OR BY LIGHTLY WETTING. IF WETTING, LET DRY OVERNIGHT BEFORE PLANTING.
6. DO NOT WORK WITHIN BIORETENTION AREA DURING RAIN OR UNDER WET CONDITIONS.
7. KEEP HEAVY MACHINERY OUTSIDE BIORETENTION AREA LIMITS.
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4. DUE TO SITE VARIABILITY, TO ENSURE THE LONG-TERM STRUCTURAL STABILITY OF THE BIORETENTION FACILITY AND ANY ADJACENT INFRASTRUCTURE CONSULT WITH A GEOTECHNICAL ENGINEER.
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6. DO NOT USE FILTER FABRIC BETWEEN BSM AND AGGREGATE.
7. PROVIDE CAPPED, THREADED PVC CLEANOUT FOR UNDERDRAIN, 4" MIN. DIA. WITH SWEEP BEND.
8. PROVIDE A CLEAN-OUT/OBSERVATION PORT IN EACH FACILITY, PER BIORETENTION TECHNICAL SPECIFICATIONS.
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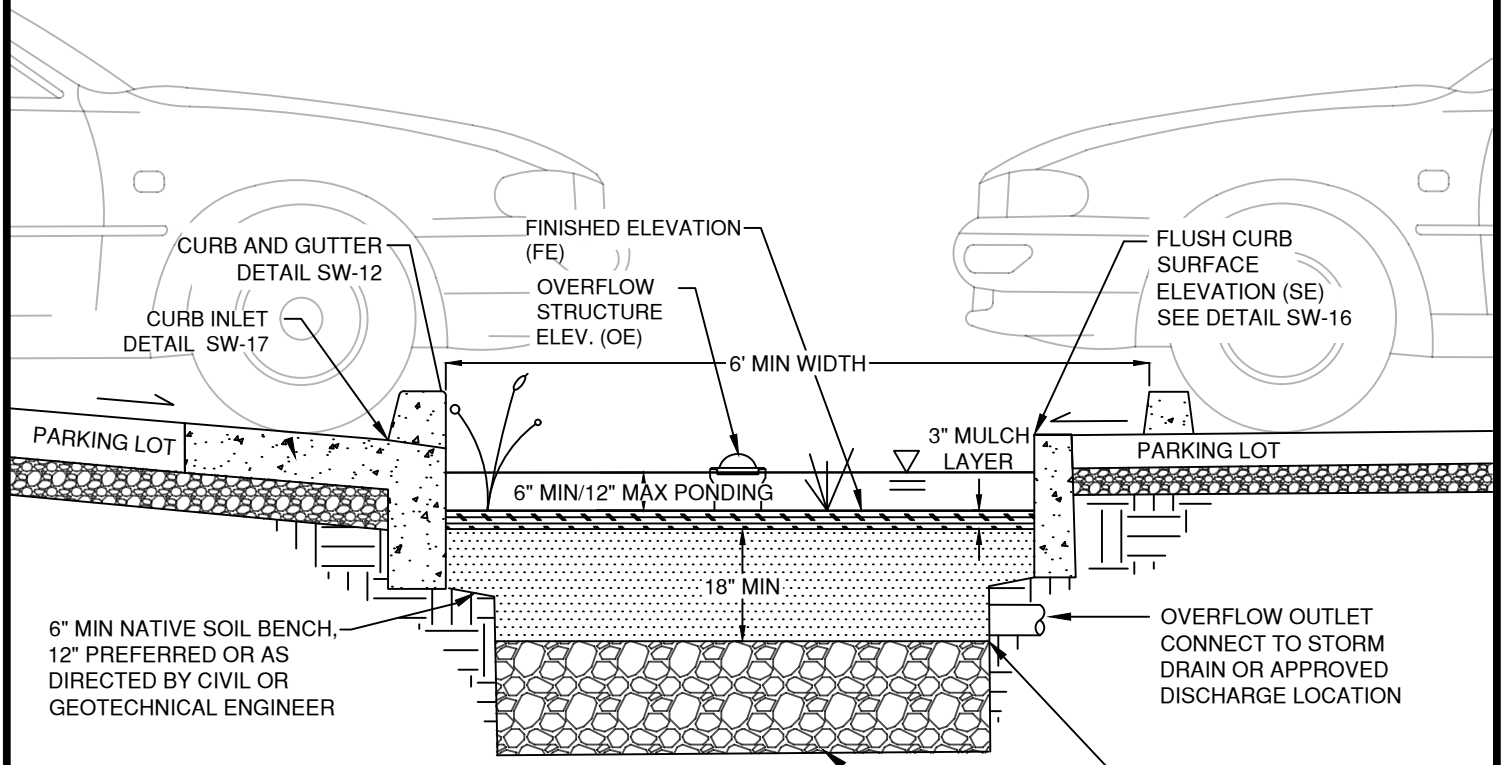

LEGEND

- MULCH/COMPOST LAYER (SEE DESIGN NOTE 12)
- BIORETENTION SOIL MEDIA (BSM)
- AGGREGATE
- NATIVE SOIL
- ASPHALT PAVEMENT
- CONCRETE

CONSTRUCTION NOTES

1. MAINTAIN UNDISTURBED NATIVE SOIL BENCH TO SUPPORT ADJACENT SIDEWALK/ROAD. SEQUENCE WORK TO CONSTRUCT CURBS BEFORE EXCAVATING BIORETENTION AREA FOR AGGREGATE AND SOIL.
2. SCARIFY SUBGRADE BEFORE INSTALLING BIORETENTION AREA AGGREGATE AND BSM.
3. FACILITY EXCAVATION TO ALLOW FOR SPECIFIED AGGREGATE, BSM, AND MULCH DEPTHS TO ACHIEVE FINISHED ELEVATIONS ON CIVIL PLANS.
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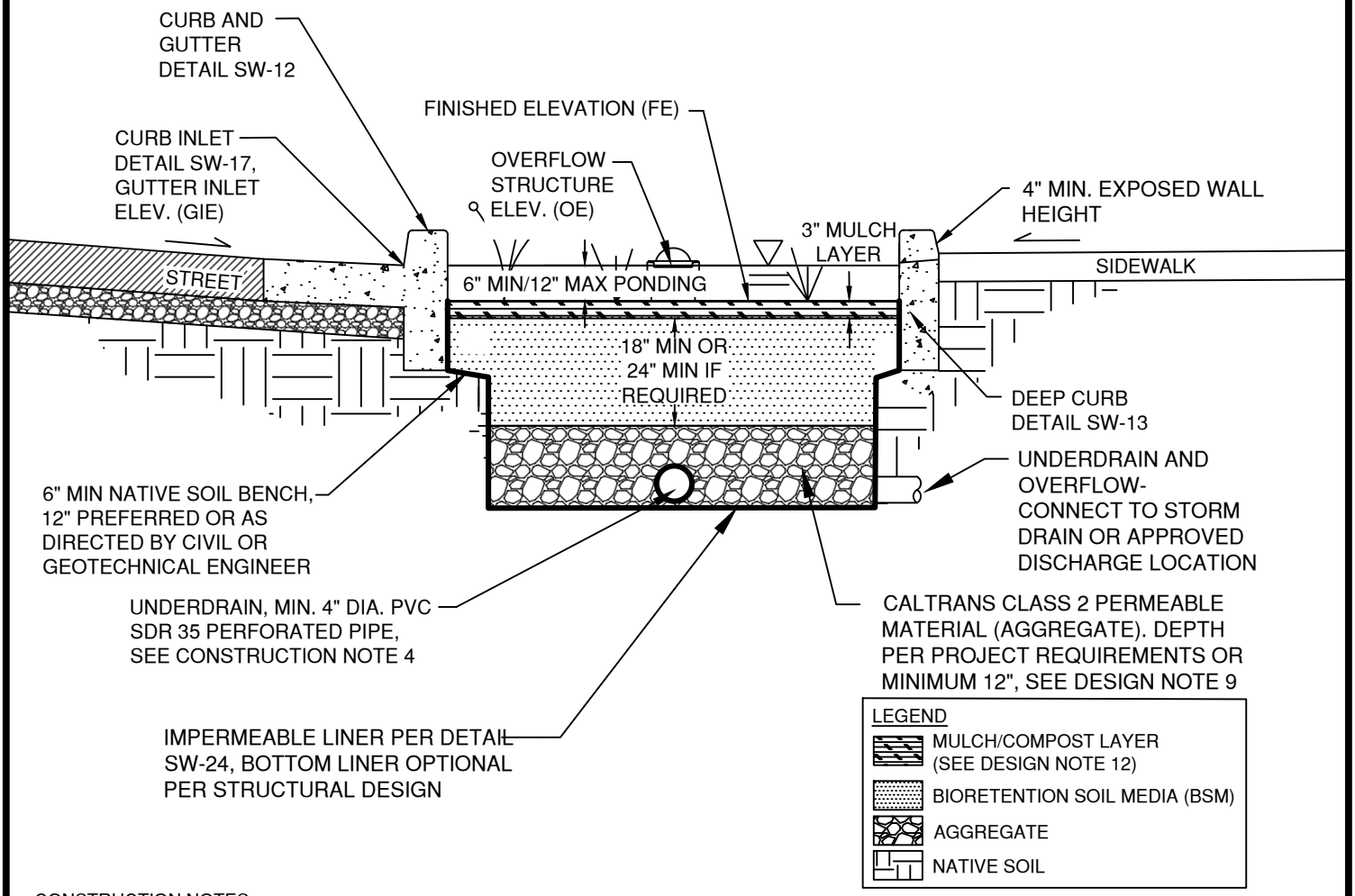
14. AVOID DECORATIVE USE OF COBBLE THAT CAN INTERFERE WITH WITH INFILTRATION.



CONSTRUCTION NOTES

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6. KEEP HEAVY MACHINERY OUTSIDE BIOFILTRATION AREA LIMITS.
7. STORMWATER SHOULD BE DIRECTED AWAY FROM BIOFILTRATION UNTIL CONSTRUCTION IS COMPLETE AND DRAINAGE AREA VEGETATION IS STABILIZED.

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3. PROVIDE SPOT ELEVATIONS AT INLETS AND OVERFLOW STRUCTURES ON CIVIL PLANS (FE,OE, GIE, SIE), PER DETAIL SW-18.
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5. DO NOT USE FILTER FABRIC BETWEEN BSM AND AGGREGATE.
6. PROVIDE CAPPED, THREADED PVC CLEANOUT FOR UNDERDRAIN, 4" MIN. DIA. WITH SWEEP BEND.
7. PROVIDE A CLEAN-OUT/OBSERVATION PORT IN EACH FACILITY, PER BIORETENTION TECHNICAL SPECIFICATIONS.
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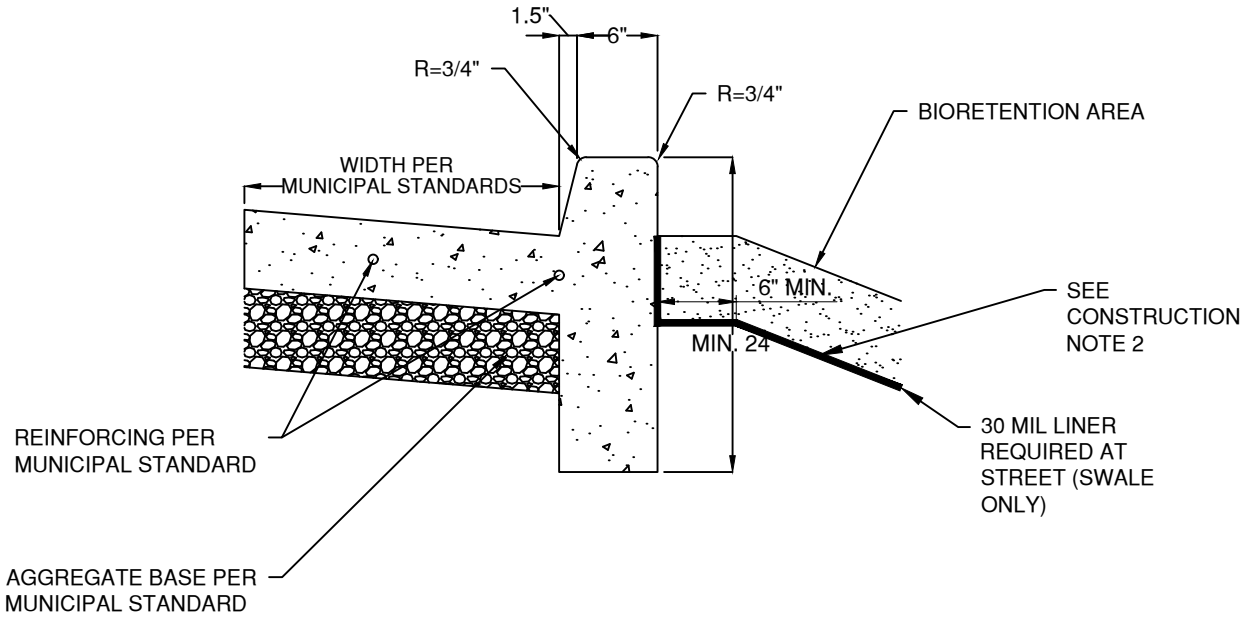
14. AVOID DECORATIVE USE OF COBBLE THAT CAN INTERFERE WITH WITH INFILTRATION.



DESIGN NOTES

1. SPECIAL DESIGN CONSIDERATION OR STRUCTURAL REVIEW MAY BE REQUIRED FOR LONGER PLANTER WALL SPANS. STEEL REINFORCEMENT OR ADDITIONAL CONCRETE CHECK DAMS MAY BE NEEDED FOR STABILITY.

2. EDGE CONDITION WILL VARY FOR NEW AND RETROFIT PROJECTS. CURB, GUTTER, AND WALL DETAILS MAY BE MODIFIED BY CIVIL AND GEOTECHNICAL ENGINEERS SUBJECT TO APPROVAL BY CITY ENGINEER.

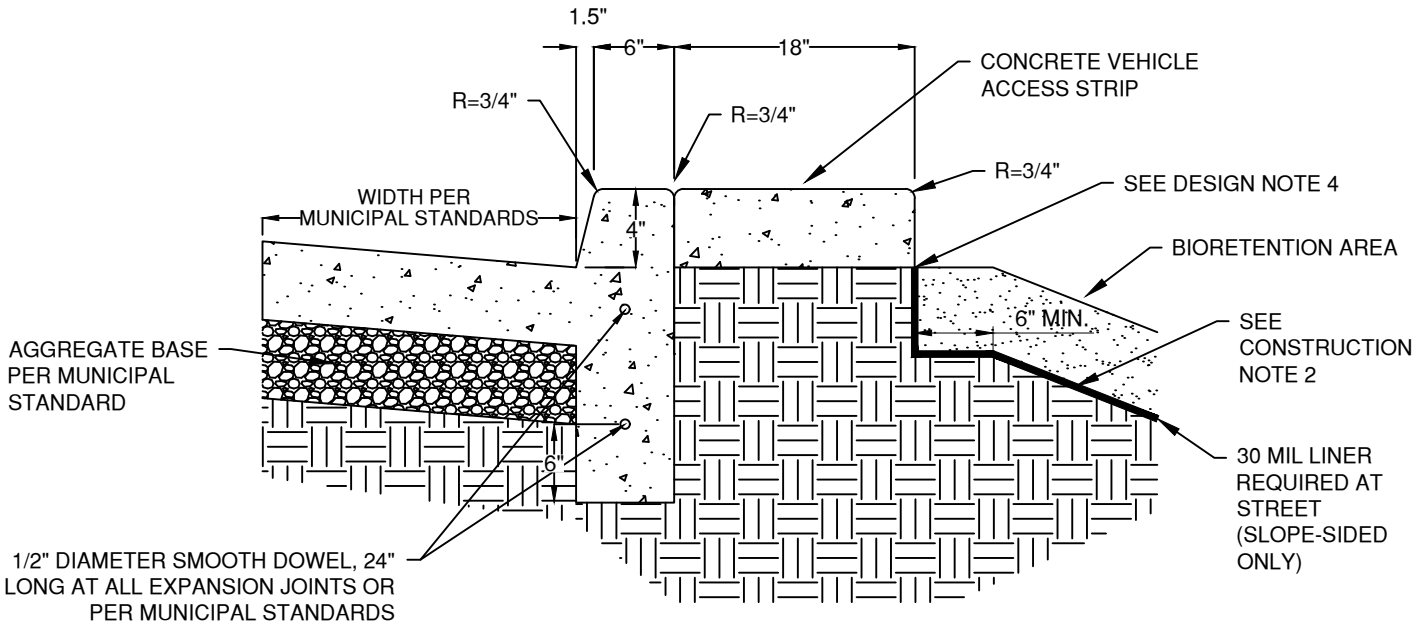
3. CONCRETE AND EXPANSION JOINTS SHALL MEET THE REQUIREMENTS OF THE MUNICIPALITY.

4. STEEL REINFORCEMENT OR ADDITIONAL CONCRETE CHECK DAMS MAY BE NEEDED FOR STABILITY.

CONSTRUCTION NOTES

1. FINISH ALL EXPOSED CONCRETE SURFACES.

2. LAYBACK SLOPE AS FLAT AS POSSIBLE UNTIL TOP WIDTH PRODUCES 1:1 SLOPE & 24" BOTTOM WIDTH. AS PLANTER GETS WIDER MAINTAIN 1:1 SLOPE AND INCREASE BOTTOM WIDTH WIDER THAN 24". ALTERNATIVE TRENCH WALL CONFIGURATIONS MAY BE PROPOSED BY THE PROJECT GEOTECHNICAL ENGINEER (I.E. VERTICAL SHORING, REINFORCED TRENCH SIDEWALL) THAT DO NOT REQUIRE SIDEWALK SUPPORT FROM THE LIGHTLY COMPACTED BSM.

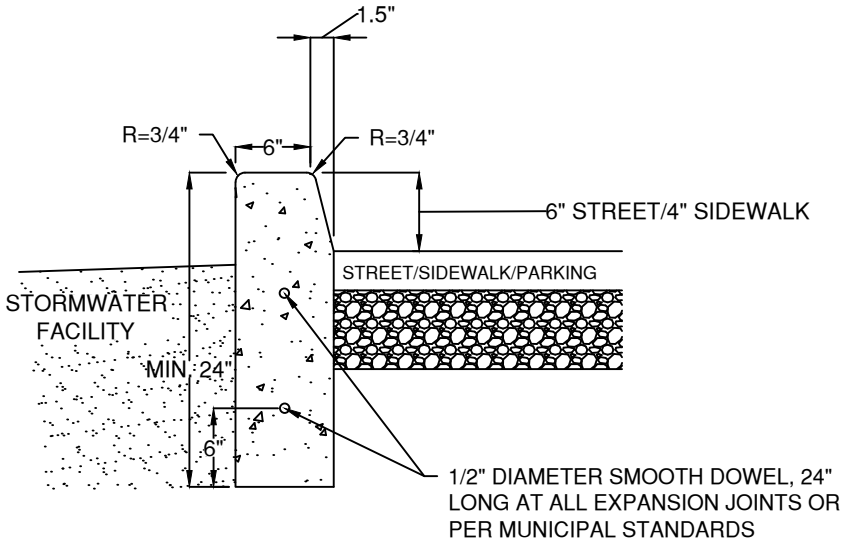


DESIGN NOTES

1. SPECIAL CONCRETE AND EXPANSION JOINS SHALL MEET THE REQUIREMENTS OF THE MUNICIPALITY.
2. PROVIDE OPENINGS IN CURB (12" WIDE) TO ALLOW FOR SURFACE DRAINAGE TO BIORETENTION AREAS IF DEDICATED INLET NOT USED. SPACING TO BE DETERMINED BY PROJECT ENGINEER BASED ON DESIGN STORM TO MINIMIZE PONDING AGAINST CURB FOR MEDIAN ISLAND APPLICATION.
3. STEEL REINFORCEMENT OR ADDITIONAL CONCRETE CHECK DAMS MAY BE NEEDED FOR STABILITY.
4. SEE REFERENCE DETAIL SW-24 FOR ATTACHMENT OF IMPERVIOUS LINER.

CONSTRUCTION NOTES

1. FINISH ALL EXPOSED CONCRETE SURFACES.
2. LAYBACK SLOPE AS FLAT AS POSSIBLE UNTIL TOP WIDTH PRODUCES 1:1 SLOPE & 24" BOTTOM WIDTH. AS PLANTER GETS WIDER MAINTAIN 1:1 SLOPE AND INCREASE BOTTOM WIDTH WIDER THAN 24". ALTERNATIVE TRENCH WALL CONFIGURATIONS MAY BE PROPOSED BY THE PROJECT GEOTECHNICAL ENGINEER (I.E. VERTICAL SHORING, REINFORCED TRENCH SIDEWALL) THAT DO NOT REQUIRE SIDEWALK SUPPORT FROM THE LIGHTLY COMPACTED BSM.



DESIGN NOTES

1. SPECIAL DESIGN CONSIDERATION OR STRUCTURAL REVIEW MAY BE REQUIRED FOR LONGER SWALE EDGE SPANS. STEEL REINFORCEMENT OR ADDITIONAL CONCRETE CHECK DAMS MAY BE NEEDED FOR STABILITY.

2. WHEN SIDEWALK DRAINS TO PLANTER, PROVIDE 4" - 6" WIDE NOTCH OPENINGS, 1" BELOW SIDEWALK, SLOPED TO FACILITY, PER BIORETENTION PLANTER DETAILS. SPACE OPENINGS TO CONVEY FLOWS. PROVIDE MINIMUM 2" COVER BETWEEN DRAINAGE NOTCH OPENING AND DOWELS.

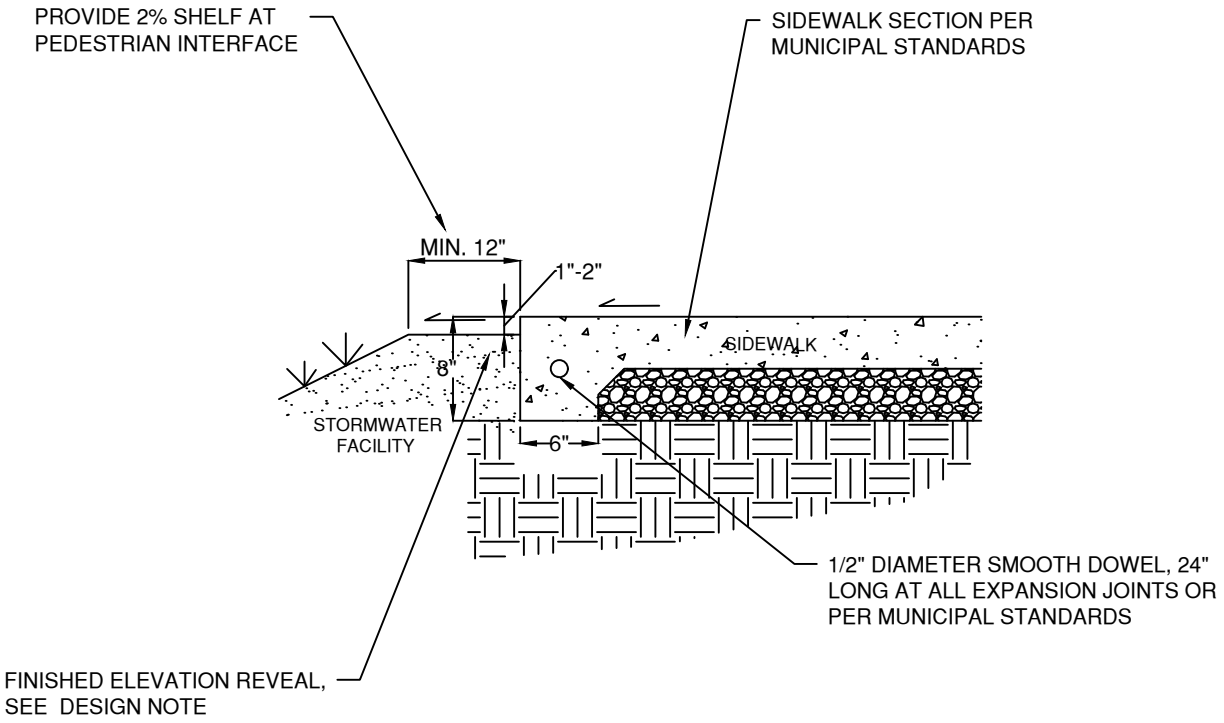
3. CONCRETE AND EXPANSION JOINTS SHALL MEET THE REQUIREMENTS OF THE MUNICIPALITY.

4. STEEL REINFORCEMENT OR ADDITIONAL CONCRETE CHECK DAMS MAY BE NEEDED FOR STABILITY.

CONSTRUCTION NOTES

1. FINISH ALL EXPOSED CONCRETE SURFACES.

2. LAYBACK SLOPE AS FLAT AS POSSIBLE UNTIL TOP WIDTH PRODUCES 1:1 SLOPE & 24" BOTTOM WIDTH. AS PLANTER GETS WIDER MAINTAIN 1:1 SLOPE AND INCREASE BOTTOM WIDTH WIDER THAN 24". ALTERNATIVE TRENCH WALL CONFIGURATIONS MAY BE PROPOSED BY THE PROJECT GEOTECHNICAL ENGINEER (I.E. VERTICAL SHORING, REINFORCED TRENCH SIDEWALL) THAT DO NOT REQUIRE SIDEWALK SUPPORT FROM THE LIGHTLY COMPACTED BSM.



DESIGN NOTES

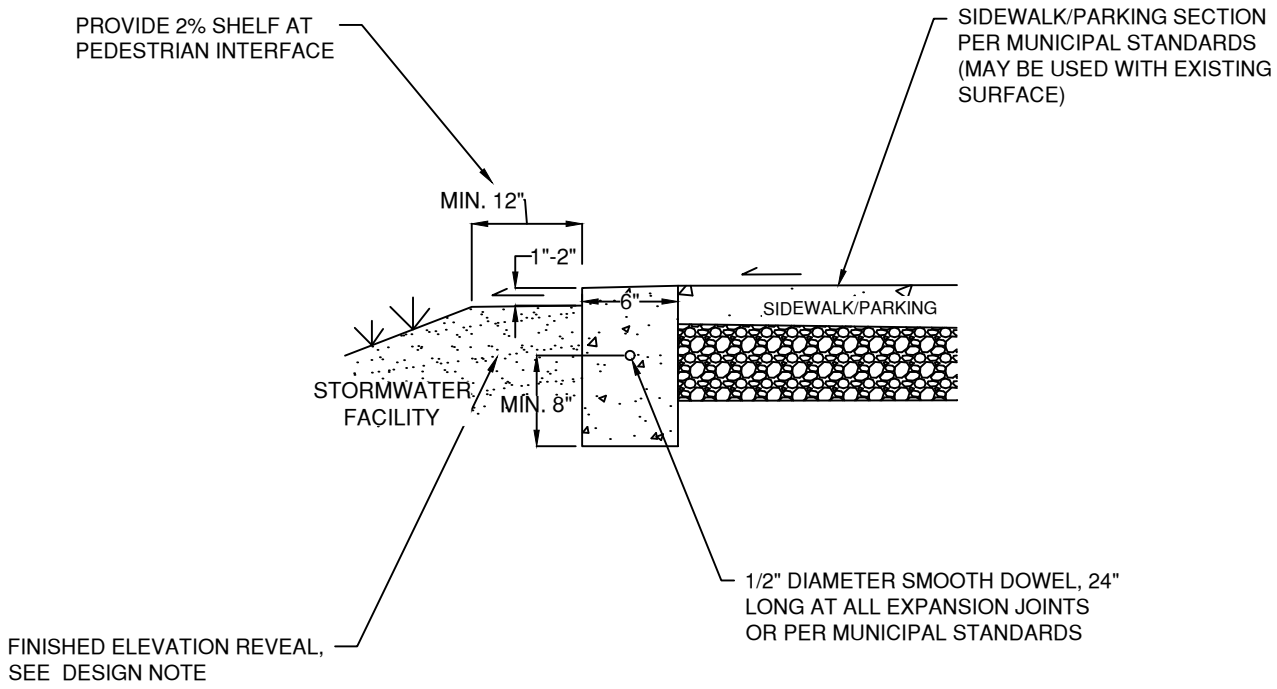
1. SPECIAL DESIGN CONSIDERATION OR STRUCTURAL REVIEW MAY BE REQUIRED FOR LONGER FACILITY EDGE SPANS. STEEL REINFORCEMENT OR ADDITIONAL CONCRETE CHECK DAMS MAY BE NEEDED FOR STABILITY.

2. FINISHED ELEVATION REVEAL - WHERE SIDEWALK CONVEYS SHEET FLOW TO FACILITY, A 1"-2" REVEAL SHOULD BE MAINTAINED BETWEEN SIDEWALK AND FACILITY FINISHED GRADE TO AVOID MULCH OR PLANT BUILDUP FROM BLOCKING FLOWS.

3. CONCRETE AND EXPANSION JOINTS SHALL MEET THE REQUIREMENTS OF THE MUNICIPALITY.

CONSTRUCTION NOTES

1. FINISH ALL EXPOSED CONCRETE SURFACES.



DESIGN NOTES

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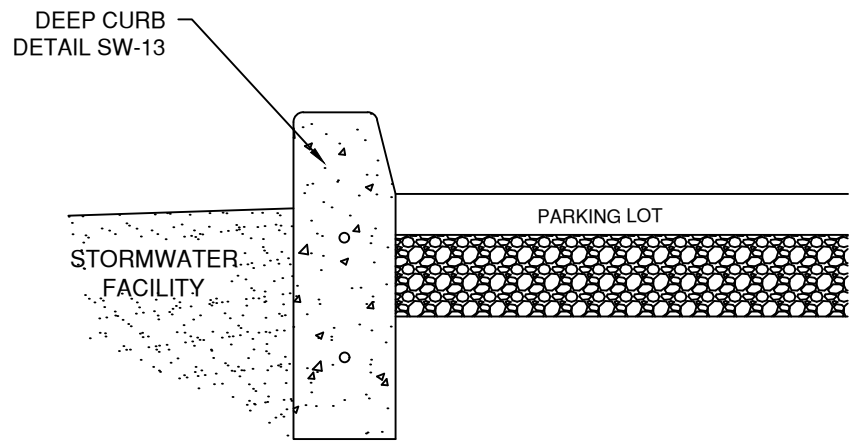
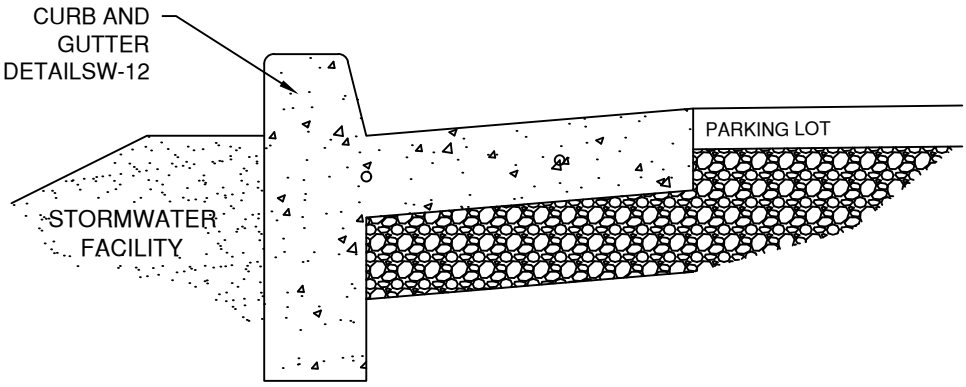
2. EDGE CONDITION WILL VARY FOR PROJECTS. CURB DETAILS MAY BE MODIFIED BY CIVIL AND GEOTECHNICAL ENGINEERS SUBJECT TO APPROVAL BY CITY ENGINEER.
3. CONCRETE AND EXPANSION JOINTS SHALL MEET THE REQUIREMENTS OF THE MUNICIPALITY.
4. FINISHED ELEVATION REVEAL AT SIDEWALK - WHERE SIDEWALK CONVEYS SHEET FLOW TO FACILITY, A 1"-2" REVEAL SHOULD BE MAINTAINED BETWEEN SIDEWALK AND FACILITY FINISHED GRADE TO AVOID MULCH OR PLANT BUILDUP FROM BLOCKING FLOWS AND REDUCE DROP AT PEDESTRIAN INTERFACE.

CONSTRUCTION NOTES

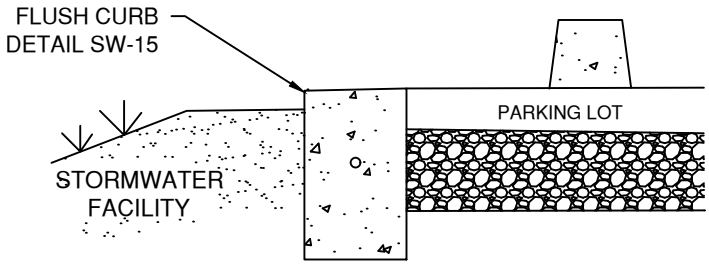
1. FINISH ALL EXPOSED CONCRETE SURFACES.



DEEP CURB



CURB AND GUTTER



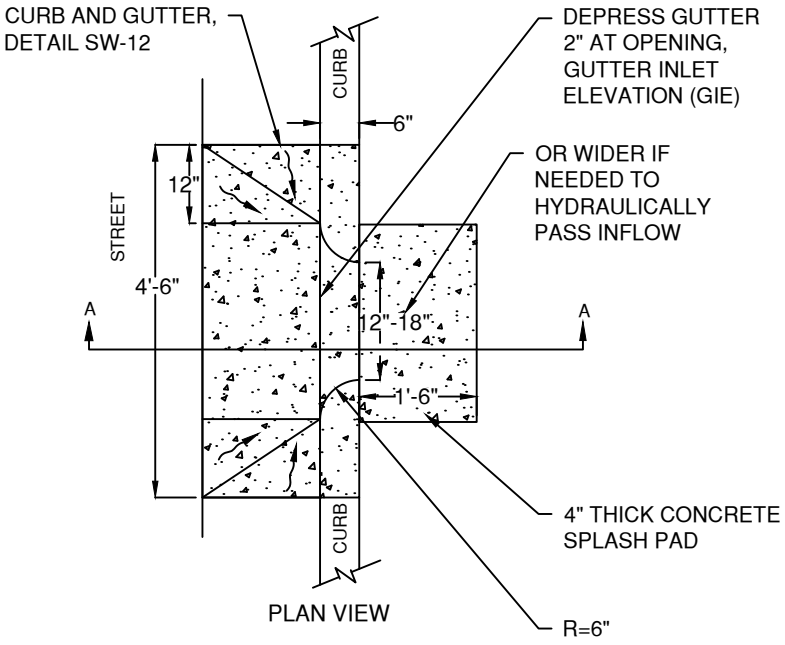
FLUSH EDGE/WHEEL STOPS

DESIGN NOTES

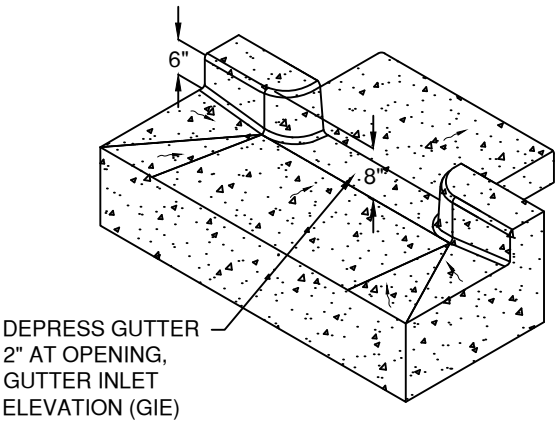
1. WHEEL STOPS MAY BE USED ON NON-FLUSH DESIGNS TO KEEP CARS FROM OVERHANGING BIORETENTION FACILITY.
2. VEHICLE OVERHANG CAN BE USED TO REDUCE IMPERVIOUS PAVEMENT AREA.
3. WHERE VEHICLE OVERHANG IS UTILIZED SELECT LOW GROWING PLANTS THAT WILL TOLERATE SHADING.

LOW IMPACT DEVELOPMENT STORMWATER MANAGEMENT STANDARD DETAILS

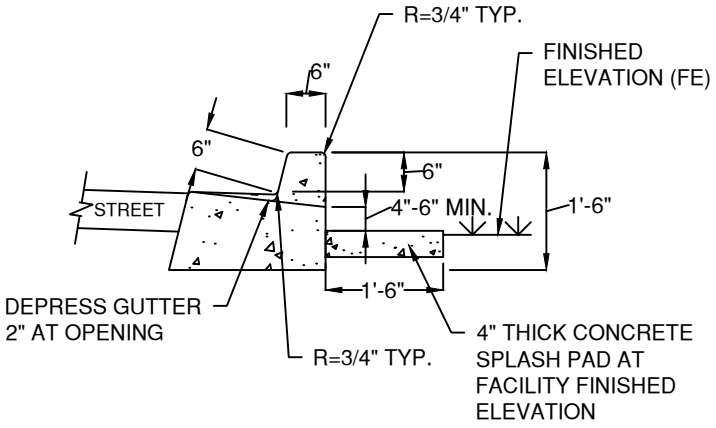
CASQA central coast LIDI DEVELOPED UNDER PROP. 84 GRANT	APPROVED BY: VERSION: 08/31/2017	PARKING LOT EDGE OPTIONS USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORK CONSTRUCTION	STANDARD PLAN NO. SW-16 SHEET 1 OF 1



PLAN VIEW



PERSPECTIVE VIEW



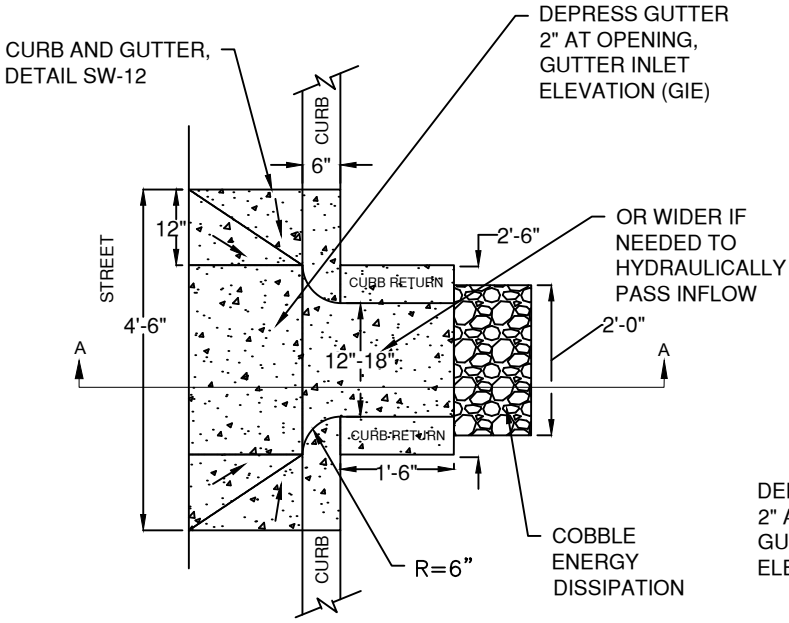
SECTION A-A

BIORETENTION DESIGN NOTES

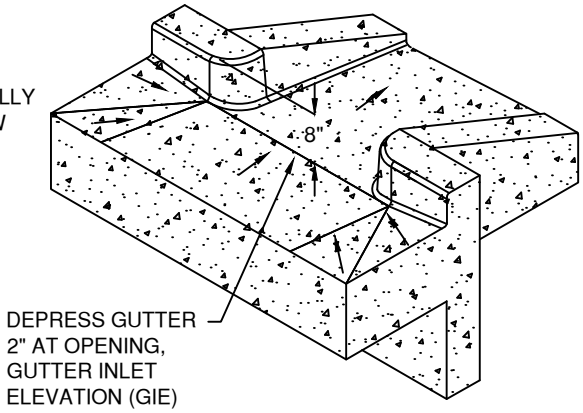
1. FOR USE WITH STORMWATER FACILITIES WITH FLAT BOTTOMS.
2. PROVIDE SPOT ELEVATIONS ON PLANS (FE, OE, GIE, IE). SEE DETAIL SW-2, SW-2A, SW-4 OR SW-4A.
3. CURB AND WALL DETAILS MAY BE MODIFIED BY CIVIL AND GEOTECHNICAL ENGINEERS SUBJECT TO APPROVAL BY CITY ENGINEER.
4. CURB HEIGHT MAY BE REDUCED TO 4-INCHES WHERE ADJACENT TO A SIDEWALK. SEE DETAILS SW-12 & SW-13.

CONSTRUCTION NOTES

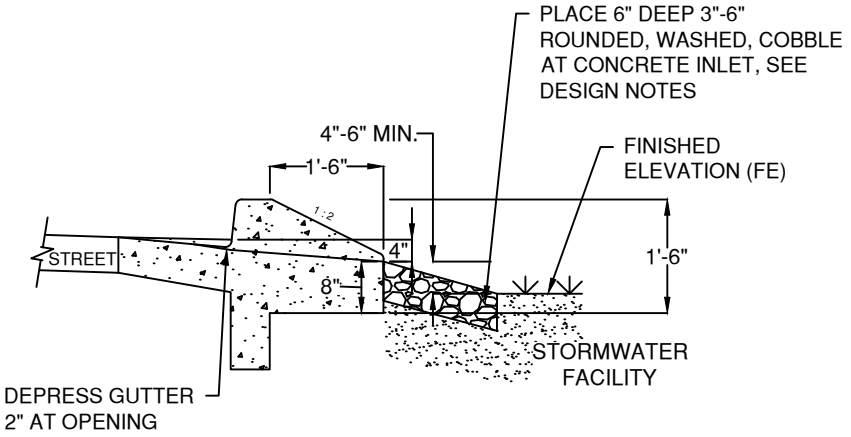
1. AFTER CONSTRUCTION PLACE SAND BAGS AT GUTTER OPENINGS TO KEEP STORM FLOWS FROM ENTERING FACILITY UNTIL VEGETATION IS ESTABLISHED.



PLAN VIEW



PERSPECTIVE VIEW



SECTION A-A

BIORETENTION DESIGN NOTES

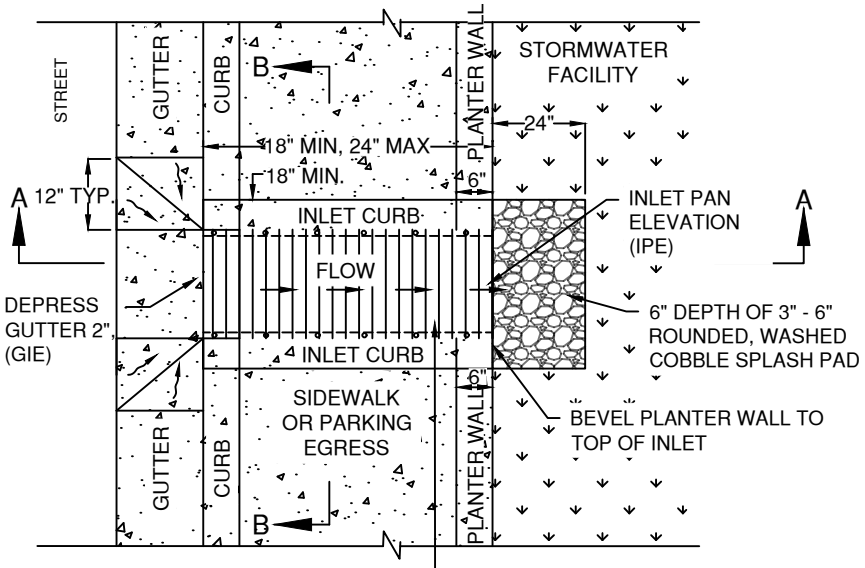
1. FOR USE WITH STORMWATER FACILITIES WITH SIDE SLOPES.
2. PROVIDE SPOT ELEVATIONS ON PLANS (FE, OE, GIE, IE). SEE DETAIL SW-1, SW-1A, SW-3 OR SW-3A.
3. CURB AND WALL DETAILS MAY BE MODIFIED BY CIVIL AND GEOTECHNICAL ENGINEERS SUBJECT TO APPROVAL BY CITY ENGINEER.
4. WHERE INLET FLOW VELOCITY IS HIGH, EXTEND COBBLE INTO FACILITY, BUT AVOID EXCESSIVE USE.
5. CURB HEIGHT MAY BE REDUCED TO 4-INCHES WHERE ADJACENT TO A SIDEWALK. SEE DETAILS SW-12 & SW-13.

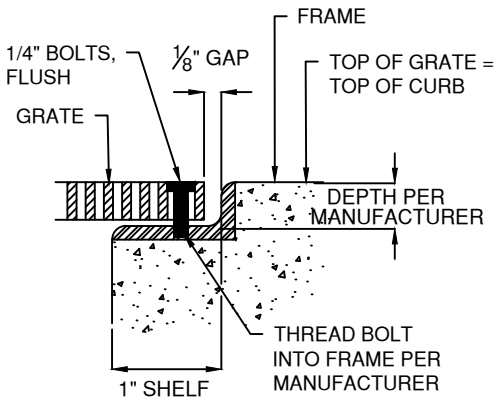
CONSTRUCTION NOTES

1. AFTER CONSTRUCTION PLACE SAND BAGS AT GUTTER OPENINGS TO KEEP STORM FLOWS FROM ENTERING FACILITY UNTIL VEGETATION IS ESTABLISHED.

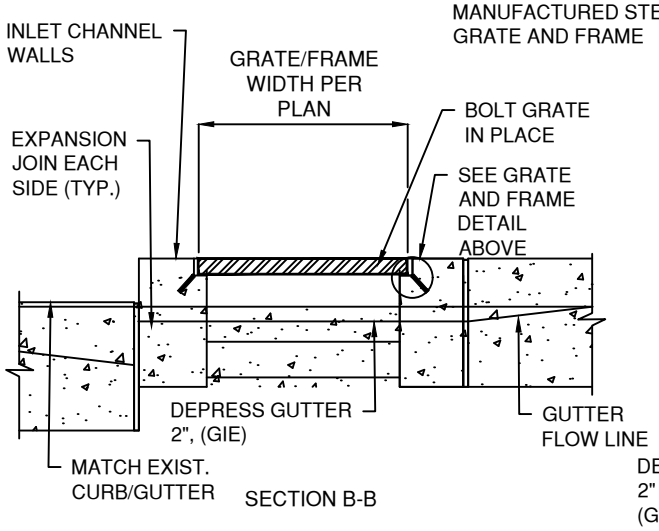
LOW IMPACT DEVELOPMENT STORMWATER MANAGEMENT STANDARD DETAILS

CASQA / central coast LIDI DEVELOPED UNDER PROP. 84 GRANT	APPROVED BY: VERSION: 08/31/2017	CURB CUT INLET FOR SLOPE SIDED BIORETENTION SWALE USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORK CONSTRUCTION	STANDARD PLAN NO. SW-18 SHEET 1 OF 1

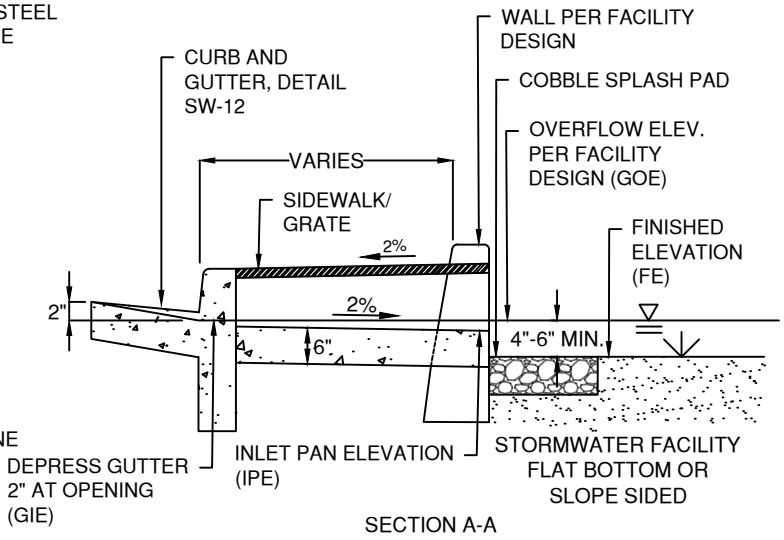




GRATE AND FRAME



SECTION B-B



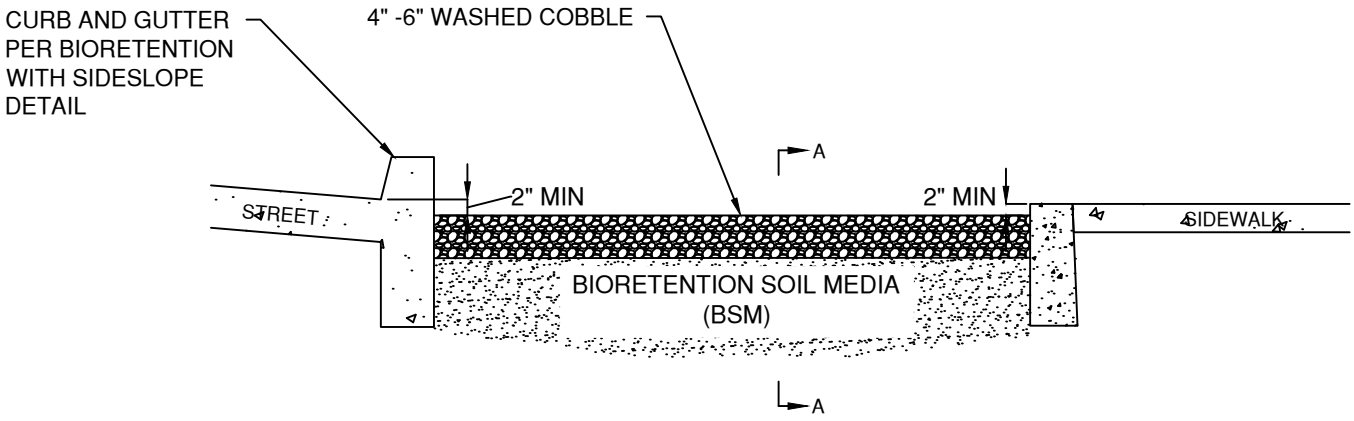
SECTION A-A

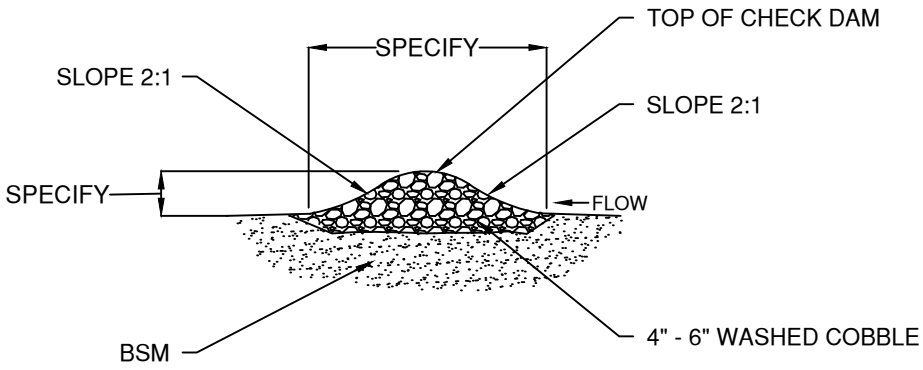
BIORETENTION DESIGN NOTES

1. FOR USE WITH STORMWATER FACILITIES WITH SLOPED SIDES OR FLAT BOTTOMS.
2. PROVIDE SPOT ELEVATIONS ON PLANS (FE, OE, GIE, IPE). SEE DETAIL SW-2, SW-2A, SW-4 OR SW-4A.
3. REFER TO MUNICIPAL STANDARD DRAWINGS AND MATCH GUTTER PAN OF ADJACENT CURB AND GUTTER.
4. IF SLOPED SIDES, WHERE INLET FLOW VELOCITY IS HIGH, EXTEND COBBLE INTO FACILITY, BUT AVOID EXCESSIVE USE.
5. BASE MATERIAL FOR CURB, GUTTER, AND SIDEWALK PER MUNICIPAL STANDARDS.
6. GRATE AND FRAME SHALL SUPPORT H-20 LOADING (ALHAMBRA FOUNDRY A-1540/A-1551 OR EQUIVALENT).
7. SOLID COVER AND FRAME (ALHAMBRA FOUNDRY A-1430/A-1433 OR EQUIVALENT) MAY BE USED IN PLACE OF GRATE AND FRAME.

CONSTRUCTION NOTES

1. AFTER CONSTRUCTION PLACE SAND BAGS AT GUTTER OPENINGS TO KEEP STORM FLOWS FROM ENTERING FACILITY UNTIL VEGETATION IS ESTABLISHED.





SECTION A-A

BIORETENTION DESIGN NOTES

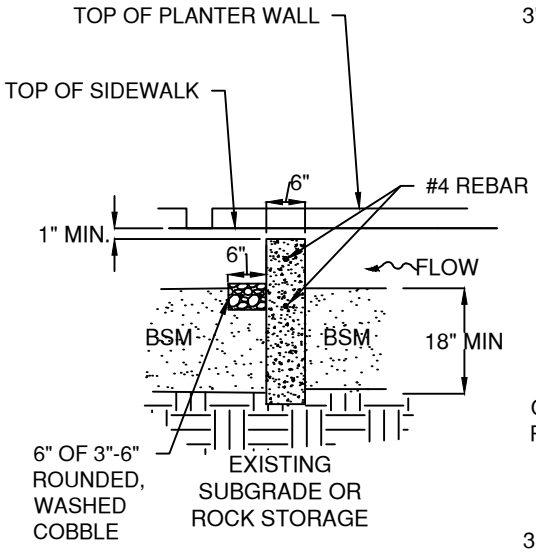
1. FOR USE WITH STORMWATER FACILITIES WITH SLOPED SIDES.
2. BEST SUITED FOR FACILITIES WITH <= 2% LONGITUDINAL SLOPE.
3. PROVIDE ELEVATIONS AND STATIONING AND/OR DIMENSIONING FOR CHECK DAMS.
4. SPACE CHECK DAMS TO MAXIMIZE PONDING ACROSS ENTIRE CELL.
5. ENSURE THAT CHECK DAM ELEVATIONS DO NOT CAUSE STORMWATER TO OVERFLOW TO SIDEWALK.

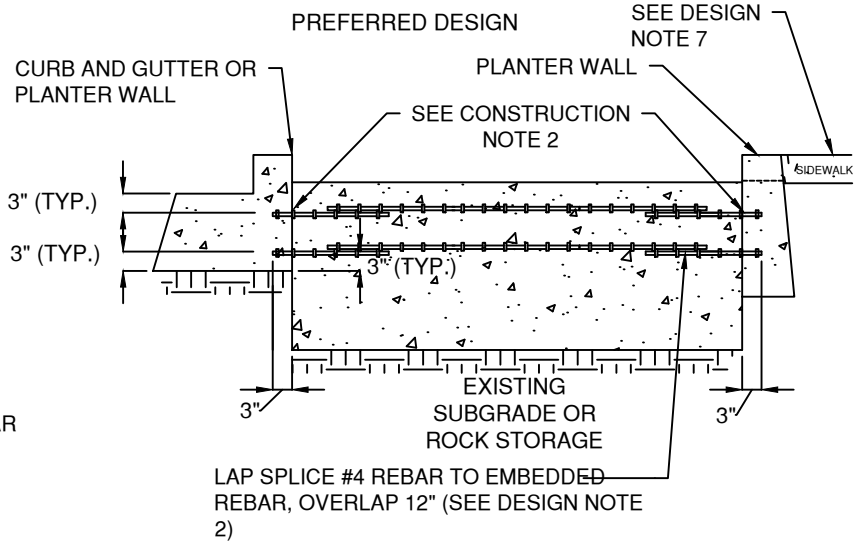
CONSTRUCTION NOTES

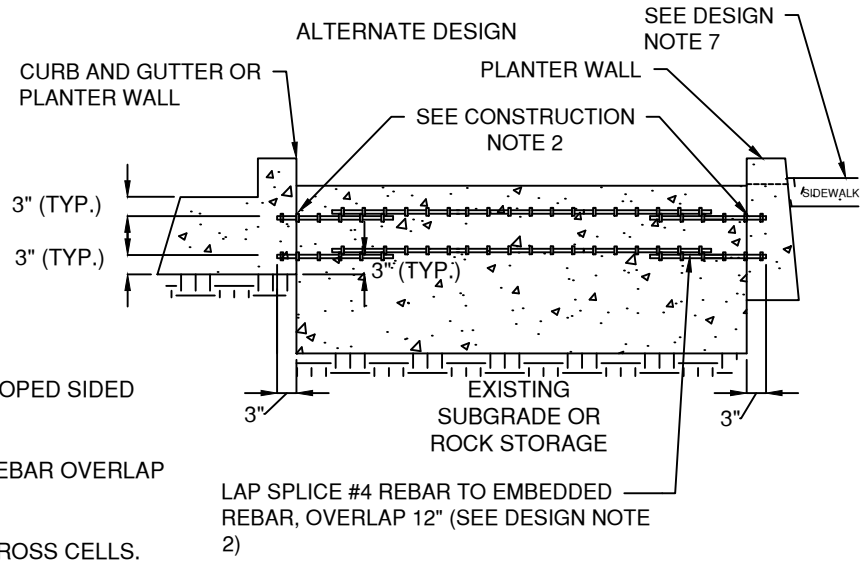
1. DO NOT WORK DURING RAIN OR UNDER WET CONDITIONS.
2. KEEP ALL HEAVY MACHINERY OUTSIDE BIORETENTION AREA LIMITS.

LOW IMPACT DEVELOPMENT STORMWATER MANAGEMENT STANDARD DETAILS

CASQA / central coast LIDI DEVELOPED UNDER PROP. 84 GRANT	APPROVED BY: VERSION: 08/31/2017	GRAVEL CHECK DAM USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORK CONSTRUCTION	STANDARD PLAN NO. SW-20 SHEET 1 OF 1





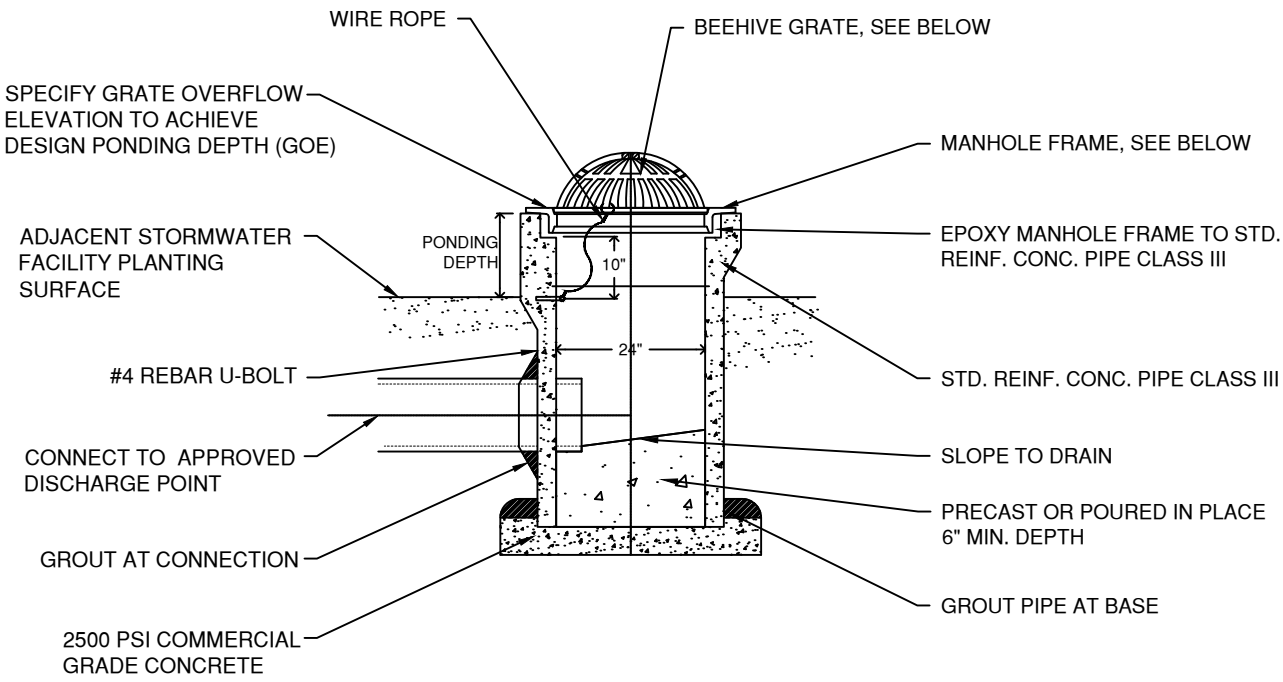


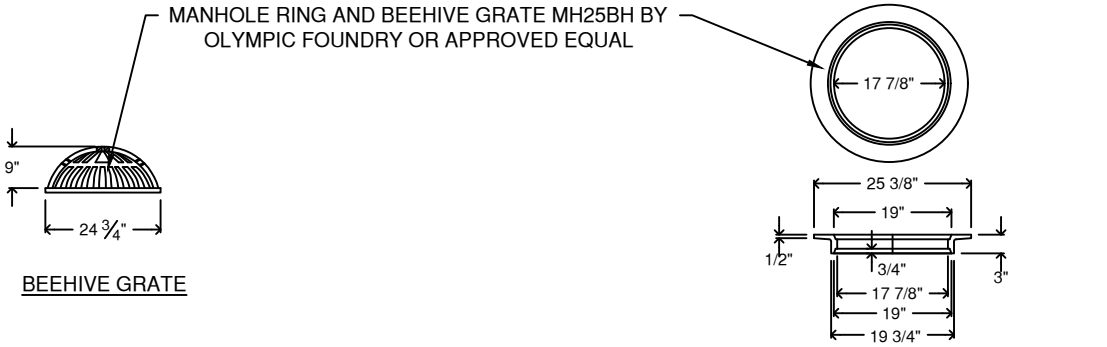
BIORETENTION DESIGN NOTES

1. FOR USE WITH BIORETENTION PLANTERS OR SLOPED SIDED SWALES/RAIN GARDENS.
2. FOR CHECK DAMS LONGER THAN 12' SPECIFY REBAR OVERLAP LENGTH.
3. SPACE CHECK DAMS TO MAXIMIZE PONDING ACROSS CELLS.
4. PROVIDE ELEVATIONS AND STATIONING AND/OR DIMENSIONING FOR CHECK DAMS.
5. ENSURE THAT CHECK DAM ELEVATIONS DO NOT CAUSE STORMWATER TO OVERFLOW TO SIDEWALK.
6. SHOW PLANTER WALL EMBEDDED IN EXISTING SUBGRADE OR DRAINROCK.
7. PREFERRED DESIGN IS TO CONSTRUCT TOP OF SIDEWALK AT GRADE WITH TOP OF PLANTER WALL TO ALLOW RUNOFF TO SHEETFLOW INTO BIORETENTION PLANTER. IF CURB IS NEEDED, USE ALTERNATE DESIGN AND ENSURE TOP OF CONCRETE CHECK DAM IS A MINIMUM OF 1" BELOW BOTTOM OF CURB NOTCH.

CONSTRUCTION NOTES

1. EMBED #3 REBAR 3" INTO CURB AND PLANTER WALL.
2. DO NOT WORK DURING RAIN OR UNDER WET CONDITIONS.
3. KEEP ALL HEAVY MACHINERY OUTSIDE BIORETENTION AREA LIMITS.





BEEHIVE GRATE

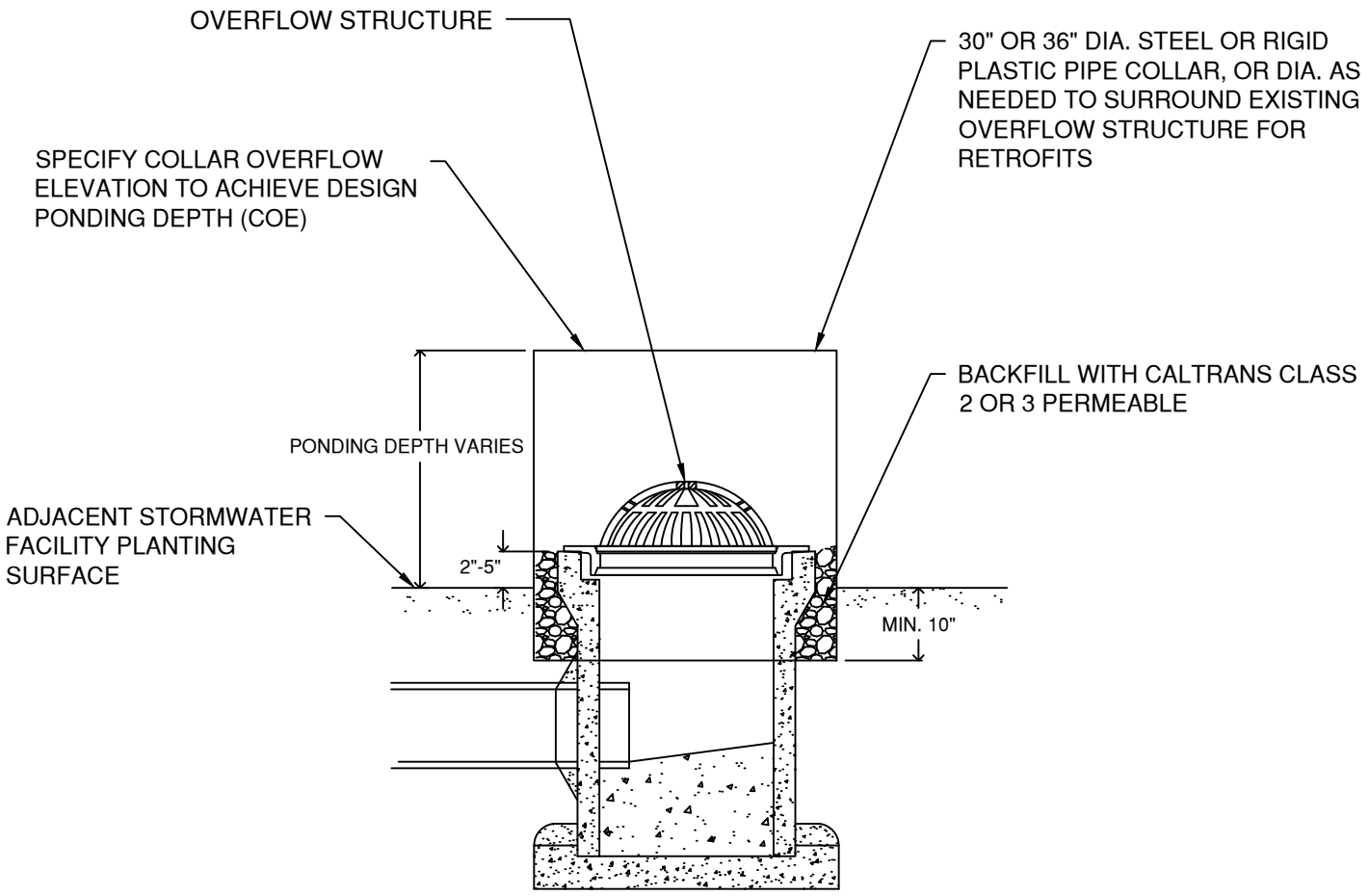
24"x4" REVERSIBLE MANHOLE FRAME

DESIGN NOTES

1. PROVIDE GRATE OVERFLOW ELEVATION ON PLANS.
2. TO INCORPORATE FLEXIBILITY INTO DESIGN OVERFLOW ELEVATION OR CORRECT ELEVATION OF AN EXISTING STRUCTURE, INSTALL OVERFLOW COLLAR, PER DETAIL SW-22A.
3. IN PRIVATE SITES NOT IN CITY R/W THE PROJECT CIVIL ENGINEER MAY PROPOSE ALTERNATIVES FOR GRATE INSTALLATIONS USING ALTERNATIVE MANUFACTURER'S PRODUCT/CONFIGURATION.

CONSTRUCTION NOTES

1. DO NOT ADJUST OVERFLOW GRATE ELEVATION, CONSTRUCT AS SHOWN ON PLANS.



DESIGN NOTES

1. MAY BE USED IN CONJUNCTION WITH OVERFLOW STRUCTURES TO ALLOW FOR FIELD ADJUSTMENT OF OVERFLOW ELEVATION, OR AS RETROFIT TO CORRECT EXISTING STRUCTURE THAT DOES NOT ALLOW PONDING TO OCCUR.

2. PROVIDE COLLAR OVERFLOW ELEVATION (COE) ON PLANS.

3. PCC PIPE RISER EXTENSIONS MAY BE UTILIZED IN LIEU OF OVER FLOW STRUCTURE COLLAR.

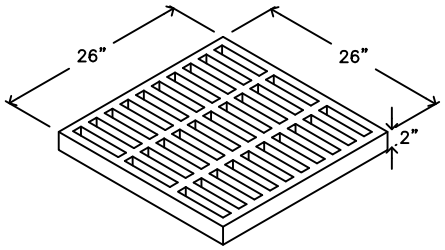
CONSTRUCTION NOTES

1. CENTER COLLAR ON OVERFLOW GRATE.

LOW IMPACT DEVELOPMENT STORMWATER MANAGEMENT STANDARD DETAILS

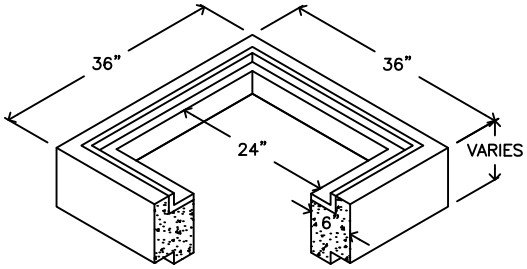
CASQA / central coast LIDI DEVELOPED UNDER PROP. 84 GRANT	APPROVED BY: VERSION: 08/31/2017	OVERFLOW STRUCTURE COLLAR USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORK CONSTRUCTION	STANDARD PLAN NO. SW-22A SHEET 1 OF 1

C.I. GRATE

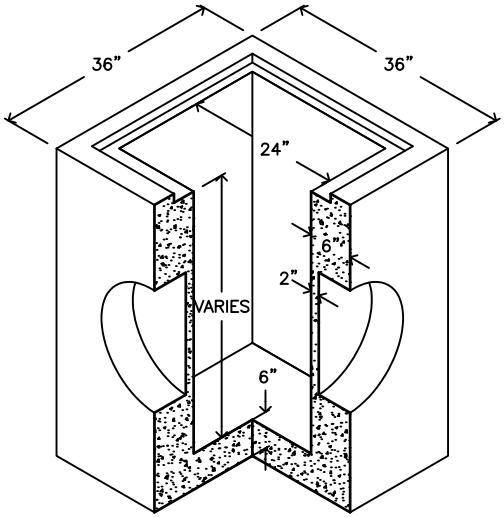


C.I. FRAME

EXTENSION



BOTTOM



DESIGN NOTES

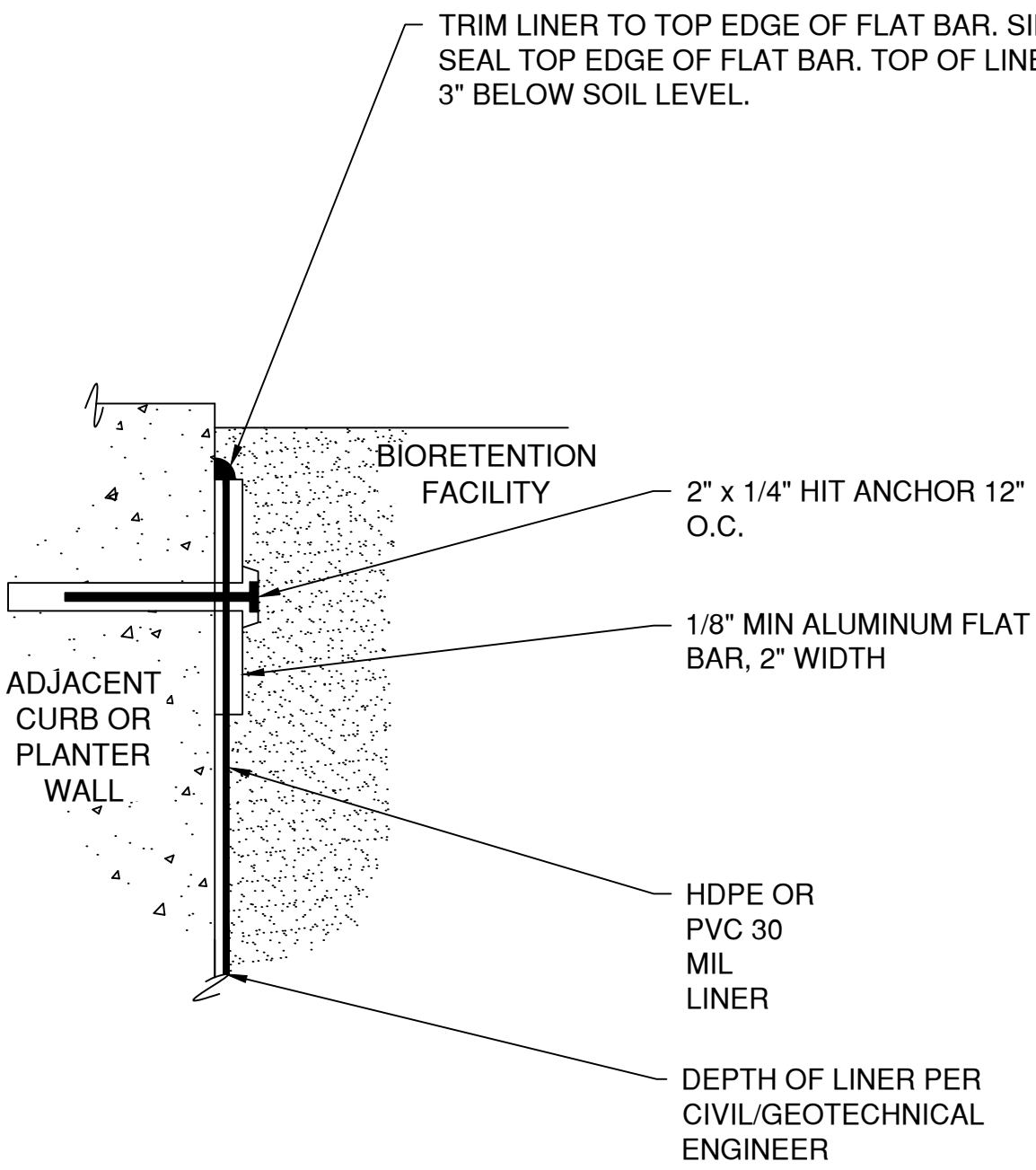
1. PROVIDE GRATE OVERFLOW ELEVATION ON PLANS.
2. PROVIDE EXTENSION OVERFLOW ELEVATION (COE) ON PLANS.
3. ON PRIVATE SITES NOT IN CITY RIGHT-OF-WAY THE PROJECT CIVIL ENGINEER MAY PROPOSE ALTERNATIVES FOR GRATE INSTALLATIONS USING ALTERNATIVE MANUFACTURER'S PRODUCTION/CONFIGURATION.

CONSTRUCTION NOTES

1. DO NOT ADJUST OVERFLOW GRATE ELEVATION, CONSTRUCT AS SHOWN ON PLANS.

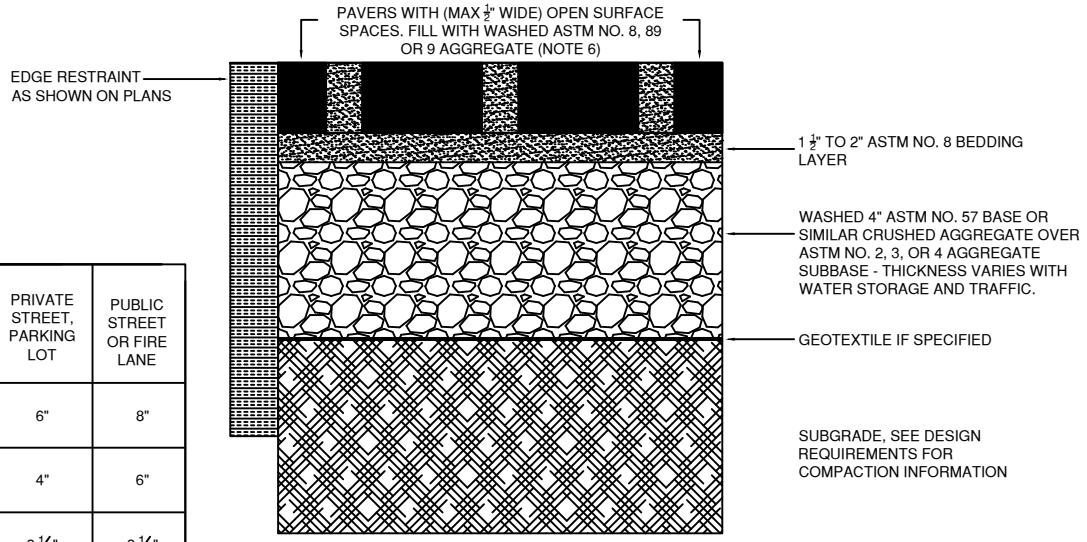
LOW IMPACT DEVELOPMENT STORMWATER MANAGEMENT STANDARD DETAILS

CASQA / central coast LIDI DEVELOPED UNDER PROP. 84 GRANT	APPROVED BY: VERSION: 08/31/2017	OVERFLOW STRUCTURE WITH SQUARE GRATE USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORK CONSTRUCTION	STANDARD PLAN NO. SW-23 SHEET 1 OF 1

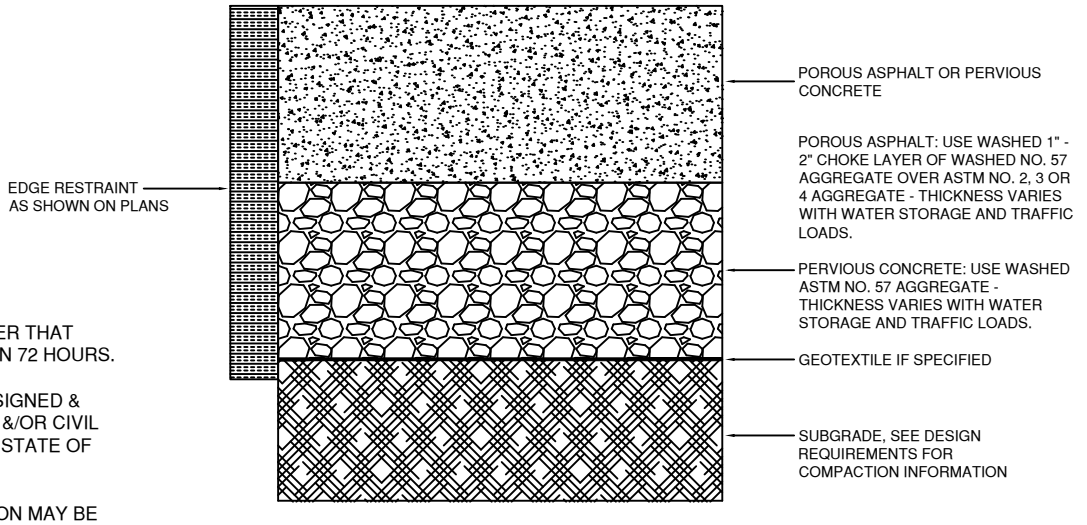


LOW IMPACT DEVELOPMENT STORMWATER MANAGEMENT STANDARD DETAILS

CASQA / central coast LIDI DEVELOPED UNDER PROP. 84 GRANT	APPROVED BY:	IMPERMEABLE LINER CONNECTION	STANDARD PLAN NO. SW-24
	VERSION: 08/31/2017	USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORK CONSTRUCTION	SHEET 1 OF 1



	RESIDENTIAL DRIVEWAY OR PEDESTRIAN ONLY	PRIVATE STREET, PARKING LOT	PUBLIC STREET OR FIRE LANE
PERVIOUS CONCRETE	4"	6"	8"
POROUS ASPHALT	3"	4"	6"
PERMEABLE INTERLOCKING PAVERS	2 ⅜"	3 ⅛"	3 ⅛"
ENGINEERING REQ'D	NO	YES	YES
COMPACTION REQ'D	NO	YES	95%



NOTES:

1. UNDERDRAIN TO REMOVE WATER THAT CANNOT BE INFILTRATED WITHIN 72 HOURS.
2. DESIGNS PROVIDED SHALL BE SIGNED & STAMPED BY A GEOTECHNICAL &/OR CIVIL ENGINEER REGISTERED IN THE STATE OF CALIFORNIA.
3. GEOTEXTILE USE AND SELECTION MAY BE DETERMINED BY A GEOTECHNICAL ENGINEER PER AASHTO M-288.
4. UNDERDRAIN AND ORIFICE CONFIGURATION SHALL BE BASED ON ENGINEERED DESIGN.

LOW IMPACT DEVELOPMENT STORMWATER MANAGEMENT STANDARD DETAILS

CASQA central coast LIDI

DEVELOPED UNDER PROP. 84 GRANT

APPROVED BY:

VERSION: 08/31/2017

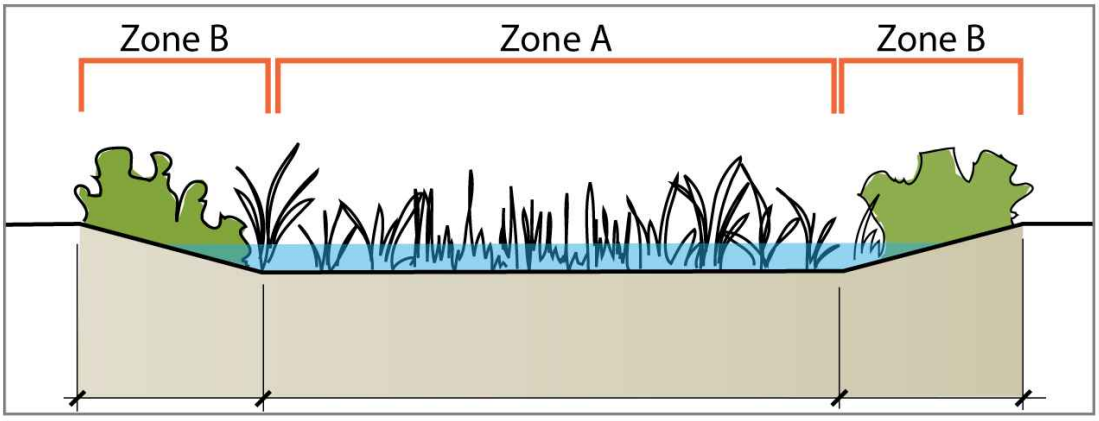
PERVIOUS PAVEMENT

STANDARD PLAN NO. SW-25

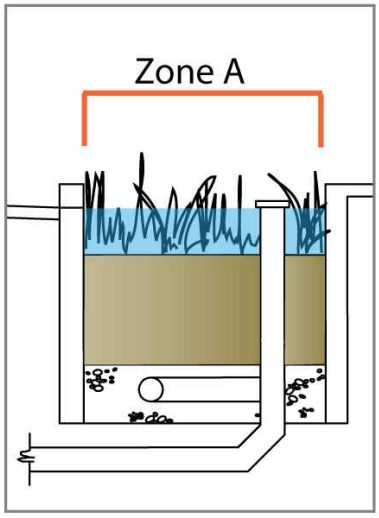
USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORK CONSTRUCTION

SHEET 1 OF 1

Varying slope and ponding levels: Varying slope and ponding levels: This bioretention planting area has sloped edges. Plants in the bottom area will be inundated during storms (**Zone A**). Those planted on the sideslopes are above the level of ponding, but will experience seasonally wet conditions (**Zone B**).



Uniform surface grade: This stormwater planter has a flat bottom with consistent depth of ponding across the structure. All of the plants selected for this design must be tolerant of periodic inundation (**Zone A**).



Trees		San Diego Co. Native - SD California Native - CA Non-Native - X	Landscape Position: 1 - Low1, 2 - Mid2, 3 - High3	Mature Size (height x width)	Irrigation Demands: High - H ▪ Moderate - M Low - L ▪ Rainfall Only - N	Light Requirements Sun - SU ▪ Shade - SH Part Shade - PS	Season Evergreen - E, Deciduous – D Semi-Evergreen - SE	Coastal Exposure? Yes - Y	City of Imperial Beach Sunset Zone: 24
Acer negundo californicum [4,5]	**California Box Elder** [5]	**SD**	**1**	**60'x60'**	**M-H**	**SU, PS**	**D**		**A2-3; 1-10, 12-24**
Cercis occidentalis [4]	**Western Redbud**	**SD**	**1**	**10-18' x 10-18'**	**M**	**SU, PS**	**D**		**2-24**
Ilex vomitoria	Yaupon Holly	X	1	15-20' x 10-15'	H	SU, PS	E		4-9, 11-24
Juglans californica	Southern California Black Walnut	SD	1	15-30' x 15-30'	N-L	SU	D		18-24
Liquidambar styraciflua [5]	Sweet Gum [5]	X	1	60' x 20-25'	M-H	SU	D		3-9, 14-24
Magnolia grandiflora [5]	Southern Magnolia [5]	X	1	80' x 60'	H	SU, PS	E	Y	4-12, 14-24, H1-2
Metasequoia glyptostroboides [5]	**Dawn Redwood** [5]	**X**	**1**	**90' x 20'**	**H**	**SU**	**D**		**A3, 3-10, 14-24**
Myrica californica	Pacific Wax Myrtle	CA	1	10-30 x 10-30'	M	SU	E	Y	4-9, 14-24
Platanus acerifolia	London Plane Tree	X	1	**40-80' x 30-40'**	M-H	SU	D		2-24
Platanus racemosa [4,5]	**California Sycamore** [5]	**SD**	**1**	**30-80' x 20-50'**	**M-H**	**SU**	**D**	**Y**	**4-24**
Quercus agrifolia [4,5]	**Coast Live Oak** [5]	**SD**	**1**	**20-70' x 20-70'**	**N-L**	**SU**	**E**	**Y**	**7-9, 14-24**
Salix gooddingii [4,5]	**Western Black Willow** [5]	**SD**	**1**	**20-40'x20-30'**	**H**	**SU**	**D**		**-**
Sambucus mexicana [4,5]	**Mexican Elderberry** [5]	**SD**	**1**	**10-30' x 8-20'**	**M-H**	**SU, PS**	**SE**		**2-24, H1**
Taxodium spp. [5]	Cypress [5]	X	1	50-70' x 15-30'	L-H	SU	D		2-10, 12-24
Umbellularia californica [5]	California Bay [5]	CA	1	20-25' x 20-25'	L-H	SU, PS, SH	E	Y	4-9, 14-24
Washingtonia filifera [4,5]	**California Fan Palm** [5]	**SD**	**1**	**60' x 20'**	**L-M**	**SU**	**E**		**8,9,10,11-24,H1-2**

DEPARTMENT OF PUBLIC WORKS
IMPE`RIAL BEACH

TITLE: ZONE A LID RECOMMENDED PLANT LIST

STANDARD PLAN

DESIGNED BY:

DRAWN BY:

CHECKED BY:

APPROVED: DATE:

CITY ENGINEER: ____________________

SW-26

SHEET 2 OF 6

Perennials		San Diego Co. Native - SD California Native - CA Non-Native - X	Landscape Position: 1 - Low1, 2 - Mid2, 3 - High3	Mature Size (height x width)	Irrigation Demands: High - H ▪ Moderate - M Low - L ▪ Rainfall Only - N	Light Requirements Sun - SU ▪ Shade - SH Part Shade - PS	Season Evergreen - E, Deciduous – D Semi-Evergreen - SE	Coastal Exposure? Yes - Y	City of Imperial Beach Sunset Zone: 24
Achillea millefolium 4	**Common Yarrow**	**SD**	**1**	**3' x 2'**	**L-M**	**SU**	**SE**	**Y**	**A1-A3, 1-24**
Anemopsis californica 4	**Yerba Mansa**	**SD**	**1**	**1'x2-4'**	**H**	**SU, PS, SH**	**D**		**-**
Aquilegia formosa	Western Columbine	SD	2	1-3' x 1.5'	H	SU, PS	SE		A1-3, 1-11, 14-24
Artemisia palmeri 4	**San Diego Sagewort**	**SD**	2	**2-3'x3'**	**H**	**SU, PS**	**SE**	**Y**	**-**
Asarum caudatum	Wild Ginger	CA	2	1' x 3'	H	SH	E		4-6, 14-24
Epilobium californica 4	**California Fuscia**	**CA**	**1**	**1-2'x3-5'**	**L-M**	**SU**	**SE**		**2-11, 14-24**
Fragaria chiloensis 4	**Beach Strawberry**	**CA**	**1**	**4-8" x spreading**	**H**	**SU, PS**	**E**	**Y**	**4-24**
Iris douglasiana	Pacific Coast Iris	CA	**1**	2' x 2'	M	SU, PS	E	Y	4-9, 14-24
Iris missouriensis	Western Blue Flag Iris	SD	**1**	2' x 2'	M-H	SU, PS	D		1-10, 14-24
Iva hayesiana 4	**San Diego Marsh Elder**	**SD**	2	**1' x 5'**	**N**	**SU, PS**	**SE**	**Y**	**17, 23-24**
Jaumea carnosa	Jaumea	SD	1	<1' x spreading	H	SU	E		-
Limonium californicum	California Sea Lavender	SD	1	1-1.5' x < 3' spreading	M-H	SU, PS	SE	Y	-
Lobelia dunnii	Dunn's Lobelia	SD	2	1-1.5' x 1.5-3'	M-H	SU, PS	E	Y	-
Mimulus cardinalis	Scarlet Monkey Flower	SD	1	2.5' x 2.5'	M-H	SU, PS, SH	D		2-24
Polystichum munitum	Western Sword Fern	CA	2	2-4' x 2-4'	H	SH	E	Y	A3, 2-9, 14-24
Potentilla glandulosa	Sticky Cinquefoil	SD	1	2' x 3'	M-H	SU, PS, SH	E	Y	-
Ribes viburnifolium	Evergreen Currant	SD	3	3-6' x 12'	N-M	SU, PS	E	Y	5,7-9,14-17, 19-24
Salicornia pacifica (or virginica) 4	Pickleweed	SD	1	1-2' x spreading	H	SU	SE	Y	-
Salvia uliginosa	Bog Sage	X	2	4-6' x 3-4'	M-H	SU	E		6-9, 14-24
Satureja douglasii	Yerba Buena	CA	2	<1' x 3'	H	PS	E		4-9, 14-24
Satureja mimuloides	Monkeyflower Savory	CA	1	1-3' x 1-3'	M-H	SU, PS	D		-

DEPARTMENT OF PUBLIC WORKS
IMPE`RIAL BEACH

TITLE: ZONE A LID RECOMMENDED PLANT LIST

DESIGNED BY:

DRAWN BY:

CHECKED BY:

APPROVED: DATE:

CITY ENGINEER: ______________________

STANDARD PLAN

SW-26

SHEET 3 OF 6

Perennials		San Diego Co. Native - SD California Native - CA Non-Native - X	Landscape Position: 1 - Low1, 2 - Mid2, 3 - High3	Mature Size (height x width)	Irrigation Demands: High - H ▪ Moderate - M Low - L ▪ Rainfall Only - N	Light Requirements Sun - SU ▪ Shade - SH Part Shade - PS	Season Evergreen - E, Deciduous – D Semi-Evergreen - SE	Coastal Exposure? Yes - Y	City of Imperial Beach Sunset Zone: 24
Sisyrinchium bellum 4	Blue-eyed Grass	SD	2	6-18" x 6-18"	M-H	SU, PS	E	Y	2-9, 14-24
Trifolium wormskioldii	Coast Clover	SD	1	2' x spreading	H	SU	D		-
Salicornia pacifica (or virginica) **4**	**Pickleweed**	**SD**	**1**	**1-2' x spreading**	**H**	**SU**	**SE**	**Y**	**-**
Salvia uliginosa	Bog Sage	X	2	4-6' x 3-4'	M-H	SU	E		6-9, 14-24
Satureja douglasii	Yerba Buena	CA	2	<1' x 3'	H	PS	E		4-9, 14-24
Satureja mimuloides	Monkeyflower Savory	CA	1	1-3' x 1-3'	M-H	SU, PS	D		-
Sisyrinchium bellum **4**	**Blue-eyed Grass**	**SD**	**2**	**6-18" x 6-18"**	**M-H**	**SU, PS**	**E**	**Y**	**2-9, 14-24**
Trifolium wormskioldii	Coast Clover	SD	1	2' x spreading	H	SU	D		-

DEPARTMENT OF PUBLIC WORKS
IMPE`RIAL BEACH

TITLE: ZONE A LID RECOMMENDED PLANT LIST

STANDARD PLAN

DESIGNED BY:

DRAWN BY:

CHECKED BY:

APPROVED: DATE:

CITY ENGINEER: ______________

SW-26

SHEET 4 OF 6

Grasses & Grass-Like Plants		San Diego Co. Native - SD California Native - CA Non-Native - X	Landscape Position: 1 - Low1, 2 - Mid2, 3 - High3	Mature Size (height x width)	Irrigation Demands: High - H ▪ Moderate - M Low - L ▪ Rainfall Only - N	Light Requirements Sun - SU ▪ Shade - SH Part Shade - PS	Season Evergreen - E, Deciduous – D Semi-Evergreen - SE	Coastal Exposure? Yes - Y	City of Imperial Beach Sunset Zone: 24
Buchloe dactyloides 'UC Verde'	'UC Verde' Buffalograss	X	1	6-8" x spreading	L-H	SU	D		-
Carex praegracilis	California Field Sedge	SD	1	1'-2' x spreading	M-H	SU, PS	E	Y	-
Carex pansa	California Meadow Sedge	CA	1	6-8" x spreading	M-H	SU, PS	SE	Y	7-9, 11-24
***Carex spissa*4**	**San Diego Sedge**	**SD**	**1**	**5' x 5'**	**H**	**SU, PS**	**SE**	**Y**	**7-9, 14-17, 19-24**
Carex subfusca	Rusty Sedge	SD	1	6-8" x spreading	M	SU, PS, SH	SE		**7-9, 11-24**
Chondropetalum tectorum	Small Cape Rush	X	1	3-4' x 3-4'	M-H	SU, PS	E	Y	8-9, 14-24
***Distichlis spicata*4**	**Salt Grass**	**SD**	**1**	**1' x 3'**	**M-H**	**SU, PS**	**D**	**Y**	**-**
***Eleocharis macrostachya*4**	**Common Spike Rush**	**SD**	**1**	**1-3' x 2'**	**H**	**SU, PS**	**E**	**Y**	**-**
Equisetum hyemale ssp. affine	Horsetail Reed	SD	1	4' x spreading	H	SU, PS	E		1-24
Festuca californica	California Fescue	CA	1	2-3' x 1-2'	M-H	SU, PS	E	Y	4-9, 14-24
Festuca rubra 'Molate'	Molate Red Fescue	CA	1	1-2' x spreading	H	SU, PS	E		A2-3, 1-10, 14-24
Juncus effusus	Soft Rush	SD	1	2.5' x 2.5	M-H	SU, PS	E		1-24, H1
Juncus mexicanus4	**Mexican Rush**	**SD**	**1**	**2' x 2'**	**M-H**	**SU, PS**	**E**		**-**
Juncus patens4	**California Gray Rush**	**CA**	**1**	**2' x 2'**	**L-H**	**SU, PS**	**E**		**4-9, 14-24**
Leymus triticoides	Creeping Wildrye	CA	1	1.5'-4.5'	L-M	SU, PS	E	Y	-
***Muhlenbergia rigens*4**	**Deer Grass**	**SD**	**1**	**2-4' x 3-4'**	**L**	**SU**	**E**		**4-24**
Nassella pulchra	Purple Needlegrass	CA	2	3' x 2'	N-L	SU	D		5-9, 11, 14-24
Schoenoplectus californicus4	**California Bulrush**	**SD**	**1**	**10' x spreading**	**H**	**SU, PS, SH**	**E**		**-**
Sporobolus airoides	Alkali Dropseed	CA	1	3' x 3'	L-M	SU	D		1-24
Zephyranthes candida	Rain Lily	X	1	12"x12"	H	SU, PS	E		4-9, 12-24, H1, H2

DEPARTMENT OF PUBLIC WORKS
IMPE`RIAL BEACH

TITLE: ZONE A LID RECOMMENDED PLANT LIST

STANDARD PLAN

SW-26

SHEET 5 OF 6

DESIGNED BY:

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DATE:

CITY ENGINEER: ______

Annuals and Short-Lived Perennials		San Diego Co. Native - SD California Native - CA Non-Native - X	Landscape Position: 1 - Low1, 2 - Mid2, 3 - High3	Mature Size (height x width)	Irrigation Demands: High - H ▪ Moderate - M Low - L ▪ Rainfall Only - N	Light Requirements Sun - SU ▪ Shade - SH Part Shade - PS	Season Evergreen - E, Deciduous – D Semi-Evergreen - SE	Coastal Exposure? Yes - Y	City of Imperial Beach Sunset Zone: 24
Limnanthes douglasii	Meadowfoam	CA	1	6-12" x 6-12"	H	SU	-		1-9, 14-24
Limnanthes gracilis ssp. Parishii	Parish Meadowfoam	SD	2	6-12" x 6-12"	H	SU	-		-
Lupinus succulentus 4	**Arroyo Lupine**	**SD**	**2**	**3'x3'**	**M-H**	**SU**	**-**		**7-24**
Oenothera elata 4	**Yellow Evening Primrose**	**SD**	**1**	**2-3' x 2-3'**	**L-H**	**SU, PS**	**E**		**5-7, 14-24**
Pluchea odorata 4	**Salt Marsh Fleabane**	**SD**	**1**	**2-3' x 1-2'**	**H**	**SU, PS**	**SE**		**-**

Vines		San Diego Co. Native - SD California Native - CA Non-Native - X	Landscape Position: 1 - Low1, 2 - Mid2, 3 - High3	Mature Size (height x width)	Irrigation Demands: High - H ▪ Moderate - M Low - L ▪ Rainfall Only - N	Light Requirements Sun - SU ▪ Shade - SH Part Shade - PS	Season Evergreen - E, Deciduous – D Semi-Evergreen - SE	Coastal Exposure? Yes - Y	City of Imperial Beach Sunset Zone: 24
Vitis californica	**California Grape**	**SD**	**1**	**30'**	**N-L**	**SU, PS**	**D**		**4-24**

DEPARTMENT OF PUBLIC WORKS
IMPE`RIAL BEACH

TITLE: ZONE A LID RECOMMENDED PLANT LIST

DESIGNED BY:
DRAWN BY:
CHECKED BY:

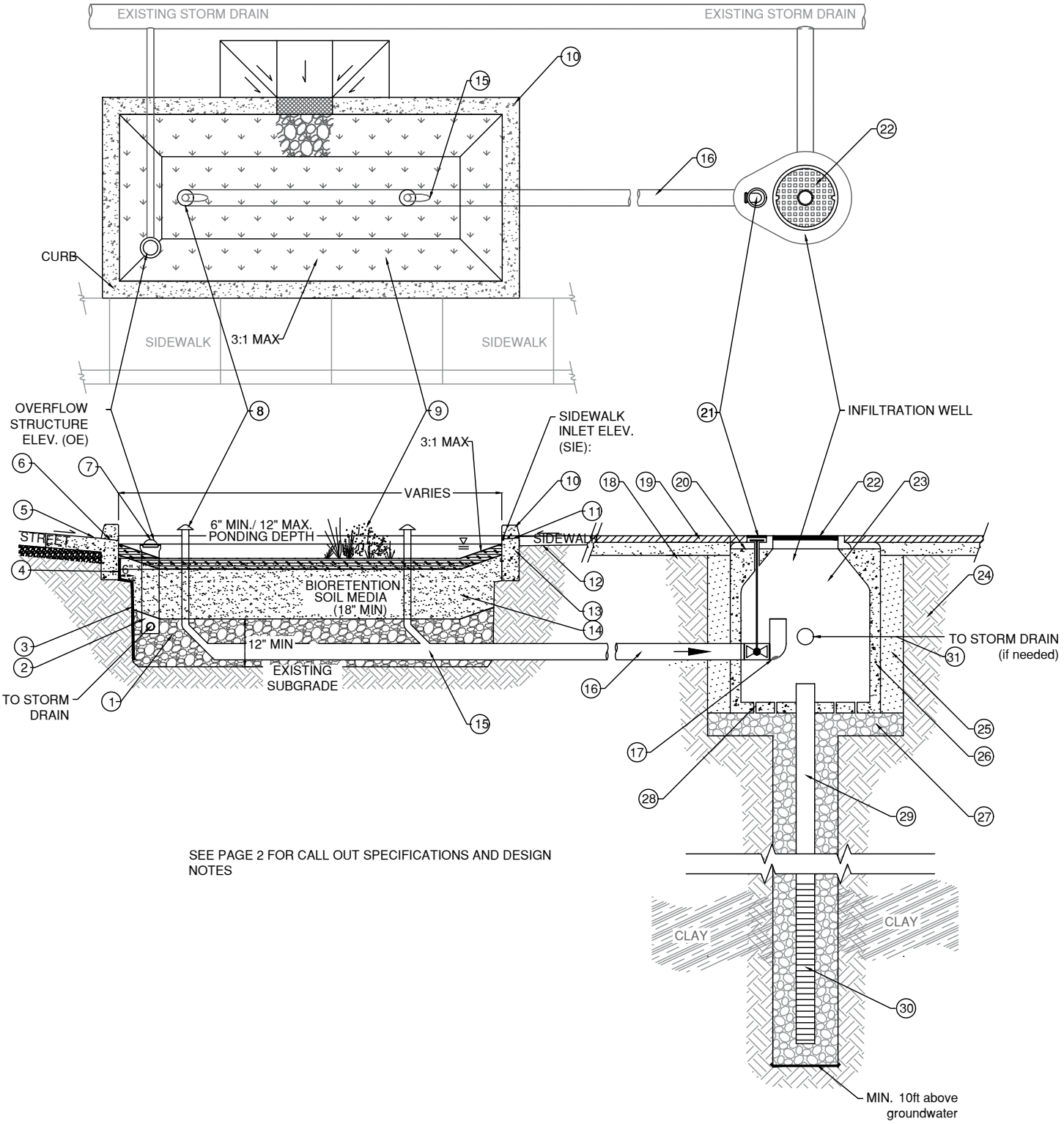
APPROVED: DATE:

CITY ENGINEER: ______________________

STANDARD PLAN

SW-26

SHEET 6 OF 6



SEE PAGE 2 FOR CALL OUT SPECIFICATIONS AND DESIGN NOTES

LOW IMPACT DEVELOPMENT STORMWATER MANAGEMENT STANDARD DETAILS

DEVELOPED UNDER PROP. 84 GRANT

APPROVED BY:

VERSION: 08/31/2017

DRYWELL STORMWATER BMP

STANDARD PLAN NO. SW-27

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORK CONSTRUCTION

SPECIFICATIONS

1. 12” DEEP OPEN GRADED WASHED STONE (TYPICALLY 3/4” TO 1-1/2” (ASTM #4 STONE) OR 1” TO 2” (ASTM #3 STONE).
2. BRIDGING LAYER(S) PER LIDI BIORETENTION TECHNICAL SPECIFICATIONS (BTS). DO NOT USE FILTER FABRIC BETWEEN BSM AND AGGREGATE. DO NOT USE FILTER FABRIC BETWEEN BIOFILTER SOIL MATERIAL (BSM) AND AGGREGATE.
3. 30 ML LINER MAY BE REQUIRED TO AVOID LATERAL INFILTRATION BELOW STREET; SUBJECT TO GEOTECHNICAL RECOMMENDATIONS.
4. MAINTAIN 6” MINIMUM BENCH OF NATIVE SOIL FOR SUPPORT OF ADJACENT SIDEWALK/ROAD (TYPICAL).
5. CURB AND GUTTER DETAIL SW-12.
6. CURB INLET DETAIL SW-17, GUTTER INLET ELEV (GIE). LOCATE ENERGY DISSIPATION COBBLE PADS AS SPECIFIED IN INLET DETAILS.
7. OVERFLOW STRUCTURE REQUIRED FOR IN-LINE SYSTEMS WITHOUT OVERFLOW BYPASS, DETAIL SW-22, SW-22A, and SW-23.
8. MAINTENANCE PIPES - 4” MIN. DIA. VERTICAL PVC PIPES CONNECTED TO UNDERDRAIN. PLACED AT START AND 3 FEET BEFORE END OF UNDERDRAIN. REQUIRES DIRECTIONAL SWEEP BEND. THREADED AND CAPPED
9. VEGETATION - PLANT SELECTION AND MULCH (OPTIONAL) PER BIORETENTION TECHNICAL SPECIFICATIONS.
10. 4” MIN. EXPOSED WALL HEIGHT
11. SIDEWALK DRAINAGE NOTCH 1” LOWER THAN SIDEWALK, SLOPED TO FACILITY
12. SEE PLANS FOR SIDEWALK RESTORATION
13. DEEP CURB DETAIL SW-13
14. BIORETENTION SOIL MEDIA (BSM). SPECIFICATION PER BIORETENTION TECHNICAL SPECIFICATIONS (BTS). SPECIFICATION SHOULD AVOID COMPOST OR OTHER MATERIAL KNOWN TO LEACH NUTRIENTS.
15. UNDERDRAIN, MIN. 4” DIA. PVC SDR 35 PERFORATED PIPE OR LARGER AS NEEDED TO CONVEY PEAK TREATED FLOWRATE WITH MINIMAL HEAD LOSS, SEE CONSTRUCTION NOTES.
16. 8” INLET PIPE OR OTHER.
17. LOW FLOW ORIFICE. (SEE DESIGN NOTE 11).
18. STABILIZED BACKFILL - TWO-SACK SLURRY MIX.
19. SIDEWALK PER MUNICIPAL STANDARDS.
20. COMPACTED BASE MATERIAL.
21. ACCESS HATCH WITH SHUT OF VALVE SWITCH. CONNECTED TO SHUT OF VALVE IN INLET PIPE.
22. MAINTENANCE HOLE COS TYPE 204-204 MH A OR B. ¾” I.D. MIN OBSERVATION PORT.
23. MANHOLE CONE - MODIFIED FLAT BOTTOM.
24. EXISTING SOILS. (SEE CONSTRUCTION NOTE 4, 8).
25. COMPACTED BACKFILL
26. PRE-CAST OR INSITU CAST CONTROL VAULT (SEE DESIGN NOTE 8)
27. ROCK - WASHED, SIZED BETWEEN 3/8” AND 1-1/2"
28. PERFORATED BASE OF CONTROL VAULT
29. DRILLED SHAFT WITH 6” WELDED STEEL OR THREADED PVC CASING (SEE DESIGN NOTE 13 & CONSTRUCTION NOTE 7,8)
30. 6 - 8” O.D. WELDED WIRE STAINLESS STEEL WELL SCREEN OR THREADED PVC SLOTTED SCREEN. SCREEN LENGTH + LENGTH + SLOT WIDTH TO BE DETERMINED IN ACCORDANCE WITH LOCAL CONSTRAINTS .I.E. DISTANCE BETWEEN CLAY LAYER AND MIN. 10FT ABOVE SEASONAL HIGH GROUNDWATER LEVEL
31. PVC STORMDRAIN CONNECTOR PIPE. SAME DIAMETER AS INFLOW PIPE TO CONTROL VAULT.

DESIGN NOTES

1. ADDITIONAL DESIGN GUIDANCE FOR BIOFILTRATION SYSTEM PROVIDED IN LIDI BIORETENTION TECHNICAL SPECIFICATIONS (BTS) DOCUMENT.
2. BOTTOM WIDTH - PROVIDE 2 FT MINIMUM FLAT BREGENALL
3. BOTTOM WITH A MAX 3:1 SLOPE FOR SURFACE FINISHING WITHIN BIOFILTRATION SYSTEM
4. IF CALTRANS CLASS 2 PERMEABLE IS NOT AVAILABLE, SUBSTITUTE CLASS 3 PERMEABLE WITH AN OVERLYING 3” DEEP LAYER OF ¾” (NO. 4) OPEN-GRADED AGGREGATE.
5. PROVIDE SPOT ELEVATIONS AT INLETS ON CIVIL PLANS (FE, OE, GIE, SIE). SEE DETAIL SW-17.
6. EDGE CONDITION WILL VARY FOR NEW AND RETROFIT PROJECTS. CURB, WALL, AND SIDEWALK DETAILS MAY BE MODIFIED FOR PROJECT BY CIVIL AND GEOTECHNICAL ENGINEERS.
7. PROVIDE MONITORING WELL IN EACH FACILITY, PER BIORETENTION TECHNICAL SPECIFICATIONS.
8. LONGITUDINAL SLOPE 6% WITH CHECK DAMS.
9. IF CHECK DAMS ARE NEEDED, SEE CONCRETE CHECK DAM DETAIL SW-18.
10. VARIATIONS IN DRY WELL DESIGN SHOULD BE MADE TO ACCOMMODATE STORAGE VOLUME DESIGN AND TO SUIT LOCAL CONDITIONS AND CONSTRAINTS.
11. IN AREAS WITHOUT A STORMDRAIN, THE SYSTEM SHOULD ONLY BE CONSTRUCTED WHERE THE MAINTENANCE HOLE SURFACE INVERT IS ABOVE THE BIOFILTER OVERFLOW ELEVATION.
12. ALTERNATIVE VAULT LOCATIONS POSSIBLE INCLUDING WITHIN THE BIOFILTER FOOTPRINT.
13. VALVE CAN BE MOVED TO THE BIOFILTER IF DESIRED. REQUIRES STRUCTURAL SUPPORT.
14. ALTERNATIVE PRODUCTS SUCH AS VENDOR-SUPPLIED DRY WELL PRODUCTS MAY BE USED AS A SUBSTITUTE PROVIDED THAT THE ALTERNATIVE PRODUCT IS EQUAL.
15. THIS DESIGN IS LIKELY TO QUALIFY AS A CLASS V WELL SUBJECT TO REGISTRATION WITH THE USEPA.

Low Impact Development Initiative (LIDI)
Bioretention Technical Specifications

The following technical information is for use in conjunction with the complete set of bioretention area standard details developed by the LIDI for use in the Central Coast region and throughout California. Central Coast region-specific requirements are noted where applicable.

Facility Design/Dimensions

- Bioretention facilities should be sized to retain and/or treat the water quality design flow and/or volume in accordance with the stormwater permit requirements that apply to the local jurisdiction and appropriate local, countywide, and/or statewide (CASQA) guidance documents. Design parameters specified in stormwater permits will determine the surface area and storage volume required within the facility.
- Bottom width – facilities should have flat bottoms and sufficient width for ease of constructability and maintenance.
  - Provide 2' wide minimum for facilities with side slopes and planters (facilities with vertical side walls).
- Allowable standing water duration – generally 48 to 72 hours

  Allowable ponding time is typically associated with mosquito vector control or perceived nuisance flooding and varies by location.
- Ponding depth - Min. 6", max. 12". The depth is measured from the surface of the bioretention soil media and not adjusted for application of mulch.
- Planter depth – (from adjacent pedestrian walking surface to facility finished elevation/planting surface) is based on desired ponding plus freeboard, but also relates to planter width. Planters can be deeper if they are wider, and need to be shallower as they narrow. This is a pedestrian perception and safety issue. Some recommended width to depth guidelines are as follows (allowable depths and appropriate edge treatments may be specified by the local jurisdiction and may be determined by ADA requirements):

PLANTER WIDTH	MAX. PLANTER DEPTH
> 5'	16"
4' – 5'	12"
3' – 4'	10"
2' – 3'	8"

- Slope/grades
  - Side slope - 4:1 preferred
    - Max. 3:1 allowed with min. 12" wide shoulder (2% slope toward facility) adjacent to pedestrian use or curb.
  - Longitudinal slope – Facility should be relatively flat (i.e., maximum of 2% longitudinal slope of bottom) so that water ponds and infiltrates evenly across the facility surface.
    - If installed on a slope, facilities should be terraced and separated by check dams and weir overflows to provide flat-bottomed cells with proper storage and infiltration.
    - Installation not recommended on slopes > 8%.
  - Grades on opposite sides within a facility should be similar to optimize ponding across the entire basin/cell.

Hard Infrastructure

- Inlet curb cut design selection should be based on application considerations:
  - Sloped sided or planter facility
  - Curb and gutter adjacent to facility or separated by pedestrian sidewalk
- Curb cut width – 12”-18” minimum, with rounded edges, depress gutter 2” at opening (see SW-14, SW-15, SW-16)
- Sidewalk edge type selection should be based on application considerations:
  - New or retrofit
  - Sloped sided or planter box
- Sidewalk wall - planter box requires 4” min. height wall adjacent to sidewalk for pedestrian safety.
- Sidewalk wall drainage notch – when sidewalk drains to planter, provide 4”-6” wide notch openings in wall, opening 1” below sidewalk, slope to facility. Space openings to convey flows.
  - Provide minimum 2” cover between notch and structural dowels in curbs/walls.
- Energy dissipation – provide aggregate or concrete splash pads at inlets per inlet details.
  - For aggregate: 6” depth, 3" – 6" rounded, washed cobble
  - For sloped sided facilities where inlet flow velocity is high, extend cobble into facility, but avoid excessive or decorative use.
- Where impermeable liner is included between facility and adjacent

infrastructure (street, parking lot), use 30 ML HDPE or PVC material, see Impermeable Liner detail.

- Check dams – provide for facilities installed on slope
  - Per check dam details SW-17 and SW-18
  - Check dams should be placed for every 4-6" of elevation change and so that the top of each dam is at least as high as the toe of the next upstream dam.
- Overflow structure – required for on-line systems without an overflow bypass
  - Per overflow structure details SW-19, SW-20
  - Connect to approved discharge point or another downstream bioretention area.
- Provide observation well in facility if required
  - Upright 6 inch rigid PVC (SDR 40 or equivalent) pipe, perforated for the section extending through the depth of the bioretention soil media (and aggregate layer if included), extending 6 inches above the top of soil elevation, with a threaded cap.
  - Locate to avoid damage from maintenance activities.

Facility Media (soil, aggregate, mulch)

- Aggregate layer – where an aggregate layer is included in the design (underdrain design or optional use based on project requirements, depth based on sizing calculations), specify "CalTrans Class 2 Permeable."
  - CalTrans Class 2 Permeable does not require an aggregate filter course between the aggregate storage layer and the bioretention soil media above.
  - When CalTrans Class 2 Permeable is not available, substitute CalTrans Class 3 Permeable.
    - Class 3 Permeable requires an overlying 3" deep layer of ¾" (No. 4) open graded aggregate (between Class 3 and bioretention soil media above).
  - Filter fabric - do NOT use fabric between bioretention soil media and aggregate layer
- Bioretention soil media (BSM) - use local jurisdiction approved/recommended BSM (e.g. Bay Area Stormwater Management Agencies Association (BASMAA) Regional Biotreatment Soil Specification (revised January 29, 2016)[1].

[1] http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/stormwater/MRP/provisionC.3/Revised_%20Biotreatment%

- Using a performance specification for alternative bioretention soil mix is not recommended (but may be allowed by the local jurisdiction).
- A pre-mixed bioretention soil media is preferable to mixing soil on-site.

- BSM depth – 18" minimum depth; 24" recommended, or as required by the local jurisdiction. 24" depth required in the Central Coast Region for facilities with underdrains.
  - Where trees are specified, increase BSM depth in tree planting locations, per arborist's or landscape architects direction, or allow trees access to sufficient volume of native soil.
    - Tree planting in bioretention - see BASMAA Literature Review - Bioretention Design for Tree Health (September 15, 2016)[2]
- Bioretention soil media placement and compaction – place BSM in 6" lifts. Compact each lift with a landscape roller or by lightly wetting. Allow BSM to dry overnight before planting.
- Mulch depth – 2" – 3" (3" recommended and required by State Model Water Efficiency Landscape Ordinance)
  - Do not apply mulch in ponding zone just prior to or during rainy season.
  - When mulch is used, excavation must allow for specified bioretention soil depth to achieve finished elevations as shown on civil plans
- Mulch type - when used in ponding zone, must be aged, stabilized, non-floating mulch, such as a specified composted wood mulch. Gravel mulch may also be used when high flow velocities through the system are expected.

<u>Landscape (planting and irrigation)</u>

- Irrigation - Provide irrigation for plant establishment (2-3 years), and supplemental irrigation during periods of prolonged drought.
  - Provide separate zone for connection to water supply
- Planting - see LIDI plant guidance for bioretention areas technical assistance memo (TAM) or use bioretention plant list in other local or countywide guidance document.
  - Landscape Architects who have not previously designed bioretention systems should use plants from the LIDI TAM or other approved plant list. Landscape Architects with experience designing for bioretention may use additional plant species consistent with the above lists and

20_Soil.pdf
[2] www.basmaa.org

appropriate for the facility design and local conditions.

- Do not locate plants at inlets. Consider mature growth to determine planting layout and avoid future blockage of inlets by plants.
- Trees located on slopes should be 5’ minimum from inlets to avoid erosion of soil at root ball.

Underdrain Design

- Aggregate layer depth – 12” minimum depth.
- Underdrain – use 4” diameter, PVC SDR 35 perforated pipe.
  - Install underdrain with holes facing down.
  - Underdrain discharge elevation should be near top of aggregate layer if facility is allowed to infiltrate into native soil.
  - Underdrain slope may be flat or have a slight slope.
  - Connect underdrain to approved discharge point.
  - Provide capped, threaded PVC cleanout for underdrain, 4" min. dia. with sweep bend.
  - Do NOT wrap underdrain with filter fabric.

SAN FRANCISCO
stormwatermanagementrequirements
and design guidelines

Access Appendix B via: https://www.sfwater.org/Modules/ShowDocument.aspx?documentID=9101

Appendix D. Sizing Requirements for Green Infrastructure Facilities

Guidance for Sizing Green Infrastructure Facilities in Street Projects

Prepared by
Dan Cloak Environmental Consulting
EOA, Inc.

Introduction and Regulatory Background

Provision C.3.j. in the reissued Municipal Regional Stormwater Permit[1] (MRP) requires each Permittee to "complete and implement a Green Infrastructure (GI) Plan for the inclusion of low impact development drainage design into storm drain infrastructure on public and private lands, including streets, roads, storm drains, parking lots, building roofs, and other storm drain infrastructure elements."

Provision C.3.j.i.(g) further mandates that these plans include:

> *Requirements that projects be designed to meet the treatment and hydromodification sizing requirements in Provisions C.3.c. and C.3.d. For street projects not subject to Provision C.3.b.ii. (i.e., non-Regulated Projects) Permittees may collectively propose a single approach with their Green Infrastructure Plans for how to proceed should project constraints preclude fully meeting the C.3.d. sizing requirements. The single approach can include different options to address specific issues or scenarios. That is, the approach shall identify the specific constraints that would preclude meeting the sizing requirements and the design approach(es) to take in that situation. The approach should also consider whether a broad effort to incorporate hydromodification controls into green infrastructure, even where not otherwise required, could significantly improve creek health and whether such implementation may be appropriate, plus all other information as appropriate (e.g., how to account for load reduction for the PCBs or mercury TMDLs).*

This document represents the "single approach" collectively proposed by the Permittees for how to proceed when constraints on GI projects affect facility sizing in street projects. For other types of projects, information on hydraulic sizing is provided in the technical guidance manuals for Provision C.3 developed by each countywide stormwater program.

Hydraulic Sizing Requirements

MRP Provision C.3.d contains criteria for sizing stormwater treatment facilities. Facilities may be sized on the basis of flow, volume, or a combination of flow and volume. With adoption of the 2009 MRP, a third option for sizing stormwater treatment facilities was added to Provision C.3.d. This option states that "treatment systems that use a combination of flow and volume capacity shall be sized to treat at least 80 percent of the total runoff over the life of the project, using local rainfall data."

This option can also be used to develop sizing factors for facilities with a standard cross-section (i.e., where the volume available to detain runoff is proportional to facility surface area). To calculate sizing factors, inflows, storage, infiltration to groundwater, underdrain discharge, and overflows are tracked for each time-step during a long-term simulation. The continuous simulation is repeated, with variations in the treatment surface area, to determine the minimum area required for the facility to capture and treat 80% of the inflow during the simulation.

[1] Order R2-2015-0049

Such an analysis was conducted for BASMAA by Dubin Environmental Consulting and is described in the attached Technical Report. The analysis shows that bioretention facilities with the current-standard cross-section can capture and treat the Provision C.3.d amount of runoff when sized to 1.5% - 3% of tributary equivalent impervious area, depending on location.

Hydromodification Management

A principal objective of LID is to mimic natural hydrology in the post-development condition. This is accomplished by retaining and infiltrating runoff flows during small to medium events. Flows from larger events are detained and slowed.

MRP Provision C.3.g. includes requirements and criteria for implementing hydromodification management (HM). These HM requirements apply to Regulated Projects that create or replace an acre or more of impervious area, increase the amount of impervious area over the pre-project condition, and flow to creeks that are at risk of erosion. As such, the HM requirements do not apply to street projects that retrofit drainage systems that receive runoff from existing roofs and paving.

However, Provision C.3.j.i.(g) states that the Permittees' approach to sizing GI facilities "…should also consider whether a broad effort to incorporate hydromodification controls into green infrastructure, even where not otherwise required, could significantly improve creek health and whether such implementation may be appropriate…"

Various criteria for HM design have been used in California and throughout the U.S. These criteria have been based on one or more of the following principles:

- Maintaining watershed processes
- Maintaining a site-specific water balance
- Maintaining the value of the curve number used in the NRCS method of computing peak runoff
- Controlling increases in peak flows from a specified storm size
- Controlling increases in the duration of flows at each intensity within a specified range (flow duration control)
- Controlling the likelihood of downstream erosion in streams (erosion potential, or Ep)

Generally, for any HM criterion used, facilities with more storage and a larger infiltrative area will be more effective in meeting the criterion than facilities with less storage and a smaller infiltrative area.

In the statewide municipal stormwater NPDES permit for small MS4s, Provision E.12.f. includes the following HM standard applicable to Bay Area small MS4s: "Post-project runoff shall not exceed estimated pre-project flow rate for the 2-year, 24-hour storm…"

Dubin (2014) conducted modeling to evaluate whether this standard would be met in the San Francisco Phase II counties (Marin, Sonoma, Napa, and Solano) by a bioretention facility meeting the minimum requirements in that permit's Provision

E.12.f. Dubin's analysis found that a facility sized to 4% of tributary equivalent impervious area, and having a 6-inch deep reservoir with 2 inches of freeboard, 18 inches of treatment soil, and a 12-inch-deep "dead storage" gravel layer below the underdrain, would meet this standard, even in the wettest portions of the Bay Area.

Additional Considerations for Bioretention Sizing

In summary, bioretention facilities for street projects sized to 1.5% - 3% of tributary equivalent impervious area (depending on their location in the Bay Area) can meet the criteria in Provision C.3.d., according to the modeling study documented in the attached Technical Memo.

There are many reasons to design and build facilities larger than the Provision C.3.d. minimum. Building larger facilities helps ensure the facilities perform to the minimum hydraulic capacity intended, despite minor flaws in design, construction, and maintenance, providing an engineering safety factor for the project. Further, larger-sized facilities may more effectively address objectives to maximize the removal of pollutants (particularly pollutants in dissolved form), to operate as full trash capture devices, and to manage hydromodification effects.

However, municipalities often face considerable challenges in retrofitting existing streetscapes with GI facilities. Constraints and design challenges typically encountered in the public right-of-way include:

- The presence of existing underground utilities (known and unknown during the design phase);
- The presence of existing above-ground fixtures such as street lights, fire hydrants, utility boxes, etc.;
- The presence of existing mature trees and root systems;
- The elevation of or lack of existing storm drains in the area to which to connect underdrains or overflow structures;
- Challenges of defining and controlling any catchment areas on adjacent private parcels that drain to the roadway surface;
- Low soil permeability and strength, and the need to protect the adjacent roadway structure;
- Competition with other assets & uses for limited right-of-way area; and
- Presence of archeologic/cultural deposits.

Use of the sizing factors in the attached Technical Memo will provide municipalities flexibility in design of bioretention facilities for street projects where constraints are present.

Recommendations for Sizing Approaches for Green Infrastructure Retrofit Facilities in Street Projects

1. Bioretention facilities in street projects should be sized as large as feasible and meet the C.3.d criteria where possible. Constraints in the public right-of-way may affect the size of these facilities and warrant the use of smaller sizing factors.

Bioretention facilities in street projects may use the sizing curves in the attached memorandum to meet the C.3.d criteria. Local municipal staff involved with other assets in the public right of way should be consulted to provide further guidance to design teams as early in the process as possible.

2. Bioretention facilities in street projects smaller than what would be required to meet the Provision C.3.d criteria may be appropriate in some circumstances. As an example, it might be appropriate to construct a bioretention facility where a small proportion of runoff is diverted from a larger runoff stream. Where feasible, such facilities can be designed as "off-line" facilities, where the bypassed runoff is not treated or is treated in a different facility further downstream. In these cases, the proportion of total runoff captured and treated should be estimated using the results of the attached memorandum. In cases where "in-line" bioretention systems cannot meet the C.3.d criteria, the facilities should incorporate erosion control as needed to protect the facility from high flows. See Figures 1 and 2 below for illustration of the in-line and off-line concepts.
3. Pollutant reduction achieved by GI facilities in street projects will be estimated in accordance with the Interim Accounting Methodology[i] or the applicable Reasonable Assurance Analysis[ii].

Figure 1: Off-line system in El Cerrito where low flow is diverted to the sidewalk planter and high flows continue down the gutter.

Figure 2: In-line system in Berkeley/Albany where low and high flows enter the system and overflows exit through a drain within the system.

[i] The Interim Accounting Methodology for TMDL Loads Reduced Report (BASMAA 2017) describes the methodology that is being used to demonstrate progress towards achieving the PCB and mercury load reductions required during the term of MRP 2.0. The methodology is based on the conversion of land use from a higher to a lower PCB or mercury loading rate during the redevelopment of a parcel. See: www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/stormwater/Municipal/POC/Final%20Interim%20Accounting%20Methodology%20Report%20v.1.1%20(Revised%20March%202017).pdf

[ii] A Reasonable Assurance Analysis (RAA) is a methodology used to demonstrate that implementation of pollutant control measures (such as GI facilities) over a specified time period will meet required pollutant load reductions associated with a TMDL. The Bay Area Reasonable Assurance Analysis Guidance Document (BASMAA 2017) establishes a regional framework and provides guidance for conducting PCBs and mercury RAAs in the San Francisco Bay Area. See: http://basmaa.org/Announcements/bay-area-reasonable-assurance-analysis-guidance-document

Appendix E. Funding Matrix and Potential Opportunities

Green Infrastructure Funding Matrix

June 2019

Summary Matrix Contents

	Funding Category	GI Nexus	Requirements	Pros	Cons	Staff	Planning	Capital	O&M
Traditional Mechanisms									
7.2.1	Parcel Taxes	Can fund all or any parts of a GI program as stipulated in the ballot question and authorizing ordinance	Usually a 2/3 majority of voters (general taxes require only 50% majority, but can only go to General Fund)	* Flexible and legally stout; * Debt can be issued in most cases; * Most voters are familiar with Parcel Taxes	* Requires voter approval at the 2/3 level; * Must compete with other ballot measures	X	X	X	X
7.2.1	Other Special Taxes	* Business License Tax; * Vehicle License Fees; * Sales Tax; * Utility Users Tax; * Transit Occupancy Tax	Typically require a 2/3 voter approval	* Most are flexible in how they can be used; * 50% threshold can be used if a general tax;	* 2/3 voter approval is diffucult to attain; * Ballot measure can be expensive; * If a general tax, then GI must compete with other General Fund needs; * Must compete with other ballot questions	X	X	X	X
7.2.1	Property-Related Fees	Establishes Storm Drainage as a separate utility service and can fund all or any parts of a GI program	Prop 218 compliance; * Rigorous rate study; * Must define services and service area; * Property owners approval for non-Water, -Sewer, and -Garbage	* Flexible and legally stout; * Debt can be issued in most cases	* Ballot measure required if for a Storm Drain service - usually voted on by property owners (Not registered voters); * Ballot measure requires significant public outreach; * Public not familiar with balloted property-related fees	X	X	X	X
7.2.1	General Obligation Bonds	Can fund Capital GI Projects through debt taken on by municipality	* Voter approval at 2/3 level; * Will need Financial Advising Consultant	* Can fund capital projects or programs with debt paid back over time through property taxes; * Typically easier to pass than a parcel tax; * Taxes based on property value, so annual obligation of individual prop owner is vague	Can only be used for capital costs - Cannot be used for O&M or staff costs		X	X	

Funding Category		GI Nexus	Requirements	Pros	Cons	Staff	Planning	Capital	O&M
7.2.1	Senate Bill 231	Allows for adoption of property-related fees without having to go to ballot	* Cost of Service Analysis * Rate Study * Prop 218 Protest Hearing	Avoids the cost and risk of a ballot measure	* Taxpayers groups vow to sue on grounds of consititution / court provisions * Governing boards will still have political pressure to not raise rates	X	X	X	X
7.2.1	Regulatory Fees	Fees and charges for performing administrative activities related to GI	Cannot exceed the actual cost of performing activies such as permit issuanc, inspections, on-site mitigation, etc.	* No voter approval is needed; * Usually included in Master Fee Schedule; * Most municipalities already have these in place	Does not pay for capital improvements or O&M	X			
7.2.1	Developer Impact Fees	Could incorporate fees for mitigating stormwater impacts to help fund GI - Would not relieve developer of NPDES requirements	Must comply with AB 1600 and include a rigorous nexus study	Could partially fund GI	* Requires a nexus study, often times by a consultant; * Nexus study must demonstrate connection between development and GI need; * Administration of funds requires resources; * AB 1600 requires 5-year window for programming funds;		X	X	
7.2.1	Re-Alignment	GI that promotes groundwater recharge, diversion to wastewater treatment, or trash capture can be incoporated into existing property-related fee structures without need for ballot measure	Prop 218 compliance for realignment to Water, Sewer or Garbage - must demonstrate applicability	* Existing non-balloted fee mechanisms can help pay for GI services; * Enhances integration of GI into other muncipal activities; * Causes other utilities to recognize the value of GI programs	* Limited to activities attributable to other funded revenue centers; * Prop 218 hawks could challenge; * Outside revenue center will need to raise rates to fund GI activity - politically unpopular; * Has not been widely used; * May be unpopular with Water, Sewer and Garbage managers; * Water or sewer may be handled by separate agencies, making realignment impossible	X	X	X	X

Funding Category		GI Nexus	Requirements	Pros	Cons	Staff	Planning	Capital	O&M
7.2.1	Grants	One-time infusion of funds for qualifying projects from State or other granting authority	* Project concept must conform to grant requirements; * Most grants are competetive with limit funding available	* Grants are outside sources of funding that do not need to be repaid; * Readiness is a plus, so can benefit a project or program that is well developed and possibly designed; * Some State Revolving Fund loans can be converted to grants through forgiveness clauses	* Projects must be tailored to grant requirements, possibly causing scope and schedule creep; * Most grants require matching funds from other sources; * Most grants require commitment to post-project O&M, but do not fund those activities; * Little control over timing - can be difficult to coordinate with other funding sources; * Competitive nature lowers chances of obtaining grant; * Applying for grants can be time-consuming and require outside help from a grant writer; * Grant administration requires significant resources	X	X	X	???
7.2.1	Loans	Debt instruments can help accelerate project deliver while paying off debt over time	* Must have dedicated revenue stream to pay off debt; * Must have adequate credit rating to secure reasonable interest rates; * Some Bonds require voter approval	* Can leverage a modest revenue stream by borrowing money up front for rapid project delivery while paying off debt over longer periods of time; * Accelerates project delivery and makes coorination with other funding or projects easier	* Must have dedicated revenue stream to service debt; * Some debt mechanisms require voter approval (GO Bonds, Revenue Bonds, EIFD Bonds)	???	X	X	
Special Financing Districts									
7.2.2	Benefit Assessments	Can fund the construction and maintenance of GI projects	Prop 218 compliance; * Rigorous Engineer's Report; * Must deduct general benefit from special benefit; * Property owners approval is required through a ballot proceeding (weighted voting); * Works best with new development due to voting requirement	* Flexible and legally stout; * Can fund both construction and maintenance; * Can use bonded indebtedness	* General Benefit must be separated and paid for by other sources; * Votes are weighted by assessment amount, favoring large land owners		X	X	X

Funding Category		GI Nexus	Requirements	Pros	Cons	Staff	Planning	Capital	O&M
7.2.2	Community Facilities District	Can fund the construction and maintenance of GI projects	Requires vote by majority of landowners or 2/3 majority of registered voters	* Usually formed by developer, so only one ballot is cast; * Very flexible - can fund all aspects; * Subsequent annexation is simple; * Tax rate can be tiered to allow for retirement of debt yet continue with O&M; * Annual administration is more streamline than benefit assessments	* Difficult to form in an existing community due to 2/3 majority requirement; * Known as a Mello-Roos tax - which can have a negative connotation		X	X	X
7.2.2	Business Improvement Districts	Business and property owners tax themselves to build and maintain GI improvements	Formed by a municipality through a notice and protest hearing process.	* Flexible and legally stout; * Can fund both construction and maintenance; * Local improvements can generate local support and involvement * GI improvements can also be amenities; * Can enhance sense of ownership and pride in the neighborhood when results are visible	* Cannot use debt financing; * Opposing businesses can disrupt the progress; * Can burden businesses & property owners so they are unwilling to support other funding measures		X	X	X
7.2.2	Enhanced Infrastructure Financing Districts (EIFD)	Captures property tax increment similar to redevelopment (RDA) for building and maintaining infrastructure like GI	<u>With No Debt</u>: * Establish a Public Finance Authority; * Adopt a Financing Plan; * Resolution(s) from participating agencies <u>With Debt</u>: * All of the above; * Get approval from at least 55% of voters in District	* Can fund many types of projects; * Does not require a vote (unless debt is part of the plan, then a 55% majority is required); * Can include multiple municipalities and special districts, so area can be tailored to needs (e.g. watersheds, high legacy pollutant areas, countywide); * Does not require a blight finding; * Can overlap with former RDA areas; * Works well with master planned community with a single land owner; * Planning costs can be paid for from proceeds (with limitations); * EIFD can go for up to 45 years	* Cannot be used for operations, maintenance and repairs; * Education districts are not permitted to participate, so revenues would be much less than RDA; * If overlapping a former RDA area, then cannot proceed until RDA is issued a finding of completion from the State; * GI is only a small piece of what an EIFD can do - it may take a back seat to other, larger community concerns; * Some agencies (i.e. special districts) may not agree to their portion of tax increment to be diverted thereby reducing revenue potential	???	X	X	

Funding Category		GI Nexus	Requirements	Pros	Cons	Staff	Planning	Capital	O&M
Alternative Compliance									
7.2.3	Alternative Compliance	Allows developers who cannot meeting GI requirements on-site to build (or pay for) off-site construction of GI elements	Municipality would need to have alternative projects ready - could bedone case-by-case	* Enables higher density development in certain areas (such as TOD and PDA); * Enables GI in public spaces that private developers would not normally participate in; * Funds can be pooled to finance larger or regional projects that can be more effective; * Post-project O&M can be added in the form of a cash payment or other consideration; * Municipality can be flexible in enforcement to allow hybrid compliance;	* Ad hoc negotiation with developers can be challenging * Agency will need to have off-site or regional projects ready to bring to negotiation	X	X	X	X
7.2.3	In-Lieu Fee	Allows developers who cannot meet GI requirements to pay into fund that would finance off-site or regional projects	Municipality would need to estimate the costs of of mitigation - could bedone case-by-case	* Enables higher density development in certain areas (such as TOD and PDA); * Enables GI in public spaces that private developers would not normally participate in; * Funds can be pooled to finance larger or regional projects that can be more effective; * Municipality can be flexible in enforcement to allow hybrid compliance; * Municipality may consider informal fee process, negotiating each individual developer through COA; * Funds can be leveraged for grants or loans	* Case-by-case approach can be difficult; * Developers will try to evade costs; * May need to comply with AB 1600	X	X	X	X

Funding Category		GI Nexus	Requirements	Pros	Cons	Staff	Planning	Capital	O&M
7.2.3	Credit Trading Programs	Creates GI Credit program for developers and others to trade GI responsibilities to others who have better capability to meet GI goals	A municipality (or regional entity) must create credit trading program including: * Definition of GI Credits; * Relative Value of Credits; * Timing of responsibilities; * Eligibility	* Allows developers who cannot meet NPDES or GI requirements to buy credits created by other entities; * Encourages developers or other entities who have greater GI capacity to over-build GI in order to sell credits in future; * Present value of future O&M costs can be incorporated into credit value; * Allows for flexibility to guide GI to areas with greater pollutant loading need; * May save developers money	* Very few Programs (to use as an example) have been implemented - particularly in California; * Credits may need to stay within same watershed; * Overbuilding GI in some areas may not help other areas; * Overbuilding GI can lead to overlapping GI zones; * Unclear if developers are willing to overbuild on speculation of future sale of credits; * Unclear how value of credits would be established; * Unclear if municipality would be credit broker, or if developers can deal directly with each other; * May be difficult to apply credits to public rights of way; * Costing future O&M is difficult		X	X	X
Partnerships									
7.2.4	Multi-Agency	Encourages partnerships with non-Stormwater agencies to explore GI co-benefits in their work	Examples may include: * Spreading basins for groundwater agencies; * GI project sites on school grounds; * GI on housing authority sites	* Can generate credits for Credit Trading Program; * Expands GI potential and awareness; * Flexible; * Can leverage limited GI funding to greater benefit	* Not cookie-cutter; requires customization; * May be diffucult to find partners	X	X	X	???
7.2.4	Transportation	Encourages partnerships with transportation agencies to explore GI co-benefits in their work and take advantage of Complete Streets or Green Streets programs	Examples may include: * Permeable pavements; * Roadside rain gardens; * Cisterns	* Most municipalities are also transportation agencies, so internal project coordination more likely; * Can generate credits for Credit Trading Program; * Expands GI potential and awareness; * Can leverage limited GI funding to greater benefit; * Recent increase in Gas Tax may make more room for GI elements	* Not cookie-cutter; requires customization; * May be diffucult to find partners; * Road condition woes prevail, making it difficult to shift funding to GI and other amenity-type elements; * Transportation grants may preclude using funds for GI	X	X	X	???

Funding Category		GI Nexus	Requirements	Pros	Cons	Staff	Planning	Capital	O&M
7.2.4	Caltrans Mitigation	Caltrans looks for opportunities for off-site mitigation of stormwater impacts of their highways	Local municipalities may enter in a cooperative agreement with Caltrans to build GI as a way for them to mitigate stormwater impacts of their highways	* Caltrans may furnish funding for local or regional projects that help them meet their obligations; * Locals can propose solutions that benefit both Caltrans and the local agencies	* Caltrans cooperative agreements can be cumbersome and bureaucratic; * Projects that work for Caltrans may be difficult to develop		X	X	???
7.2.4	Public-Private ("P3")	Private enterprises can provide overall solutions to GI programs through better access to resources and capital	P3 is primarily a deliver system for projects where debt provides near-term funding and project acceleration	* Bypasses some of the bureaucracy; * Can make existing funding sources work more efficiently; * Draws on private sector expertise and financing; * Debt may be tax-exempt; * Debt accelerates project delivery; * Can include design, build, finance, operate; * Debt is private - may not affect public ageny's debt capacity	* Does not provide additional funding; * Dedicated revenue stream is needed - cash flow is an important element		X	X	X
7.2.4	Financial Capability Assessment	Can allow an agency to delay compliance with certain NPDES permit requirements	Follow EPA guidelines for application	Allows a qualifying agency to defer compliance with certain Permit compliance requirements	* Not a source funding - only can grant time extenstions to Permit compliance; * Communities must meet several criteria such as poverty rates, income distibutions, bond ratings, etc.				
7.2.4	Not-for-Profit & Volunteers	Volunteer groups can be a resource for GI operations and maintenance (O&M) as well as program planning	* To be effictive, volunteers need organization and oversight; * Can be used to supplement paid contractors, or perform entire projects	* "Free" labor; * Some volunteers provide needed expertise; * Increases awareness of GI program; * Some non-profit organizations have ready-made volunteer groups that are trained and organized; * Can build public support for dedicated revenue mechanism such as a fee; * Education program for community	* Requires significant staff resources to recruit, organize, train and plan & supervise the work; * Can be unreliable - hard to build schedule and cost forecasts around volunteer work force; * Can create conflict with prevailing wage requirements; * Difficult to incorporate into project construction work		X	???	X